



**BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY), PUNE**

**Faculty of Science
(B.Sc.) - Bachelor Of Science
New Syllabus**

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

**YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,
PUNE – 411 038**

Accredited with 'A+' Grade (2017) by NAAC
'A' Grade University Status by MHRD, Govt. of India
Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF SCIENCE (B.Sc.) PROGRAME
REVISED COURSE STRUCTURE (CBCS 2018 Course)

Under the Faculty of Science

To Be Implemented From Academic Year 2018-19

BHARATI VIDYAPEETH UNIVERSITY, PUNE (INDIA)

BACHELOR OF SCIENCE (B.SC.) (CBCS 2018 COURSE)

Under: The Faculty of Sciences (To be implemented from June 2018)

The Bachelor of Science (B.Sc.) degree of three years integrated choice based credit and grading system (CBCS-2018) course is being implemented from the academic year 2018- 2019. Thus, first year B.Sc. CBCS-2018 course will commence from 2018-2019 and will be implemented in successive years.

1. Aims of Bachelor Degree program in Physics - (B.Sc. Physics):

The aims and objectives of our UG educational programs in sciences in general and Physics in particular should be structured to

- Create the facilities and environment in all the educational institutions to consolidate the knowledge acquired at +2 level and to motivate and inspire the students to create deep interest in Physics, to develop broad and balanced knowledge and understanding of physical concepts, principles and theories of Physics.
- Learn, design and perform experiments in the labs to demonstrate the concepts, principles and theories learned in the classrooms.
- Develop the ability to apply the knowledge acquired in the classroom and laboratories to specific problems in theoretical and experimental Physics.
- Expose the student to the vast scope of Physics as a theoretical and experimental science with applications in solving most of the problems in nature
- Emphasize the discipline of Physics to be the most important branch of science for pursuing the interdisciplinary and multidisciplinary higher education and/or research in interdisciplinary and multidisciplinary areas.
- To emphasize the importance of Physics as the most important discipline for sustaining the existing industries and establishing new ones to create job opportunities at all levels of employment.

In view of opening the new windows in higher education and research and opening job opportunities at all levels from technicians to innovator scientists and engineers, the undergraduate program is offered in our universities.

1.1 Nature and extent of Bachelor Degree program in Physics:

The UG programs in Physics builds on the basic Physics taught at the +2 level in all the schools in the country. Ideally, the +2 senior secondary school education should aim and achieve a sound grounding in understanding the basic Physics with sufficient content of topics from modern Physics and contemporary areas of exciting developments in physical sciences to ignite the young minds. The curricula and syllabi is framed and implemented in such a way that the basic connection between theory and experiment and its importance in understanding Physics should be apparent to the student. This is very critical in developing a scientific temperament and urge to innovate, create and discover in Physics. Unfortunately the condition of our school system in most parts of the country lacks the facilities to achieve the above goal and it is incumbent upon the college/university system to fill the gaps in the knowledge creation of our young minds created by the lack of infrastructural and academic resources of our school system and strengthen their understanding in all the subjects through the UG programs specially in Physics. All the courses are of three year duration spread over six semesters after the higher secondary (+2) level Physics course.

1.2 Graduate attributes in Physics:

Some of the characteristic attributes of a graduate in Physics are

- **Disciplinary knowledge and skills:** Capable of demonstrating
 - (i) Good knowledge and understanding of major concepts, theoretical principles and experimental findings in Physics and its different subfields like Astrophysics and Cosmology, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and other related fields of study, including broader interdisciplinary subfields like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology etc.

(ii) Ability to use modern instrumentation and laboratory techniques to design and perform experiments is highly desirable in almost all the fields of Physics.

- **Skilled communicator:** Ability to transmit complex technical information relating all areas in Physics in a clear and concise manner in writing and oral ability to present complex and technical concepts in a simple language for better understanding.
- **Critical thinker and problem solver:** Ability to employ critical thinking and efficient problem solving skills in all the basic areas of Physics.
- **Sense of inquiry:** Capability for asking relevant/appropriate questions relating to the issues and problems in the field of Physics, and planning, executing and reporting the results of a theoretical or experimental investigation.
- **Team player/worker:** Capable of working effectively in diverse teams in both classroom, laboratory, Physics workshop and in industry and field-based situations.
- **Skilled project manager:** Capable of identifying/mobilizing appropriate resources required for a project, and manage a project through to completion, while observing responsible and ethical scientific conduct; and safety and laboratory hygiene regulations and practices.
- **Digitally Efficient:** Capable of using computers for simulation studies in Physics and computation and appropriate software for numerical and statistical analysis of data, and employing modern e-library search tools like Infilbnet, various websites of the renowned Physics labs in countries like the USA, Europe, Japan etc. to locate, retrieve, and evaluate Physics information.
- **Ethical awareness / reasoning:** The graduate should be capable of demonstrating ability to think and analyze rationally with modern and scientific outlook and identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, and adopting objectives, unbiased and truthful actions in all aspects of work.
- **National and international perspective:** The graduates should be able to develop a national as well as international perspective for their career in the chosen field of the

academic activities. They should prepare themselves during their most formative years for their appropriate role in contributing towards the national development and projecting our national priorities at the international level pertaining to their field of interest and future expertise.

- **Lifelong learners:** Capable of self-paced and self-directed learning aimed at personal development and for improving knowledge/skill development in all areas of Physics.

1.3 Qualification descriptors for a UG programs in Physics:

The graduates should be able to:

Demonstrate

- (i) A fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas like Astrophysics, Material science, Nuclear and Particle Physics, Condensed matter Physics, Atomic and Molecular Physics, Mathematical Physics, Analytical dynamics, Space science and applications, and its linkages with related disciplinary areas/subjects like Chemistry, Mathematics, Life sciences, Environmental sciences, Atmospheric Physics, Computer science, Information Technology;
 - (ii) Procedural knowledge that creates different types of professionals related to different areas of study in Physics outlined above, including research and development, teaching and government and public service;
 - (iii) Skills in areas related to specialization area relating the subfields and current developments in the academic field of Physics.
- Use knowledge, understanding and skills required for identifying problems and issues relating to Physics, collection of relevant quantitative and/or qualitative data drawing on a wide range of sources from various Physics laboratories of the world, and their application, analysis and evaluation using methodologies as appropriate to Physics for formulating new theories and concepts.
 - Communicate the results of studies undertaken accurately in a range of different contexts using the main concepts, constructs and techniques of Physics. Develop communication abilities to present these results in technical as well as popular science meetings organized in various universities and other private organizations.

- Ability to meet one's own learning needs, drawing on a range of current research and development work and professional materials, and interaction with other physicists around the world.
- Apply one's knowledge of Physics and theoretical and laboratory skills to new/unfamiliar contexts to identify and analyse problems and issues and solve complex problems in Physics and related areas with well-defined solutions.

Demonstrate Physics-related technological skills that are relevant to Physics-related job trades and employment opportunities.

1.4 Program Specific Learning Outcomes a for UG programs in Physics:

Students will be able to

- Acquire a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics
- Procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and government/public service
- Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems and identifying and applying appropriate physical principles
- Recognize the importance of mathematical modeling simulation and computing, and the role of approximation and mathematical approaches to describe the physical world
- Plan and execute Physics-related experiments or investigations, analyze and interpret data/information collected
- Get ability of problem-solving skills that are required to solve different types of Physics-related problems, investigative skills, communication skills, analytical skills, ICT skills and personal skills
- The ability to identify the potential ethical issues in work-related situations
- Promote safe learning and working environment

2. Aims of Bachelor's degree programme in Chemistry:

The aim of bachelor's degree programme in chemistry is intended to provide:

- Broad and balance knowledge in chemistry in addition to understanding of key chemical concepts, principles and theories.
- To develop students' ability and skill to acquire expertise over solving both theoretical and applied chemistry problems.
- To provide knowledge and skill to the students' thus enabling them to undertake further studies in chemistry in related areas or multidisciplinary areas that can be helpful for self-employment/entrepreneurship.
- To provide an environment that ensures cognitive development of students in a holistic manner. A complete dialogue about chemistry, chemical equations and its significance is fostered in this framework, rather than mere theoretical aspects.
- To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

2.1 Nature and extent of the B.Sc Chemistry Programme:

Chemistry is referred to as the science that systematically study the composition, properties, and reactivity of matter at atomic and molecular level. The scope of chemistry is very broad. The key areas of study of chemistry comprise Organic chemistry, Inorganic Chemistry, Physical Chemistry and Analytical Chemistry. Organic chemistry deals with study of substances containing carbon mostly; inorganic chemistry deals with study of all other elements/compounds/substances and their chemical properties. Physical chemistry deals with applications of concepts, laws to chemical phenomena. Analytical chemistry, in general, deals

with identification and quantification of materials. Thus, the degree programme in chemistry also intended to cover overlapping areas of chemistry with physics, biology, environmental sciences. Further, a broad range of subjects such as industrial chemistry, environmental chemistry, etc., has also been introduced which can be helpful for students/faculty members to broaden the scope of their studies and hence applications from job prospective point of view. Therefore, as a part of efforts to enhance employability of graduates of chemistry, the curricula also include learning experience with industries and research laboratories as interns

This modified syllabus has been drafted to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/ introduced in this framework, including Physics, Mathematics, Biology and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Chemistry graduate is given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the employability of graduates, a number of skill development courses are also introduced in this framework.

2.2 Attributes of a Chemistry Graduate:

Attributes of chemistry graduate under the outcome-based teaching-learning framework may encompass the following:

- **Core competency:** The chemistry graduates are expected to know the fundamental concepts of chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Chemistry graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience.
- **Critical thinking:** Chemistry graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.

- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various socio-cultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self- reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problem-solving philosophical approaches that are pertinent across the disciplines;
- **Analytical reasoning:** Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other *a priori* reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive co- operations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decision- making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

2.3 Qualification Descriptors for Graduates in B.Sc. Chemistry:

The qualification description for B.Sc. programme in Chemistry includes:

- Systematic and fundamental understanding of chemistry as a discipline. ii).Skill and related developments for acquiring specialization in the subject.

- Identifying chemistry related problems, analysis and application of data using appropriate methodologies.
- Applying subject knowledge and skill to solve complex problems with defined solutions.
- Finding opportunity to apply subject-related skill for acquiring jobs and self-employment.
- Understanding new frontiers of knowledge in chemistry for professional development.
- Applying subject knowledge for solving societal problems related to application of chemistry in day to day life.
- Applying subject knowledge for sustainable environment friendly green initiatives.
- Applying subject knowledge for new research and technology.

2.4 Programme Specific Learning Outcomes in B.Sc. Chemistry:

The B.Sc. programme in Chemistry is designed to develop in students in depth knowledge of the core concepts and principles that are central to the understanding of this core science discipline. Undergraduates pursuing this programme of study go through laboratory work that specifically develops their quantitative and qualitative skills, provides opportunities for critical thinking and team work and exposes them to techniques useful for applied areas of scientific study. Some of the programme specific learning outcomes are:

- Gain the knowledge of Chemistry through theory and practicals.
- Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.
- Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
- Create an awareness of the impact of chemistry on the environment, society and development outside the scientific community.
- Find out the green route for chemical reaction for sustainable development.
- To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
- Identify chemical formulae and solve numerical problems.
- Use modern chemical tools, Models, Chem-draw, Charts and Equipments.
- Understand good laboratory practices and safety.
- Develop research oriented skills.
- Make aware and handle the sophisticated instruments/equipments.

3. Aims of Bachelor's Degree Programme in Botany:

The broad aims of Bachelor's degree programme in Botany are:

- To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered, rather than didactic monologues on mere theoretical aspects
- To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
- To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
- To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination.

3.1 Nature and extent of the B.Sc. degree Programme in Botany:

Botany, as traditionally delimited epistemologically, is the broad discipline encompassing various subjects involved with the study of plants. Emphasis has been shifted to modern science at the cost of traditional botany. This shift is discussed at various forums. There is need to balance the traditional botany and upcoming modern computational and applied approach.

In view of above, adequate balance of topics is proposed displaying latest APG IV based phylogenetic systematics of plants covering higher plants, lower plants, aquatic (fresh and marine water) plants, nature/ field study, functional aspects of various cellular processes of plants, molecular genetics and modern tools i.e. tissue culture, genetic engineering and computational studies are required to be introduced at undergraduate level.

This modified syllabus has been drafted to enable the students to equip for national level competitive exams that they may attempt in future. To ensure implementation of a holistic pedagogical model, several allied disciplines are covered/introduced in this framework, including Chemistry, Mathematics and a number of generic, and ability enhancement electives. In addition, employability of B.Sc. Botany graduate is given due importance such that their core competency in the subject matter, both theoretical and practical, is ensured. To expand the employability of graduates, a number of skill development courses are also introduced in this framework.

3.2 Graduate Attributes in a Bachelor's Degree programme in Botany Botany:

- **Core competency:** The botany graduates are expected to know the fundamental concepts of botany and plant science. These fundamental concepts would reflect the latest understanding of the field, and therefore, are dynamic in nature and require frequent and time-bound revisions.
- **Communication skills:** Botany graduates are expected to possess minimum standards of communication skills expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/finding/concepts to wider audience
- **Critical thinking:** Botany graduates are expected to know basics of cognitive biases, mental models, logical fallacies, scientific methodology and constructing cogent scientific arguments.
- **Psychological skills:** Graduates are expected to possess basic psychological skills required to face the world at large, as well as the skills to deal with individuals and students of various sociocultural, economic and educational levels. Psychological skills may include feedback loops, self-compassion, self-reflection, goal-setting, interpersonal relationships, and emotional management.
- **Problem-solving:** Graduates are expected to be equipped with problem solving philosophical approaches that are pertinent across the disciplines; Occam's razor for instance.
- **Analytical reasoning:** Graduates are expected to formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc. in fallacious arguments.
- **Research-skills:** Graduates are expected to be keenly observant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment through statistical hypothesis testing and other a priori reasoning including logical deduction.
- **Teamwork:** Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.
- **Digital Literacy:** Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as MOOC and other digital

tools for lifelong learning. Graduates should be able to spot data fabrication and fake news by applying rational skepticism and analytical reasoning.

- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing, Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with decision making process and basic managerial skills to become a better leader. Skills may include defining objective vision and mission, how to become charismatic inspiring leader and so on.

3.3 Qualification Descriptors for a Bachelor's Degree programme in Botany:

The qualification descriptors for a Bachelor's degree in Botany may include following:

- To demonstrate a systematic, extensive and coherent knowledge and understanding of academic fields of study as a whole and its applications and links to disciplinary areas of the study; including critical understanding of the established theories, principles and concepts of a number of advanced and emerging issues in the field of Botany;
- To demonstrate procedural knowledge that creates different types of professionals in the field of Botany like in research and development, teaching government and public services e.g. conservationist, plant explorer, ecologist, horticulturist, plant biochemist, genetics, nursery manager, molecular biologist, plant pathologist, taxonomist, farming consultant and environmental consultant. Further application of knowledge can enhance productivity of several economically important product/botanicals. Knowledge of Botany is also necessary for the development and management of forests, parks, wastelands and sea wealth
- Developing skills and ability to use knowledge efficiently in areas related to specializations and current updates in the subject
- Demonstrate comprehensive knowledge about plants, current research, scholarly and professional literature of advanced learning areas of Botany
- Use knowledge understanding and skills for critical assessment of wide range of ideas and problems in the field of Botany

- Communicate the results of studies in the academic field of Botany using main concepts, constructs and techniques.
- Apply one's knowledge and understanding of Botany to new/unfamiliar contexts and to identify problems and solutions in daily life.
- Apply one's knowledge and understanding of Botany to new/unfamiliar contexts and to identify problems and solutions in daily life.

3.4 Programme Specific Learning Outcomes for a Bachelor's Degree programme in Botany:

The programme learning outcomes relating to B.Sc. degree programme in Botany:

- Stewardship responsibility.
- Hands on expertise in Botanical sciences and its applied branches.
- Entrepreneurship skill development.
- Focus on taking up research and teaching opportunities.
- Acquire skills related to specialization areas within Botany as well as within subfields of Botany and have hands on expertise in life sciences.
- Promote career and job opportunities in both Govt. and private sectors.
- Develop foundation for higher study in botany.
- Facilitate for taking up and shaping successful carrier in botany.
- Identify different species of plants and understand their characteristics along with uses.
- Develop the entrepreneurial skills in the field of applied botany.
- Understand how plants are classified and identified.
- Demonstrate knowledge of basic botanical principles.
- Use appropriate information with a critical understanding.
- Learn basic laboratory and analytical skills.
- Demonstrate competence in handling and statistical analysis of data gained from practical.
- Learn communication and IT skills, including the collation and statistical analysis of data, citing and referencing work appropriately, communicating using a range of formats.

4. Aims of Bachelor's degree programme in Microbiology:

The aim of the undergraduate degree in Microbiology is to make students knowledgeable about the various basic concepts in wide ranging contexts which involve the use of knowledge and skills of Microbiology. Their understanding, knowledge and skills in Microbiology needs to be developed through a thorough teaching learning processes in the class, practical skills through the laboratory work, their presentation and articulation skills, exposure to industry and interaction with industry experts, write short research-based projects where they are guided and mentored by the academic and other experts of the subject.

4.1 Nature and extent of the B.Sc.(Microbiology) Programme:

The undergraduate programme in Microbiology is the first level of college or university degree in the country as in several other parts of the world. After obtaining this degree, a microbiologist may enter into the job market or opt for undertaking further higher studies in the subject. After graduation the students may join industry, academia, public health and play their role as microbiologists in a useful manner contributing their role in the development of the welfare society. Thus the undergraduate level degree in microbiology must prepare the students for all these objectives. Thus the LOCF curriculum developed has a very wide range covering all aspects of Microbiology with reasonable depth of knowledge and skills so as to diversify them in various specialties of the subject and play their role professionally as expected of them. It is also imperative that microbiologists are evaluated in a manner appropriate to assess their proper development as Microbiologists. The current LOCF in Microbiology has been designed in keeping all these important points in mind.

4.2 Graduate Attributes in Microbiology:

As mentioned earlier B.Sc. degree in Microbiology is the first college/university level degree in the country as in several parts of the world. The students graduating in this degree must have through understanding of basic knowledge or understanding of the fundamentals of Microbiology as applicable to wide ranging contexts. They should have the appropriate skills of Microbiology so as to perform their duties as microbiologists. They must be able to analyze the problems related to microbiology and come up with most suitable solutions. As microbiology is an interdisciplinary subject the students might have to take inputs from other area of expertise. So the students must develop the spirit of team work. Microbiology is a very dynamic subject

and practitioners might have to face several newer problems. To this end, the microbiologists must be trained to be innovative to solve such newer problems. Several newer developments are taking place in microbiology.

The students are trained to pick up leads and see the possibility of converting these into products through entrepreneurship. To this end, the students are made to interact with industry experts so that they may be able to see the possibility of their transition into entrepreneurs.

They are also made aware of the requirements of developing a Microbiology enterprise by having knowledge of patents, copyrights and various regulatory processes to make their efforts a success. Besides attaining the attributes related to the profession of Microbiology, the graduates in this discipline should also develop ethical awareness which is mandatory for practicing a scientific discipline including ethics of working in a laboratory work and ethics followed for scientific publishing of their research work in future. The students graduating in microbiology should also develop excellent communication skills both in the written as well as spoken language which are must for them to pursue higher studies from some of the best and internationally acclaimed universities and research institutions spread across the globe.

4.3 Qualification Descriptors:

The following may serve as the important qualification descriptors for a UG degree in Microbiology:

1. Knowledge of the diverse places where microbiology is involved.
2. Understanding of diverse Microbiological processes.
3. Basic skills such as culturing microbes, maintaining microbes, safety issues related to handling of microbes, Good Microbiological practices etc.
4. Moderately advanced skills in working with microbes such as pilot scale culturing, downstream processes, diagnostics etc.
5. Generation of new knowledge through small research projects
6. Ability to participate in team work through small microbiology projects.
7. Ability to present and articulate their knowledge of Microbiology.
8. Knowledge of recent developments in the area of Microbiology.
9. Analysis of data collected through study and small projects.
10. Ability to innovate so as to generate new knowledge.

11. Awareness how some microbiology leads may be developed into enterprise.
12. Awareness of requirements for fruition of a microbiology-related enterprise.

4.4 Programme Learning Outcomes of B.Sc. Microbiology course:

A candidate who is conferred an UG degree i.e. B.Sc. degree in microbiology needs to have acquired/developed following competencies during the programme of the study:

1. Acquired knowledge and understanding of the microbiology concepts as applicable to diverse areas such as medical, industrial, environment, genetics, agriculture, food and others.
2. Demonstrate key practical skills/competencies in working with microbes for study and use in the laboratory as well as outside, including the use of good microbiological practices.
3. Competent enough to use microbiology knowledge and skills to analyze problems involving microbes, articulate these with peers/ team members/ other stake holders, and undertake remedial measures/ studies etc.
4. Developed a broader perspective of the discipline of Microbiology to enable him to identify challenging societal problems and plan his professional career to develop innovative solutions for such problems.

5. Eligibility for Admission:

1. Higher Secondary School Certificate Examination (10+2) of the Maharashtra State Board or its equivalent examination of any other statutory Board/University with English and with any three Science subjects such as (i) Physics (ii) Chemistry (iii) Biology (iv) Mathematics (v) Geography (vi) Geology etc
2. Higher Secondary School Certificate Examination (10+2) with English and with any one of the following vocational subjects in technical group of +2 levels.
3. Diploma in Pharmacy, Diploma in Engineering (polytechnic) or its equivalent examination recognized by MBTE, Mumbai or its equivalent of any other statutory Board or University.

Subject code	Subject
79	Auto Electrical
A1	Electrical Maintenance
A2	Mechanical Maintenance
A4	General Civil Engg.
C2	Electronics
C3	Chemical Plant Operation
C5	Elementary Laboratory Technology
D9	Computer Science
J1/J2/J3	Electronics Technology
J4/J5/J6	Maintenance & Repairs of Electrical Domestic Appliances
K1/K2/K3	Auto Engg. Technician
P1/P2/P3	Medical Lab. Technician
P4/P5/P6	X-ray Technician
P7/P8/P9	Ophthalmic Technician
T1/T2/T3	Repair, Maintenance & Rewinding of Electrical Motors.

6. Admission process:

1. Admissions will be given as per the selection procedure/policies adopted by the college, in accordance with conditions laid down by Bharati Vidyapeeth University, Pune.
2. Reservation and relaxation will be as per the Government rules and Bharati Vidyapeeth University, Pune.

7. **Intake Capacity:** The intake capacity of the course will be 120 seats every year.

8. Course Structure and scheme of credits of B.Sc.Course:

8.1 F. Y. B. Sc. (Sem. I and II):

Core selective groups (Select any one group from the following)

Group I :- Physics, Chemistry, Mathematics and Statistics (PCMS)

Group II :- Physics, Mathematics, Statistics and Computer Application (PMSCA)

Group III :- Physics, Chemistry, Botany and Zoology (PCBZ)

Group IV :- Chemistry, Botany, Zoology and Microbiology (CBZM)

Group V: - Chemistry, Zoology, Microbiology and Geography (CZMG)

Semester I
(From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Physics						
	P - 11	Mechanics & Properties of Matter	03	03	03	40	60	100
	P- 12	Modern Physics	03	03	03	40	60	100
	P - 13	Practical course – I	04	02	03	40	60	100
Core Course		Chemistry						
	C-11	Physical and Inorganic Chemistry – I	03	03	03	40	60	100
	C-12	Organic and Inorganic Chemistry – I	03	03	03	40	60	100
	C -13	Practical course – I	04	02	03	40	60	100
Core Course		Botany						
	B –11	Plant diversity and utilization of plants – I	03	03	03	40	60	100
	B –12	Cell biology	03	03	03	40	60	100
	B- 13	Practical course - I	04	02	03	40	60	100
Core Course		Zoology						
	Z – 11	Animal systematic and Functional Anatomy of Non-chordates-I	03	03	03	40	60	100
	Z –12	Cell Biology and Genetics	03	03	03	40	60	100
	Z- 13	Practical course - I	04	02	03	40	60	100
Core Course		Microbiology						
	MB- 11	Introduction to Microbiology	03	03	03	40	60	100
	MB- 12	Structure of Prokaryotes and Eukaryotes	03	03	03	40	60	100
	MB- 13	Practical course - I	04	02	06	40	60	100
Core Course		Mathematics						
	M-11	Algebra	03	03	03	40	60	100
	M-12	Calculus	03	03	03	40	60	100
	M- 13	Practical course - I	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Statistics						
	S-11	Descriptive Statistics- I	03	03	03	40	60	100
	S-12	Discrete Probability and Probability Distributions –I	03	03	03	40	60	100
	S- 13	Practical course - I	04	02	03	40	60	100
Core Course		Geography						
	G -11	Physical Geography - I	03	03	03	40	60	100
	G -12	Climatology - I	03	03	03	40	60	100
	G- 13	Practical course - I	04	02	03	40	60	100
Core Course		Computer Application						
	CA-11	Computer Fundamentals	03	03	03	40	60	100
	CA-12	Programming in C -I	03	03	03	40	60	100
	CA-13	Practical course - I	04	02	03	40	60	100

B.Sc. Sem. II
(From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Physics						
	P - 21	Kinetic Theory & Thermodynamics	03	03	03	40	60	100
	P -22	Electricity & Magnetism	03	03	03	40	60	100
	P - 23	Practical course - II	04	02	03	40	60	100
Core Course		Chemistry						
	C-21	Physical and Inorganic Chemistry – II	03	03	03	40	60	100
	C-22	Organic and Inorganic Chemistry - II	03	03	03	40	60	100
	C- 23	Practical Course-II	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Botany						
	B-21	Plant diversity and utilization of plants – II	03	03	03	40	60	100
	B –22	Industrial Botany-I	03	03	03	40	60	100
	B-23	Practical course – II	04	02	03	40	60	100
Core Course		Zoology						
	Z-21	Functional Anatomy of Chordates-I	03	03	03	40	60	100
	Z-22	Applied zoology (Vermiculture and Sericulture)	03	03	03	40	60	100
	Z-23	Practical course – II	04	02	03	40	60	100
Core Course		Microbiology						
	MB-21	Microbial Nutrition, Growth and control	03	03	03	40	60	100
	MB-22	The diversity of Microbial World	03	03	03	40	60	100
	MB-23	Practical course – II	04	02	06	40	60	100
Core Course		Mathematics						
	M-21	Analytical Geometry	03	03	03	40	60	100
	M-22	Integral Calculus and Differential Equations	03	03	03	40	60	100
	M-23	Practical course – II	04	02	03	40	60	100
Core Course		Statistics						
	S-21	Descriptive Statistics-II	03	03	03	40	60	100
	S-22	Discrete Probability and Probability Distributions-II	03	03	03	40	60	100
	S-23	Practical course – II	04	02	03	40	60	100
Core Course		Geography						
	G -21	Physical Geography – II	03	03	03	40	60	100
	G- 22	Oceanography	03	03	03	40	60	100
	G- 23	Practical course – II	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Computer Application						
	CA-21	Operating Environment	03	03	03	40	60	100
	CA-22	Programming in C -II	03	03	03	40	60	100
	CA-23	Practical course – II	04	02	03	40	60	100
Skill Enhancement Course	This course is compulsory for all the students.							
	UG-SEC-21	Renovable Energy And Energy Harvesting	02	02	02	20	30	50

8.2 S.Y. B. Sc. (Sem. III and IV) :

Core selective groups (Select any one group from the following)

Group I : Physics, Chemistry and Mathematics (PCM)

Group II : Physics, Mathematics and Statistics (PMS)

Group III : Physics, Mathematics and Computer Application (PMCA).

Group IV : Mathematics, Statistics and Computer Application (MSCA)

Group V : Chemistry, Botany and Zoology (CBZ)

Group VI : Chemistry, Botany and Microbiology (CBM)

Group VII : Chemistry, Zoology and Microbiology (CZM)

Group VIII : Botany, Zoology and Microbiology (BZM)

Group IX : Zoology, Microbiology and Geography (ZMG)

B.Sc. Sem. III **(From the Academic Year 2019-20)**

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Physics						
	P - 31	Mathematical Methods for Physics	04	04	03	40	60	100
	P- 32	Optics	04	04	03	40	60	100
	P - 33	Practical course - III	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Chemistry						
	C-31	Physical and Analytical Chemistry – I	04	04	03	40	60	100
	C-32	Organic and Inorganic Chemistry - III	04	04	03	40	60	100
	C- 33	Practical Course-III	04	02	03	40	60	100
Core Course		Botany						
	B –31	Plant anatomy and Embryology	04	04	03	40	60	100
	B –32	Angiosperm Taxonomy	04	04	03	40	60	100
	B -33	Practical course - III	04	02	03	40	60	100
Core Course		Zoology						
	Z-31	Functional Anatomy of Non-chordates-II and Biodiversity	04	04	03	40	60	100
	Z-32	Histology of Mammals	04	04	03	40	60	100
	Z-23	Practical course - III	04	02	03	40	60	100
Core Course		Microbiology						
	MB-31	Microbial Metabolism	04	04	03	40	60	100
	MB-32	Bacterial Genetics	04	04	03	40	60	100
	MB-33	Practical course - III	04	02	06	40	60	100
Core Course		Mathematics						
	M-31	Calculus of Several Variables	04	04	03	40	60	100
	M-32	Group Theory and Differential Equations	04	04	03	40	60	100
	M–33	Practical course - III	04	02	03	40	60	100
Core Course		Statistics						
	S-31	Probability Distributions And Statistical Inference-I	04	04	03	40	60	100
	S-32	Probability Distribution And Statistical Methods- I	04	04	03	40	60	100
	S- 33	Practical course – III	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Geography						
	G- 31	Human Geography-I	04	04	03	40	60	100
	G- 32	Biogeography - I	04	04	03	40	60	100
	G- 33	Practical course - III	04	02	03	40	60	100
Core Course		Computer Application						
	CA-31	Advanced C Concepts - I	04	04	03	40	60	100
	CA-32	Digital Electronics I	04	04	03	40	60	100
	CA-33	Practical course - III	04	02	03	40	60	100
Elective Course	Any one of the following.							
	ENG-31	English –I	04	04	03	40	60	100
	MAR-32	Marathi – I	04	04	03	40	60	100
SEC*	This course is compulsory for all the students.							
	UG- SEC-31	Medical Dignostics	02	02	02	20	30	50

*SEC: Skill Enhancement Course

B.Sc. Sem. IV
(From the Academic Year 2019-20)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Physics						
	P - 41	Waves & Oscillations	04	04	03	40	60	100
	P - 42	Electronics	04	04	03	40	60	100
	P - 43	Practical course – IV	04	02	03	40	60	100
Core Course		Chemistry						
	C-41	Physical and Analytical Chemistry – II	04	04	03	40	60	100
	C-42	Organic and Inorganic Chemistry - IV	04	04	03	40	60	100
	C- 43	Practical Course-IV	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Botany						
	B –41	Plant Biotechnology	04	04	03	40	60	100
	B –42	Plant Physiology	04	04	03	40	60	100
	B -43	Practical course - IV	04	02	03	40	60	100
Core Course		Zoology						
	Z –41	Functional Anatomy of chordates-II	04	04	03	40	60	100
	Z - 42	Physiology of Mammals	04	04	03	40	60	100
	Z- 43	Practical course - IV	04	02	03	40	60	100
Core Course		Microbiology						
	MB-41	Principles of Disease, Epidemiology and Immunology	04	04	03	40	60	100
	MB 42	Applied Microbiology	04	04	03	40	60	100
	MB-43	Practical course - IV	04	02	06	40	60	100
Core Course		Mathematics						
	M-41	Vector Calculus	04	04	03	40	60	100
	M-42	Complex variables	04	04	03	40	60	100
	M–43	Practical course - IV	04	02	03	40	60	100
Core Course		Statistics						
	S-41	Probability Distributions And Statistical Inference-II	04	04	03	40	60	100
	S-42	Probability Distribution And Statistical Methods-II	04	04	03	40	60	100
	S-43	Practical course - IV	04	02	03	40	60	100
Core Course		Geography						
	G- 41	Human Geography-II	04	04	03	40	60	100
	G– 42	Biogeography - II	04	04	03	40	60	100
	G- 43	Practical course - IV	04	02	03	40	60	100
Core Course		Computer Application						
	CA-41	Advanced C Concepts –II	04	04	03	40	60	100
	CA-42	Digital Electronics II	04	04	03	40	60	100
	CA-43	Practical course – IV	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Elective Course	Any one of the following.							
	ENG-41	English –II	04	04	03	40	60	100
	MAR-42	Marathi - II	04	04	03	40	60	100
Ability Enhance ment Com- pulsory Course								
	UG- AECC -41	Environmental Science	02	02	02	20	30	50

8.3 T. Y. B. Sc. (Sem. V and VI):

The student should select any one subject from the core group which he / she has opted at S.Y.B.Sc. (Semester III and IV) as Principle subject.

B.Sc. Sem. V **(From the Academic Year 2020-21)**

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Physics						
	P-51	Mathematical Methods in Physics	04	04	03	40	60	100
	P-52	Quantum Mechanics	04	04	03	40	60	100
	P-53	Solid State Physics	04	04	03	40	60	100
	P-54	Advanced Electronics	04	04	03	40	60	100
	P-55	Classical Mechanics	04	04	03	40	60	100
	P-56	Practical Course – V	04	02	03	40	60	100
	P-57	Practical Course – VI	04	02	03	40	60	100
	P-58	Practical Course - VII	04	02	03	40	60	100
Elective Course	Any one of the following.							
	P-59A	Elements of Materials Science	04	04	03	40	60	100
	P-59B	Medical Electronics	04	04	03	40	60	100
	P-59C	Digital Electronics I	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Chemistry						
	C-51	Physical Chemistry –I	04	04	03	40	60	100
	C-52	Inorganic Chemistry – I	04	04	03	40	60	100
	C-53	Organic Chemistry – I	04	04	03	40	60	100
	C-54	Analytical Chemistry – I	04	04	03	40	60	100
	C-55	Industrial Chemistry - I	04	04	03	40	60	100
	C-56	Practical Course – V	04	02	03	40	60	100
	C-57	Practical Course – VI	04	02	03	40	60	100
	C-58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	C-59A	Environment Chemistry-I	04	04	03	40	60	100
	C-59B	Nuclear Chemistry-I	04	04	03	40	60	100
	C-59C	Polymer Chemistry-I	04	04	03	40	60	100
Core Course		Botany						
	B –51	Biology of lower cryptogams(Algae & Fungi)	04	04	03	40	60	100
	B –52	Biology of seed plants (Angiosperms)	04	04	03	40	60	100
	B –53	Plant pathology and Plant protection	04	04	03	40	60	100
	B –54	Genetics and Biostatistics	04	04	03	40	60	100
	B –55	Molecular biology and Biochemistry	04	04	03	40	60	100
	B-56	Practical Course – V	04	02	03	40	60	100
	B -57	Practical Course – VI	04	02	03	40	60	100
	B - 58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	B-59A	Aerobiology	04	04	03	40	60	100
	B-59B	Medico Botany	04	04	03	40	60	100
	B-59C	Conservation of Medicinal Plants	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Zoology						
	Z- 51	Developmental Biology	04	04	03	40	60	100
	Z -52	Genetics and evolution	04	04	03	40	60	100
	Z -53	Applied Zoology- Apiculture and Inland fisheries	04	04	03	40	60	100
	Z -54	Parasitology	04	04	03	40	60	100
	Z -55	Ecology and environmental pollution	04	04	03	40	60	100
	Z-56	Practical Course – V	04	02	03	40	60	100
	Z -57	Practical Course – VI	04	02	03	40	60	100
	Z - 58	Practical Course - VII	04	02	03	40	60	100
Elective Course	Any one of the following.							
	Z-59A	Biochemistry and Molecular Biology	04	04	03	40	60	100
	Z-59B	Comparative anatomy of Chordates and Micro- techniques	04	04	03	40	60	100
	Z -59C		04	04	03	40	60	100
Core Course		Microbiology						
	MB-51	Medical Microbiology	04	04	03	40	60	100
	MB-52	Clinical Pathology	04	04	03	40	60	100
	MB-53	Virology	04	04	03	40	60	100
	MB-54	Genetics of Prokaryotes	04	04	03	40	60	100
	MB-55	Enzyme Kinetics and Regulation	04	04	03	40	60	100
	MB -6	Practical Course – V	04	02	03	40	60	100
	MB-57	Practical Course – VI	04	02	03	40	60	100
	MB-58	Practical Course - VII	04	02	03	40	60	100
Elective Course	Any one of the following.							
	MB-59A	Food and dairy Microbiology	04	04	03	40	60	100
	MB-59B	Applied Microbiology-I	04	04	03	40	60	100
	MB-59C	Advance Techniques in Microbiology-I	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Mathematics						
	M-51	Real Analysis- I	04	04	03	40	60	100
	M-52	Abstract Algebra – I	04	04	03	40	60	100
	M-53	Discrete Mathematics – I	04	04	03	40	60	100
	M-54	Differential Geometry-I	04	04	03	40	60	100
	M-55	Computer Programming and Applications –I	04	04	03	40	60	100
	M -56	Practical Course – V	04	02	03	40	60	100
	M-57	Practical Course – VI	04	02	03	40	60	100
	M- 58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	M– 59A	Mechanics(statics)	04	04	03	40	60	100
	M – 59B	Operation Research-I	04	04	03	40	60	100
	M – 59C	Special Functions-I	04	04	03	40	60	100
Core Course		Statistics						
	S-51	Distribution Theory - I	04	04	03	40	60	100
	S-52	Statistical Inference - I	04	04	03	40	60	100
	S-53	Sampling Methods and Design of Experiments- I	04	04	03	40	60	100
	S-54	Applied Statistics(A)-I	04	04	03	40	60	100
	S-55	Applied Statistics(B)-I	04	04	03	40	60	100
	S- 56	Practical Course – V	04	02	03	40	60	100
	S-57	Practical Course – VI	04	02	03	40	60	100
	S- 58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	S – 59A	Computer Programming. ‘C’ Programming (Turbo C)-I	04	04	03	40	60	100
	S – 59B	Principles of Computer Science-I	04	04	03	40	60	100
	S – 59C	Statistical Ecology	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UE	Total
Core Course		Geography						
	G -51	World Regional Geography-I	04	04	03	40	60	100
	G-52	Geography of India-I	04	04	03	40	60	100
	G-53	Resources and environment-I	04	04	03	40	60	100
	G-54	Economic Geography-I	04	04	03	40	60	100
	G-55	Applied Geography-I	04	04	03	40	60	100
	G-56	Practical Course – V	04	02	03	40	60	100
	G-57	Practical Course – VI	04	02	03	40	60	100
	G- 58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	G-59A	Geography of Water Resources-I	04	04	03	40	60	100
	G-59B	Geography of Soils-I	04	04	03	40	60	100
	G-59C	Population Geography-I	04	04	03	40	60	100
Core Course		Computer Application						
	CA-51	Operating System-I	04	04	03	40	60	100
	CA-52	Visual basic. Net programming-I	04	04	03	40	60	100
	CA-53	Software Engineering -I	04	04	03	40	60	100
	CA-54	Database Management System-I	04	04	03	40	60	100
	CA-55	Data and File structure-I	04	04	03	40	60	100
	CA-56	Practical Course – V	04	02	03	40	60	100
	CA-57	Practical Course – VI	04	02	03	40	60	100
	CA-58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	CA-59A	Computer Networks-I	04	04	03	40	60	100
	CA-59B	Internet Programming-I	04	04	03	40	60	100
	CA-59C	Theoretical computer science-I	04	04	03	40	60	100
Ability Enhancement Compulsory Course		This course is compulsory for all the students.						
	UG-AEC C-51	Soft skills	02	02	02	20	30	50

B.Sc. Sem. V
(From the Academic Year 2020-21)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UEX	Total
Core Course		Physics						
	P-61	Classical Electrodynamics	04	04	03	40	60	100
	P-62	Atomic and Molecular Physics	04	04	03	40	60	100
	P-63	Nuclear Physics	04	04	03	40	60	100
	P-64	Computational Physics	04	04	03	40	60	100
	P-65	Thermodynamics & Statistical Physics	04	04	03	40	60	100
	P-66	Practical Course – VIII	04	02	03	40	60	100
	P-67	Practical Course – IX	04	02	03	40	60	100
	P-68	Practical Course - X	04	02	03	40	60	100
Elective Course		Any one of the following.						
	P-69A	Renewable Energy sources	04	04	03	40	60	100
	P-69B	Physics of Nano Materials	04	04	03	40	60	100
	P-69C	Digital Electronics II	04	04	03	40	60	100
Core Course		Chemistry						
	C-61	Physical Chemistry-II	04	04	03	40	60	100
	C-62	Inorganic Chemistry-II	04	04	03	40	60	100
	C-63	Organic Chemistry-II	04	04	03	40	60	100
	C-64	Analytical Chemistry-II	04	04	03	40	60	100
	C-65	Industrial Chemistry-II	04	04	03	40	60	100
	C-66	Practical Course – VIII	04	02	03	40	60	100
	C-67	Practical Course – IX	04	02	03	40	60	100
	C-68	Practical Course - X	04	02	03	40	60	100
Elective Course		Any one of the following.						
	C-69A	Environment Chemistry-II	04	04	03	40	60	100
	C-69B	Nuclear Chemistry-II	04	04	03	40	60	100
	C-69C	Polymer Chemistry-II	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UEX	Total
Core Course		Botany						
	B –61	Biology of higher cryptogams (Bryophytes & Pteridophytes)	04	04	03	40	60	100
	B –62	Biology of seed plants (Gymnosperms & Paleobotany)	04	04	03	40	60	100
	B –63	Environmental Botany	04	04	03	40	60	100
	B –64	Palynology & Plant breeding	04	04	03	40	60	100
	B –65	Industrial botany II	04	04	03	40	60	100
	B-66	Practical Course – VIII	04	02	03	40	60	100
	B -67	Practical Course – IX	04	02	03	40	60	100
	B- 68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	B-69A	Horticulture & Gardening	04	04	03	40	60	100
	B-69B	Pharmacognosy	04	04	03	40	60	100
	B-69C	Seed Technology	04	04	03	40	60	100
Core Course		Zoology						
	Z – 61	General Embryology	04	04	03	40	60	100
	Z – 62	Toxicology	04	04	03	40	60	100
	Z – 63	Biological Techniques	04	04	03	40	60	100
	Z – 64	Functional Anatomy of Chordates-III	04	04	03	40	60	100
	Z – 65	Economic Entomology	04	04	03	40	60	100
	Z-66	Practical Course – VIII	04	02	03	40	60	100
	Z -67	Practical Course – IX	04	02	03	40	60	100
	Z - 68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	Z-69A	Biotechnology	04	04	03	40	60	100
	Z-69B	Biostatistics	04	04	03	40	60	100
	Z-69C	Biodiversity and wild Life	04	04	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UEX	Total
Core Course		Microbiology						
	MB-61	Chemotherapy and Biomedical Instrumentation.	04	04	03	40	60	100
	MB 62	Immunology	04	04	03	40	60	100
	MB 63	Biotechnology	04	04	03	40	60	100
	MB 64	Genetics of Eukaryotes and Gene Manipulation	04	04	03	40	60	100
	MB 65	Microbial Metabolism and Biochemical Evolution	04	04	03	40	60	100
	MB-66	Practical Course – VIII	04	02	03	40	60	100
	MB-67	Practical Course – IX	04	02	03	40	60	100
	MB-68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	MB-69A	Agricultural and Environmental Microbiology.	04	04	03	40	60	100
	MB-69B	Applied Microbiology-II	04	04	03	40	60	100
	MB-69C	Advanced Techniques in Microbiology-II	04	04	03	40	60	100
Core Course		Mathematics						
	M-61	Real Analysis- II	04	04	03	40	60	100
	M-62	Abstract Algebra – II	04	04	03	40	60	100
	M-63	Discrete Mathematics –II	04	04	03	40	60	100
	M-64	Differential Geometry-II	04	04	03	40	60	100
	M-65	Computer Programming and Applications –II	04	04	03	40	60	100
	M-66	Practical Course – VIII	04	02	03	40	60	100
	M-67	Practical Course – IX	04	02	03	40	60	100
	M- 68	Practical Course - X	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UEX	Total
Elective Course	Any one of the following.							
	M– 69A	Operation Research-II	04	04	03	40	60	100
	M – 69B	Mechanics(Dynamics)	04	04	03	40	60	100
	M – 69C	Special Functions-II	04	04	03	40	60	100
Core Course		Statistics						
	S-61	Distribution Theory - II	04	04	03	40	60	100
	S-62	Statistical Inference - II	04	04	03	40	60	100
	S-63	Sampling Methods and Design of Experiments-II	04	04	03	40	60	100
	S-64	Applied Statistics(A)-II	04	04	03	40	60	100
	S-65	Applied Statistics(B)-II	04	04	03	40	60	100
	S- 66	Practical Course – VIII	04	02	03	40	60	100
	S-67	Practical Course – IX	04	02	03	40	60	100
	S- 68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	S– 69A	Computer Programming. ‘C’ Programming (Turbo C)-II	04	04	03	40	60	100
	S- 69B	Principles of Computer Science-II	04	04	03	40	60	100
	S-69C	Medical Statistics	04	04	03	40	60	100
Core Course		Geography						
	G-61	World Regional Geography-II	04	04	03	40	60	100
	G-62	Geography of India-II	04	04	03	40	60	100
	G-63	Recourses and Environment-II	04	04	03	40	60	100
	G-64	Economic Geography-II	04	04	03	40	60	100
	G-65	Applied Geography-II	04	04	03	40	60	100
	G- 66	Practical Course – VIII	04	02	03	40	60	100
	G-67	Practical Course – IX	04	02	03	40	60	100
	G- 68	Practical Course - X	04	02	03	40	60	100

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment IA	University Examination UEX	Total
Elective Course	Any one of the following.							
	G - 69A	Geography of Water Resources-II	04	04	03	40	60	100
	G- 69B	Geography of Soils-II	04	04	03	40	60	100
	G- 69C	Population Geography-II	04	04	03	40	60	100
Core Course		Computer Application						
	CA-61	Operating System-II	03	03	03	40	60	100
	CA-62	Visual basic. Net programming-II	03	03	03	40	60	100
	CA-63	Software Engineering-II	03	03	03	40	60	100
	CA-64	Database Management System-II	03	03	03	40	60	100
	CA-65	Data and File structure-II	03	03	03	40	60	100
	CA 66	Practical Course-VIII	04	02	03	40	60	100
	CA-67	Practical Course-IX	04	02	03	40	60	100
	CA-68	Practical Course-X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	CA- 69A	Computer Networks-II	04	04	03	40	60	100
	CA- 69B	Internet Programming-II	04	04	03	40	60	100
	CA- 69C	Theoretical computer science-II	04	04	03	40	60	100

9. Scheme of Teaching:

Class	Subjects	Work Load / Week			
		Theory	Tutorial	Total	Practical
F.Y.B.Sc.	13	2	1	03	04
S.Y.B.Sc.	11	3	1	04	04
T.Y.B.Sc	10	3	1	04	04

10. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

11. UNIVERSITY TERMS:

The dates for the commencement and conclusion of the First and the Second terms shall be fixed by the University authorities. The terms can be kept by students, who have registered their names with the University.

12. SCHEME OF EXAMINATION:

The Assessment of Regular students of Bachelor of Science (B.Sc.) course in the academic session 2016-17 and thereafter shall be based on

- (a) University Examinations (UE),
- (b) Continuous Internal Assessment (IA),
- (c) Choice Based Credit System (CBCS), and
- (d) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average system (CGPA)

For each core and elective paper of 100 marks, there will be Continuous Internal Assessment of 40 marks and the University Examination of 60 marks/3 hours duration at the end of each semester. The 04 credit will be given to a student who secures at least 40% of marks allotted to each paper. A candidate who does not pass the examination in any subject or subjects in one semester will be permitted to reappear in such failed subject or subjects along with the papers of following semesters.

The Continuous Internal Assessment (IA) for each paper will be of 40 marks. The Continuous Internal Assessment may be in the forms as follows:

a) Attendance	10 Marks
b) Home Assignment/Tutorial/Test/Presentation	15 Marks
c) Mid Semester Examination	15 Marks

13. STANDARD OF PASSING:

For all courses, both UE and IA constitute separate heads of passing. In order to pass in such courses and to earn the assigned credits, a student must obtain a minimum grade point of 5.0 (40% marks) at UE and also a minimum grade point of 5.0 (40% marks) at IA.

Even a student fails in IA, he/she shall be declared 'pass' in the course provided he/she obtains a minimum of 25% in IA and GPA for the course is at least 6.0 (50% in aggregate). The GPA for a course will be calculated only if the student passes at the UE.

A student who fails at UE in a course has to reappear only at UE as a backlog candidate and clear the head of passing. Similarly, a student who fails in a course at IA has to reappear only at IA as a backlog candidate and clear the head of passing.

The 10-point scale Grades and Grade Points according to the following table.

Range of Marks (Out of 100)	Grade	Grade Point
$80 \leq \text{Marks} \leq 100$	O	10
$70 \leq \text{Marks} < 80$	A+	9
$60 \leq \text{Marks} < 70$	A	8
$55 \leq \text{Marks} < 60$	B+	7
$50 \leq \text{Marks} < 55$	B	6
$40 \leq \text{Marks} < 50$	C	5
Marks < 40	D	0

The performances at UE and IA will be combined to obtain the Grade Point Average (GPA) for the course. The weighteg for performance at UE and IA shall be 60% and 40% respectively.

GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to grade point, which will be the GPA

14. FORMULA TO CALCULATE GRADE POINTS (GP):

Suppose that 'Max' is the maximum marks assigned for an examination or evaluation based on which GP will be computed. In order to determine the GP, Set $x = \text{Max} / 10$ (since we have adapted 10-point system). Then GP is calculated by the formulas shown as below.

Range of Marks at the evaluation	Formula for the Grade Point
$8x \leq \text{Marks} \leq 10x$	10
$5.5x \leq \text{Marks} < 8x$	Truncate (Marks/x) +2
$4x \leq \text{Marks} < 5.5x$	Truncate (Marks/x) +1

Two kinds of performance indicators, namely, the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA) shall be computed at the end of each term. The SGPA measures the cumulative performance of a student in all the courses in a particular semester, while the CGPA measures the cumulative performance in all courses since his/her enrolment to the course. The CGPA of learner when he/she completes the programme is the final result of the learner.

The SGPA is calculated by the formula $\text{SGPA} = \frac{\sum C_k \times GP_k}{\sum C_k}$, where C_k is the credit-value assigned to a course and GP_k is the GPA obtained by the student in the course. In the above, the sum is taken over all the courses that the student has undertaken for the study during the semester, including those in which he/she might have failed or those for which he/ she remained absent. The SGPA shall be calculated up to two decimal place accuracy.

The CGPA is calculated by the formula $CGPA = \frac{\sum C_k \times GP_k}{\sum C_k}$, where C_k is the credit-value assigned to a course and GP_k is the GPA obtained by the student in the course. In the above, the sum is taken over all the courses that the student has undertaken for the study from the time of his/her enrolment to the course and also during the semester for which CGPA is calculated, including those in which he/she might have failed or those for which he/she remained absent. The CGPA shall be calculated up to two decimals place accuracy.

The Formula to compute equivalent percentage marks for specified CGPA:

% Marks (CGPA) =	$10 \times CGPA - 10$	if $5.00 \leq CGPA \leq 6.00$
	$5 \times CGPA + 20$	if $6.00 \leq CGPA \leq 8.00$
	$10 \times CGPA - 20$	if $8.00 \leq CGPA \leq 9.00$
	$20 \times CGPA - 110$	if $9.00 \leq CGPA \leq 9.50$
	$40 \times CGPA - 300$	if $9.50 \leq CGPA \leq 10.00$

15. AWARD OF HONOURS:

A student who has completed the minimum credits specified for the programme shall be declared to have passed in the programme. The final result will be in terms of letter grade only and is based on the CGPA of all courses studied and passed. The criteria for the award of honours are given below.

Range of CGPA	Equivalent Range of Marks (%)	Final Grade	Performance Descriptor	Final Class
$9.50 \leq CGPA \leq 10.00$	$80 \leq \text{Marks} \leq 100$	O	Outstanding	First Class with Distinction
$9.00 \leq CGPA \leq 9.49$	$70 \leq \text{Marks} < 80$	A+	Excellent	
$8.00 \leq CGPA \leq 8.99$	$60 \leq \text{Marks} < 70$	A	Very Good	First Class
$7.00 \leq CGPA \leq 7.99$	$55 \leq \text{Marks} < 60$	B+	Good	Higher Second Class
$6.00 \leq CGPA \leq 6.99$	$50 \leq \text{Marks} < 55$	B	Average	Second Class
$5.00 \leq CGPA \leq 5.99$	$40 \leq \text{Marks} < 50$	C	Satisfactory	Pass Class
CGPA Below 5.00	Marks Below 40	F	Fail	Fail

A candidate shall be permitted to precede further from the First Semester up to Fourth Semester irrespective of his/her failure in any of the Semester examinations subject to the condition that the candidates should register for all the backlog subjects of earlier semesters along with current (subsequent) semester subjects. However, he/she should have cleared all the papers at F.Y.B.Sc. Semester I & II when he/she is admitted to T.Y.B.Sc. Semester V.

16. GRACING:

The gracing shall be done as per existing rules of the University.

17. VERIFICATION AND REVALUATION:

There is provision for verification and revaluation of the result. A student can apply for the verification and revaluation of the result within two weeks from the declaration of the results with the prescribed fee. The verification and revaluation shall be done as per the existing rules of the University.

18. FORMAT OF THE TRANSCRIPT:

The student will be given a transcript indicating his/her performance at the end of every semester examination. The transcript shall be given as per the following table along with other necessary details:

Course No.	Course Name	No. of Credits	University Examination		Internal Assessment		Grade Point Average	Result
			Grade	Grade Point	Grade	Grade Point		
1								
2								
3								
4								
5								
6								
Total Cumulative Credits Completed			SGPA		CGPA		Equivalent Marks (%)	
<u>Note:</u> GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to Grade Point, which will be the GPA.								

19. GRADE/CLASS IMPROVEMENT SCHEME (GIS/CIS):

The rules regarding the improvement of the Grade/Class of B.Sc. course will be as per notification of Bharati Vidyapeeth University which is as follows:

1. The candidate who has passed UG and PG degree examinations of this university with the final grade/class as shown in column no. 1 and who desires to improve the grade/class as shown in column no. 2 below will be permitted at his/her option to appear for the same examination without being required to keep any terms.

Column no. 1	Column no. 2
Final grade: 'C' or 'B' or 'B+' or 'A' or 'A+' as the case may be	'B' or 'B+' or 'A' or 'A+' or 'O' as the case may be
OR	OR
Final class: 'Pass Class' or 'Second Class' or 'Higher Second Class' or 'First Class' as the case may be	'Second Class' or 'Higher Second Class' or 'First Class' or 'First Class with Distinction' as the case may be

2. For improvement of final grade/class, the candidate will be required to apply and allowed to appear only for the theory examinations.
3. A candidate shall have to reappear for minimum 1/3 and/or maximum of all the theory papers at a time, on which the final grade/class is awarded. Candidate should ensure that the examination time table for the subject he is appearing will not clash.

4. Performance of the candidates reappearing for the subject less than 1/3 of the total theory examinations mentioned above will not be considered. However, his/her appearance will be counted as an attempt.
5. If the candidate, who has reappeared for the final year examination under the provisions for his/her final grade/class, is successful in improving his/her final grade/class by such reappearance, he/she will have to surrender to the university the original degree and the grade sheet that he/she had obtained in that course/subject. Unless original degree and the grade sheet are returned to the university by the candidate, the new degree certificate and the grade sheet cannot be issued to the candidate. In the revised degree certificate/ grade sheet to be given to the candidate a mention will be made of the fact that he/she improved his/her grade/class under class improvement attempt.
6. A candidate appearing for the improvement of the final grade/class shall not be entitled to get benefit of any other rules/orders of the university regarding condonation /grace marks.
7. A candidate appearing for the improvement of the final grade/class shall not be entitled to get any prize/medal/scholarship/award etc.
8. A candidate who has reappeared for the above examination/s under the provision fails to improve his/her final grade/class; his/her performance at such reappearance at such reappearance shall be ignored.
9. If the candidate makes no improvement in the final grade/class, then earlier performance will be retained.
10. A candidate will be allowed to reappear for the examination for improvement of the final grade/class within a period of three years from the date of his/her passing the degree examination.
11. The candidate will be given maximum of three attempts for the improvement of his/her final grade/class.
12. The candidate who desires to apply for improvement of the final grade/class should submit his/her application form for improvement of the final grade/class from the College/School of Distance Education, Study Centre through which he/she has undergone the course. Form should be submitted for improvement before **31st August** for the October/November examination and **28th February** for April/May examination sessions. No form for improvement of the final grade/class shall be accepted after the prescribe dates for the respective/corresponding examination sessions.
13. Revised grade/class sheet will be issued with remark Under '**Grade/Class Improvement Scheme**' (GIS/CIS).

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F. Y. B. Sc. (CBCS – 2018 Course)
SEM. - I
P - 11: MECHANICS & PROPERTIES OF MATTER

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Basics of mechanics and related dynamics
- To understand Newton's laws of motion
- To know Kepler's laws
- Different forces those exist in nature and their physical significance
- Conservation of energy and their dynamics
- Deep knowledge of physical quantities such as Elasticity, Viscosity and Surface Tension
- Capacity to investigate and analyze the daily problems related to mechanical movement

Course Content:

1. NEWTON'S LAWS OF MOTION:

Revision of Laws of motion, Various types of forces in nature (explanation) and concept of field, Equation of motion of a particle with different form of forces, Frame of reference (Inertial, Noninertial), Pseudo Forces (e.g. Centrifugal Force), Kepler's laws (only statements)

2. MECHANICS OF PARTICLES

Kinetic Energy of particle in translational and rotational motion, Work and Work-Energy Theorem, Calculation of Work done with Constant Force, Variable Force with Illustration, Conservative and Non-conservative Forces, Potential energy and conservation of Mechanical energy, Mass-energy equivalence,

3. ELASTICITY

Revision of stress, strain and Hook's law, Poisson's ratio, its limiting values, Elastic constant for isotropic solid, Relation between Young modulus, Bulk Modulus and Modulus of elasticity (without derivation), Torsion of a cylinder (wire) and Torsional rigidity, To determine it by torsional oscillations, Bending of beam, Bending moment and shear force, bending equation, Cantilever: Beam supported at both the ends and loaded at the centre (double cantilever)

4. VISCOSITY

Revision of Viscosity, Viscous fields and viscous force, Streamline flow and turbulent flow, streamline flow of liquid through capillary tube: Poiseuille's equation, Comparison of viscosities of liquids by Ostwald's viscometer. Effect of temperature on viscosity, Study of variation of viscosity with temperature, Bernoulli's Principle (Without Proof), Application of Bernoulli's equation i) Speed of Efflux, ii) Ventury meter, iii) Aspirator Pump, iv) Change of plane of motion of a spinning ball.

5. SURFACE TENSION

Revision of Surface tension, angle contact, concept of surface tension as surface energy, surface tension by Jaeger's method, Ferguson method, Factors affecting surface tension, Applications of surface tension.

TEXT AND REFERENCE BOOKS

1. R. P. Feynman, R. B. Leighton M. Sands, " The Feynman Lectures on Physics" Vol. I (B. 1. publications, Bombay, Delhi, Calcutta, Madras).
2. Problems in Physics: P.K. Srivastava, Wiley Eastern Ltd
3. D. S. Mathur " General Properties of Matter" (Shamlal Charitable Trust, New Delhi)
4. D. Halliday and R. Resnik, " Physics Part V.
5. B. Gupta, College Physics Volume 1, Book's and Allied (P) Ltd.
6. H.C. Varma, "Concept of Physics", (Bharati Bhavan Publisher)
7. Properties of Matter: D. S. Mathur, Shamlal Charitable Trust New Delhi
8. Mechanics: D.S Mathur, S Chand and Company New Delhi-5.

F. Y. B. Sc. (CBCS – 2018 Course)

SEM. – I

P-12: MODERN PHYSICS

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of atomic and nuclei structures as well as their history
- Properties of electromagnetic waves and their dynamics.
- Use of electromagnetic wave spectrum and associated breakthrough research such as Planck's hypothesis
- Student will be able to understand how technological equipment uses electromagnetic waves and has various applications in our day to day life.
- Understanding of how LASER works, what Physics is associated with it and various applications of LASER
- Ability to explain molecular Physics and underlying basic concepts.
- Understanding of renewable energy sources and application of solar cell and their various application

Course Content:

1. ATOMS AND NUCLEI

Bohr's hydrogen atomic Model (revision), Bohr's correspondence principle, discovery of neutron, Frank and Hertz experiment, Composition of nucleus, concept of mass defect and binding energy with curve, packing fraction

2. ELECTROMAGNETIC WAVES

Prospective of electromagnetic waves with characteristics, electromagnetic spectrum, Planks hypothesis of photons, electromagnetic waves: Radio waves, Microwave, Infrared, Visible light, Ultraviolet, X-rays and Gamma rays with properties, Applications: microwave oven, RADAR, Pyroelectric thermometer, X-ray radiography and CT scan.

3. LASER

Introduction to Lasers, properties of laser, principle with absorption, spontaneous emission and stimulated emission, optical pumping, population inversion, laser action and applications

4. PHYSICS OF MOLECULES

Bonding mechanism: A Survey of Ionic bond, Covalent bonds, Van der Waals bonds, Metallic bonds and Hydrogen bond, Concept of electrostatic potential with potential energy, Variation of potential energy with inter-atomic distance

5. RENEWABLE ENERGY SOURCES

Need and importance of energy sources, Different Renewable energy sources, Solar energy as a principle source, solar cell: Photovoltaic principle, construction and working of solar cell, I-V characteristics, Fill factor, efficiency of solar cell and applications.

Text and reference books

1. J. B. Rajan, "Atomic Physics"
2. A. Beiser, "Prospective of Modern Physics"
3. H. S. Mani and G. K. Mehata, "Introduction to Modern Physics"
4. F. K. Richtmayer, "Modern Physics"
5. S. P. Sukhatme, "Solar Energy"
6. D. O. Hall and R. P. Overend, "Biomass-Renewable energy"
7. S.K.Kulkarni, Nanotechnology: Principles and Practices

F. Y. B. Sc. (CBCS – 2018 Course)
SEM. - I
P - 13: Practical Course -I

Total Credits: 02

Learning Outcome :

By the end of this course student will be able to have following learning outcomes,

1. Study of basic instruments like Vernier caliper, micrometer screw gauge, traveling microscope, spectrometer etc..
2. Study of Surface tension and viscosity.
3. Measurement of moment of inertia and modulus of rigidity
4. To understand kirchoff's laws and measurement of capacity of condenser
5. To know diode characteristic and vector diagram of L-R circuit

Course Content:

1. Basic study of instruments (Vernier caliper, micrometer screw gauge, traveling microscope, spectrometer etc.) with least count, error analysis and range
2. Viscosity by flow through capillary tube (Poiseuille's method)
3. M. I. of disc by Torsional oscillations and η - by torsional pendulum
4. M.I. of Flywheel
5. Poisson's ratio by rubber and cord method
6. Surface tension of water by Jaeger's method
7. Verification of Kirchoff's laws
8. Charging and discharging of condenser
9. Vector diagram of L-R circuit and power factor
10. Study of inductive reactance
11. Diode characteristics
12. Study of Analog/digital multi-meter
13. Comparison of capacitances (De-Sauty's method)

Note: Any eight (8) experiments should be performed.

Text and reference books:

1. B. L. Worsnop and H. T. Flint, " Advanced Practical in Physics"
2. D. P. Khandewal, " Laboratory manual for Physics for Undergraduate students"
3. B. Saraf, " Physics through experiments, vol. II

F. Y. B.Sc. (CBCS-2018 COURSE)
SEMESTER – I
C-11: PHYSICAL & INORGANIC CHEMISTRY-I
Total Credits: 03 **Total Lectures: 45**

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the kinetics of various chemical reactions.
2. Apply the concept of distribution law to different chemical processes.
1. 3 Know the applications of differential calculus and integral calculus.
2. 4. Understand units of concentrations w.r.t. primary and secondary standards.
6. Find out oxidation state and use it in problem solving.

Course Content:

SECTION – I (PHYSICAL CHEMISTRY)

1. Chemical Kinetics

Chemical kinetics and its scopes, Measurement of Reaction rate, Order and Molecularity of reaction, First Order Reactions, Properties of first order reactions, Examples of first order reactions.

Second order reactions, Properties of second order of reactions, examples of second order reactions.

Third order reactions, Properties of third order reactions, Pseudo- unimolecular reactions. Numericals.

Ref. 8 Page No. 548-564

2. Distribution Law

Introduction, Nerst distribution law, statement and thermodynamic proof for Nerst distribution law, limitations of distribution law, Association and dissociation of solute in solvent, Application of distribution law, Numericals.

Ref. 10 Page No. 743-772

3. Basics of Chemical Mathematics

Logarithms: Definition and rules of logarithms without derivation, Application of logarithm to pH, pOH, pK and solving numerical problems.

Graphical Representation: Equation of straight line, Plotting of graph, Meaning and significance of slope and intercept, Plotting of graph using chemical equations.

Differentiation: Definition and meaning of derivative, Rules of differentiation and partial differentiation pertaining to algebraic, logarithmic and exponential functions without proof, examples related to chemistry.

Integration: Rules of integration pertaining to algebraic and exponential functions without proof, examples related to chemistry.

Ref. 11 Page No. 93-187

REFERENCES:

1. Physical Chemistry by G. M. Barrow
Fifth Edition (McGraw-Hill) (2007)
2. Physical Chemistry by Robert G Mortimer
Third Edition, Elsevier (2008)
3. Physical Chemistry by Atkins and Paula
8th Edition (2008)
4. College Chemistry by Barua, Bijoy and Y. R. Sharma
Kalyani Publishers (1995)
5. Principles of Physical Chemistry by Puri, Sharma and Pathania, Vishal publishing Company (2008)
6. Physical Chemistry by Dr. S. Pahari
New Central book agency (P) Ltd. (2007)
7. Physical Chemistry by Ira N. Levine
Fifth Edition Tata McGraw-Hill (2004)
8. Principles of Physical Chemistry by Maron and Prutton
4th Edition (2008)
Oxford IBM Publishing Co. Pvt. Ltd.
9. Advanced Physical Chemistry by D. N. Bajpai
S. Chand (2011)
10. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl and
G. D. Tuli
S. Chand (2012)
11. The Chemistry of Maths Book by Erich Steiner,
Oxford University Press, 2nd edition, Reprint (2011)
12. Physical chemistry N. Kundu and S.K.Jain,S.Chand & company Ltd New Delhi.
First edition 1984, reprint 1990
13. Physical Chemistry, A Molecular approach.Donald A. Mc Quarrie and John D.Simon, Published by University Science Books CA, USA.First edition 1998, reprint 2006

SECTION – II (INORGANIC CHEMISTRY)

1. Mole Concept and Stoichiometry

Mole concept-Determination of mol. Weight by gram molecular volume relationship, problems based on mole concept. Methods of expressing concentrations, strength, normality, molarity, molality, %w/v, %v/v, ppm, standardization of solutions, primary & secondary standard substances, Preparation of standard solution of acids & bases, problems related to acid base titrations only.

[Ref. 1,2]

2. Oxidation & reduction

Definitions of the related terms like oxidation, reduction, oxidizing agent, reducing agent, oxidation number, Balancing of redox reactions using oxidation number method & ion electron method, problems based one equivalent weight of oxidant & reluctant.

[Ref.1,2]

REFERENCES:

1. General Chemistry - Raymond Chang, Kenneth A. Goldsby, McGraw-Hill ; 11th edition (2012)
2. General and Inorganic Chemistry, R.P. Sarkar, Part-I, New Central book agency LTD, London, Third Edn (2011), P 383-461.

F. Y. B.Sc. (CBCS-2018 COURSE)
SEMESTER - I
C-12: ORGANIC & INORGANIC CHEMISTRY-I
Total Credits: 03 **Total Lectures: 45**

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the Structural effects , types of organic reaction and meaning of electrophiles & nucleophiles.
2. Write generation, structure, stability and reactions of carbocations, carbanions& free radicals.
3. Explain theHuckel's rule, Reactions and mechanism of Nitration, Sulphonation, Halogenation and Friedel – craft reactions.
4. Know synthesis and reactions of Aldehydes & ketones.
5. Describe periodic table, properties, compounds and applications of S-block elements.

Course Content:

SECTION – I (ORGANIC CHEMISTRY)

1) INTRODUCTION TO ORGANIC CHEMISTRY

Development of Organic Chemistry: -

Unique properties of organic compounds, sources of organic compounds and applications of organic compounds.

Structural effects: -

Inductive, Resonance, Hyper conjugative and steric effects and their effects on strength of acids and bases.

Bond fission: -

Homolysis & Heterolysis.

Types of Organic Reaction: -

Substitution, Addition, Elimination and Rearrangement with one example of each.

Types of Reagents: -

Electrophilic and Nucleophilic reagents (Definition & examples)

[Ref. 3, Pages 18-25.]

2) FUNDAMENTALS OF ORGANIC REACTION MECHANISM

Reactive Intermediates:

Carbocation : Introduction, generation, structure, stability, elimination of a proton, reaction with neucleophiles, addition to unsaturated compounds and molecular rearrangement.

Carbanions: Introduction, generation, structure, stability, reactions-, displacement and rearrangement.

Free Radicals: Introduction, generation-photolysis, thermolysis and redox Reaction, stability, reaction - recombination, disproportionate, reaction with olefins and rearrangements.

[Ref. 4, Pages. 78 – 121]

3) AROMATIC COMPOUNDS

Aliphatic and Aromatic Compounds, Structure of Benzene, Kekule's structure, stability of benzene, Aromatic character, Huckel's rule, Reactions and mechanism of Nitration, Sulphonation, Halogenation and Friedel – craft reaction.

[Ref. 1, Pages 209-216.]

4) ALDEHYDES AND KETONES

Synthesis of Aldehydes:- From alcohols, methyl benzenes, acid chlorides and phenols. Synthesis of ketones from alcohols, carboxylic acids, acid chlorides & nitriles.

(i) Grignard reagent

(ii) Wittig reaction

(iii) Reduction reactions – Catalytic reduction, LiAlH_4 , NaBH_4 , Clemmensen, Wolf – Kishner.

(iv) Cannizzaro's reaction (v) Perkins reaction (vi) Aldol Condensation

(vii) Analysis of aldehydes and ketones.

[Ref. 1, Pages 291-236.]

REFERENCES:

1. Organic Chemistry (Sixth Edition) by Robert Morrison and Robert Boyd. Prentice Hall of India Pvt. Ltd. New Delhi (1989).
2. Guide book to mechanism in organic chemistry (Sixth Edition) by Peter Sykes, Orient Longman (1981).
3. Organic Chemistry by Francies A. Carey (Sixth Edition), McGraw Hill book Company (1987).
4. Organic Reaction Mechanism (Third edition), by V.K. Ahluwalia, Narosa publishing house, Mumbai.
5. Textbook of Organic Chemistry (Fifth Edition) by Raj K. Bansal - New Age International (P) Ltd. Publishers, Mumbai (2007)

SECTION – II (INORGANIC CHEMISTRY)

1. Chemistry of s-block Elements

Recapitulation of periodic table, special position of hydrogen in the long form of the periodic table, properties of s-block elements w.r.t. electronic configuration, extraction, trends and properties, Introduction to crown ethers and cryptans, separation of s-block elements using crown ethers, Compounds of s-block elements: oxides, hydroxides, peroxides, superoxides.

Application of s-block elements in industrial, biological and agricultural fields.

[Ref. 1,2,3]

REFERENCES:

1. Concise Inorganic Chemistry-J.D. Lee, Wiley- India 5th Edition (Reprint 2009), Chapter 8, P 241-242, Chapter-9, P 276-324, Chapter-11, 326-356.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, P.L. Gaus, Wiley- India 3rd Edition, (Reprint 2008), P 273-287, 288-307.
3. Concept & model of Inorganic Chemistry-B.E. Douglas D.H. Mc Doniels, Wiley, 3rd Edn (1994), p 8-32.

F. Y. B.Sc. (CBCS-2018 COURSE)
SEMESTER – I
C-13 : PRACTICAL COURSE - I

Total Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Determine the heat of solution of Potassium nitrate/Ammonium Chloride
2. Find out the relative viscosity of the liquids.
3. Study heat of neutralization and heat of ionization.
4. Perform Qualitative Analysis of Inorganic Mixture containing two basic and two acidic radicals.
5. Preparation of Inorganic compounds

Course Content:

PHYSICAL CHEMISTRY EXPERIMENTS (Any 2)

1. Instructions in first-aid and safety measures in the laboratory.
2. Determine the heat of solution of the salt, Potassium nitrate/Ammonium Chloride.
3. Determine the relative viscosity of the liquids A and B. hence find by graphical method, the percentage composition of A and B in the given unknown mixture C, using viscosity data.
4. Determination of heat of neutralization and heat of ionization.

REFERENCES:

1. Systematic Experimental Physical Chemistry by Rajbhoj and Chondhekar, Anjali Publication. 1st Edition, 1990.
2. Experiments in Chemistry by D.V. Jahagirdar, Himalaya Publishing House. Rerprint (2013).

INORGANIC CHEMISTRY EXPERIMENTS

Qualitative Analysis: (Three mixtures)

A) Qualitative Analysis of Inorganic Mixture containing two basic and two acidic radicals (other than phosphates & borates)

B) Inorganic Preparation (Any One)

- i) Preparation of tris ethylenediaminenickel (II) thiosulphate $[\text{Ni}(\text{en})_3]\text{S}_2\text{O}_3$
- ii) Preparation of Tetrammine Copper (II) sulphate monohydrate

REFERENCES:

- 1) Inorganic Qualitative Analysis.- by A.I. Vogel, 7th Edition, Pearson Education (2002)
- 2) Inorganic Quantitative Analysis. - by A.I. Vogel, 6th Edition Prentice Hall; (April 7, 2000)

ORGANIC CHEMISTRY EXPERIMENTS

A) Organic preparations: (Any one)

- (i) Aspirin from salicylic acid.
- (ii) Phthalimide from Phthalic anhydride.

B) Qualitative Analysis: (Any Three)

Detection of type, elements, functional group and M.P. /B.P. of an organic compound.

The 3 compounds analyzed are to be selected from:

- a) Acids: - Benzoic acid, salicylic acid, oxalic acid & Cinnamic acid.
- b) Phenols: - a - Naphthol & b - Naphthol
- c) Bases: - P – Toluidine, Aniline, & m – Nitroaniline.
- d) Neutrals: - m – dinitrobenzene, Acetanilide, Acetone, Nitrobenzene.

REFERENCES:

- 1) Organic qualitative analysis by A.I. Vogel, (Fourth Edition), Longman group Ltd., England (1996)
- 2) Laboratory Manual of Organic Chemistry by R.K. Bansal, (Second Edition), Wiley Eastern Ltd., New Delhi (1990)

F.Y. B.Sc. (C.B.C.S. 2018 Course)

SEMESTER-I

**B-11: PLANT DIVERSITY AND UTILIZATION OF PLANTS-I
(ALGAE, FUNGI, BRYOPHYTA & PTERIDOPHYTA)**

Core Course – Theory; Credits- 03

Total lectures- 45 L

Learning outcomes:

On completion of this course, the students will be able to:

1. Learn about the importance of the plant diversity of cryptogams.
2. Know about the economic importance of algae, fungi, lichen and pteridophytes.
3. Understand evolutionary trends among non-flowering plants.
4. Understand and study detail about various types of algae, fungi, lichen and pteridophytes
5. Conceptualize the role of plants in human welfare with special reference to India.

Course Content:

Algae

09L

Unit- I General characters diversity in habitat, forms and classification of algae as per F.E. Fritsch (1935),

Unit- II 1 Economic importance and salient features of the following divisions.

- a. Chlorophyta – e.g. *Chlorella*, *Oedogonium*.
 - b. Xanthophyta – e.g. *Vaucheria*
 - c. Phaeophyta – e.g. *Sargassum*
 - d. Rhodophyta – e.g. *Batrachospermum*
 - e. Cyanophyta – e.g. *Nostoc*, *Oscillatoria*
2. Study of life history of *Sargassum*.

Unit- III Utilization of algae in the manufacture of industrial products.

02 L

2. Fungi

09 L

Unit- I General characters & classification as per Alexopoulos & Mims (1979);

Unit- II 1.Economic importance and important features of the following divisions.

- a. Mastigomycotina – e.g. *Albugo*.
 - b. Zygomycotina – e.g. *Mucor*
 - c. Ascomycotina - e.g. *Aspergillus*.
 - d. Basidiomycotina - e.g. *Agaricus*
 - e. Deuteromycetes – e.g. *Cercospora*.
2. Study of life history of *Aspergillus*..

Unit- III Utilization of fungi in the manufacture of industrial products.

02 L

3. Lichens – General account, forms and economic importance.

02 L

4. Bryophyte

09 L

Unit- I General characters and classification (as per Parihar N.S.)

Unit- II 1.Occurrence, thallus structure, reproduction, economics importance of the following divisions.

- a. Hepaticopsida – e.g. *Riccia*.
- b. Anthocerotopsida – e.g. *Anthoceros*.
- c. Bryopsida – e.g. *Funaria*
2. Study of life history of *Funaria*.

Unit- III Utilization of bryophyta in the manufacture of industrial products.

02 L

5. Pteridophyt

08 L

Unit- I Salient features, classification (as per Parihar N.S.)

Unit- II 1.Comparative study of morphology, reproduction and stellar evolution of the following classes.

- a) Psilopsida– e.g. *Psilotum*
- b) Lycopsida – e.g. *Selaginella*
- c) Sphenopsida– e.g. *Equisetum*
- d) Pteropsida– e.g. *Adiantum*

2. Life history of *Selaginella*.

Unit- III Utilization of Pteridophyta in the manufacture of industrial products.

02 L

Note: Development of sex organs not expected for all above mentioned types.

Reference books:

1. Bold, H.C., Alexopoulos, C.J. and Delevoryas, T. 1980. Morphology of plants and fungi (4th Edition). Harper and Foul Co., New York.
2. Dube, H.C.1990. An Introduction of fungi. Vikas Publishing House Ltd., Delhi.
3. Gifford, E.M.and Foster, A.S.1989.Morphology and Evolution of Vascular Plants. W.H.Freeman&Co., New York.
4. Gilbert,M.S. 1985. Cryptogamic Botany, Vol.I&II (2nd Edition).Tata McGraw Hill Publishing Co.Ltd., New Delhi.
5. Kumar, H.D.1988. Introductory Phycology.Affiliated East-West Press Ltd., New York.
6. Puri, P.1985. Bryophytes.Atmaram& Sons, Delhi, Lucknow.

7. Parihar, N.S. 1991 Bryophyta. Central Book Depot. Allabad.
8. Parihar, N.S. 1996. Biology & Morphology of pteridophytes. B.I. Publishing pvt. Ltd.
9. E.J. Butler. 2008. The fungi of India. Biotech Book, Delhi.
10. K.S. Bilgrami and R.N. Verma. 2011. Physiology of fungi. Scientific Publisher India.
11. G. Jahir Hussain. 2011. Microbiology fungi and plant pathology. RBSA. Publishers.
12. A.V.S.S. Sambamurthy. Text book of Algae. I.K. International .2006.

F.Y.B.Sc. (C.B.C.S. 2018 Course)
SEMESTER-I
B-12: CELL BIOLOGY

Core Course – Theory; Credits- 03

Total lectures- 45 L

Learning outcomes

On completion of this course, the students will be able to:

1. Understand the structure of cell organelle in relation to the functional aspects.
2. Understand the difference between prokaryotic and eukaryotic cells.
3. Understand and study detail cell division and cell cycle.
4. Study the details of the plant cell wall, cytosol and cytoplasmic organelles.
5. Understand the properties of nucleic acids (DNA & RNA).

Course Content:

1. The Cell

6L

Historical background; cell theory; kingdom-wise cell structure; viroids and prions; comparative account of prokaryotic and eukaryotic cell.

2. Cell division and its regulation

10 L

Mitosis and meiosis – historical perspective and significance; various stages of cell division progression; cytokinesis; role of centromere, kinetochore and spindle apparatus; animal and plant cell cycle ; mechanisms of cell cycle control; apoptosi

3. Nucleus and ribosome

8 L

Ultra structure; nuclear envelope and nuclear pore complex; nuclear matrix and nucleoplasm; DNA and histones; nucleosome and higher level of organization; centromere and telomeres; ribosome structure; prokaryotic, eukaryotic and organelle ribosomes and their functional significance.

4. Mitochondrion and chloroplast

7 L

Origin of organelles; organelle structure and biogenesis; organelle membrane and organization of macromolecular complexes; organelle genome organization.

5. Structure / function of other sub-cellular structures

7 L

Golgi complex; endoplasmic reticulum ; lysosome; microbodies- peroxisomes and glyoxysomes; cytoskeleton.

6. Cell wall and cell membrane

7 L

Origin, ultra structure, chemical constituents and functions of cell wall; models of cell membrane organization; role of various membrane proteins, lipids and carbohydrates; role of ion channels and pumps in cellular transport and signaling.

Reference books:

1. Alberts, B., Bray, Lewis, J., Raff, M., Roberts, K. and Watson, J.D. 1999. Molecular Biology of Cell. Garland Publishing Co., Inc., New York, USA.
2. Avers, C.J. 1986. Molecular Cell Biology. Addison- Wesley Publishing, Massachusetts, USA.
3. Campbell, M.K. 1999. Biochemistry (3rd Edition). Saunders College Publishing, Philadelphia, USA.
4. Gupta, P.K. 1999. A Text –book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
5. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd Edition). Harper Collins College Publishers, New York, USA.
6. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4th Edition). W.H. Freeman and Co., New York, USA.
7. Nelson, D.L. and Cox, M.M. 2000. Lehninger Principles of Biochemistry (3rd Edition). Worth Publishers, New York, USA.
8. Rawn, D.J. 1989. Biochemistry. Neil Patterson Publishers, North Carolina, USA.
9. Stryer, L. 1995. Biochemistry. W.H. Freeman and Co., New York, USA.

F.Y.B.Sc. (BOTANY) (C.B.C.S. 2018 Course)
B-I: PRACTICAL COURSE-I
(PLANT DIVERSITY AND UTILIZATION OF PLANTS-I AND II)
Core Course – Theory; Credits- 02

Learning Outcome :

1. Study of algal diversity w.r.t Systematic position and morphology.
2. Study of Life cycle of *Spirogyra* and *Sargassum*.
3. Students will learn to identify the plants with their systematic position
4. Know botanical source/s, characteristics and utilities of Plants/ plant products.
5. Training students to prepare micropreparation and showing the stages of mitosis (Onion root tips) and showing permanent slides/photographs of mitosis and meiosis .
6. Know the Economic Importance of Fungi.
7. Understand the features of Lichens.
8. Understand the habit of the angiosperm plant body. Know the vegetative characteristics of the plant. Learn about the reproductive characteristics of the plant. Understand the plant morphology.

Course Content:

1. Study of Algae with the help of permanent slides / material of the following types. 1P(D)
e.g. *Chlorella*, *Vaucheria*
e.g. *Volvox*, *Hydrodictyon*, *Batrachospermum*
2. Study of Life history of *Sargassum* 1P
3. Study of Fungi with the help of permanent slides /material of of the following types. 1P D)
e.g. *Mucor* Yeast, *Albugo*, *Penicillium*, *Aspergillus*, *Puccinia*, *Agaricus* .
4. Study of life history of *Cystopus* 1 P
5. Study of Lichens - forms with suitable examples, *Usnea* – apothecium - T.S. 1 P
6. Study of Bryophyta - morphology, reproductive structures in of the following types. 1P D
e.g. *Marchantia*, *Anthoceros* and *Funaria*.
7. Study of life history of *Funaria*. 1 P
8. To demonstrate production of algal biomass (SCP) by culturing *Spirulina* at Laboratory level 1 P
9. Study of movement of protoplasm in *Hydrilla* and *Tradescantia* 1 P
10. Study of various stages of mitosis and meiosis using root tips and flower buds of onion. 2P
11. Demonstration: Use of yeast in bakery industry. 1 P

ANGIOSPERMS

12-16. A Study of representative members of the following families

i) Brassicaceae	1 P
ii) Papilionaceae	1P
iii) Malvaceae	1P
iv) Rubiaceae	1 P
v) Liliaceae	1 P

F. Y. B.Sc. (CBCS - 2018 Course)

SEMESTER I

Z 11: Animal systematic and Functional Anatomy of Non-chordates - I

Total Credit: 03

Total lectures: 45

Course Outcomes:

On completion of the course, students are able to:

1. Love and understand the fascinating world of invertebrates.
2. Understand and study the animal kingdom and principles of classification of animals, Binomial Nomenclature and five kingdom approach.
3. Understand and study of *Paramecium* w.r.to systematic position, morphology, nutrition and reproduction.
4. Understand systematic position external morphology of non-chordate animals like cockroach and earthworm.
5. Understand the various internal systems like digestive system, nervous system, reproductive system and sense organ -eye of cockroach with the help of charts, models.
6. Understand the various internal systems like digestive system, nervous system, reproductive system of earthworm with the help of charts, models.

Course Content

UNIT I

1. Principles of classification

- i) Importance of classification
- ii) Binomial nomenclature
- iii) Five kingdom approach

2. Study of *Paramecium*

- i) Systematic position, habits and habitat
- ii) General morphology
- iii) Nutrition
- iv) Reproduction (Binary fission and conjugation)

UNIT II

3. Study of *Earthworm*

- i) Systematic position and external morphology
- ii) Digestive system
- iii) Circulatory system
- iv) Excretory system
- v) Nervous system
- vi) Reproductive system

UNIT III

4. Study of Cockroach

- i) Systematic position and external characters
- ii) Digestive system
- iii) Respiratory system -Thoracic spiracle and Abdominal spiracle structure and function
- iv) Excretory system - Malpighian tubules and physiology of excretion
- v) Nervous system - Central nervous system and Photoreceptor organ
- vi) Reproductive system - Sexual dimorphism, male and female reproductive system.

Reference Books

1. Text book of zoology Invertebrates Vol.1 (1992) - Parker andHaswell.
2. Invertebrate Zoology (1983) - E.L.Jordan and P.S.Verma
3. Modern text book of Zoology – Invertebrate - Kotpal, Agarwal and Khetarpal.
4. Invertebrate structure and function - Barrington.
5. College Zoology - Boolootin and stiles.
6. A manual of Zoology, part-I: Invertebrate - EkambernathIyer.
7. Text book of Zoology Invertebrates - Marshall and Williams.
8. Biology of Non-chordates - Nigam.
9. A life of invertebrate - Russel Hunter.
10. Zoology, Non-chordates - Marathe, Agarkar and Joshi
12. Protozoa, Mollusca and Arthropoda.- R.L. Kotpal
13. InvertebrateZoology- Barnes.
14. A manual of practical Zoology Invertebrates - P.S.Verma.

F. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER I

Z 12 :Cell Biology and Genetics

TotalCredits- 03

Total lectures : 45

Course Outcomes:

On completion of the course, students are able to:

1. Understand the scope of cell biology because cell is the basic unit of life.
2. Understand the main distinguishing characters of plant cell and animal cell.
3. Able to differentiate between prokaryotes and eukaryotes.
4. Study and understand the cell organelles with their structure and function.
5. Explain Mendelism expanding Mendel's Laws.
6. Understand the basic concepts of Mendelian genetics, its variations and applications.
7. Study and understand structure of chromosome, chromosomal abnormalities.
8. Gain knowledge about applications of genetics.

Course Content

UNIT I - Cell Biology

1. Introduction to cell Biology

- i. Definition and scope
- ii. General cell structure – Prokaryotic and Eukaryotic cell

2. Ultrastructure and Functions of

- i. Nucleus
- ii. Plasma membrane (Fluid Mosaic model)
- iii. Mitochondria
- iv. Lysosomes
- v. Ribosomes
- vi. Golgi complex
- vii. Endoplasmic reticulum
- viii. Cytoskeleton – Microtubules & Microfilaments

UNIT II - Genetics

3. Introduction to genetics

- i. Mendelian inheritance
 - a) Monohybrid cross
 - b) Dihybrid cross
- ii. Multiple Alleles
 - a) ABO blood group system and its importance
- iii. Incomplete dominance, Co-dominance

4. Chromosomes

- i. Morphology and composition
- ii. Classification
- iii. Types (Autosomes and sex chromosomes)
- iv. Aberrations – numerical and structural changes

5. Introduction to Human genetics

- i. Syndromes
 - a) Autosomal – Down's (Mangolism), Cri-du-chat.
 - b) Sex chromosomal abnormalities in man – Klinefelter and Turner's syndrome

6. Application of genetics

- i. Genetic counselling
- ii. Eugenics

Reference books :

1. Cell and Molecular Biology By De Robertis, EDP. And De Robertis EME, Molt Saunders Inc.
2. Cell Biology By Pawar, CB, Himalaya Publication House
3. Cell and Molecular Biology By Dupraw I, Academic Press, New York
4. Cell Biology By Avers, CJ., Addison Wesley Pub. Co. New York and London
5. Genetics By Verma, PS. And Agarwal VK., S. Chand and Co., New Delhi
6. Genetics By Gupta PK., Rastogi Publication, Meerut
7. Genetics By Sarin, C., Tata McGraw Hill, New Dehi
8. Cell Biology, Genetics, Evolution and Ecology By Verma, PS. And Agarwal S. Chand and Co., New Delhi

F. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER I
Z 13 : Zoology Practical course –I
(Practical based on paper: Z-11, Z-12)

Total Credits: 02

Contact hours per practical – 04 h

Course Outcomes:

On completion of the course, students are able to:

1. Study and understand the classification of whole phyla from protozoa to Annelida with the help of charts/ models/ pictures.
2. Study of *Paramecium* with the help of slides.
3. Understand the various internal systems like digestive system, nervous system, reproductive system, respiratory organs of cockroach with the help of charts.
4. Understand the various internal systems like digestive system, nervous system, reproductive system, respiratory organs of earthworm with the help of charts.
5. Study and understand prokaryotes and eukaryotes with the help of photographs.
6. Study and understand the animal cell with the help of photograph.
7. Study and understand various cell organelles by using microphotographs.
8. Understand genetics through genetic examples based on monohybrid ratio, dihybrid ratio and multiple alleles.
9. Study of characters of syndromes.

Course Content

1. Study of general and distinguishing characters and classification of non-chordates upto class level with one example of each class. **D**
 - a. Protozoa
 - b. Porifera
 - c. Coelentrata
 - d. Platyhelminthes
 - e. Aschelminthes
 - f. Annelida
2. Study of systematic position, external features, binary fission and conjugation of *paramecium*. **D**
3. Study of external characters and Digestive system of Earthworm. **E**
4. Study of Nervous system of Earthworm. **E**
5. Mounting of Earthworm- Septal nephridium, setae and spermatheca. **E**
6. Study of systematic position, external characters and digestive system of Cockroach. **E**
7. Study of Nervous system of Cockroach. **E**
8. Mounting of Cockroach - Gizzard, salivary glands, mouthparts, Trachea, spiracles. **E**
9. Study of prokaryotic and eukaryotic cell with the help of suitable material. **D**
10. Study of any 3- cell organelles with the help of suitable material. **D**

11. Examples in Genetics: **E**
Examples based on Monohybrid cross, Dihybrid cross & Multiple alleles (At least 10 examples must be solved).
12. Study of characters of syndromes – Down's, Klinefelter's & Turner's Syndrome. **E**

Study Tour:

Compulsory visit to large water body / Biodiversity spot / ZSI / Any project

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

***E** – Experiments

***D** – Demonstration Practical

Reference books:

1. A manual of practical zoology Invertebrates : P. S. Verma
2. A manual of practical zoology Non Chordata Vol. 1 : P. K. G. Nair and K. P. Achar
3. Practical Zoology, Invertebrates : S.S. Lal
4. Practical Invertebrates Zoology : Agarwal.
5. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata : Rastogi Publications
6. Cell and Molecular Biology De Robertis, E.D.P. and E.M.F. De Robertis 1987
7. Genetics: Verma, P.S. and V.K. Agarwal. 1997. S.Chand & Co.
8. Genetics : Gupta P.K. 1995-96, Rastogi Publications

F. Y. B. Sc. (CBCS – 2018 course)
Semester I
MB – 11: Introduction to Microbiology
Total credits: 03 **Total Lectures: 45**

Learning outcomes:

At the end of this course the students will be able to:

1. Understand the scope of the Microbiology subject.
2. Use the Microscopes for observing different life forms including Bacteria, Fungi, Protozoa and Algae
3. Understand principles of chemistry to be used for exploring biological interactions among microorganisms.

Course Content:

(I) The Development of Microbiology and its Scope 08

- Microbes in our lives
- The scope and Relevance of Microbiology, Microbes and Human Welfare: Aerobiology, Recycling of Vital Elements
Sewage treatment: Using Microbes to Recycle water
Bioremediation: Using microbes to clean up Pollutants.
Insect/ pest control by microorganisms.
Modern Biotechnology and Genetic Engineering: Basic concepts
- A Brief History of Microbiology
The first observations – Antony van Leeuwenhoek
Theories of spontaneous generation.
The golden age of Microbiology – Louis Pasteur; Pasteur and disease, Robert Koch and pure culture Techniques
Development of Microbiology in 19th, 20th and 21st century:
Ten important/Noble prize winning contributions from each century.
- Microbes and Human Diseases, Normal Micro biota
Infectious Diseases, The birth of Modern chemotherapy Emerging Infectious Diseases.
- Modern Developments in Microbiology
- The future of Microbiology.

(II) Principles of Chemistry 12

- How atoms form Molecules: Chemical bonds.
- Types of bonds: Ionic Bonds, Covalent bonds, Hydrogen bonds., Molecular Weight & Moles
- Chemical Reactions

Energy in Chemical reactions

Types of chemical reactions: Synthesis, Decomposition, Exchange and Reversible reactions.

Inorganic compounds – Water, Acids, Bases and Salts. Acid-Base Balance

- Major organic compounds of living things – Structure & Function of Carbohydrates, Lipids, Proteins, Nucleic acids, Adenosine Triphosphate (ATP).

(III)

Microscopy

25

- Units of Measurement
- Lenses and the Bending of Light
- Light Microscopy: parts and their functions (Principle working and applications)
- Dark field and phase contrast microscopy functions (Principle working and applications)
- Fluorescence and Electron Microscopy, TEM & SEM (Principle working and applications)
- Preparation of Specimens for light microscopy
 - Preparing smears for staining
 - Simple Staining - Monochrome, Negative
 - Differential staining – Gram's staining and Acid Fast staining
 - Special Staining – Spore, Capsule, Cell wall, Flagella, Lipid granules, Metachromatic granules.

References:

1. Alcamo, Edward. I. (2007). Fundamentals of Microbiology, Eighth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Chapter No.1,2,3.)
2. Dubey R.C., D. K. Maheshwari, Second Ed.(2010)
A Textbook of Microbiology, S. Chand And Company
3. Ingraham. J. L and C. A. Ingraham (2000) Introduction to Microbiology .Second Edition Thompson Learning Inc. (Chapter No2,3.)
4. Hofkin Bruce V.(2011) Living in a Microbial World. Garland Science. . (Chapter No1,2,5,15,16)
5. Madigan , M.T. and J.M. Martinko (2006), Brock. Biology of Microorganisms 11th Edition, International Edition. Pearson , Prentice Hall. (Chapter No.4.)
6. Manoharachary K. and B.R. Tilak(2012),
Principles of Microbiology, I. K. International Publishing House Pvt. Ltd
7. Pelczar M. J., Chan E.C.S., Krieg N.R. (2010),
Microbiology, 39th Edition , Tata McGraw-Hill
8. Powar Daginwala Tenth Ed.(2010)
General Microbiology Vol.2, Himalaya Publishing House
9. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2008) Microbiology, Eighth Edition McGraw Hill Higher Education. (Chapter No.,2.)
10. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2007) Microbiology: an Introduction, Ninth Edition, Pearson Education. (Chapter No. 3,5.)

F.Y.B.Sc. (CBCS – 2018 course)
Semester I
MB – 12: Structure of Prokaryotes and Eukaryotes

Total credits: 03

Total Lectures: 45

Learning Outcomes:

1. Learn intracytoplasmic organelles of Microorganisms and their significance
2. Understand the significance of different groups of microorganisms
3. Know the structure, properties and significance of viruses
4. Understand the useful and harmful activities of microorganisms in soil, water and air
5. Know the futuristic therapeutic tools like ESKAPE therapy to overcome drug resistant pathogens
6. Understand the ethical and unethical use of microorganisms in the form of 'Bioterrorism'
7. Develop practical skills for observation and cultivation of microorganisms.

Course Content:

(I)	Prokaryotic Cell Anatomy	10
	• Size, shape and arrangement of bacterial cells. • Structure of typical bacterial cell. • Structure and functions of cell wall. • Composition and functions of 'Bacterial capsule'. • Fluid Mosaic Model of bacterial cell membrane. • Structure and functions of Flagellum • Arrangements of Flagella • Pili	
(II)	Structure & functions of cell organelles	10
	• Ribosome • Metachromatic granules • Poly β hydroxybutyrate (PHB) granules. • Carboxysomes • Gas vacuoles • Endospore	

- (III) General properties and significance of following groups of microorganisms. 10
- *Rickettsias*
 - *Chlamydia*
 - *Coxiella*
 - *Mycoplasma*
 - *Archaeobacteria*
 - *Actinomycetes*
 - Algae
 - Fungi
 - Protozoa
- (IV) The Viruses 15
- Introduction and General characteristics,
 - Morphological types of viral capsids
 - Icosahedral, Helical, Complex
 - Types of viral nucleic acids with representative examples.
 - Virus cultivation using ‘Embryonated Egg’
 - Virus cultivation using ‘Tissue Culture Technique’
 - Merits and demerits of the following-
 - Primary cell cultures
 - Diploid cell cultures
 - Continuous cell cultures
 - Structure of ‘T4 Bacteriophage’.
 - Viroids and Prions.

References:

1. Alcamo, Edward. I. (2001) .Fundamentals of Microbiology, Sixth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts.(Topic No-1 and2).
2. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) Microbiology, Sixth Edition McGraw Hill Higher Education.(Topic No 1 , 2 ,4)
3. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2004). Microbiology: an Introduction, Eight Edition, Pearson Education.(Topic No 1 and 2).
4. Madigan , M.T. and J.M. Martinko (2006), Broch Biology of Microorganisms 11th Edition, International Edition. Pearson , Prentice Hall (Topic No. 1 and3)
5. Pelczar M. J.,Chan E.C.S., Krieg N.R. (2010), Microbiology, 39th Edition, Tata McGraw-Hill.(Topic No. 3,4).
6. Manoharachary K. and B. R.,Tilak (2012), Principles of microbiology, I. K. International Publishing House Pvt. Ltd.(TopicNo.3).

F. Y. B. Sc. (CBCS – 2018 course)
Semester I

Practical Course: MB-13 (Based on MB 11 and MB 12)

Learning Outcomes:

After completion of the paper, students will be able to,

1. Observe bacteria and other life forms under 100x objectives
2. Observe motility bacteria
3. Cultivate the bacteria
4. Observe the bacteria or a part of bacteria using appropriate staining procedure.

Course Contents:

- 1) Laboratory safety: General rules and regulations.
- 2) Study of laboratory equipment.
 - i) Incubator,
 - ii) Autoclave,
 - iii) Laminar Air Flow
 - iv) Oven
 - v) Colony counter
 - vi) Water bath,
 - vii) pH-Meter
- 3) Use care and study of Compound Microscope
 - i) Parts of microscope and their functions.
 - ii) Taking care of Microscope
 - iii) Using a Microscope.
- 4) Aseptic transfer techniques and demonstration of Inoculation techniques
 - i) Broth inoculation
 - ii) Plate inoculation
 - iii) Slant inoculation
 - iv) Butt inoculation
- 5) Staining Techniques.
 - a) Basic Staining Techniques
 - i) Monochrome Staining
 - ii) Negative staining
 - iii) Gram staining
 - b) Special Staining Techniques
 - i) Cell wall staining
 - ii) Endospore staining
 - iii) Capsule Staining
 - iv) Flagella Staining
 - v) Staining of 'Metachromatic Granules'
 - vi) Staining of 'Lipid Granules'

References

1. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London ,Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory Manual in General Microbiology, Fifth Edition Wm.C Brown Publisher.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory Manual Sixth Edition, Pearson Education
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology , Churchill Livingstone Edinburgh, London and New York.
5. Pelzar M.J. and E.C.Schan(1972) laboratory Exercise in Microbiology Third Edition (Practical Manual Tata Macgraw Hill Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Books New Delhi.

Course Learning Outcomes:

At the end of this course students are expected to be able to

1. Find the rank of matrix by conversion of matrix into echelon form.
2. Solve the system of Linear equations.
3. Division algorithm and obtain g.c.d. by division algorithm.
4. Solution of the equations by De Moivre's theorem and n^{th} root of unity.

Course content:

Unit 01: Matrices and System of Linear Equations.

- 1.1 Revision, adjoint of a square matrix and inverse of square matrix by adjoint method.
- 1.2 Echelon and reduced echelon form of a matrix, Reduction of a matrix to its echelon form. Rank of a matrix by using echelon form. Rank of a matrix by reducing the matrix into normal form.
- 1.3 System of homogeneous Linear equations in matrix form and its general solution.
- 1.4 System of non-homogeneous Linear equations in matrix form. Consistency of system of non-homogeneous linear equations and the solution of the system. Gauss Elimination method.
- 1.5 Eigen Values, characteristic equation of matrix of order up to 3×3 .
- 1.6 Statement of Cayley Hamilton theorem and its use to find the inverse of a matrix.

Unit 02: Integers.

- 2.1 Well ordering principle for $\mathbb{N}$. Principle of mathematical induction.
- 2.2 Divisibility in $\mathbb{Z}$: Definition and elementary properties. Division algorithm, Euclidean algorithm (without proof).
- 2.3 G.C.D. and L.C.M. of integers. Relatively prime integers, Euclid's lemma; Basic properties of G.C.D., G.C.D. of any two integers a and b if they exist are unique and can be expressed in the form $ax + by$ where $x, y \in \mathbb{Z}$
- 2.4 Equivalence relations, Equivalence classes, Properties of equivalence Classes. Definition of partition, every partition gives an equivalence relation. Definition of congruence; congruence as equivalence relation in $\mathbb{Z}$.

Unit 03: Complex Numbers.

- 3.1 Complex numbers, Algebra of complex numbers, conjugate complex number, properties of conjugate complex numbers. Sum and product of complex number and its conjugate is real.
- 3.2 Modulus amplitude form of a complex number properties of modulus and amplitude.
- 3.3 De Moivre's theorem.
- 3.4 n^{th} roots of unity.
- 3.5 Solution of the equations by using De Moivre's theorem.

Reference Books:-

- 1 K. B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi – 2000
- 2 P.B. Bhattacharya, S. K. Jain, S. R. Nagpal, First course in Linear Algebra, Wiley Eastern, New Delhi, 1983
- 3 Shanti Narayan: A text Book of Matrices.
- 4 S. K. Jain, A Gunawardena and P.B. Bhattacharya: Basic Linear Algebra with MATLAB, Key College publishing (Springer - Verlag), 2001.
- 5 Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar,: Algebra & Geometry; Nirali Prakashan

F. Y. B. Sc. (CBCS 2018 Course)

Semester-I

M-12: Calculus

Total Credit: 03

Total Lectures: 45

Course Learning Outcomes:

At the end of this course students are expected to be able to

1. Discuss the continuity of the functions at a point and interval.
2. Verify mean value theorems.
3. Obtain Taylor's and Maclaurin's expansions of functions.
4. Discuss the convergence of sequences and series.

Course content:

Unit 1: Limit and Continuity:

- 1.1 ϵ - δ definition of the limit of a function.
- 1.2 Basic properties and some theorems of limits.
- 1.3 Continuity of a function at a point. Types of discontinuity.
- 1.4 Continuous function on an interval.
- 1.5 Properties of continuous function on closed and bounded intervals
(a) Boundedness (b) Attains its bounds (c) Intermediate value theorem

Unit 2: Differentiability:

- 2.1 The derivative of a function. Property between continuity and differentiability.
- 2.2 Mean value theorem: (a) Rolle's mean value theorem (b) Lagrange's mean value theorem
(c) Cauchy's mean value theorem
- 2.3 Geometrical interpretations of mean value theorems.
- 2.4 Indeterminate forms L' Hospital's rule.
- 2.5 Higher order derivatives, n^{th} derivatives of some standard functions, Leibnitz's theorem.

Unit 3: Sequences and Series:

- 3.1 Convergent and divergent sequences, Algebra of convergent sequences.
- 3.2 Bounded sequence, monotonic sequences and convergence of sequences.
- 3.3 Convergence of $\{a_n\}$ where $a_n = \left(1 + \frac{1}{n}\right)^n$
- 3.4 Taylor's and Maclaurin's theorem with Lagrange's form of remainder (without proof)
- 3.5 Convergence of $\sum_{n=1}^{\infty} \frac{1}{n^p}$
- 3.6 Convergence of simple series by using comparison test and Ratio test.

Reference Books:-

1. P. K. Jain and S. K. Kaushik, An Introduction to Real Analysis, S. Chand and Co., New Delhi.
2. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Alahabad
3. T. M. Apostol, calculus Vol. I and Vol. II, Wiley International Edition.
4. Shanti Narayan: Differential Calculus.
5. R. G. Bartle, Dr. R. G. Sherbert; Introduction to Real Analysis, John Wiley and sons.
6. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Calculus and Differential Equations; Nirali Prakashan

F. Y. B. Sc. (CBCS 2018 Course)
Semester-I
M-13: Mathematics Practical Course –I
(Practicals based on the applications and Problems of articles in M-11 and M-12)

Total Credit :02

Course Learning Outcomes :

After completion of this course students will acquire:

- i. Knowledge of solving problems of Matrices, Systems of linear equations.
- ii. Knowledge of solving problems of Limit and Continuity.
- iii. Knowledge of solving problems of Derivatives and applications of mean value theorem.
- iv. Solve Problems on finding Eigen values and Eigen vectors.

Course content

List of Practicals:

1. Rank of matrix
2. Solution of system of Linear equations
3. Limit and Continuity
4. Integers
5. Equivalence relation, equivalence classes and partition, congruence relation.
6. Differentiation.
7. Complex numbers (De Moivre's theorem and n^{th} roots of unity)
8. Leibnitz's theorem
9. Convergence of Sequences and series
10. Eigen values and inverse of a matrix by Cayley Hamilton theorem

F. Y. B. Sc.: (CBCS 2018 Course)

Semester-I

S-11: Descriptive Statistics– I

Total Credit: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students will acquire:

- i. Importance and scope of statistics in various fields such as medical, management, economics, social science etc.
- ii. Information about statistical organization in India and state and their functions in social development.
- iii. Knowledge of different types of data and its classification
- iv. Knowledge of organisation and evaluation of different types of data and evaluation of summary measure such as measures of central tendency, dispersion, skewness and kurtosis
- v. Knowledge of qualitative data including concept of association of two attributes

Course content:

Unit 1. Introduction to Statistics

1.1 Meaning of Statistics as a Science.

1.2 Importance of Statistics.

1.3 Scope of Statistics: In the field of Industry, Biological sciences, Medical sciences, Economics, Social Sciences, Management sciences, Agriculture, Insurance, Information technology, Education and Psychology.

1.4 Statistical organizations in India and their functions:

Unit 2. Types of Data and Population and Sample

2.1 Types of characteristics:

Attributes: Nominal scale, ordinal scale,

Variables: Interval scale, ratio scale, discrete and continuous variables, difference between linear scale and circular scale

2.2 Types of data:

(a) Primary data, Secondary data

(b) Cross-sectional data, time series data, directional data.

2.3 Notion of a statistical population: Finite population, infinite population, homogeneous population and heterogeneous population. Notion of a sample and a random sample

2.4 Methods of sampling (Description only): Simple random sampling with and without replacement (SRSWR and SRSWOR) stratified random sampling, systematic sampling, cluster sampling and two-stage sampling.

Unit 3. Basic Statistics:

Review / Revision of Presentation of Data

3.1 Classification: Raw data and its classification, ungrouped frequency distribution, Sturges' rule, grouped frequency distribution, cumulative frequency distribution, inclusive and exclusive methods of classification, Open end classes, and relative frequency distribution.

3.2 Measures of Central Tendency

Review / Revision of following topics: Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average. Arithmetic Mean (A.M.): Definition, effect of change of origin and scale, combined mean of a number of groups, merits and demerits, trimmed arithmetic mean. Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits. Empirical relation between mean, median and mode (without proof). Topics to be taught in detail: Partition Values: Quartiles, Deciles and Percentiles (for ungrouped and grouped data), Box Plot. Geometric Mean (G.M.): Definition, formula, merits and demerits. Harmonic Mean (H.M.): Definition. Formula, merits and demerits. Order relation between arithmetic mean, geometric mean, harmonic mean. Weighted Mean: weighted A.M., G.M. and H.M. Situations where one kind of average is preferable to others.

3.3 Measures of Dispersion

Review / Revision of following topics: Concept of dispersion, characteristics of good measure of dispersion. Range, Semi-interquartile range (Quartile deviation): Definition, merits and demerits. Variance and standard deviation: Definition, merits and demerits, effect of change of origin and scale, combined variance for n groups (derivation for two groups).

Topics to be taught in detail: Mean squared deviation: Definition, minimality property of mean squared deviation (with proof), Measures of dispersion for comparison: coefficient of range, coefficient of quartile deviation and coefficient of mean deviation, coefficient of variation (C.V.)

3.4 Examples

Unit 4. Moments, Skewness and Kurtosis

4.1 Raw moments (m'_r) for ungrouped and grouped data.

4.2 Central moments (m_r) for ungrouped and grouped data, Effect of change of origin and scale.

4.3 Relations between central moments and raw moments, upto 4-th order (without proof).

4.4 Concept of skewness of frequency distribution, positive skewness, negative skewness, symmetric frequency distribution.

4.5 Bowley's coefficient of skewness : Bowley's coefficient of skewness lies between -1 to 1 (with proof), interpretation using Box plot.

4.6 Karl Pearson's coefficient of skewness.

4.7 Measures of skewness based on moments (β_1, γ_1).

4.8 Concepts of kurtosis, leptokurtic, mesokurtic and platykurtic frequency distributions.

4.9 Measures of kurtosis based on moments (β_2, γ_2).

4.10 Examples

Unit 5. Theory of Attributes

- 5.1 Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class- frequency, order of a class, positive class frequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to three attributes), and dot operator to find the relation between frequencies, fundamental set of class frequencies.
- 5.2 Consistency of data upto 2 attributes.
- 5.3 Concepts of independence and association of two attributes.
- 5.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.
- 5.5 Examples

Recommended Books:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis Third Edition, John Wiley and Sons
3. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
4. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
6. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
7. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
8. Snedecor G. W. and Cochran W. G. (1989). Statistical Methods, Eighth Ed. East- West Press.
9. Hanagal David D. (2009). Introduction to Applied Statistics: A non –calculus based approach. Narosa Publishing House. New Delhi

S- 12: Discrete Probability and Probability Distributions –I

Total Credit: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students will acquire:

- i. Ability to distinguish between deterministic and non-deterministic experiments.
- ii. Knowledge related to different types of events.
- iii. Knowledge of probability of events including axiomatic approach, simultaneously they are learning conditional probability including Baye's theorem.
- iv. Knowledge related to concept of discrete random variable and their probability distributions including expectations and moments.
- v. Knowledge of important discrete distributions such as uniform distribution, Binomial distribution, hypergeometric distribution and acumen to apply standard discrete distributions to different situations.

Course content:

Unit 1. Basic Concept of probability, conditional probability, independence and Bayes' Theorem

- 1.1 Experiments/Models, Ideas of deterministic and non-deterministic models. Random Experiment, concept of statistical regularity.
- 1.2 Definitions of - (i) Sample space, (ii) Discrete sample space: finite and countably infinite, (iii) Event, (iv) Elementary event, (v) Complement of an event. (vi) Certain event (vii) Impossible event
- 1.3 Concept of occurrence of an event.
- 1.4 Algebra of events and its representation in set theory notation. Occurrence of following events.
 - (i) at least one of the given events,
 - (ii) none of the given events,
 - (iii) all of the given events,
 - (iv) mutually exclusive events,
 - (v) mutually exhaustive events,
 - (vi) exactly one event out of the given events.
- 1.5 Classical definition of probability and its limitations.
- 1.6 Probability model, probability of an event, equiprobable and non-equiprobable sample space,
- 1.7 Axiomatic definition of probability.
- 1.8 Definition of conditional probability of an event.
- 1.9 Definition of independence of two events $P(A \cap B) = P(A) \cdot P(B)$
- 1.10 Pairwise independence and mutual independence for three events
- 1.11 Multiplication theorem $P(A \cap B) = P(A) \cdot P(B|A)$. Generalization to $P(A \cap B \cap C)$.
- 1.12 Partition of the sample space
- 1.13 Proof of Bayes' theorem. Applications of Bayes' theorem in real life
- 1.14 Examples

Unit 2. Univariate Probability Distributions

- 2.1 Concept and definition of a discrete random variable.
- 2.2 Probability mass function (p.m.f.) and cumulative distribution function (c.d.f.), $F(\cdot)$ of discrete random variable, properties of c.d.f..
- 2.3 Mode and median of a univariate discrete probability distribution.
- 2.4 Examples

Unit 3. Mathematical Expectation (Univariate Random Variable)

- 3.1 Definition of expectation (Mean) of a random variable, expectation of a function of a random variable, m.g.f. and c.g.f. Properties of m.g.f and c.g.f.
- 3.2 Definitions of variance, standard deviation (s.d.) and Coefficient of variation (c.v.) of univariate probability distribution, effect of change of origin and scale on mean, variance and s.d.
- 3.3 Definition of raw, central and factorial raw moments of univariate probability Distributions and their interrelations (without proof).
- 3.4 Coefficients of skewness and kurtosis based on moments.
- 3.5 Examples

Unit 4. Some Standard Discrete Probability Distributions - I

- 4.1 Degenerate distribution (one point distribution), $P(X=c) = 1$, mean and variance.
- 4.2 Uniform discrete distribution on integers 1 to n: p.m.f., c.d.f., mean, variance, real life situations, comments on mode and median.
- 4.3 Bernoulli Distribution: p.m.f., mean, variance.
- 4.4 Binomial Distribution: p.m.f.

$$p(x) = \binom{n}{x} p^x q^{n-x}; x = 0, 1, 2, 3, \dots, n, 0 < p < 1, q = 1 - p \\ = 0 \text{ otherwise}$$

Notation : $X \sim B(n, p)$.

Recurrence relation for successive probabilities, computation of probabilities of different events, mode of the distribution, mean, variance, m.g.f. and c.g.f. moments, skewness (comments when $p = 0.5$, $p > 0.5$, $p < 0.5$). Situations where this distribution is applicable.

- 4.5 Hypergeometric Distribution : p.m.f.,

$$p(x) = \frac{\binom{M}{x} \binom{N-M}{n-x}}{\binom{N}{n}}; x = 0, 1, \dots, \min \{M, n\}, \\ = 0 \text{ otherwise}$$

Notation : $X \sim H(N, M, n)$.

Computation of probability, situations where this distribution is applicable, binomial approximation to hypergeometric probabilities, mean and variance of the distribution.

- 4.6 Examples

Recommended Books:

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
5. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
6. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
7. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.
8. Hanagal David D. (2009). Introduction to Applied Statistics: A non –calculus based approach. Narorse Publishing House. New Delhi

F. Y. B. Sc.: (CBCS 2018 Course)
Semester-I
S- 13: Statistics Practical Course –I

Total Credits: 02

Course Learning Outcomes:

After completion of this course students will acquire:

- i. Knowledge of drawing sample from population and draw the graphs and diagrams.
- ii. Knowledge of computing average, dispersion, moments, skewness and kurtosis for different types of data.
- iii. Knowledge of computing of various probabilities and fitting of binomial distribution.

Course content

List of Practicals

- 1 Use and Generation of random numbers.
- 2 * Diagrammatic representation of statistical data: simple and subdivided bar diagrams, multiple bar diagram, percentage bar diagram, pie diagram.
- 3 * Graphical representation of statistical data: histogram, frequency curve and ogive curves. Determination of mode and median graphically.
- 4 * Computation of measures of central tendency, quartiles, Box plots.
- 5 * Computation of measures of central tendency and dispersion (ungrouped data).
- 6 * Computation of measures of central tendency and dispersion (grouped data).
- 7 Computation of measures of skewness and kurtosis.
- 8 Computation of moments (ungrouped and grouped data)
- 9 Fitting of binomial distribution and computation of expected frequencies.
- 10 Applications of binomial and hypergeometric distributions.

F. Y. B. Sc. (CBCS – 2018 Course)
Semester – II
P – 21: Kinetic Theory & Thermodynamics

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

At the end of this course student will be able to have following learning outcomes:

1. Ability to explain the concept of ideal gas and real gas and their equations of state.
2. Basic understanding of Laws of Thermodynamics and its application to various physical processes in the system
3. Application of Kinetic theory of gases for calculating the transport properties of gases.
4. Ability to explain how an Engine works, its efficiency and comparison between different types of engines
5. Understanding of the concept of entropy, reversible and Irreversible processes.

Course Content:

1. KINETIC THEORY OF GASES

Review of kinetic model of an ideal gas, various equations of state, Behavior of real gases: Van-der-Waals model, Van-der-Waals equation of states, determination of Van der Waals constant, nature of Van-der-Waals forces, critical constants. Defect of Van der Waals equation, reduced equation of state, Boyle temperature.

2. THERMODYNAMICS

Concept of thermodynamic state, adiabatic and isothermal thermodynamic changes, indicator diagram, adiabatic transformation and relations, work done during isothermal and adiabatic changes, first law of thermodynamics, Second law of Thermodynamics reversible and irreversible processes and illustrations.

3. HEAT ENGINES

Conversion of Heat into Work and its converse, Carnot's theoretical heat engine, Carnot's cycle and its efficiency, Practical heat engines; Diesel engine-construction, working, Diesel cycle and its efficiency, Otto engine –Construction, Working, Otto cycle and its efficiency, comparison of Diesel engine and Otto engine, Refrigerator.

4. ENTROPY

Concept of entropy, definition of entropy, change in entropy in a reversible, irreversible and in natural processes, Determination of the change in entropy when substance heated and during change of state, temperature-entropy diagram, change of phase; First latent heat equation (Clausius-Clapeyron equation), Variation of melting point and boiling point.

Text and Reference Books:

1. W. Zemanasky, "Heat and Thermodynamics"
2. Saha and Shrivastava, "A Treatise on Heat".
3. Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.
4. A. B. Gupta, College Physics Volume 1, Book's and Allied (P) Ltd.

5. Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
6. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition,
 1. McGraw-Hill International Editions
7. Thermodynamics and Statistical Physics: J.K. Sharma, K.K. Sarkar, Himalaya Publishing House
8. Thermal Physics (Heat & Thermodynamics): A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.

F. Y. B. Sc. (CBCS – 2018 Course)
Semester– II
P – 22: Electricity & Magnetism

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

At the end of this course student will be able to have following learning outcomes,

1. Ability to demonstrate different laws of electrostatics such as Coulomb's law, Gauss's law etc. and their applications.
2. Understanding of dielectric properties of materials and polarization concept.
3. Ability to measure the magnetic forces acting on moving charges and the magnetic fields due to currents using the applications of Biot-Savart's and Ampere laws
4. Understanding of different parameters associated with magnetic field and their interrelations

Course Content:

1. Electrostatics

Revision of Coulomb's law, Superposition principle, Electric field due to an electric dipole, line and disc, Revision of Gauss's law, Coulomb's law from Gauss's law, Gauss's law applications in Cylindrical, planar and spherical symmetry

2. Dielectrics

Electric Dipole, Electric dipole and dipole moment, Electric potential and intensity at any point due to dipole, Torque on a dipole placed in an electric field, Polar and non-polar molecules, Electric polarization of dielectric material, Gauss' law in dielectric, Electric vectors and relation between them

3. Magneto statics

1. Revision of Biot-Savart's law with examples, Amperes' law, e.g. Solenoid and Toroid, Gauss law for magnetism

4. Magnetic properties of materials

1. Magnetic materials and Bohr magneton, Magnetization (M), magnetic intensity (H), magnetic

induction (B), magnetic susceptibility and permeability, Relation between B, M and H,

Hysteresis

Text and Reference Books:

1. Fundamentals of Physics: 8th Edition, Halliday Resnik and Walker
2. Electromagnetics: B. B. Laud
3. Ritz and Milford, "Electricity and Magnetism"
4. A. S. Mahajan and A. A. Rangawala, "Electricity and Magnetism"
5. Brijal and Subramanyarn, "Electricity and Electronics"
6. B. L. Tharej a, "Textbook of Electrical Technology"
7. S. S. Atwoods, "Electricity and Magnetism"
8. E. M. Pucell Ed, "Physics Course Vol. I, "Electricity and Magnetism"
9. D. Haliday and R. Resnick, "Physics Volume 2"

F. Y. B Sc. (CBCS – 2018 Course)
Semester - II
P - 23: Practical Course -II

Total Credits: 02

Course Learning Outcomes:

At the end of this course student will be able to have following learning outcomes:

1. Study of spectrometer , thermocouple and determination of inversion temperature
2. Study of temperature coefficient of resistance
3. Measurement of specific heat of graphite by electrical method and Thermal conductivity by Lee's method
4. To understand fill factor of solar cell
5. To know how the diode can be used as a rectifier.

Course Content

1. Y by Flat spiral spring and η by Flat spiral spring
2. 2 . Y-by bending (rectangular thin bar)
3. Specific heat of graphite by electrical method
4. Study of temperature coefficient of resistance
5. Velocity of sound in air by Kund's tube
6. Study of thermocouple and determination of inversion temperature
7. Study of spectrometer (angle of prism, refractive index of glass material)
8. Calibration of spectrometer
9. LCR series resonance circuit and Q-factor
10. Frequency of A.C. using vibrating wire and magnet
11. Study of capacitive reactance
12. To determine fill factor of solar cell
13. Diode as a rectifier (Full wave and Bridge rectifier)
14. Thermal conductivity by Lee's method

Note: Any eight (8) experiments should be performed.

Text and reference books:

1. B. L. Worsnop and H. T. Flint, " Advanced Practical in Physics"
2. D. P. Khandewal, " Laboratory manual for Physics for Undergraduate students"
3. B. Saraf, " Physics through experiments, vol. II

F. Y. B.Sc. (CBCS-2018 COURSE)
Semester – II
C-21: Physical & Inorganic Chemistry-II

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the physical properties of liquids.
2. Write Van der waal's equation and significance of the terms involved in it.
3. Inculcate the phenomenon of fluorescence and phosphorescence in the students and outside the scientific community.
4. Know the types of hybridization and their geometries

SECTION – I (Physical Chemistry)

Course Content:

1. Liquid state

Properties of liquid, Comparison between gaseous and solid state, Experimental determination of vapour pressure by isoteniscopic method and viscosity by Ostwald method, Liquid crystals and their applications.

[Ref. 8 Page No. 57-61 and Ref. 11]

2. Gaseous State

Introduction, Ideal and non-ideal gases, Effect of pressure, Effect of temperature, Vander Waals equations, Critical phenomena, The law of corresponding states and reduced equation of state, Liquefaction of gases, Joule Thomson effect, Numericals.

[Ref. 8 Page No. 5 -56]

3. Photochemistry

Introduction, Difference between photochemical and ordinary chemical reactions, Different laws of photochemistry, Quantum efficiency, Fluorescence, Phosphorescence, Experimental study of photochemical reactions, Numericals.

[Ref. 8 Page No. 775-786]

References:

1. Physical Chemistry by G. M. Barrow, 5th Edition (McGraw-Hill) (2007).
2. Physical Chemistry by Robert G Mortimer, 3rd Edition, Elsevier (2008).
3. Physical Chemistry by Atkins and Paula 8th Edition (2008).
4. College Chemistry by Barua, Bijoy and Y. R. Sharma, Kalyani Publishers (1995).
5. Principles of Physical Chemistry by Puri, Sharma and Pathania (2008).
6. Physical Chemistry by Dr. S. Pahari, New Central book agency (P) Ltd. (2007).
7. Physical Chemistry by Ira N. Levine Fifth Edition Tata McGraw-Hill (2004).
8. Principles of Physical Chemistry by Maron and Prutton, 4th Edition (2008), Oxford IBM Publishing Co. Pvt. Ltd.
9. Advanced Physical Chemistry by D. N. Bajpai, S. Chand (2011).
10. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl and G. D. Tuli, S. Chand (2012).
11. Mathematical Preparation of Physical Chemistry by F. Daniel's, McGraw Hill Book Comp.Inc.
12. Chemistry 9th edition, 8th edition 2010 by Raymond Chang. McGraw-Hill companies Inc. New York Published by Tata McGraw –Hill Education Private Limited, New Delhi. 9th edition, 8th reprint 2010.

13. Physical chemistry N. Kundu and S.K.Jain,S.Chand & company Ltd New Delhi. First edition 1984, reprint 1990.
14. Physical Chemistry, A Molecular approach.Donald A. Mc Quarrie and John D.Simon, Published by University Science Books CA, USA.First edition 1998, reprint 2006.

SECTION – II (Inorganic Chemistry)

1. Chemical bonding

Attainment of stable configuration, Types of bonds ionic, covalent,

co-ordinate & metallic,Types of overlaps: s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma & pi bonds,Theories of bonding- a)valance bond theory, b) Heitler London theory and c) Pauling Slater

theory, Concept of hybridization: Definition & need of hybridization, steps involved in hybridization, explanation of covalency of atoms in the moles based on hybridization, types of hybridization involving s, p, & d orbitals.Applications of hybridization geometries of molecules like

- i) BeH_2 ii) BF_3 iii) $[\text{MnCl}_4]^{2-}$ iv) $[\text{Ni}(\text{CN})_4]^{2-}$ v) $\text{Fe}(\text{CO})_5$
vi) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ vii) IF_7

VSEPR theory: Assumptions, need of theory, application of theory to explain geometry of irregular molecules such as

- i) ClF_3 ii) Cl_2O iii) BrF_5 iii) TeCl_4 iv) XeO_3 v) XeOF_4

[Ref. 1,2,3]

References:

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, , R. L. Keiter, Prentice Hall; 4th Edition (1997) P 205,222.
2. New guide to Modern Valance Theory-G.I. Brown, Longman, 3rd
3. Edn. (1980).
4. Concise Inorganic Chemistry-J.D. Lee,Wiley-India,
5. Fifth Edition(2009)- Chapter-4, p 72-81
6. 4. Concept & model of Inorganic Chemistry-Douglas Mc Doniels,Wiley.

F. Y. B.Sc. (CBCS-2018 COURSE)

Semester – II

SECTION – I (Organic Chemistry)
C-22: Organic & Inorganic Chemistry-II

Total Credits: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students should be able to:

1. Expound conformational isomerism in alkanes
2. Distinguish between geometrical and optical isomerism.
3. Enumerate R/S and E/Z nomenclature.
4. Know synthesis and reactions of naphthalene and anthracene.
5. Describe position, electronic configuration, trends in properties and anomalous behaviour of p-block elements. Explain preparation and reactions of cycloalkanes & cycloalkenes.
7. Understand the Huckel's rule, synthesis, Resonance, molecular orbital structure and reactions of Furan, Pyrrole & Thiophene.

Course Content:

1. STEREOCHEMISTRY OF ORGANIC COMPOUNDS

Concept of Isomerism: -

Types of isomerism, structural isomerism, chain, position, functional group and Tautomerism.

Representation of organic molecules: -

Projection formulae – Saw horse (Adrian), Newman, Fischer, Dotted – Wedge – Line formula.

Conformational isomerism: -

Conformational isomerism in alkanes, free rotation about Carbon – carbon single bond. Conformations of Ethane, propane and Butane. Relative stabilities of different conformations.

Optical isomerism: -

Tetrahedral Carbon atom, optical isomerism, polarimeter, specific rotation, Enantiomerism Diastereomerism, Chirality, Prediction of optical activity, plane of symmetry, centre of symmetry. Relative and Absolute Configuration – sequence rules, R and S system of nomenclature.

Geometrical isomerism: -

Geometrical isomerism restricted to carbon – carbon double ($C = C$) bond and open chain compounds only. Conditions for geometrical isomerism, cis – trans and E / Z nomenclatures, Physical and chemical properties of geometrical isomerism.

[Ref. 1, Pages 125,126,135 to 146, 279 to 282, 1162 to 1164]

2. Polynuclear Aromatic Compounds

Fused ring aromatic compounds, Nomenclature of naphthalene derivative, Haworth synthesis of Naphthalene, Reactions of naphthalene - oxidation reduction, nitration, halogenation, sulphonation and Friedel Craft acylation. Haworth Synthesis of Anthracene, Reactions of anthracene-oxidation, reduction, nitration, halogenations and sulphonation.

[Ref. 1: Pages: - 1167-169, 1170-174, Ref.3: pages: - 710-713]

3. Cycloalkanes and cycloalkenes

Cycloalkanes: -

Introduction.

Method of formation - a) By addition of carbene to alkene

b) Action of metallic sodium on dihaloalkane

c) Diels - Alder reaction d) By reduction of aromatic compounds.

Chemical properties- a) Photohalogenation b) Catalytic halogenations

c) Catalytic hydrogenation d) Effect of heat e) Reaction with hydrogen halide

Cycloalkenes :

Introduction.

Method of formation- From cyclic compounds:

Chemical Properties - a) Hydrogenation b) Addition of Halogens and halogen acids c) Allylic halogenations

[Ref.1 , Pages:- 272 – 279; Ref.5 Pages:- 585-589]

4. Heterocyclic Compounds

Introduction, Huckel's rule for aromatic heterocyclic compounds, synthesis, Resonance, molecular orbital structure and reactions of Furan, Pyrrole & Thiophene.

[Ref.3 , Pages:- 836 – 850]

References:

1. Organic Chemistry (Sixth Edition) by Robert Morrison and Robert Boyd. Prentice Hall of India Pvt. Ltd. New Delhi (1989).
2. Guide book to mechanism in organic chemistry (Sixth Edition) by Peter Sykes, Orient Longman (1981).
3. Textbook of Organic Chemistry (Fifth Edition) by Raj K. Bansal - New Age International (P) Ltd. Publishers, Mumbai (2007)
4. Principles of modern Heterocyclic Chemistry By L.A. Paquette.
5. Text – book of Organic Chemistry by Arun Bhal , B.S.Bhal (18th Edition), S.Chand & company, Ltd. New Delhi (2006)
6. Stereochemistry of Organic Compounds by D. Nasipuri, (Second Edition), Wiley Eastern Ltd., New Delhi.(1999)
7. Stereochemistry of Carbon Compounds by Eliel, (Fourth Edition), New Age International (P) Ltd. Publishers New Delhi (1997)

SECTION – II (Inorganic Chemistry)

1. CHEMISTRY OF p-BLOCK ELEMENTS

Position of elements in periodic table, electronic configuration of elements trends in properties like atomic size, ionization potential, electronegativity, electron affinity, reactivity, oxidation states, anomalous behaviour of first member of each group.

Structure and properties of: Borate, Halides of aluminium, Allotropes of carbon, Classification of silicates, Oxyacids of phosphorous and sulphur, Inter-halogen compounds.

[Ref. 1,2,3]

References:

1. Concise Inorganic Chemistry-J.D. Lee, Wiley-India 5th Edition(2011)
-P 359-638pages.
2. Concept & model of Inorganic Chemistry-Douglas Mc Daniels, Wiley, 3rd Edⁿ (1994), p 789
3. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, P.L. Gaus Wiley-India, 3rd Ed(2008), p 319-483.

F. Y. B.Sc. (CBCS-2018 COURSE)
Semester – II
C-23: Practical Course - II

Total Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Determine equivalent weight of a given metal by Eudiometer.
2. Analyse hydrolysis of methyl acetate in presence of HCl.
3. Find out ΔH and ΔS for the chemical reactions.
4. Study specific and molar refractivities of methyl group.
5. Investigate the Loss/gm and percentage purity of given mixture of NaHCO_3 and Na_2CO_3 .
6. Calculate the number of water molecules of crystallization.
7. Elucidate the total hardness of the given sample of water by using EDTA.
9. Standardize 0.1N KMnO_4 solution with 0.1 N sodium oxalate.
10. Estimate % purity of a given sample of sodium chloride

Course Content:

PHYSICAL CHEMISTRY EXPERIMENTS (Any 2)

1. Determination of equivalent weight of a given metal by Eudiometer.
2. To study the hydrolysis of methyl acetate in presence of HCl.
3. To study the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI (equal concentration).
4. To determine DH and DS for the following chemical reactions
 - i) $\text{Zn(s)} + \text{CuSO}_4\text{(aq)} \longrightarrow \text{Cu(s)} + \text{ZnSO}_4\text{(aq)}$
 - ii) $3\text{Mg(s)} + 2\text{FeCl}_3\text{(aq)} \longrightarrow 2\text{Fe(s)} + 3\text{MgCl}_2\text{(aq)}$
5. Determination of specific and molar refractivities of benzene, toluene and xylene.

References:

1. Systematic Experimental Physical Chemistry by Rajbhoj and Chondhekar, Anjali Publication. 1st Edition, 1990.
2. Experiments in Chemistry by D.V. Jahagirdar, Himalaya Publishing House. 1st Edition, 1994.

INORGANIC CHEMISTRY EXPERIMENTS

A) Gravimetric Analysis:

(Any Two)

- 1) To determine the Loss/gm and percentage purity of given mixture of NaHCO_3 and Na_2CO_3 .
- 2) To determine the number of molecules of water of crystallization from given BaCl_2 sample by heating.
- 3) To determine the number of molecules of water of crystallization from given MgSO_4 sample by heating.

B) Volumetric Analysis:

(Any Two)

- 1) To determine the total hardness of the given sample of water by using EDTA.
- 2) To prepare 0.1 N sodium oxalate solution and standardization of given 0.1N KMnO_4 solution.

- 3) To standardize given NaOH solution and hence to find out the strength of the given HCl solution.
- 4) Estimation of % purity of a given sample of sodium chloride.

References:

- 1) Inorganic Qualitative Analysis.- by A.I. Vogel
- 2) Inorganic Quantitative Analysis. - by A.I. Vogel

ORGANIC CHEMISTRY EXPERIMENTS

A) Volumetric estimations: (Any Two)

- (i) Aniline (ii) Phenol (iii) Acetone

B) Techniques: (Any Two)

- a) Purification of an impure organic compound by crystallization/sublimation method and determination of melting point of purified sample.
- b) Student will report M.P. of organic compound before and after
 - a. crystallization/sublimation
- c) Solvents like water, alcohol water + alcohol can be selected for crystallization.

References:

1. Organic qualitative analysis by A.I. Vogel, (Fourth Edition), Longman group Ltd., England (1996)
2. Laboratory Manual of Organic Chemistry by R.K. Bansal,
3. (Second Edition), Wiley Eastern Ltd., New Delhi (1990)

F.Y.B.Sc. (CBCS 2018 Course)

Semester-II

B-21: Plant Diversity and Utilization of Plants-II

Total Credits- 03

Total lectures- 45

Course Learning Outcomes:

After the completion of this course, the learner will be able to:

1. The students will learn about the structure and reproduction of certain selected species.
2. of Angiosperm and Gymnosperm.
3. Know about the structure, life history and Economic importance of Angiosperm and Gymnosperm.
4. Enable to identify morphological and anatomical peculiarities
5. Apply skills to manage plant biodiversity
6. Conceptualize the role of plants in human welfare with special reference to India

Course Content:

Angiosperms and Gymnosperms

1. Angiosperms

Salient features of angiosperms, identification, nomenclature and classification according to Bentham and Hookers system, Primitive and advanced features, salient features of the International code of Botanical nomenclature, general account of morphology, flower structure and reproduction.

2. Study of families

According to Bentham and Hookers system of classification, with the reference to diagnostic characters, floral formulae, floral diagram and economic importance.

- a) Brassicaceae
- b) Malvaceae
- c) Papilionaceae
- d) Rubiaceae
- e) Liliaceae

3. Utilization of some following angiosperms in the manufacture of industrial products.

i) Neem, ii) Tinospora, iii) Adulsa

4. Gymnosperm

Important characters and classification, evolutionary significance of gymnosperms, comparative study of Cycadales (e.g. *Cycas*), Coniferales (e.g. *Pinus*) and Gnetales (e.g. *Gnetum*), Ginkgoales (e.g. *Ginkgo*).

5. Study of life history of *Pinus*.

6. Utilization of *Ginkgo biloba* in the manufacture of industrial products.

Reference books:

1. Sporne, K.R. 1991. The Morphology of Gymnosperms. B.I. Publications Pvt., Mumbai, Calcutta, Delhi.
2. Coulter J.M. & Chamberlain C.J. Morphology of Gymnosperm.
3. P.C. Vashishta – Gymnosperm.
4. Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson (Printers) Ltd.
5. Foster, A.S. and Gifford, A.E.M. Jr. 1967. Comparative morphology of vascular plants.
6. Spore, K.R. 1977. The morphology of Angiosperms.. B.I. Publication, Bombay.
7. B.R. Vashishta 1997. Taxonomy of Angiosperm.
8. Kar & Gangulee, 1996, College Botany.

F.Y.B.Sc. (CBCS 2018 Course)
Semester-II
B-22: Industrial Botany

Total Credits- 03

Total lectures- 45

Course Learning Outcomes:

1. Gain thorough knowledge about various plant groups from primitive to highly evolved plants.
2. Become aware of applications of different plants in various industries.
3. To highlight the potential of these studies to become an entrepreneur.
4. To equip the students with skills related to laboratory as well as industries based studies.
5. To make the students aware about conservation and sustainable use of plants.
6. To address the socio-economic challenges related to plant sciences.
7. To Study the method of large scale production of biofertilizer & Organic farming
8. Get knowledge on Biopesticide - characteristics, physiology, mechanism of action and application.

Course Content:

1. Introduction, scope and importance of Industrial Botany.

2. Biopesticide Industry-

- a. Introduction, Definition and need, concept of biodegradable and non- residual effect.
- b. Environmental and health hazards due to pesticides and fungicides.
- c. Plant base chemical products-Azadirachtin, Neem Cake, Indiarina, Pyrethrins,
- b) Pheromones, Trichoderma, and Trichogramma.

3. Bioenergy Industry -

Introduction, definition, scope and importance of energy plantation – criteria for selecting plants its need and advantages. Utilization of industrial wastes, plant & animal waste for production of bioenergy.

4. Plant tissue culture Industry

Introduction, history of tissue culture scope & importance. Brief idea of tissue culture – plant propagation by tissue culture.

5. Biofertilizer Industry

Definition, types of culturing N₂ fixing blue green algae and their utilization in agriculture, culturing of *Rhizobium* and their utilization in agriculture. utilization in agriculture, culturing of *Rhizobium* and their utilization in agriculture.

6. Mushroom Industry

Introduction, edible and poisonous mushroom, genera used for cultivation, method of cultivation of *Agaricus*, *Pleurotus* and *Volvariella*, scope and commercial cultivation, food value.

7. Non conventional Food Industry

Introduction, definition, concept and need, advantages. Types with examples (listing) bacterial, fungal, algal and transgenic (GMO).

Algal biomass *Spirulina* – Morphology of thallus, merit of *Spirulina* cultivation, method of culture – small and large scale, harvesting, limiting factors, products, powder, tablets & biscuits.

Reference books:

1. Biofertilizer in Agriculture -N.S.Subbarao
2. Biotechnology – Keshav Trehans
3. Algae and Man - D.F. Jackson
4. Biofertilizer techniques (Marathi) -L.V.Gangawane
5. Biofertilizers -Somani
6. Cultivation of algae -G.S.Venkataraman
7. Role of blue green algae in Nitrogen fixation - R.N.Singh
8. A text book of plant Biotechnology -Dhumal et al, Nirali Prakashan
9. A text book of pharmacognosy by C.S.Shah, J.S. Quady, M/s. B.S.Shah publication, Ahmadabad.
10. Text book of pharmacognosy by Mohammed Ali – C.B.S. Publisher & distribution, Delhi-110032.
11. Phamacognosy -G.E.Treasc, W.C. Evans.
12. Hand book of mushroom -Dr.Mrs.Nita Bahh – Oxford & IBH, publishing Co. Delhi
13. Botany for degree student -B.R.Vashishta
14. A text book of Biotechnology - H.D.Kumar
15. 15. A text book of applied Botany More T.N. *et al*, Gaaj Prakash.
16. A text book of Applied Botany.- B.A. Patil *et. al.*-Sunny Prakashan.

F.Y.B.Sc. (CBCS 2018 Course)

B-23: PRACTICAL COURSE-II

PTERIODOPHYTA, GYMNOSPERMS AND INDUSTRIAL BOTANY

Course Learning Outcome :

Students should understand

1. Study of diversity of Pteridophyte and gymnosperm w.r.t systematic position and morphology.
2. Students learned application of organic fertilization
3. Realization and differentiation of various tissue system
4. Study of life cycle of *Agaricus* and their cultivation.
5. Cultivation of Mass culture of B.G.A. and *Pleurotus*.
6. Preparation of bio- pesticide Azadirachtin, Squash and Ketchup.

Course Content:

1. Study of Pteridophyta – morphology and reproductive structure in e.g. *Psilotum*, *Lycopodium*, *Equisetum* & *Marsilea*
2. Study life history of *Selaginella*.
3. Study of Gymnosperms - morphology and reproductive structures in e.g. *Pinus*
4. Cultivation of Dhingri (Oyster) mushroom.
5. Isolation of *Rhizobium*, from root nodules and culturing of *Rhizobium* by using medium.
6. Isolation of B.G.A. from soil and culturing of B.G.A. by using BG – 11 medium.
7. To demonstrate plant based products and microbes used in biological control.
8. To Study a range of biofertilizers available in local market.
9. Visit to Plant Tissue Culture Lab
10. Field Visit (Forest)
11. Revision

F. Y. B.Sc. (CBCS 2018 Course)

Semester-II

Z- 21 : Functional Anatomy of Chordates-I

Total Credits : 03

Total lectures:45

Course Learning Outcomes:

On completion of the course, students are able to:

1. Study and understand the phylum cephalochordata.
2. Study and understand the systemic position, external morphology and systems developed in Amphioxus.
3. Study primary, secondary and special characters of cephalochordata i.e. in Amphioxus.
4. Study and understand the systematic position, external morphology and sexual dimorphism in frog.
5. Study and understand various systems of frog like digestive system, circulatory system, excretory system, reproductive system, nervous system and sense organ-eye.
6. Understand and study metamorphosis and its significance in frog.

Course Content :

UNIT I - Study of Amphioxus

- i) Systematic position, habits and habitat.
- ii) External characters.
- iii) Digestive system - Alimentary canal, food and feeding and physiology of digestion
- iv) Circulatory system: Arterial and venous system.
- v) Nervous system and sense organs.
- vi) Affinities of Amphioxus - primitive characters, secondary characters and degenerate characters.

UNIT II - Study of Frog

- i) Systematic position, Habits and habitat
- ii) External characters and sexual dimorphism.
- iii) Structure of integument and its functions.
- iv) Digestive system - Alimentary canal, digestive glands, food, feeding mechanism and physiology of digestion.
- v) Blood vascular system: Blood and its functions, Heart - structure, Arterial and venous system.
- vi) Nervous system, Brain and its functions,
- vii) Sense organs - Eye - structure and working.
- viii) Reproductive system - Male and female reproductive system.
- ix) Metamorphosis.

Reference books :

1. Modern text book of Zoology - Vertebrates (1992) Kotpal, Agarwal and Khetarpal.
2. Chordate Zoology (1988) R.C. Dalela.
3. Text book of modern Zoology (1991) P.S. Verma and P.C. Shrivastava.
4. Chordate Zoology E.L. Jordan.
5. Chordate Zoology (1996) Kishor Pawar.
6. Non-chordates and chordate Zoology- II Kishor Pawar.
7. A Text book of Zoology - Animal systematics and diversity-II Marathe. Agarkar and Jos Joshi.

F. Y. B.Sc. (CBCS 2018 Course)
Semester-II
Z- 22: Applied zoology (Vermiculture and Sericulture)

Total Credits:03

Total lectures: 45

Course Learning Outcomes:

On completion of the course, students are able to:

1. Know the skills and knowledge in the field of vermiculture and sericulture.
2. Identify various methodology and perspectives of applied branches of zoology for the possibilities of self-employment.
3. Learn the basic principles involved in the culture of earthworms.
4. Apply the gained knowledge of vermiculture for the self- employment.
5. Study and understand basic principles involved in the moriculture i.e. mulberry cultivation.
6. Understand and study silkworm rearing techniques, various diseases-symptoms, control and prevention and raw silk production, its composition and uses.

Course Content:

UNIT I - Vermiculture

1. Introduction to vermiculture biotechnology
2. Living soil
3. Taxonomy and distribution of useful species of earthworms for vermiculture
4. Manure processing earthworm species
 - i) *Eudrilus eugenia* ii) *Eisenia foetida* iii) *Perionyx excavatus*
6. Soil processing earthworm species
 - i) *Pheretima posthuma* ii) *Pheretima elongata*
7. Earthworm culturing techniques and production of vermicompost
 - i) Vermiculturing in house garden (small scale method).
 - ii) Vermiculturing in the farm (Large Scale)
8. Usefulness of vermiculture
 - i) In agriculture: Advantage of vermiculture farming over chemical farming
 - ii) In sewage treatment
 - iii) In agro industries - Agroindustrial Waste treatment
 - iv) Methods of using vermiculture biotechnology in garden and farms
 - v) Vermiculture biotechnology: Solution of many problems facing the World
9. Economic importance of vermiculture
10. Factors influencing the culturing of earthworms.

UNIT II - Sericulture

1. Introduction to history of sericulture and sericulture industry in India
2. Taxonomy and distribution of silkworm species
3. Types of silk worm: *Bombyx mori* (Mulberry silkworm), Eri Silkworms, Tasar Silkworms and Muga Silkworms
4. External morphology and life-cycle of *Bombyx mori*
5. Cultivation and harvesting of mulberry

6. Silkworm rearing:
 - i) Requirements
 - iii) Rearing appliances
 - iv) Rearing techniques
7. Important diseases: Bacterial, viral, fungal and protozoan
8. Silkworm pests: Dermestid beetles, Uziflies and ants

Reference Books:

1. Biology of earthworms -Edwards and Lofty
2. Earthworm ecology -E. S & chell
3. Earthworm biology - J.A.Wallwark
4. Sustainable agriculture - J.P.Reganold
5. Earthworms - K.E.Lee
6. A Text book of Applied Zoology - Kishor Pawar and Desai
7. Waste management - Kharbonda and Stallworthy
8. Annelida. - R.L.Kotpal

F. Y. B.Sc. (CBCS 2018 Course)
Semester-II
Z- 23: Zoology Practical Course –II
(Practical based on paper: Z-21, Z-22)

Total Credits: 02

Contact hours per practical– 04 h

Course Learning Outcomes:

On completion of the course, students are able to:

1. Understand different categories of chordates and general characters of chordates.
2. Study and understand chordate animals distinguishing characters and classification through slides and museum specimens.
3. Understand how organisms are classified and identified.
4. Study external characters, sexual dimorphism, digestive system, male and female reproductive system of frog with the help of charts and models.
5. Understand the methods of vermiculture and study different products.
6. Study and understand the different varieties of silk moth with the help of museum specimens, composition and uses of silk.
7. Study and understand the stages of life cycle of mulberry silk moth with the help of museum specimens and composition and uses of silk.

Course Content:

1. Study of general and distinguishing characters and classification of chordates up to order with one example of each order. **D**
 - a. Urochordata
 - b. Cephalochordata
 - c. Cyclostomata
 - d. Chondrichthyes
 - e. Osteichthyes
 - f. Amphibia
2. Study of Amphioxus – T. S. through pharynx, gonads, intestine and caudal region with the help of microprepared slide. **D**
3. Study of external characters, sexual dimorphism of frog with the help of model / chart.
4. Study of digestive system of Frog with the help of model / chart. **D**
5. Study of Male reproductive system of frog with the help of model / Chart. **D**
6. Study of Female reproductive system of frog with the help of model / Chart. **D**
7. Study of Brain of frog with the help of model / chart. **D**
8. Metamorphosis in frog with the help of larval forms. **D**
9. Study of taxonomy, external characters and distribution of useful species of earthworm for vermiculture. **D**
10. Earthworm culturing in garden (Small Scale). **D**
11. Study of taxonomy, external characters and distribution of useful species of silkworm for sericulture. **D**
12. Life cycle of mulberry silkworm – Eggs, larva, cocoon, adult (male & female), silk. **D.**

Study Tour:

Compulsory visit to large water body / Vermiculture unit / Sericulture project / Biodiversity spot / ZSI / Any project

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

***E** – Experiments

***D** – Demonstration Practical

Reference books:

1. A manual of practical zoology Chordata Vol. 2 : P. K. G. Nair and K. P. Achar
2. Hand Book of Animal Husbandary and Dairy: Mudlyer
3. Advanced Practical zoology By J. Sinha, A. K. Chatterjee, P. Chattopadhyay

F. Y. B. Sc. (CBCS – 2018 course)
Semester II
MB – 21: Microbial Nutrition, Growth and Control

Total credits: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of the paper, students will be able to:

1. Understand different media to be used for cultivation of microorganisms
2. Know different chemical methods for controlling microbial growth
3. Understand different physical methods for controlling microbial growth

Course content:

(I) Microbial Nutrition

1. Requirements for Growth
2. Physical and Chemical Requirement
3. The common Nutrient Requirements
4. Requirements for Carbon, Hydrogen and Oxygen
5. Nutritional types of Microorganisms
6. Requirements for Nitrogen, Phosphorous and Sulfur
7. Uptake of Nutrients by the cell.
8. Culture Media Chemically defined media Complex media Anaerobic Growth media and methods Special Culture techniques Selective and Differential media Enrichment Culture
9. Obtaining Pure cultures .Methods of purification: Streak plate, spread plate and pours plate technique. Methods of obtaining pure cultures of motile organisms
10. Preserving bacterial cultures .Methods of preservation: On Nutrient agar slants, agar overlay method, Cryopreservation, Freeze drying, Lyophilization.
11. Concept of culture collection center.

(II) Microbial Growth

1. The Growth of bacterial cultures
2. Bacterial Division
3. Generation time
4. Phases of Growth – The Growth curve
5. Measurement of Microbial Growth
 - a. Direct Measurement
 - b. Estimating bacterial numbers by indirect methods.
6. Microbial Growth in Natural Environments
7. The influence of Environmental factors on growth eg. Temperature, oxygen, pH, pressure, heavy metals, salts.

(III) Control of Microbial Growth

1. The Terminology of Microbial control
2. The rate of Microbial Death
3. Actions of Microbial control Agents. Alteration of Membrane permeability

Damage to proteins & Nucleic acids.

4. The pattern of Microbial Death
5. Physical methods of Microbial control E.g. Heat, Filtration, low temperatures, High Pressure, Desiccation, Osmotic Pressure, Radiation, Sonic waves
6. Chemical methods of Microbial control : Principles of Effective disinfection-Evaluation of a disinfectant types of disinfectants – Phenols & Phenolics, Alcohol, Halogen compounds, Heavy metals, Gaseous agents , Formaldehyde, Glutaraldehyde, Ethylene oxide, Hydrogen peroxide, Soaps, Detergents , Dyes Acids.
 - a) Microbial Characteristics and Microbial control.
 - b) Universal Precautions for Microbiology laboratory
 - c) Safety in Microbiology laboratory

References:

1. Alcamo, Edward. I. (2007).Fundamentals of Microbiology, Eighth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Chapter No.1,2,3.).
2. Dubey R. C., D. K. Maheshwari, Second Ed. (2010).A Textbook of Microbiology, S. Chand And Company.
3. Ingraham. J. L and C. A. Ingraham (2000) Introduction to Microbiology .Second Edition Thompson Learning Inc. (Chapter No2,3).
4. Hofkin Bruce V . (2011) Living in a Microbial World. Garland Science. . (Chapter No1,2,5,15,16).
5. Madigan , M. T. and J. M. Martinko (2006), Brock. Biology of Microorganisms 11th Edition, International Edition. Pearson , Prentice Hall. (Chapter No.4.)
6. Manoharachary K. and B.R. Tilak (2012).Principles of Microbiology, I. K. International Publishing House Pvt.Ltd
7. Pelczar M. J., Chan E. C. S., Krieg N.R. (2010),Microbiology, 39th Edition , Tata McGraw-Hill
8. Powar Daginwala Tenth Ed.(2010).General Microbiology Vol.2, Himalaya Publishing House.
9. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2008) Microbiology, Eighth Edition McGraw Hill Higher Education. (Chapter No.2.)
10. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2007) Microbiology: an Introduction, Ninth Edition, Pearson Education. (Chapter No. 3,5).

F.Y.B.Sc. (CBCS – 2018 course)
Semester II
MB-22: The Diversity of Microbial World

Total credits: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of the paper, students will be able to,

1. Understand significance of microorganisms in soil, water and air
2. Know different methods for controlling drug resistant bacteria
3. Understand spread and control of deliberately spread pathogenic
4. microorganisms

Course content:

(I) Ecological Groups of Microorganisms

1. Soil Microorganisms
2. Microflora of soil
 - Interaction among soil microorganisms.
 - Mutualism Commensalism Antagonism
 - Microorganisms as fertilizers.
 - Microorganisms in plant protection *Bacillus thuringiensis* *Pseudomonas fluorescens*
3. Aquatic Microorganisms

(II) Distribution of microorganisms in aquatic environment

1. Microorganisms in sewage
2. Oxidation lagoons
3. Bioluminescence of the marine bacteria and its significance
4. in aquatic ecosystem.
5. Waterborne transmission of diseases.
6. Aquatic microbes for controlling 'oil spill'

(III) Air Microorganisms

1. Distribution of air microflora
2. Significance of microorganisms in air.
3. Laboratory control of 'air contaminant'
 - a. Laminar air flow
 - i. Ultraviolet radiation

(IV) Extremophiles: Definition, examples and significance based on Temperature

1. Psychrophiles
2. Mesophiles
3. Thermophiles
 - i) Based on pH
 - Acidophiles, Alkalophiles
 - ii) Halophiles (Based on salt conc.)
 - iii) Barophiles (Based on pressure)

(V) New horizons in Microbiology

1. Viruses that kill superbug (ESKAPE Therapy)
2. Microbes in 'Bioterrorism'

Reference:

1. Rubina Lawrence (Ed.), (2013) Antimicrobial Resistance, a cause of global concern, Narosa Publishing House. (Topic No.III).
2. Dubey R.C., D.K.Maheshwari, Second Ed. (2010). A Textbook of Microbiology, S. Chand And Company. (Topic No. I, II, III).
3. Powar Daginwala 10th Ed. (2010), General Microbiology Vol.2, Himalaya Publishing House (Topic No. I).
4. Alcamo, Edward. I. (2001). Fundamentals of Microbiology, Sixth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Topic No-I and II).
5. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) .Microbiology, Sixth Edition McGraw Hill Higher Education. (Topic No I, II).
6. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010) Microbiology, 39th Edition, Tata McGraw-Hill. (Topic I).
7. Manoharachary K. and B.R. Tilak (2012), Principles of Microbiology, I.K. International Publishing House Pvt. Ltd. (Topic No. I, II)

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F. Y. B. Sc. (CBCS 2018 course)
Semester-II
Practical Course MB-23 (Based on MB21, MB 22)

Course Learning Outcomes:

After completion of the paper, students will be able to:

1. Understand different methods for cultivation of bacteria
2. Understand different methods of sterilization
3. Know effect of environmental factors on the growth of bacteria

Course Contents:

- 1) Preparation and sterilization of common laboratory media.**
 - i) Peptone Water, ii) Nutrient Broth, iii) Nutrient agar,
 - ii) Mac Conkey's Agar. V) Sabaroud's Agar
- 2) Motility by 'Hanging drop method'**
Demonstration of swarming growth.
- 3) Pure Culture Techniques**
 - i) Streak plate method,
 - ii) Spread plate method
 - iii) Pour plate method,
- 4) Isolation, Colony characteristics, Gram staining and Motility of following microorganisms**
 - i) *Escherichia coli*
 - ii) *Bacillus spp.*
 - iii) *Staphylococcus spp.*
 - iv) *Micrococcus spp.*
- 5) Demonstration of Algae, fungi and protozoa using permanent slides / cultures /sample source**
Amoeba sp, Paramoecium sp, Nostoc sp, Chlorella sp, Aspergillus sp, Mucor sp, Penicillium sp
- 6) Effect of environmental factors on growth of Bacteria.**
 - i) pH
 - ii) Temperature
 - iii) Heavy Metals
 - iv) salt

References:

1. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London ,Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory Manual in General Microbiology, Fifth Edition Wm.C Brown Publisher.
3. Cappuccino J.G. and N. Sherma(2004) Microbiology A Laboratory Manual Sixth Edition, Pearson Education.
4. Cruickshank R and J.P. Duguid(1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology , Churchill Livingstone Edinburgh, London and New York..
5. Pelzar M.J. and E.C. Schan(1972) laboratory Exercise in Microbiology Third Edition (Practical Manual Tata Macgraw Hill Edition New Delhi. 6.Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane
6. Books New Delhi.

F. Y. B. Sc. (CBCS 2018 Course)
Semester-II
M-21: Analytical Geometry

Total Credit :03

Total Lectures :45

Course Learning Outcomes:

At the end of this course students are expected to be able to:

1. Understand translation and rotation of equations of general equation of second degree in x and y .
2. Equations of sphere, tangent plane and normal to sphere.
3. Equations of cone and cylinder.

Course content:

Unit 01: Analytical Geometry of Two Dimensions:

- 1.1 Translation of axes.
- 1.2 Rotation of axes.
- 1.3 Conic section: General equation of second degree in x and y . Centre of conic, nature of conic. Reduction to standard form. Length of the axes.

Unit 02: Planes in co-ordinate Geometry of 3 – Dimensions:

- 2.1 First degree equation in x, y, z represents a plane. Transformation to the normal form. Equation of plane in intercept form. Equation of plane passing through three given points.
- 2.2 System of planes.
- 2.3 Length of the perpendicular from a point to a plane.
- 2.4 Joint equation of two planes. Angle between planes.

Unit 03: Lines in co-ordinate Geometry of 3-Dimension:

- 3.1 Equations of a line, Equations of line in terms of direction cosines and the point on it, equations of lines through two points. Equations of line in symmetrical form. Angle between line and Plane.
- 3.2 The shortest distance between two skew lines, the length and equations of the line of shortest distance.

Unit 04: Sphere:

- 4.1 Definition and equation of the sphere in various forms
- 4.2 Plane section of a sphere, intersection of two spheres.
- 4.3 Equation of a circle, sphere through a given circle, intersection of a sphere and a line.
- 4.4 Equation of a tangent plane and normal to sphere

Unit 05: Cones and Cylinders:

- 5.1 Definition of cone. Equation of cone with vertex at the origin and $(\alpha \beta \gamma)$
- 5.2 Quadratic cone and some properties of quadratic cone
- 5.3 The right circular cone and equation of right circular cone.
- 5.4 Definition of cylinder, Right circular cylinder and equation of a right circular cylinder.

Reference Books:-

1. S. L. Loney, The Elements of Co-ordinate Geometry, Macmillan and Company, London.
2. Gorakh Prasad and H.C.Gupta. Textbook on Co-ordinate Geometry, Pothishala Pvt., Ltd., Allahabad.
3. R. J. T. Bill, Elementary Treatise on Co-ordinate Geometry of Three dimensions, Macmillan India, Ltd., 1994
4. P. K. Jain and Khalil Ahmed, A textbook of Analytical Geometry of two dimensions, Wiley Eastern Ltd. 1994.
5. Shanti Narayan: Analytical Solid geometry, S-Chand & Co.
6. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Algebra & Geometry; Nirali Prakashan

F. Y. B. Sc. (CBCS 2018 Course)
Semester-II
M-22: Integral Calculus and Differential Equations

Total Credit :03

Total Lectures :45

Course Learning Outcomes:

At the end of this course students are expected to be able to

1. Solve the integrals by partial fractions and reduction methods.
2. Obtain lengths of the curves, volumes and surfaces of solids obtained by revolving the curves.
3. Solve the differential equations of first order and first degree and their applications.

Course content:

Unit 1: Integration:

1.1 Integration by method of substitution and integration by parts.

1.2 Integration by partial fractions:

- a) Denominator contains non-repeated linear factors.
- b) Denominator contains repeated linear factors
- c) Denominator contains one linear and one irreducible quadratic form.

1.3 Integration of the following form

$$(i) \int \frac{dx}{a+b\cos x} \quad (ii) \int \frac{dx}{a+b\sin x} \quad (iii) \int \frac{dx}{a+b\cos x+c\sin x}$$

1.4 $\int \frac{x^2 \pm 1}{x^4 + 1} dx$

1.5 (i) $\int (Ax+B)\sqrt{ax^2+bx+c}$ (ii) $\int \frac{Ax+B}{\sqrt{ax^2+bx+c}} = dx$

1.6 Reduction formulae

$$(i) \int \sin^n x dx \quad (ii) \int \cos^n x dx \quad (iii) \int_0^{\pi/2} \sin^n x dx$$

$$(iv) \int_0^{\pi/2} \cos^n x dx \quad (v) \int \sec^n x dx \quad (vi) \int \operatorname{cosec}^n x dx$$

$$(vii) \int \tan^n x dx \quad (viii) \int \cot^n x dx \quad (ix) \int_0^{\pi/2} \sin^n x \cos^m x dx$$

Unit 2: Applications of Integration:

2.1 Quadrature, Rectification – Lengths of plane curves

2.2 Volumes and Surfaces of solids obtained by revolving the curves about the co-ordinate axes.

Unit 3: Differential Equations of first order and first Degree:

- 3.1 Differential equations, order and degree of differential equations, formation of differential equations.
- 3.2 General and particular solutions of differential equations.
- 3.3 Methods of finding solution of differential equations of first order and first degree
 - a) Variables separable form
 - b) Homogeneous differential equations.
 - c) Differential equations reducible to homogeneous form.
 - d) Exact differential equations.
 - e) Differential equations reducible to exact differential equations, Integrating factors and rules (without proof) for obtaining integrating factors.
 - f) Linear differential equations. Bernoulli's differential equations.

Unit 4: Applications of Differential Equations:

- 4.1 Orthogonal trajectories of one parameter family of curves in Cartesian co-ordinates

Reference Books:-

- 1. Robert G Bartle and Donald R Sherbert; Introduction to Real Analysis, John Wiley & Sons.
- 2. Shantinayakan: Integral Calculus, S. Chand & Co.
- 3. R. Courant and F. John, Introduction to Calculus and Analysis, Springer-Verlag, New York 1999.
- 4. Rainville and Bedient: Elementary Differential Equations, Macmillin Publication.
- 5. Gorakh Prasad; Integral Calculus, Pothishala Pvt. Ltd. Alahabad
- 6. D. A. Murray, Introductory course in Differential Equations; Orient Longman (India 1967)
- 7. G. F. Simmons: Differential Equations, Tata McGraw Hill (1972)
- 8. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Calculus and Differential Equations; Nirali Prakashan

F. Y. B. Sc. (CBCS 2018 Course)
Semester-II
M-23: Mathematics Practical Course -II

Total Credit :02

(Practicals based on the applications and Problems of articles in M-21 and M-22)

Course Learning Outcomes:

At the end of this course students are expected to be able to:

1. Knowledge of solving problems on Integration, application of integration.
2. Solving the problems on translation and rotation.
3. Finding equations of following conics: Parabola, Hyperbola, Ellipse.
4. Finding equations of plane in 3-D and line in 3-D.
5. Finding Solution of differential equations of first order and first degree (Homogenous, Non-homogenous, Exact and linear)
6. Finding different types of equations of Cones, Cylinders and Sphere.

Course content

List of Practical:

1. Integration
2. Applications of Integration
3. Change of axes; translation and rotation
4. Conic Section
5. Planes in three dimensions
6. Lines in three dimensions
7. Solution of differential equations of first order and first degree
8. (Homogenous, Non-homogenous, Exact and linear)
9. Applications of differential equations
10. Cones and cylinders
11. Spheres.

F. Y. B. Sc.: (CBCS 2018 Course)

Semester-II

S-21: Descriptive Statistics – II

Total Credit: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students will acquire:

1. Knowledge to bi-variable data, their organization and evaluation.
2. Knowledge of scatter diagram and their interpretations.
3. Knowledge of correlation coefficients, types of correlation and rank correlation coefficient.
4. Concept of regression, regression line and their utility.
5. Knowledge of non-linear regression and different types of curves.
6. Concept of index number, their different types and uses.

Course content:

Unit 1. Correlation

- 1.1 Bivariate data, Scatter diagram and interpretation.
- 1.2 Concept of correlation between two variables, positive correlation, negative correlation, no correlation.
- 1.3 Covariance between two variables (m11) : Definition, computation, effect of change of origin and scale.
- 1.4 Karl Pearson's coefficient of correlation (r) : Definition, computation for ungrouped data and interpretation. Properties: (i) $-1 \leq r \leq 1$ (with proof), (ii) Effect of change of origin and scale (with proof).
- 1.5 Spearman's rank correlation coefficient: Definition, derivation of formula, computation and interpretation (without ties). In case of ties, compute Karl Pearson's correlation coefficient between ranks. (Spearman's rank correlation coefficient formula with correction for ties not expected.)
- 1.6 Examples

Unit 2. Fitting of curves to the bivariate data

- 2.1 Fitting of line ($Y = a + bX$),
- 2.2 Fitting of second degree curve ($Y = a + bX + cX^2$),
- 2.3 Fitting of exponential curves of the type $Y = ab^x$ and $Y = aX^b$. In all these curves parameters are estimated by the method of least squares.
- 2.4 Examples

Unit 3. Linear Regression Model

- 3.1 Meaning of regression, difference between correlation and regression,
- 3.2 Concept of error in regression, error modeled as a continuous random variable.
Simple linear regression model: $Y = a + bX + \epsilon$, where ϵ is a continuous random variable with $E(\epsilon) = 0$, $V(\epsilon) = \sigma^2$. Estimation of a, b by the method of least squares. Interpretation of parameters. Statement of the estimator of σ^2 .
- 3.3 Concept of residual, plot of residual against X, concept of coefficient of determination.

Unit 4 Index Numbers

- 4.1 Introduction.
- 4.2 Definition and Meaning.

- 4.3 Problems/considerations in the construction of index numbers.
- 4.4 Simple and weighted price index numbers based on price relatives.
- 4.5 Simple and weighted price index numbers based on aggregates.
- 4.6 Laspeyre's, Paasche's and Fisher's Index numbers.
- 4.7 Consumer price index number: Considerations in its construction. Methods of construction of consumer price index number - (i) family budget method(ii) aggregate expenditure method.
- 4.8 Examples

Recommended Books:

1. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
2. Draper, N. R. and Smith, H. (1998). Applied Regression Analysis Third Edition, John Wiley and Sons
3. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
4. Gupta, S. C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
5. Gupta, S. C. and Kapoor, V. K. (1997). Fundamentals of Applied Statistics, Third Edition, Sultan Chand and Sons Publishers, New Delhi.
6. Freund, J. E. (1977). Modern Elementary Statistics. Fourth Edition, Prentice Hall of India Private Limited, New Delhi.
7. Montgomery, D. C; Peck, E. A.; Vining, G. G. (2006). Introduction to Linear Regression Analysis, John Wiley and Sons
8. Hanagal David D.(2009). Introduction to Applied Statistics: A non –calculus based approach. Narorse Publishing House. New Delhi

F. Y. B. Sc.: (CBCS 2018 Course)

Semester-II

S- 22: Discrete Probability and Probability Distributions –II

Total Credit: 03

Total Lectures: 45

Course Learning Outcomes:

After completion of this course students will acquire:

2. Knowledge of important discrete distributions such as Poisson distribution and geometric distribution.
3. Acumen to apply standard discrete probability distributions to different situations.
4. Knowledge related to concept of discrete bivariate data, discrete bivariate probability distributions including expectations and moments.
5. Knowledge of correlation, regression for discrete probability distributions.

Course content:

Unit 1. Some Standard Discrete Probability Distributions - II

1.1 Poisson distribution: Notation : $X \sim P(m)$.

$$p(x) = \frac{e^{-m} m^x}{x!} \quad 1, 2, \dots, m > 0$$
$$= 0 \quad \text{otherwise}$$

m.g.f. and c.g.f. Moments, mean, variance, skewness and kurtosis.

Situations where this distribution is applicable.

1.2 Geometric distribution: Notation: $X \sim G(p)$,

Geometric distribution on support $(0, 1, 2, \dots)$ with p.m.f. $p(x) = pq^x$.

Geometric distribution on support $(1, 2, \dots)$ with p.m.f. $p(x) = pq^{x-1}$.

$0 < p < 1, q = 1 - p$.

Mean, variance, m.g.f. and c.g.f. Situations where this distribution is applicable.

Unit 2. Bivariate Discrete Probability Distribution

2.1 Definition of two-dimensional discrete random variable, its joint p.m.f. and its distribution function and their properties, concept of identically distributed r.v.s.

2.2 Computation of probabilities of events in bivariate probability distribution.

2.3 Concepts of marginal and conditional probability distributions.

2.4 Independence of two discrete random variables based on joint and marginal p.m.f.s

2.5 Examples

Unit 3. Mathematical Expectation (Bivariate Random Variable)

3.1 Definition of raw and central moments, m.g.f, c.g.f.

3.2 Theorems on expectations of sum and product of two jointly distributed random variables.

- 3.3 Conditional expectation.
- 3.4 Definitions of conditional mean and conditional variance.
- 3.5 Definition of covariance, coefficient of correlation, independence and uncorrelatedness of two variables.
- 3.6 Variance of linear combination of variables $\text{Var}(aX + bY)$.
- 3.7 Additive property for binomial and Poisson distributions.
- 3.8 Conditional distribution of X given $(X+Y)$ for binomial and Poisson distributions.
- 3.9 Examples

Recommended Books:

1. Agarwal B. L. (2003). Programmed Statistics, second edition, New Age International Publishers, New Delhi.
2. Gupta, S.C. and Kapoor, V. K. (1983). Fundamentals of Mathematical Statistics, Eighth Edition, Sultan Chand and Sons Publishers, New Delhi.
3. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons, New York.
4. Hogg, R. V. and Craig R. G. (1989). Introduction to Mathematical Statistics, Ed.
5. MacMillan Publishing Co., New York.
6. Mayer, P. (1972). Introductory Probability and Statistical Applications, Addison Wesley Publishing Co., London.
7. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics, Ed. 3, McGraw Hill Book Company.
8. Ross S. (2002). A First Course in Probability, Sixth Edition, Pearson Education, Inc. & Dorling Kindersley Publishing, Inc.
9. Hanagal David D.(2009). Introduction to Applied Statistics: A non –calculus based approach. NarorsePublishing House. New Delhi

F. Y. B. Sc.: (CBCS 2018 Course)
Semester-II
S-23: Statistics Practical Course –II

Total Credits: 02

Course Learning Outcomes:

After completion of this course students will acquire:

1. Concept of different types of correlation using scatter diagram.
2. Knowledge of computing of correlation coefficient and regression lines for ungrouped and grouped data.
3. Knowledge of fitting of second degree curve and exponential curve & computation of different types of Index numbers.

Course content

List of Practicals

Sr.No	Title of the Experiment
1	Testing consistency of data, computation of coefficient of association.
2	Scatter diagram, computation of correlation coefficient for ungrouped data.
3	Computation of correlation coefficient for grouped data.
4	Computation of Spearman's rank correlation coefficients.
5	Fitting of lines of regression for ungrouped data and grouped data.
6	Fitting of second degree curve, exponential curve of type $y = ab^x$
7	Fitting of Poisson distribution and computation of expected frequencies
8	Applications of Poisson and geometric distributions
9	Problems on Bivariate Probability distributions
10	Index numbers

F.Y.B.Sc. (CBCS-2018 Course)
Semester: II
UG SEC-21: Renewable energy and energy harvesting

Total credits: 02

Total Lectures: 23

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

1. Student will be able to understand the different renewable resources available in the nature.
2. Understanding of advantages of renewable energy.
3. Understanding of conversion of solar energy, ocean energy, wind energy and hydro energy to usable energy
4. Understanding of harvesting the renewable energy resources

Course content:

1. Fossil fuels and alternative sources of energy:

Fossil fuels, need of renewable energy, non-conventional energy sources, An overview of developments in offshore wind energy, tidal energy, wave energy system, ocean thermal energy conversion, solar energy, biomass, biochemical conversion, biogas generation, hydroelectricity.

2. Solar energy:

Solar energy and its importance, storage of solar energy, solar water heater, flat plate collector, solar oscillation, solar cooker, solar cell, need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits and sun tracking systems.

3. Wind energy harvesting:

Fundamentals of wind energy, wind turbines and different electrical machines in wind turbines, power electronic interfaces and grid interconnection technologies.

4. Ocean energy:

Ocean energy potential against wind and solar, wave characteristics and statistics, wave energy devices, tidal energy technologies, ocean thermal energy.

5. Hydro energy:

Hydropower resources, hydropower technologies, environmental impact of hydropower sources.

• Demonstrations and experiments:

Demonstrations of training modules on solar energy, wind energy etc. Conversion of thermal energy into voltage using thermoelectric modules.

S.Y.B.Sc. (CBCS – 2018 Course)
SEM. - III
P – 31: MATHEMATICAL METHODS FOR PHYSICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of how partial differentiation works and different types of coordinates systems
- Ability to explain complex algebra using their different forms, associated theorems and trigonometric functions
- Explain the vector algebra and vector analysis
- Understanding of different vector identities and their physical significance

Course Content:

1. Partial Differentiation: (16)

Introduction, Idea, Definition and notation of partial differentiation, rules for obtaining partial derivative, total differential, exact differential, chain rule, Theorems of differentiation, change variables from the Cartesian to Spherical polar co-ordinates, problems based on change of variables, maxima and minima (Qualitative treatment), Problems, Frequently occurring differential equations (Cartesian coordinates), Degree, order, linearity and homogeneity of differential equation.

2. Complex Algebra: (16)

Complex Numbers, algebra of complex numbers, complex conjugate. Argand Diagram, Algebra of complex numbers by using Argand diagrams; Rectangular and polar form of complex numbers; Exponential form of complex numbers; Euler's relations De-Moivre's theorem (statement only), Trigonometric functions; exponential and hyperbolic functions, powers and roots of complex numbers; Applications of complex numbers to determine velocity and acceleration in Curved motion, Problems.

3. Vector Algebra (08)

Introduction to scalars and vectors, dot product and cross product of two vectors and its physical significance, Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Problems.

4. Vector Analysis: (20)

Introduction, differentiation of a vector with respect to scalar, scalar and vector fields, Vector differential operator and Laplacian operator, gradient of a scalar, physical significance of a gradient of a scalar, physical significance of divergence of a vector field, curl of a vector field, its physical significances, del operator, some vector identities, Problems.

(a) $\nabla \times \nabla \phi = 0$, (b) $\nabla \cdot (\nabla \times \mathbf{V}) = 0$, (c) $\nabla \cdot (\nabla \phi) = (\nabla \cdot \nabla) \phi$, (d) $\nabla \cdot (\phi \mathbf{A}) = \nabla \phi \cdot \mathbf{A} + \phi \cdot (\nabla \cdot \mathbf{A})$,
(e) $\nabla \times (\nabla \mathbf{A}) = \phi (\nabla \times \mathbf{A}) + (\nabla \phi) \times \mathbf{A}$, (f) $\nabla \cdot (\mathbf{A} \times \mathbf{B}) = \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B})$

Reference books:

1. A Course in Mathematics - Laud and Takawale
2. Mathematical Methods in Physical Science - Mary Boas.
3. Mathematical Physics - B.D. Gupta and Gupta
4. Vector Analysis - Spiegel (Schaum Series)
5. Mathematical Physics - B.S. Rajput (Pragati prakashan)
6. Advanced Engineering Mathematics - Krezick (8th Edition)
7. Introduction to Classical Mechanics - R.G.Takwale and P. S. Puranic, Tata McGraw-Hill Publishing Company Ltd; New Delhi

S.Y.B.Sc. (CBCS – 2018 Course)
SEM. - III
P – 32: OPTICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding the basics of optics
- Properties of light such as interference, diffraction and polarization
- Applications of properties of light in modern world

Course Content:

1. Geometrical Optics: (10)

Introduction, thin and thick Lenses, Sign convention, lens equation for thin lenses, Lens maker equation, Magnification of thin lens, Deviation by thin lens, Power of thin lens, Equivalent focal length of two thin lenses, Cardinal points, Optical instruments: Simple Microscope, Compound Microscope, Eyepieces - Ramsden and Huygen's Eyepieces, their merits and demerits, Problems.

2. Interference: (20)

Introduction - (Revision of Idea of coherence, Analytical treatment of interference - Intensity distribution in interference pattern, classification of interference), phase change on reflection (Stoke's treatment). Interference by parallel sided thin films, fringes of equal thickness (conditions for maxima and minima only), interference in thin wedge shaped films (normal incidence), Newton's rings. Theory and its application to determine wavelength of light, refractive index of liquid and flatness testing (Brief description)

3. Diffraction: (20)

Concept of diffractions, Fresnel and Fraunhofer diffractions - Fraunhofer diffraction at a single slit. Theory of plane transmission grating, intensity distribution in diffraction pattern, Fresnel diffraction - rectilinear propagation of light, simple theory of zone plate, Rayleigh's criteria of resolution, Resolving power, R.P of prism and transmission grating, crystal as a diffraction grating, Bragg's diffraction condition, Problems.

4. Polarization: (10)

Introduction to polarization, Methods to produce polarized light, Brewster's law, polarization by refraction/pile of plates, Law of Malus polarization by reflection, detection of polarized light, polarized by selective absorption, Double refraction in uniaxial crystals, Construction of polarizer, Quarter and Half Wave plates, Nicol prism, Problems

Reference Books

1. Geometrical and Physical Optics - Jenkins and White
2. Optics - Ajay Ghatak 2nd edition
3. Principles of optics - D.S. Mathur, Gopal Press, Kanpur
4. Optics - Brijlal and Subramanyam
5. Optics - Ghatak Loknathan.
6. A Text book of Optics - N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication
7. Lasers and Non-linear light - Dr. B.B. Laud
8. Laser Applications - Mont Ross (Academic Press).

S.Y.B.Sc. (CBCS – 2018 Course)

SEM. - III

P – 33: PRACTICAL COURSE - III

Total Credits: 02

Total Lectures : 60

Learning Outcome :

1. Study of acceleration due to gravity 'g' by resonance pendulum
2. Study of coupled oscillators
3. Measurement of Young's modulus and modulus of rigidity
4. To understand Zener stabilized power supply.
5. To know diode as rectifier and calculation of ripple factor

Course Content:

1. 'g' by resonance pendulum - change in length of simple pendulum for two different amplitudes of compound pendulum.
2. Log decrement - Determination of Log decrement in air
3. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
4. Study of musical scales using a signal generator and musical instruments.
5. Determination of frequency of AC mains using sonometer.
6. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
7. Measurement of Y and η of given wire by Searle's method.
8. Y by vibration of wooden bar.
9. Velocity of Sound by phase shift method.
10. Study of acoustic resonance by using bottle as a resonator.
11. Newton's Ring: Determination of wavelength of monochromatic light source
12. Dispersive power of glass prism
13. Measurement of beam divergence / beam size of a LASER beam
14. Diffraction at the edge of a razor blade.
15. Optical activity of sugar solution (polarimeter)
16. Wavelengths of any three colors in the Hg spectrum using Diffraction Grating.
17. Zener stabilized power supply, load and line regulation and % ripple factor
18. Study of rectifiers & calculation of ripple factor with & without filter

Note: At least 8 experiments should be performed from the course

REFERENCE BOOKS:

1. Advanced Practical Physics - Worsnop and Flint
2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
3. Experimental Physics - Rajopadhye and Purohit
4. B.Sc. Practical Physics - C. N. Arora
5. Physics through Experiments Vol. 1, Mechanical System - B. Saraf
6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
7. World Wide View of Physics - A. W. Joshi & others.

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III
C - 31 : PHYSICAL & ANALYTICAL CHEMISTRY-I

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Know the meaning of conductance, specific conductance, molecular conductance etc.
2. Understand the efficiency of Carnot cycle.
3. Solve numerical based on entropy.
4. Study the real meaning of sampling.
5. Realize the actual calculations of significant figures.
1. 6. Analyse qualitative and quantitative estimation of C,H,(O)

Course Content:

SECTION - I (PHYSICAL CHEMISTRY)

1. Electrochemistry

[18]

Introduction, Conduction of electricity, Types of conductors: electronic and electrolytic, Explanation of the Terms: Specific, equivalent and molecular conductance's, relation between specific and equivalent conductance, variation of conductance with dilution, equivalent conductance at infinite dilution, Measurement of Conductance by Wheatstone Bridge, Types of Conductivity cells, Cell constant and its determination, Migration of Ions, Hittorf's Rule (Migration), Transport number, Determination of transport number by moving boundary method, Factors influencing transport number: Concentration, Temperature, Complex formation, Abnormal transport number, Degree of hydration, Kohlrausch Law: i) Relation between ionic conductance, ionic mobility and transport number ii) Determination of equivalence conductance at infinite dilution for weak electrolytes iii) Determination of degree of dissociation iv) Determination of ionic product of water v) Determination of solubility and solubility product of sparingly soluble salts.

Conductometric Titrations: Theory, general procedure, different types of conductometric titrations and applications of conductometric titrations.

Ref.7 Page no. 339-464.

2. Thermodynamics - I

[06]

Spontaneous and non-spontaneous process, Second law of thermodynamics and its different statements, Carnot's Theorem (Heat engine), Carnot cycle and its efficiency. Numerical.

Ref.1 and 2.

3. Thermodynamics - II

[06]

Entropy: Introduction, Concept of entropy, Entropy as a state function, Definition mathematical expression, unit, physical significance of entropy, Entropy changes for reversible and irreversible processes in isolated system, Entropy changes for an ideal gas as a function of V and T and as a function of P and T, Entropy change in mixing of gases. Entropy change in Physical transformations: (i) Fusion of a solid.(ii) Vaporization of a liquid. (iii) Transition from one crystalline form to another.

Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, Use of absolute entropies: Determination of entropy changes in chemical reactions.

Ref.1 and 2.

REFERENCE BOOKS:

1. Essentials of Physical Chemistry (2012), S Chand & Co. Ltd., ArunBahl, B. S. Bahl & G. D. Tuli.
2. Advanced Physical Chemistry (2011), S Chand & Co. Ltd., D. N. Bajpai.
3. Physical Chemistry, G.M.Barrow, International Student Edition, McGraw Hill.
4. Physical Chemistry, R.A.Alberty, Wiley Eastern Ltd.
5. University General Chemistry, C.N.Rao, Macmillan.
6. Physical Chemistry Through Problems, S.K.Dogra, Wiley Eastern Ltd.
7. Principles of Physical Chemistry, Samuel H. Maron, Carl F. Prutton, Fourth Edn.

SECTION – II (ANALYTICAL CHEMISTRY)

1) Importance of Analytical Chemistry and Sampling [04]

The analytical process, types of analytical techniques and their comparison. Sampling, storage of samples, sampling of solids, liquids and gases,.

2) Errors in Quantitative Analysis. [06]

Accuracy, precision, mean deviation, standard deviation, classification of errors, minimization of errors, significant figures and computations, reliability of results, Numericals.

3) Theory of Qualitative Analysis [10]

Basic principle, common ion effect, solubility, solubility product, preparation of original solution, classification of basic radicals in groups, separation of basic radicals, removal of interfering anions (Phosphate and borate), detection of acidic radicals.

4) Analysis of Organic Compounds (Qualitative & Quantitative) [10]

I. Qualitative

A. Types of organic compounds, Characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

II Quantitative

- B. Estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen's test.
- C. Estimation of nitrogen by Dumas's Kjeldahl's flask method, estimation of halogen, sulphur and phosphate by Carious tube method.
- D. Determination of empirical and molecular formula and numerical problems.

REFERENCE BOOKS:

- 1) The Quantitative Inorganic Chemistry - by A.I. Vogel
- 2) Fundamentals of Analytical Chemistry - by S.M.Khopkar
- 3) Quantitative Analysis - by Day and Underwood
- 4) Analytical Chemistry - by G.D.Christian

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III

C-32 : ORGANIC & INORGANIC CHEMISTRY-III

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the types of organic reaction and mechanism of some name reactions.
2. Write stereochemistry of cycloalkanes.
3. Study of ethers and epoxides.
1. 4. Know synthesis and reactions of pyridine, quinoline & isoquinoline.
2. 5. Explain study of chemistry of d-block elements.
6. Describe the role of metals in bioinorganic compounds.
7. Specify principles in metallurgy and its applications

Course Content:

SECTION – I (ORGANIC CHEMISTRY)

1. Organic reaction Mechanism [10]

- a) Introduction, types of reagents—electrophile, nucleophile and free radical.
- b) Types of organic reactions: Addition, Elimination (β -elimination and Hofmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement.
- c) Mechanism: (i) Aldol condensation (ii) Markovnikov and anti-Markovnikov addition reaction (iii) SN^1 and SN^2 reactions

Ref. 1 & 4

2. Stereochemistry of Cycloalkanes [08]

- a) Baeyer's strain theory, Heat of combustion,
- b) cycloalkanes, factors affecting the stability of conformation,
- c) Conformation of cyclohexane - equatorial and axial bonds,
- d) Monosubstituted cyclohexane stability with $-CH_3$ and $-C(CH_3)_3$
- e) substitutes.

Ref. 3

3. Ethers and Epoxides [06]

- a) Ether linkage, classification, Nomenclature, Physical properties.
 - b) Industrial source.
 - i) Williamson's synthesis.
 - ii) Diazomethane method.
 - iii) Alkoxy mercuration demercuration.
 - iv) Reactions of ethers with cold HI, hot HI and dil H_2SO_4 .
 - v) Synthesis of epoxides, Acid base catalyzed ring opening of epoxides, Reactions with Grignard reagent
- (Ref.1, Pages 699 - 708, 713 - 719)

4. Heterocyclic Chemistry

[06]

- a) Introduction.
- b) Structure.
- c) Nomenclature.
- d) Synthesis and reactions of:- (i) Pyridine (ii) Quinoline (iii) Isoquinoline.
(Ref. 5 :- Sections 7 & 8, Pages :- 223-232, 273-293).

Reference Books:

1. Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.
2. Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.
3. Stereochemistry of carbon compounds - E. L. Eliel
4. Reactions, rearrangements and reagents – S N Sanyal
5. Principles of modern Heterocyclic Chemistry By L.A. Paquette.

SECTION – II (INORGANIC CHEMISTRY)

1. Chemistry of d-block elements

[08]

Position of d-block in periodic table, electronic configuration, trends in properties of these elements w.r.t.(a) Size of atoms & ions (b) Reactivity (c) Catalytic activity (d) Oxidation states (e) Complex formation ability (f) Colour (g) Magnetic properties (h) Nonstoichiometry (i) Density (j) Melting & Boiling points.

Ref.1 Page no. 651-675 and

2 Page no. relevant pages.

2. Bioinorganic chemistry

[08]

Role of metals in bioinorganic compounds, Biological role of some alkali metals and transition metals: compounds of Ca, Mg, Fe and Co, Bioinorganic chemistry of iron, Haemoglobin and myoglobin, Functions of oxygen transfer, oxyhaemoglobin and deoxyhaemoglobin, photosynthesis; photosystem-I and photosystem-II, Vitamin B-12, Structure and Applications.

Ref.3. page no. 851-921

4. page no. 645-655.

3. General Principles of Metallurgy:

[08]

Introduction, occurrence of metals, ores and minerals, types of ores, operations involved in metallurgy, Crushing, Pulverisation, Methods of concentration such as Hand picking, Gravity separation, Magnetic separation. Froth flotation, Calcinations, Roasting etc.

Reduction, Various methods of reduction such as smelting, Aluminothermic process and Electrolytic reduction, Refining of metals, Various methods of refining such as poling, liquation, electrolytic and vapour phase refining (Van Arkel Process).

Ref. 5. page no. 262-271.

6. page no. 2.3-2.8, 2.13-2.17.

4. Metallurgy of Aluminium (Electrometallurgy):

[06]

Occurrence, Physiochemical principles, Extraction of Aluminium, Purification of bauxite by Baeyer's process, Electrolysis of alumina, Application of aluminum and its alloys.

Ref. 5 page no. 458-463. 6 page no. 2.209 to 2.211.

References:

1. Concise Inorganic Chemistry by J. D. Lee.
2. General Chemistry-Raymond Chang.
3. Inorganic Chemistry-James Huheey, Third Edⁿ
4. Inorganic Chemistry-Shriver and Atkins, Third Edⁿ
5. Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu,
6. Text book of Inorganic Chemistry, P.L. Soni.

S.Y.B.Sc (CBCS-2018 Course)
SEMESTER – III

C-33 : PRACTICAL COURSE - III

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Study the reaction between $K_2S_2O_8$ and KI.
2. Determine the normality of strong acid conductometrically.
3. Find out the CST of phenol-water system.
4. Analyse binary mixture of organic compound.
5. Estimate the Vitamin C and Acetamide.

Course Content:

A. PHYSICAL CHEMISTRY EXPERIMENTS (Any 5)

- 1 To study the reaction between $K_2S_2O_8$ and KI (Equal concentrations).
- 2 To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.
- 3 Determination of solubility of benzoic acid at different temperature and to determine ΔH of dissociation process.
- 4 To determine critical solution temperature of phenol water system
- 5 To determine molecular weight of given organic liquid by steam distillation
- 6 To study neutralization of acid (HCl) base (NaOH) and CH_3COOH by NaOH and H_2SO_4 by NaOH.
- 7 To determine the rate constant of base catalyzed ester hydrolysis.
- 8 To determine the specific and molar refractions of benzene, toluene and xylene by Abbe's refractometer and hence determination of the refraction of $-CH_2-$ group (Methylene group). (Densities should be determined by students.)

B. ORGANIC CHEMISTRY EXPERIMENTS

Organic qualitative analysis: (3 Mixtures)

a) Separation of binary mixtures (without ether) followed by Type determination, Recrystallization, M.P./B.P. of separated organic components from mixture.

Type determination, Recrystallization, M.P./B.P.

The following compounds should be selected:-

Acids:- Benzoic, salicylic, phthalic, cinnamic and oxalic acid.

Phenols:- α -Naphthol, β -Naphthol & Resorcinol

Bases:- Aniline, p-Toluidine, o-Nitroaniline, p-Nitroaniline, m-Nitroaniline, and N-N dimethyl aniline.

Neutrals:- Acetone, Ethylmethyl ketone, Ethyl acetate, Naphthalene, m-Dinitrobenzene, Nitrobenzene, Acetanilide, Thiourea

Volumetric analysis : (Any two)

- (i) Estimation of Acetamide.
- (ii) Estimation of Carboxylic acid.
- (iii) Estimation of Vitamin C

S.Y.B.Sc. (C.B.C.S. 2018 Course)

SEMESTER-III

B - 3 1 : ANGIOSPERM TAXONOMY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. Know the vegetative characteristics of the plant.
2. Know the scope and importance of the discipline.
3. Learn about the reproductive characteristics of the plant.
4. Understand the plant morphology and the diversity of angiosperms.
5. Understand the comparative account among the families of angiosperms.
6. Know the economic importance of the angiosperm plants.
7. Understand plant communities and ecological adaptations in plants.

Course content

TAXONOMY

- 1. Introduction to plant taxonomy: 09 L**
Definition, objectives, importance, concept of systematics and taxonomy.
- 2. Aspects of plant systematic: 09 L**
System of classification: Natural, Artificial and Phylogenetic.
- 3. System of classification: 09 L**
Salient features of Bentham & Hooker's and Engler & Prantle's system of classification with merits & demerits.
- 4. Botanical nomenclature: 11 L**
Salient features of ICBN; concept of binomial nomenclature, taxonomic ranks and concept of species.
- 5. Study of plant families: 22 L**
Study of following flowering plant families according to Bentham & Hooker's system distribution, distinguishing character, floral formula, floral diagram and economic importance.
 - Annonaceae
 - Brassicaceae
 - Meliaceae
 - Caesalpiniaceae
 - Apiaceae
 - Asteraceae
 - Solanaceae
 - Acanthaceae
 - Euphorbiaceae
 - Amaryllidaceae

Reference Books:

1. Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson (Printers) Ltd., London & Edinburgh.
2. Delevoryas Th. 1965. Plant Diversification. modern biology series, Halt, Rinehart & Winston, New York.
3. Foster, A.S. and Gifford, A.E.M., Jr. 1967. Comparative Morphology of Vascular Plants. Vakils. Peffer& Simons Pvt. Ltd.
4. Spome, K.R. 1977. The Morphology of Angiosperms. B.I. Publication, Bombay.
5. Bhowani. S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas publishing house, Deihi.
6. Johri B.M.1984, Embryology of Angiosperms. Springer-Verlag, Berlin.
7. V.N.Naik, 1985. Taxonomy of Angiosperms.
8. P.Shukla and S.Mishra, 1979. An Introduction to taxonomy of Angiasperms.
9. A text book of Botany – K.N.Dhumal *et al* Nirali Prakashan

S.Y.B.Sc.(C.B.C.S. 2018 Course)

SEMESTER-III

B-32: DEVELOPMENTAL BOTANY & EMBRYOLOGY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. Understand the various components of stem and wood during its secondary growth.
2. Enlighten about the mechanism of pollination and basic structure of the embryo.
3. Understand the scope & importance of anatomy and embryology.
4. Know various tissue systems, normal and anomalous secondary growth in plants and their causes. Perform the techniques in anatomy.
5. Understand structure and development of microsporangium and megasporangium.
6. Understand male and female gametophytes.
7. Know fertilization, endosperm and embryogeny.

Course content

DEVELOPMENTAL BOTANY:

1. **Organization of higher plant body:-** **06 L**
Primary structure of root and shoot systems, tissue systems in plants.
Meristematic tissues: general characters, theories-Histogen theory, apical cell theory and Tunica corpus theory; shoot apical meristem, root apical meristem, lateral meristems and their functions, Permanent tissues.
2. **Epidermal tissue system-** **05L**
Epidermal cells, structure of typical stoma, types & functions, Epidermal outgrowths - trichomes and their functions.
3. **Mechanical tissues system-** **04L**
Types of mechanical tissues, distribution of mechanical tissues in
 - *Coleus, Zea mays*.
 - Leaf - *Eucalyptus, Cycas*
 - Root- *Zea mays* -Functions of the mechanical tissue system.
4. **Secondary growth:** **05L**
Normal secondary growth in dicotyledonous root, stem and leaf, monocotyledonous root, stem, and leaf; their tissues and their function
5. **Anomalous Secondary Growth:** **05L**
Definition, causes, anomalous secondary growth in *Bignonia, Borrhavia, Dracena*.

EMBRYOLOGY

1. **Introduction to plant Embryology, definition and scope.** **03L**
2. **Microsporangium** **08L**
structure of tetrasporangiate anther, tapetum types, sporogenous tissue.
Microsporogenesis: Process, cytokinesis and its types. Types of microspore tetrad.
Male gametophyte: structure of pollen grain, development of male gametophyte.
3. **Megasporangium** **10L**
Structure and types of ovules – anatropous, orthotropous, amphitropous, campylotropous, circinotropous.
Megasporogenesis: Tenuinucellate and crassinucellate ovules, types of megaspore tetrads.

Female gametophyte: structure of typical 8-nucleate embryo sac, types and development of embryo sacs – monosporic, bisporic and tetrasporic.

4. **Fertilization** **08 L**
Pollen stigma interaction, self compatibility, entry of pollen tube, discharge of pollen tube content, fusion of gametes, syngamy, triple fusion, significance of double fertilization.
5. **Endosperm types:** nuclear, helobial, cellular. **03L**
6. **Embryo** - structure of dicot and monocot embryo (development not expected) **03L**

Reference books:

1. Carlquist, S. 1988, Comparative wood Anatomy: Systematic, Ecological and Evolutionary Aspects of Dicotyledonous wood, Springer-Verlag, Berlin.
2. Cutter, E.G. 1969. Part I. Cells and Tissues. Edward Arnold, London.
3. Cutter, E.G. 1971. Plant Anatomy; Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
4. Esau, K. 1977. Anatomy of seed Plants, 2nd edition. John Wiley and Sons. New York.
5. Fahn, A. 1974. Plant Anatomy, 2nd edition. Pergamon Press, Oxford.
6. Fuller, K.W. and Gallon, J.R. 1985. Plant Products and New Technology. Clarendon Press, Oxford, New York.
7. Lyndon, R.F. 1990. Plant Development; The Cellular Basis Unwin Hyman, London.
8. Mauseth, J.D. 1988. Plant Anatomy. The Benjamin/Cummings Publishing Company Inc. Menlo Park, California, USA.
9. Nair, M.N.B. 1998. Wood Anatomy and Major Uses of Wood. Faculty of Forestry, Universiti Putra Malaysia, 43400 Serdang, Selangor D.E./ Malaysia.
10. Raghavan, V. 2000. Developmental Biology of Flowering Plants. Springer-Verlag, New York.
11. Raven P.H., Evert, R.E. and Eichhorn, S.E. 1999. Biology of Plants 6th edition W.H. Freeman and Co. Worslem Publishers, New York.
12. Steeves, T.A. and Sussex, I.M. 1989. Patterns in Plant Development, 2nd edition. Cambridge University Press, Cambridge.
13. Thomas, P. 2000. Trees: Their Natural History. Cambridge University Press, Cambridge.
14. Tippo, O. and Stern, W.L. 1977. Ornamental Horticulture, Macmillan India Ltd. New Delhi.
15. P. Maheshwary: Plant Embryology.

S. Y. B.Sc. (C.B.C.S. 2018 Course)

SEMESTER- III

B 33 - Botany Practical course

Core Course – Practical; Credits- 02

Contact hours per practical – 04 h

(ANY-10)

Course Learning Outcomes :

On Completion of this course, students are able to:

- Understand the plant morphology and the diversity of angiosperms.
- Understand the comparative account among the families of angiosperms.
- Know the economic importance of the angiosperm plants.
- Understand the scope & importance of Anatomy and Embryology.
- Know various tissue systems, normal and anomalous secondary growth in plants and their causes. Perform the techniques in anatomy.

Course content

ANGIOSPERM TAXONOMY

1.- 6 Study of plant families (according to Bentham & Hooker's system of classification) with the help of locally available specimen. E

- Annoniaceae
- Brassicaceae
- Meliaceae
- Caesalpinaceae
- Apiaceae
- Asteraceae
- Solanaceae
- Acanthaceae
- Euphorbiaceae
- Amaryllidaceae

7. Study hydrophytic and xerophytic plants and their adaptations. E

8. Methods of sampling plant communities. E

9. Determination of rain fall, temperature, light intensity and humidity of atmosphere. D

DEVELOPMENTAL BOTANY & EMBRYOLOGY

10. Study of epidermal structures - E

- i) Stomata - types with suitable examples.
- ii) Multilayered epidermis in *Nerium* and *Opuntia*.
- iii) Trichomes - types with suitable examples.

11. Study of mechanical tissues in E

- i) Stem - *Coleus*, maize.
- ii) Leaf - *Eucalyptus*, *Cycas*. Root - Maize.

12. Study of vascular cambium in stem and root. Secondary growth in dicot stem and root . E

13. Study of anomalous secondary growth in *Bignonia*, *Borrhaevia* and *Dracena* by hand sectioning method. E

14. Study of types of ovules. E

15. Study of dicotyledons and embryo E

16. A) Study of pollen grains by acetolysis method. E

B) Study of pollen grains by NPC observation. E

Reference books:

1. Copeland, R.A 1996, Enzymes: A Practical introduction to Structure, Mechanism, and Data Analysis. VCH Publisher, New York.
2. Dryer, R.L. and Lata, G.F. 1989, Experimental Biochemistry. Oxford, University Press, New York .
3. Moore, T.C. 1974. Research Experience in plant Physiology. A Laboratory Manual. Springe-Verlag, Berlin.
4. Wilson, K. and Goulding , K.H. (Eds)1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, Uk.
5. Practical Botany-S. B. Agarwal
6. A Mannual in Plant Physiology Practical –Vaidya&Kulkarni
7. Practical Botany- By S C Santra, Vol. 1, Vol. 2, New Central Book Agency (P) Ltd., Kolkata.

S. Y. B.Sc. (CBCS - 2018 Course)

SEMESTER III

Z 3 1 : Functional Anatomy of Non-Chordates II and Biodiversity

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Understand the systematic position and external morphology of Starfish.
2. Understand and study the various systems like structure and types of pedicellariae, digestive system, respiratory system, nervous system, sense organs, autotomy and regeneration in starfish.
3. Understand the classification and diversity of various classes of phylum Arthropoda, Mollusca, Echinodermata, Hemichordata.
4. Understand and study classification and general characters of Nematoda, Nematode development.
5. Study and understand various types of shell and foot modification in Mollusca.
6. Explain, study and understand concept of mimicry in insects.
7. Study and understand metamorphosis in insects.
8. Gain knowledge about Bioluminescence.

Course Content

UNIT I

15L

Study of starfish (*Asterias rubens*)

- i) Systematic position, Habits and habitat.
- ii) External characters.
- iii) Structure and types of pedicellariae.
- iv) Digestive system – Alimentary canal, food, feeding mechanism and physiology of digestion.
- v) Water vascular system.
- vi) Nervous system and sense organs.
- vii) Reproductive system, Larval development and metamorphosis.
- viii) Autotomy and regeneration.

UNIT II

20L

Salient features and classification upto classess of the following : (any two examples from each class)

- i) Arthropoda – Crustacea, Arachnida, Insecta, Myriapoda, Onychophora
- ii) Mollusca – Aplacophora, Gastropoda, Pelecypoda, Scaphopoda, Cephalopoda
- iii) Echinodermata - Asteroidea, Ophuroidea, Holothuria, Echinoidea, Crinoidea
- iv) Hemichordata – Enteropneusta, Pterobranchia

UNIT III

Study of following with reference to

20L

- i) Nematoda – Classification and general characters of Nematoda, Nematode development, Some common nematode parasites of man (Any Four)
- ii) Arthropoda – Metamorphosis in Insects, Mimicry in Insects
- iii) Mollusca – Shell and foot modification in mollusca

UNIT IV

05L

Bioluminescence in Firefly

Reference books :

1. The invertebrates – Hyman L. H.
2. Arthropoda, Mollusca and Echinodermata – Kotpal R.L.
3. Mollusca – Mortan J.E.
4. Echinodermata – Nicholas D.
5. Zoology, Non-chordates – Marathe, Agarkar and Joshi. Narendra Publication.
6. Invertebrate Zoology (1983). – E.L. Jordan and P.S. Verma
7. Biology of higher invertebrates – Russell- Hunter.
8. Invertebrates – Kotpal R.C.
9. A Text book of Invertebrate zoology – Prasad S. N.
10. A Text book of Invertebrate zoology – Srivastava M.
11. Modern text book of zoology – Invertebrates – Kotpal, Agarwal and Khetarpal.
12. Invertebrate structure and function – Barrington.
13. Biology of Non-chordates – Nigam
14. Invertebrate Zoology – Barnes.
15. Textbook of Zoology – Invertebrates Vol.1(1992) – Parker and Haswell.
16. A life of invertebrate – Russel Hunter.
17. College Zoology – Boolootin and Stiles.
18. A manual of practical Zoology Invertebrates – P.S. Verma

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER III
Z 3 2 : Histology of Mammals

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Understand the term histology.
2. Understand how tissues are produced from cells.
3. Understand and study cell, various types of tissue- structure and function, organ and system.
4. Study and understand gross anatomical structure of various organs through vertical section, longitudinal section and transverse section.
5. Study and understand gross anatomical structure and function of endocrine glands.

Course Content

UNIT I

20L

Study of Tissues

Review of the following tissues with reference to structure and functions.

i) Epithelial Tissues

- a) Simple epithelial tissue
- b) Compound epithelial tissue
- c) Glandular epithelium

ii) Connective Tissues

- a) Loose connective tissue
- b) Reticular tissue
- c) Adipose tissue.
- d) Skeletal tissue – Cartilage and Bone
- e) Fluid connective tissue – Blood and Blood cells

iii) Muscular tissue

- a) Smooth muscle
- b) Striated muscle
- c) Cardiac muscle

iv) Nervous tissue

- a) Neuron
- b) Nerve fibre

UNIT II

25L

Study of gross histological structure of different system organs Part I.

- i) Skin
- ii) Tooth
- iii) Tongue
- iv) Alimentary canal
 - a) Oesophagus b) Stomach c) Duodenum. D) Ileum
- v) Associated glands
 - a) Salivary glands
 - b) Liver
 - c) Pancreas

- vi) Respiratory system
 - a) Lung
 - b) Trachea

UNIT III

15L

Study of gross histological structure of different system organs Part II.

- i) Kidney
- ii) Spinal cord
- iii) Reproductive organs
 - a) Testis
 - b) Ovary
- iv) Endocrine glands- General idea of endocrine glands
 - a) Pituitary gland
 - b) Thyroid gland
 - c) Adrenal gland

Reference books :

1. Histology of Mammals by : Athavale M.V. & Latery A.N.Narendra Prakashan,Pune.
2. Bailey's Text Book of Histology by : W.M.Copenhaver R.P. Bunge M.B.Bunge.
3. An Atlas of Histology by : W.H. Freeman B. Bracegirdle.
4. Histology by : A.W. Ham Lippincott.
5. A Text Book of Histology by : W. Bloom D.W. Fawcett(1975) Saunders,Philadelphia.
6. Histology: Greep, R. O. and Well L.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER III
Z 33 : Zoology Practical course
(Practical based on paper: Z-31, Z-32)

Total Credits: 02

Contact hours per practical – 04 h

Course Outcomes:

On completion of the course, students are able to:

1. Study of general and distinguishing characters and classification of non-chordates with the help of museum specimens.
2. Understand the systematic position and external characters of Starfish.
3. Understand digestive system, water vascular system in Starfish.
4. Understand structure of T. S. of arm of starfish, tube feet and gonads in starfish.
5. Understand shell and foot modification in Mollusca with some examples.
6. Impart the knowledge about mimicry in insects.
7. Students gain fundamental knowledge of various types of tissues with the help of permanent slides.
8. Gain knowledge and understand structure of various organs with the help of permanent slides.

Course Content

Functional Anatomy of Non-Chordates II and Biodiversity

1. Study of general and distinguishing characters and classification of non-chordates upto class level with one example of each class. (Sketches/Photographs may be used) a. Arthropoda b. Mollusca c. Echinodermata d. Hemichordata	D
2. Study of systematic position, external features and digestive system of Starfish.	D
3. A. Study of water vascular system of Starfish. B. Temporary preparation of gonads and tube feet from star fish.	D E
4. Study of permanent slides of T. S. of an arm of Starfish and bipinnaria larva.	D
5. Study of shell in mollusca .	D
6. Study of foot in mollusca.	D
7. Study of Mimicry in insects.	D

Histology of mammals

1. Study of permanent slides of tissues. a. Squamous epithelium b. Columnar epithelium c. Areolar connective tissue d. Hyaline cartilage e. Smooth muscle fibre f. Striated muscle fibre	D

9. Study of permanent slides of following organs. **D**
- a. Skin – vertical section
 - b. Tooth – vertical section
 - c. Tongue – vertical section
 - d. Oesophagus – cross section
 - e. Stomach – cross section
 - f. Duodenum – cross section
 - g. Ileum – cross section
 - h. Salivary gland – parotid
 - i. Liver – cross section
 - j. Pancreas – cross section
 - k. Trachea – cross section
10. Study of permanent slides of following organs. **D**
- l. Kidney – longitudinal section
 - m. Spinal cord - cross section
 - n. Testis - cross section
 - o. Ovary - cross section
 - p. Thyroid gland - cross section
 - q. Adrenal gland - cross section
 - r. Pituitary gland - cross section

Reference books:

- 1. A Manual of Practical Zoology Invertebrate : P. S. Verma S.Chand and Co.,New Delhi.
- 2. A Manual of Practical Zoology Vol. I : Non- Chordata,1994: P. K. G. Nair and K. P. Aehar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
- 3. A Manual of Practical Zoology Vol.II Non Chordata,1994: P. K. G. Nair and K. P. Aehar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
- 4. Practical Zoology, Invertebrate/Vertebrate : S.S. Lal Rastogi Publications,Meerut.
- 5. Practical Invertebrate Zoology – 1972. V. S. Srivastava. Central Book Depot. Allahabad.
- 6. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata - Rastogi Publications.
- 7. A Text Book of Histology : W. Bloom D.W. Fawcett(1975) Saunders, Philadelphia.

S. Y. B.Sc. (CBCS - 2018 Course)
Semester III
MB - 31 Microbial Metabolism

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand different aspects of microbial metabolism needed for commercial exploitation of microorganisms.
2. Understand different properties of enzymes.
3. Know how to investigate the active site of enzymes
4. Understand different ways of transportation of nutrients
5. Know differential photosynthesis in bacteria, plants and algae.

Course Content

**No. Of lectures
(15)**

(I) Enzymes

- i) Physicochemical properties of enzymes
- ii) Theories of enzyme catalysis
 - a) Proximation effect
 - b) Pauling concept of strain
 - c) Acid-Base Catalysis
 - d) Covalent Catalysis
- iii) Nomenclature of enzymes
- iv) Factors affecting enzyme activity – pH & Temperature
- v) Mechanism of enzyme action:
 - a) Lock and Key hypothesis
 - b) Induced fit hypothesis
- vi) Enzyme specificity –
 - a) Absolute specificity
 - b) Group specificity
 - c) Optical specificity
 - d) Geometrical specificity
- vii) Introduction to ‘Allosteric Enzymes’
- viii) Biological role of Enzymes
- ix) Methods of investigation of active site
 - a) Trapping of ‘Enzyme substrate complex’
 - b) Use of ‘substrate analogues’

(II) Bioenergetics

(12)

- i) Principles of Bioenergetics
- ii) Role of ATP in bacterial metabolism
- iii) Reducing power and its significance in bacterial metabolism
- iv) Generation of ATP through substrate level phosphorylation
- v) Component's of Electron Transport chain (ETC)
 - a) Flavoproteins (FMN & FAD)
 - b) Quinones (Ubiquinone & Menaquinone)
 - c) Iron sulphur proteins
 - d) Cytochromes
- vi) Generation of ATP through ETC

- (III) Energy Cycles (18)**
- i) Energy Production by Anaerobic Processes
 - a) EMP pathway
 - b) Pentose phosphate pathway
 - c) Entner Doudoroff pathway
 - ii) Energy Production by aerobic processes
 - a) Tricarboxylic Acid cycle
 - b) Anaplerotic reactions of 'Tricarboxylic Acid cycle'.
- (IV) Transport of Nutrients by Bacteria: (08)**
- i) Passive Diffusion
 - ii) Facilitated Diffusion
 - iii) Group Translocation
 - iv) Active Transport
- (V) Photosynthesis (07)**
- i) Bacterial Photosynthesis
 - ii) Concept of 'Purple Membrane' in *Halobacterium* and its significance.
 - iii) Plant /Algal/*Cynobacterial* Photosynthesis.

References:

1. Michael Pelczar ECS Chan, Noel Krieg, Microbiology 11th print 1998, Tata McGraw Hill Publishing Company Limited, New Delhi. (Topic No. II and III)
2. Prescott L.M., J.P. Harley and D.A. Klein Microbiology 5th Edition 2002, McGraw Hill Higher Education.(Topic No. II)
3. Roger V. Stainier 1995, John L. Ingraham, Mark L. Wheelis, Page R. Painter, General Microbiology 5th Edition, Macmillan Press Ltd., Houndmills, Basingstoke Hampshire & London.(Topic No II and IV)
4. Tortora G.J., B.R. Funke and C.L. Case Microbiology an Introduction , 8th Edition Pearson education
5. Voet D and J.G.Voet (2004) Biochemistry 3rd Edition Vol I John Wiley & Sons Inc.(Topic No. II)
6. Trevor,Palmer,Understanding of Enzymes,2ⁿ Edition,John Wiley& sons limited(Topic No-I)
7. Kulkarni,Deshpande,General Enzymology,First Edition,Himalay Publishing House(Topic No.I)

S. Y. B.Sc. (CBCS - 2018 Course)
Semester III
MB – 32 Bacterial Genetics

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand different aspects of genetics needed for commercial exploitation of microorganisms.
2. Understand replication of bacterial DNA.
3. Know concept of genetic code and the process of translation and transcription in bacteria.
4. Understand the process of mutagenesis and repair.

Course Content

No. Of lectures

I. Structure of DNA, Gene and Chromosome	13
i) Characteristics of Genetic Material	
ii) The Molecular Basis of Heredity:-	
a) Different experiments which helped to understand the structure and function of DNA 1928-1956	
b) RNA as Genetic Material	
iii) The Structure of DNA	
a) The Primary and Secondary Structure of DNA	
b) DNA Methylation, Bends in DNA	
II. DNA Replication	15
i) Semi conservative Replication	
ii) Meselson and Stahl's Experiment	
iii) Requirements of Replication: Enzymes, Proteins and mechanisms involved	
iv) The Mechanism of Replication:	
a) Initiation, Unwinding, Primers, Elongation, Termination	
b) Bacterial DNA Replication- Components required for Replication	
c) The fidelity of DNA replication	
III. The Genetic Code	12
i) The one gene one enzyme hypothesis	
ii) The Genetic code:	
a) Milestones in deciphering the Genetic code	
b) Dictionary of the Genetic code	
iii) Features of the Genetic code:	
a) Genetic code is degenerate	
b) Genetic code is universal	
c) Genetic code is a triplet code	
d) Genetic code is non-overlapping	
e) Genetic code is comma less	

- iv) Initiation and Termination codons
- v) Wobble hypothesis, Isoaccepting tRNAs
- vi) The Central Dogma, Overlapping Genes
- vii) The process of Transcription and Translation

IV. Mutagenesis and Repair

20

- i) Mutagenesis: Definitions, Auxotrophic Mutants, Conditional Lethal mutants, Resistant Mutants. Experiments using mutants
- ii) Mutations are Spontaneous or induced?: Luria and Delbruck Experiment, the Newcomb Experiment, The Lederberg's Experiment
- iii) Mutation Rate: Calculation of mutation Rates
- iv) Types of Mutations:
 - a) Microlesions and Macrolesions: different types
 - b) Transitions and Transversions
 - c) Chemicals that mimic normal DNA bases-base analogs
 - d) Chemicals that react with DNA bases-base modifiers
 - e) Chemicals that bind DNA bases- Intercalators
 - f) Mutagens that physically damage the DNA; Ultraviolet light and ionizing radiations
- v) Reversion and suppression: Types with examples
- vi) Isolating mutants : Réplica plating, Enrichment techniques
- vii) Complementation
- viii) Ames' Test: How have we exploited mutants?
- ix) Repair:
 - a) Photo- reactivation
 - b) The methyl – Directed mismatch Repair system
 - c) Nucleotide Excision repair d) Recombination repair
 - d) SOS inducible repair

References:

- Gardner E.J, Simmons M.J and D.P. Snustad (1991) Principles of Genetics. 8th edition, John Wiley and Sons. Inc.
- Lewin B (2000) Genes VII. Oxford University Press.
- Pierce B.A. (2005) Genetics a conceptual Approach 2nd Edition W.H. Freeman and Company New York. Chapter No. 10,12,15,17.
- Russel P.J. (2006) 1. Genetics a Molecular Approach. 2nd Edition Pearson Benjamin Cummings San Francisco, Boston New York. Chapter No. 1,2,3,4,5,6,7.
- Stanier R Y, J.N. Ingraham, M.L. Wheelis and P.R. Painter (1996) General Microbiology, 5th Edition, MacMillan Press.
- Snyder L and W. Champers (2003) Molecular Genetics of bacterial 2nd Edition ASM Press, Washington. Chapter No. 1, 2,3,11.
- Trun Nancy and Janine Trempy (2004) fundamental Bacterial Genetics Blackwell Publishing. Chapter No. 2, 3, 4.

S. Y. B.Sc. (CBCS - 2018 Course)
Semester III
MB-33 : Practical Course
(based on MB 31, MB 32)

Course Outcomes:

At the end of this course the students will be able to:

1. Develop the skills for detecting different microbial enzymes.
2. Understand carbohydrate fermentations and other tests used for gross identification of bacteria.
3. Learn the techniques used for study and control of microbial growth.
4. Understand the basic laboratory techniques for the study of bacterial genetics.

Course content

Total number of Experiments: 18

I. Extracellular Enzymatic Activities of Micro-organisms	(04)
i) Starch hydrolysis ii) Lipid hydrolysis iii) Caesin hydrolysis iv) Gelatin hydrolysis	
II. Intracellular Enzymatic Activities of Microorganisms.	(06)
i) Carbohydrate fermentation – Lactose, Sucrose, Dextrose, ii) Triple Sugar Iron Agar test. iii) Hydrogen sulfide test. iv) Urease test. v) Litmus milk test. vi) Nitrate Reduction test. vii) Catalase test.	
III. Study of bacterial Growth	(02)
i) Enumeration of cell numbers-direct counting/ turbidometry. ii) Determination of viable count.	
IV. Study of Environmental Influences on Bacterial Growth	(02)
i) Study of Effect of Energy Source and Role of buffers on growth ii) Study of oxygen requirements of bacteria.	
V. Study of control of Microbial Growth by Antimicrobial Agents (Any Two)	(01)
i) Study of Effect of Antiseptic and Disinfectant. ii) Determination of Phenol coefficient. ii) Study of lethal action of UV light and photoreaction in Bacteria.	
VI. Study of Bacterial Genetics (Any Two)	(02)
i) Isolation of Temperature variants/Antibiotic Resistant variants. ii) Isolation of Nutritional Mutants by Replica plating iii) Mutant isolation by Gradient Plate method.	

References:–

1. Bradshaw L. Jack (1979) Laboratory Microbiology, 3rd Edition W.B. Saunders co Philadelphia, London, Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
3. Cappuccino J.G. and N. Sharma (2004) Microbiology A Laboratory manual Sixth Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
5. Pelczar M.J. and E.C. Schwann (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata McGraw Hill) Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Anne Book New Delhi.

S.Y.B.Sc. (CBCS 2018 Course)
Semester – III
M – 31: Calculus of Several Variables

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

At the end of this course students are expected to be able to-

- i) Examine and evaluate the limits of functions of two and three variables.
- ii) Discuss and examine the continuity of functions at given points.
- iii) Expansions of functions about the point by Taylor's theorem.
- iv) Evaluate double and triple integrals.

Course content :

Unit 01 - FUNCTIONS OF SEVERAL VARIABLES:

1. Functions of two and three variables
2. Notions of limits and continuity for functions of two and three variables.
3. Simultaneous limit, limit along a path, repeated limits.
4. If $f(x,y)$ approaches to l as (x, y) approaches (a, b) then $f(x,y)$ approaches the limit l along any path (Proof).
5. Counter examples on continuity.
6. Partial derivatives and higher order partial derivatives
7. Chain rules.
8. Differential and differentiability. Necessary and sufficient Conditions for differentiability (with proof), Counter examples..
9. Euler's theorem for homogeneous functions and its corollary.
10. Converse of Euler's theorem (with proof).
11. Jacobians.

Unit-02 - MEAN VALUE THEOREMS.

1. Lagrange's mean value theorem for functions of two variables (with proof).
2. Taylor's theorem for functions of two variables (with proof).
3. Statement of Maclaurin's theorem (without proof).
4. Expansions of functions of two and three variables by using Taylor's Theorem, and Maclaurin's theorem.

Unit-03 - EXTREME VALUES

1. Extreme values for functions of two variables.
2. Maxima, minima and saddle points of functions of two variables.
3. Necessary condition for extreme values (with proof).
4. Sufficient condition for the existence of extreme values. (without proof).
5. Lagrange's method of undetermined multipliers.

Unit - 04 - MULTIPLE INTEGRALS -

1. Integrals over plane areas in xy plane.
2. Evaluation of double and triple integrals.
3. Area of a region by double integrals.
4. Volume by double and triple integrals.
5. Change of order of integration for two variables.
6. Change of variables in double integrals.
7. Change of variables in polar co-ordinates.
8. Illustrative examples of change of variables using Jacobians.

Reference Books :-

1. T. M. Apostol; Calculus, Wiley Student edition.
2. D. Somasundaram and B Choudhary : A first course in Mathematical Analysis; Narosa Publishing House, New Delhi 1997.
2. Gorakh Prasad : Differential Calculus; Pothishala Pvt. Ltd. Allahabad
3. Gorakh Prasad : Integral Calculus ; Pothishala Pvt. Ltd., Allahabad.
4. Shanti Narayan : A Course of Mathematical Analysis; S. Chand and Company, New Delhi.
6. J.N. Sharma - Mathematical Analysis - II (Chapter 4); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
7. 7. J.N.Sharma - Differential Calculus (Chapter 3); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
8. M.L.Khanna : Integral Calculus . (Chapter 5 & 7); Jai Prakash Nath

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S.Y.B.Sc. (CBCS 2018 Course)

Semester – III

M-32: Group Theory and Differential Equations

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

At the end of this course students are expected to be able to.

- (i) Understand the concepts in Group and simple properties of group.
- (ii) Understand the concepts of subgroup and simple properties of subgroup.
- (iii) Understand the concept of differential equations of first order and higher degree.
- (iv) Concept of linear differential equations with constant coefficients.

Course content :

Unit-01: GROUPS :

1. Binary operations, definition and examples.
2. Definition of a group with examples.
3. Types of groups.
4. Simple properties of group.
5. Integral powers of Elements in a Group.

Unit-02 : SUBGROUPS :

1. Introduction.
2. Subgroups.
3. Criteria for a subset to be subgroup.
 - a. H is subgroup of G iff for all $a, b \in G$ implies $ab^{-1} \in G$
 - b. H is subgroup of G iff
 - i. for all $a, b \in G$ implies $ab \in G$
 - ii. $a \in G$ implies $a^{-1} \in G$
 - c. Intersection of two subgroups of a group G is also a subgroup G .
4. Order of an element in a group.
5. Properties of order of an element in a group.
6. Cyclic subgroups.
7. Properties of cyclic subgroup

Unit-03 : DIFFERENTIAL EQUATIONS OF FIRST ORDER AND HIGHER DEGREE

1. Equations solvable for p .
2. Equations solvable for y .
3. Equations solvable for x .
4. Clairaut's equation.
5. Lagrange's equation.

Unit-04 : LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS:

1. Introduction.
2. Complementary function and Particular Integral.
3. Fundamental laws of operators, $f(D)y = 0$,

4. The operator $\frac{1}{f(D)}$
5. Evaluation of $\frac{1}{f(D)} e^{ax}$
6. Evaluation of $(D^2 + a^2)^{-1} \sin ax$ and $(D^2 + a^2)^{-1} \cos ax$.
7. Evaluation of $\frac{1}{f(D)} x^m$
8. Evaluation of $\frac{1}{f(D)} e^{ax} V$ and $\frac{1}{f(D)} (xV)$

where V is a function of x

Reference Books :-

- 1) N.S. Gopalkrishana ; University Algebra ; Wiley Eastern, 1986.
- 2) P.B. Bhattacharya, S.K.Jain and S.R.Nagpal Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition 1997.
- 3) Shanti Narayan : A Text Book of Modern Abstract Algebra, S.Chand & co; New Delhi.
- 4) Vivek Sahai and Vikas Bist : Algebra ; Narosa Publishing house. 1997.
- 5) D.A. Murry; Introductory course in Differential Equations; Orient Longman (India 1967)
- 6) E.A. Cochington; A Introduction to ordinary Differential Equations; Prentice Hall of India, 1961.
- 7) Gupta P.P.; Malik G.S.; Mittal S.K.; Differential Equations; Pragati Prakashan Meerut.
- 8) Earl D. Rainville and Phillip E. Bedient : Elementary Differential Equations; Maxwell Mac. Millan International Edition.
- 9) David A Murray: Introductory Course in Differential Equations; Orient Logman.

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S.Y.B.Sc. (CBCS 2018 Course)

Semester – III

M-33: Mathematics Practical Course-III

(Practicals based on the applications and Problems of articles in M-31 and M-32)

Total Credit :02

Course Learning Outcomes:

At the end of this course students are expected to be able to

1. Knowledge of applications of Euler's theorem, Taylor's theorem and Maclaurin's series.
2. Finding the extreme values of multivariable functions.
3. Solving the problems of double and triple integration.
4. Solving the Differential equations of first order and higher degree.
5. Finding the solution of Linear differential equations with constant coefficient.

Course content

List of Practicals:

- 1) Euler's theorem for homogeneous functions.
- 2) Expansions of functions of two and three variables by using Taylor's theorem and Maclaurin's theorem.
- 3) Lagrange's method of undetermined multipliers.
- 4) Necessary condition for extreme values.
- 5) Evaluation of double integrals by change of order of integration and change of variables in double integrals.
- 6) Problems in Groups.
- 7) Problems in Subgroups.
- 8) Differential equations of first order and higher degree.
- 9) Clairaut's equation and Lagrange's equation.
- 10) Linear differential equations with constant coefficients.

S.Y.B.Sc. (CBCS 2018 Course)

Semester – III

ENG 31: English – I

Course Outcomes:

At the end of this course, a student shall be able to:

- get exposed to the prose passages, grammar units and communicative skills
- read and interpret the various types of texts on their own and discuss them among peers
- communicate effectively by developing their proficiency in language
- understand their language abilities and facilitate them to with the necessary online & offline resources

Course content:

60

Lectures

a. Texts - *Pleasant Prose Selection* by Oxford University Press

1. Old Man at the Bridge	-	Ernest Hemingway
2. Mebel	-	W. Somerset Maugham
3. Too Dear	-	Leo Tolstoy
4. The Open Window	-	H.H. Munro ('Saki')
5. The Bet	-	Anton Chekhov
6. The Necklace	-	Guy de Maupassant

b. Dialogue Writing:

1. Asking, Giving & Refusing Permission	2. Inviting
3. Asking for Information	4. Suggesting

c. English Grammar:

1. Prepositions	2. Conjunctions

The books recommended:

1. Chettur G. K.: *English Grammar, Composition and Essay*.
2. M.L. Tickoo: *A Remedial Grammar, Usage and Grammar* (Orient Longman, 1976)
3. Thomson A. J. & Martinet A.V.: *Practical English Grammar* (OUP, 1986).
4. Tickoo C. & Shashikumar J.: *Writing With Purpose* (Oxford University Press, 1979).

अध्ययन निष्पत्ती :

१. मराठीतील विज्ञान साहित्याच्या प्रेरणा, उगम, वाटचाल आणि विकास जाणून घेण्यास मदत झाली.
२. वैज्ञानिक साक्षरता व वैज्ञानिक दृष्टिकोन विकसित झाला.
३. विज्ञानाचा प्रसार स्वभाषेतून करण्यासाठी आवश्यक ती भाषिक क्षमता वाढीस लागली.
४. मराठीतील विज्ञान कथांचा स्थूल स्वरूपात परिचय झाला.

Total Credit :- 04

तासिका - ६०

घटक-विश्लेषण :

१. संकरित (विज्ञानकथासंग्रह) - डॉ.संजय ढोले, मेहता पब्लिशिंग हाऊस, पुणे
(१) उत्परिवर्तन (२) परिवर्तन (३) मोहीम फत्ते (४) कोळिष्टक (५) अकल्पित (६) संकरित
२. मराठी विज्ञान साहित्याच्या प्रेरणा
३. मराठी विज्ञान साहित्याची वाटचाल
४. मराठी विज्ञान साहित्याचा विकास
५. मराठी विज्ञान साहित्यातील कथांचे स्वरूप
६. विज्ञान साहित्य आणि मराठी वाचक
७. मराठी विज्ञान साहित्यातील विषयांची विविधता
८. निबंधलेखन

संदर्भ - साहित्य

१. विज्ञान : उदय व विकास-डॉ. प्र. न. जोशी, सन पब्लिकेशन्स, पुणे
२. श्रद्धा-अंधश्रद्धा-डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
३. भ्रमनिरास -डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
४. मराठी विज्ञान साहित्य-संपा. म. सु. पगारे, प्रशांत प्रकाशन, पुणे
५. विज्ञान कथा : स्वरूप आणि समीक्षा - श्री. विश्वेश्वर सावदेकर, शलाका प्रकाशन, मुंबई
६. विज्ञान साहित्य आणि संकल्पना- व. दि. कुलकर्णी, निरंजन घाटे, निहारा प्रकाशन, पुणे
७. विज्ञान युग- वार्षिक दिवाळी अंक १९८६, विज्ञान कथा विशेषांक
८. निबंध आणि कला - डॉ.प्र.न.जोशी, स्नेहवर्धन प्रकाशन, पुणे
९. व्यावहारिक मराठी - (संपा) डॉ.लीला गोविलकर, डॉ.जयश्री पाटणकर, स्नेहवर्धन प्रकाशन, पुणे
१०. व्यावहारिक मराठी - (संपा) डॉ.स्नेहल तावरे, स्नेहवर्धन प्रकाशन, पुणे

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S.Y.B.Sc. (CBCS 2018 Course)
Semester – III
UG - SEC 31: MEDICAL DIAGNOSTICS

Total Credits: 02

Total lectures: 30

Course Learning Outcomes:

On completion of the course, students are able to:

1. Understand and study importance of medical diagnostic.
2. Study diagnostics methods used for analysis of blood.
3. Study and understand diagnostic methods used for urine analysis.
4. Impart the knowledge about non-infectious and infectious diseases.
5. Understand and study types of tumors, detection and metastasis; MRI and CT Scan (using photographs).

Course Content

Unit 1: Introduction to Medical Diagnostic and its Importance

Unit 2: Diagnostics Methods Used for Analysis of Blood

Blood composition, Types of Blood groups, Methods of Blood grouping – slide method, six tube method, Haemolytic Disease of New born (HDN)

Unit 3: Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

Unit 4: Non-infectious Diseases

Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

Unit 5: Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Unit 6: Tumours

Types (Benign/Malignant), Detection and metastasis; MRI and CT Scan (using photographs).

SUGGESTED READINGS

1. Park, K. (2007), preventive and Social Medicine, B.B. Publishers
2. Godkar P.B. and Godkar D. P Textbook of Medical Laboratory Technology, II Edition Bhalani Publishing House
3. Cheesbrough M., A Laboratory Manual for Rural Tropical Hospital, A Basis for Training Courses
4. Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders
5. Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders
6. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S Chand and Co. Ltd.

S. Y. B. Sc.: (CBCS 2018 Course)
Semester – IV
P – 41: WAVES AND OSCILLATIONS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

1. Understanding of different forms of Wave and its dynamics
2. Acquire the knowledge of different types of oscillations
3. Concept of sound and its underlying phenomenon

Course Content:

1. Composition of two S. H. M.'s (18)

Composition of two S.H.M.s of equal frequencies along same line of vibration (analytical method only), Composition of two S. H. M.s of equal frequencies acting at right angles (analytical method with different cases), Composition of two S. H. M.'s right angles to each other (time period in the ratio 1 : 2), Lissajous figures - demonstration by mechanical, optical and electrical methods, Problems.

2. Damped Oscillations (12)

Introduction, Differential equation of damped harmonic oscillator and its solution, discussion of different cases, Logarithmic decrement, Energy equation of damped oscillations, Power dissipation, Quality, factor, Application of Damped oscillations: LCR series circuit, Problems.

3. Forced oscillations: (18)

Forced oscillations with one degree of freedom, Resonance and its examples, Equation of forced oscillations, Transient and steady state solution, log decrement, amplitude resonance and its condition, velocity resonance its condition, sharpness of resonance, energy absorption, power resonance curve, low and high frequency response, bandwidth and quality factor, forced oscillations in series LCR circuit, Problems.

4. Doppler Effect: (06)

Concept of Doppler Effect in sound, expression for apparent frequency in different cases, Asymmetric nature of Doppler Effect in sound. Doppler Effect in light (Red shift and violet shift), Symmetric nature of Doppler Effect, problems

5. Sound: (06)

Definition of sound intensity, loudness, pitch, quality and timbre, Acoustic intensity level measurement, Acoustic pressure and its measurement, Reverberation time and Reverberation of a hall, Sabine's formula (without derivation), Stroboscope, Problems,

Reference Books

1. Waves and Oscillations - by Stephenson.
2. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co. ltd.
3. Fundamentals of vibration and waves - S. P. Puri, Tata McGraw-Hill Publishing co. ltd.
4. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd. S.Y.B. Sc.(PHYSICS)
5. Waves and Oscillation, Berkely Physics Course, Vol. III
5. Oscillation and Waves - by D. P. Khandelwal
6. College Physics Vol. II - by Narasappaya N.

S. Y. B. Sc.: (CBCS 2018 Course)

Semester – IV

P – 42: ELECTRONICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of important concepts in electronics
- Knowledge of power supply, voltage, current and different circuits
- Understanding the characteristics of transistor, amplifier, oscillators and its application
- Student will be able to apply this knowledge to daily life as well as technological problems

Course Content:

1. Network Theorems: (08)

Kirchhoffs laws (revision), Voltage and Current divider circuits, Thevenin's theorem, Norton's theorem, Super-position theorem, Maximum power transfer theorem, Problems.

2. Power Supply Units: (08)

Diode as a rectifier (half wave, full wave and bridge) for determination of ripple factor and efficiency, RC filter circuit, - Unregulated and regulated power supply SMPS,

3. Bipolar Transistor: (18)

Revision of bipolar junction transistor, types, symbols and basic action, Configurations (Common Base, Common Emitter & Common Collector), Characteristic of BJT, common emitter configuration input and output characteristics, common-base configuration, output characteristics, load line concept, emitter follower, biasing methods (self bias, Potential divider etc.), and stability factor. RC coupled CE amplifier. Definition of α and β and their inter-relations, Transistor as a switch,

4. Uni-junction Transistor: (06)

Symbol, types, construction, working principle, I-V characteristics, Specifications, Parameters of- Uni-Junction Transistor (UJT), Use of UJT as a relaxation oscillator

5. Oscillators: (08)

Feedback principle, types of feedback, Basic theory of oscillator, Barkhausen's criteria, Negative feedback in amplifier, advantages of negative feedback, multivibrators – bistable, monostable and astable.

6. Digital Electronics: (12)

Number systems: Binary, Binary coded decimal (BCD), Octal, Hexadecimal, Addition and subtraction of binary numbers and binary fractions using one's and two's complement, Basic logic gates (OR, AND, NOT), Derived gates: NOR, NAND, EXOR, EXNOR with symbols and truth tables, Boolean Algebra, De Morgan's theorems and its verification, RS flip-flop, IC 7400, IC7402, Problems. Elementary concept on nano-electronics

Reference Books

1. Electronic Devices and Circuits – Allen Mottershed (HPI)
2. Principles of Electronics – V.K. Mehta (S. Chand)
3. Basic Electronics – Grob.
4. Electronics Fundamentals and Applications – John D. Ryder
5. Electronic Devices and Circuits – Milliman and Halkins
6. Digital Principles and Applications – Malvino and Leech Tata Mc-Graw Hills Pub.
7. Electronics Principles, Malvino, 7th Edition TaTa Mc-Graw Hills.
8. Op Amp and Linear integrated circuits – Ramakant Gaikwad, Prentice Hall of India Pub
9. Introduction for nano Technology – S.K. Kulkarni

S. Y. B. Sc.: (CBCS 2018 Course)
Semester – IV
P – 43: PRACTICAL COURSE - IV

Total Credits: 02

Learning Outcome :

1. Study of circuit theorems and De-Morgan's theorems.
2. Study of I-V characteristics of UJT.
3. Measurement of A.C, and D.C. voltages by C.R.O.
4. To understand logic gates and C.R.O..
5. To know Transistor characteristics (CE configuration)

Course Content:

1. Verification of circuit theorem - Norton, Thevenin's and Maximum power transfer theorems.
2. Use of CRO - Measurement of frequency, A.C, D.C. voltages, Lissgeous figures.
3. Single stage transistor amplifier (R-C coupled).
4. I-V characteristics of UJT
5. Application of UJT as relaxation oscillator.
6. Study of astable multivibrator
7. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor.
8. Study of logic gates
9. Verification of De-Morgan's theorems
10. Transistor characteristics (CE configuration)
11. Study of RS flip-flop

Additional Activities (Any one)

- 1) One educational tour with report equivalent to two experiments
- 2) Demonstrations: any three demonstrations equivalent to two experiments
- 3) Mini project equivalent to two experiments
- 4) Computer aided demonstrations (Using computer simulations or animations)
(Any 1 demonstrations equivalent to 2 experiments)

Note:

- i) Students have to perform at least one additional activity in addition to eight experiments mentioned above.
- ii) Total laboratory work with additional activity should be equivalent to 10 experiments.

REFERENCE BOOKS:

1. Advanced Practical Physics - Worsnop and Flint
2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
3. Experimental Physics - Rajopadhye and Purohit
4. B.Sc. Practical Physics - C. N. Arora
5. Physics through Experiments Vol. 1, Mechanical System - B. Saraf
6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
7. World Wide View of Physics - A. W. Joshi & others.

S. Y. B. Sc.: (CBCS 2018 Course)

Semester – IV

C - 41 : PHYSICAL & ANALYTICAL CHEMISTRY-II

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Determine normality, molarity and molality of solution.
2. Understand theories of reaction rates.
3. Know the significance of sol, gel and emulsions.
4. Standardize the solutions .
5. Perform the acid-base, complexometric redox and iodometric titrations.

Course Content:

SECTION - I (PHYSICAL CHEMISTRY)

1. Solutions

[13]

Ways of expressing concentration, Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids, azeotropes – HCl-H₂O and ethanol – water systems.

Partially miscible liquids – Phenol – water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature effect of impurity on consolute temperature. Immiscible liquids, steam distillation.

Ref. 7

2. Chemical Kinetics

[13]

Introduction, Simultaneous reactions such as opposing reactions, Side reactions, Consecutive reactions and chain reactions. (Derivations of rate equations for these reactions are not expected).

Effect of temperature on the rate of reaction : (i) Temperature, coefficient, (ii) Arrhenius equation, (iii) Energy of activation.

Theories of reaction rate : (i) Collision theory, (ii) Transition state theory.

Ref no. 1

3. Colloidal State

[04]

Definition of colloids, classification of colloids.

Solids in liquids (sols) : properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schule law, gold number.

Liquids in liquids (emulsions): preparation and properties, inhibition, general applications of colloids.

Ref. 1 and 7

REFERENCE BOOKS:

1. Essentials of Physical Chemistry (2012), S Chand & Co. Ltd., ArunBahl, B. S. Bahl & G. D. Tuli.
2. Advanced Physical Chemistry (2011), S Chand & Co. Ltd., D. N. Bajpai.
3. Physical Chemistry, G.M.Barrow, International Student Edition, McGraw Hill.
4. Physical Chemistry, R.A.Alberty, Wiley Eastern Ltd.
5. University General Chemistry, C.N.Rao, Macmillan.
6. Physical Chemistry Through Problems, S.K.Dogra, Wiley Eastern Ltd.
7. Principles of Physical Chemistry, Samuel H. Maron, Carl F. Prutton, Fourth Edn.

SECTION – II (ANALYTICAL CHEMISTRY)

1) Introduction to Volumetric Analysis [08]

Introduction: Methods of expressing concentrations, Methods of preparation of standard solutions, primary and secondary standard substances.

Apparatus used and their calibration (burettes, volumetric pipettes, graduated pipettes, volumetric flask etc.), methods of calibration.

2) Non Instrumental Volumetric Analysis [10]

Indicators : Theory of indicators, acid base indicators, mixed and universal indicators

Acid–Base titrations: Strong acid–Strong base, Weak acid–strong base, Weak acid-Weak base titration, Displacement titrations, polybasic acid titrations.

Complexometric titrations: Principle, EDTA titrations, choice of indicators

Redox titrations: Principle of redox titration, detection of equivalence point using suitable indicators.

3) Argentimetry: [6]

Theory of precipitation titration, Mohr's method, Fajan's method, Preparation and standardization of silver nitrate solution, Determination of chloride, bromide and iodide individually and in a mixture.

4) Iodometry and Iodimetry: [6]

Theory of iodometry and iodimetry, Preparation and standardization of sodium thiosulphate, Preparation and standardization of iodine solution, Determination of copper in copper sulphate, available chlorine in bleaching powder

REFERENCE BOOKS:

1. The Quantitative Inorganic Chemistry - by A.I. Vogel
2. Fundamentals of Analytical Chemistry - by S. M. Khopkar
3. Quantitative Analysis - by Day and Underwood
4. Analytical Chemistry - by G. D. Christian

S. Y. B. Sc.: (CBCS 2018 Course)
Semester – IV
C-42: ORGANIC & INORGANIC CHEMISTRY-IV

Credits: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the organic conversions.
2. Study of aspects of green chemistry.
3. Explain preparations, reactions and applications of aromatic nitro & amino compounds.
4. Know chemistry of carbohydrates.
5. Expound inorganic high polymers .
6. Describe acids, bases and solvents.
7. Summaries hydrogen bonding and Van-der Waals forces.
8. Express chemistry & our life.

Course Content:

SECTION – I (ORGANIC CHEMISTRY)

1. **Organic Conversions** [10]
Based on the knowledge of functional group Chemistry the students should be able to suggest how to bring about the given Organic conversions. The conversion should include.
 - a. Converting one functional group in to the other.
 - b. Converting a given molecule in to another with more or less number of carbon atoms.
 - c. Suggesting synthetic routs to the given targets molecule.
 - d. Suggesting the product/s at reactants and conditions are given indicating major/minor products if any.Ref. 1 & 4
2. **Green Chemistry** [06]
 - a) Introduction ,
 - b) 12 principles of green chemistry,
 - c) Green chemicals - Green reagents, green catalyst, green solvents.
 - d) Emerging green technologies-Microwave chemistry, Sonochemistry.
 - e) Green synthesis
 - f) Ref. 5 & 6
3. **Aromatic Nitrogen compounds** [08]
Aromatic nitrocompounds:
 - a. Preparation : Nitration using mixed acid, Preparation of mononitro and dinitro-compounds through nitration of benzene (mechanism), toluene.
 - b. Reactions : Reduction of nitro-compounds under different conditions.
 - c. Applications of nitro compounds : In the preparation of amines.
Aromatic amino compounds:
 - a. Preparation : Reduction of aromatic nitro compounds using catalytic hydrogenation, dissolving metal reduction using – Fe-HCl, Sn-HCl.

- b. Reactions : Basicity of aromatic amines – effect of substituents on basicity of aniline, salt formation, N-alkylation, halogenations, diazotization of aromatic primary amines

Reactions of aryl diazonium salts-Sandmeyer reactions,
Replacement of diazo group by H – OH- CN
Azo-coupling reaction with phenols/naphthols,
Ref. 1, 7 & 8

4. Introduction of Bio-molecules: [06]

Carbohydrates:

- Definition, classification, reaction of monosaccharide (glucose)- oxidation, reduction, osazone and ester formation, isomerization,
- Killiani-Fischer synthesis and Ruff degradation,
- Configuration of D/L configuration of (+) Glucose,
- Brief account of disaccharides: Sucrose and lactose.

Ref. 2

References:

- Organic Chemistry - By Morrison - Boyd (6th Edition)
- Organic Chemistry - By Finar Vol. II (5th Edition)
- Advanced organic Chemistry - By B.S. Bahl & Arun Bahl.
- Reactions, rearrangements and reagents – S N Sanyal
- Advances in green chemistry: chemical synthesis using MW irradiation by
- R.S.Varma
- Green chemistry: Environment friendly alternatives by Rashmi Sanghi and
- M.M.Srivastava
- A guide to mechanism in Organic Chemistry, 6th Edition, Peter Sykes,
- Pearson Education
- Organic Chemistry, S.H. Pine, McGraw Hill Kogakusha Ltd.

SECTION – II (INORGANIC CHEMISTRY)

1. Inorganic high polymers: [08]

Basic concepts & definitions, classification, comparison of organic and inorganic polymers, classification of inorganic polymers, polymer backbone, Polymers containing Boron, Silicon, Phosphorous, sulfur, fluorocarbons, Heteroatomic polymers, silicones, phosphonitrilic compounds PON polymers, Borazole and its derivatives.

Ref. 1 Relevant pages.

2. Acids, Bases and Solvents [08]

Definition of acids and bases, Arrhenius theory, Lowry-Bronsted theory, Lewis concept, Lux-Flood theory, strength of acids and bases, trends in the strength of hydrides and oxyacids, Properties of solvents, M.P-B.P range, dipole moment, dielectric constant, Lewis acid-base character and types of solvents.

Ref.2. Page no. 163-173.

3. Page no. 143-170.

4. Page no. 299-322.

3. **Hydrogen Bonding and Van-der Waals Forces** [08]
 Introduction, Definition of Hydrogen bonding, conditions for formation of Hydrogen bond, strength of Hydrogen bond, Types of Hydrogen bond, Effect of Hydrogen bonding on properties of compounds like M.P, B.P, Physical state, solubility, density, viscosity. Van-der Waals forces, Types of Van-der Waals forces, factors affecting strength of Van-der-Waals forces.
 Ref. 1 Page no. 256-258
4. **Chemistry and our life** [06]
 Introduction, Essential Nutrients for plants, e.g. carbon, oxygen, hydrogen, nitrogen etc., physiological role of essential elements e.g. phosphorus, potassium, manganese, sulphur, magnesium, calcium, iron, copper, boron etc., Sources of nutrients, Inorganic compounds as medicines e.g. Antacids like Sodium bicarbonate, Aluminium hydroxide gel, Aluminium phosphate, Magnesium hydroxide, platinum complex as anticancer agent.
 Ref. 4. Page no. 124-167.
 5. Page no. 71-77.
 6. Page no. 1-107 and 506-520.

References:

1. Concise Inorganic Chemistry by J. D. Lee, Fifth Edⁿ.
2. Basic Inorganic Chemistry – F. A. Cotton
3. Inorganic Chemistry- Inorganic Chemistry-Shriver and Atkins, Third Edⁿ.
4. Modern Inorganic Chemistry-P.R. Shukla, Pages-299-322
5. Environmental Chemistry-A.K.Day, Seventh Edn, Pages
6. Bioinorganic Chemistry-I. Bertini, H. Gray, Viva Low-Priced Student Edn.

S. Y. B. Sc.: (CBCS 2018 Course)
Semester – IV
C-43 : PRACTICAL COURSE - IV

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Determine the strength of H_2O_2 using KMnO_4 .
2. Estimate the amount of lactic acid .
3. Find out the amount of Aspirin .
4. Identify the acidic and basic radicals in the given mixture.
5. Prepare Ferrous ammonium sulphate.
6. Understand TLC techniques for separation of pigments, dyes etc.

Course Content:

A. ANALYTICAL CHEMISTRY EXPERIMENTS (Any 5)

- 1 To determine the strength of given H_2O_2 solution by using 0.05M KMnO_4 & hence to find out the volume strength of H_2O_2 .
- 2 To determine the amount of acetic acid from the given commercial sample of Vinegar by using standard NaOH solution.
- 3 To determine the amount of Lactic acid from the given sample of curd by using 0.05N NaOH solution.
- 4 Estimation of sodium carbonate content of washing soda.
- 5 To find out the saponification value of the given sample of an oil.
- 6 Estimation of Al (III) from the given aluminium salt solution by using Erichrome Black–T indicator (Back titration method)
7. Estimation of Aspirin from given tablet

B. INORGANIC CHEMISTRY EXPERIMENTS

Inorganic Qualitative Analysis

(3 Mixtures)

Qualitative Analysis of Inorganic mixture containing two Basic and two Acidic radicals

INORGANIC PREPARATION

(Any One)

- i) Preparations of Ferrous ammonium sulphate (Mohr's salt)
- ii) Synthesis of nitropenta-amino Cobalt (III) Chloride.

Laboratory techniques

(Any one)

- (i) TLC:- Separation of pigments, dyes, nitroanilines.
- (ii) Isolation of Anthocyanin from flowers.

Note:- a) Double burette method should be used for all types of titrations.
b) Stock solutions should be supplied in 100 ml volumetric flask (10 to 15 ml)
c) Student must write general reactions for all tests that are performed during analysis.

REFERENCE BOOKS

1. Organic qualitative analysis - By A.I.Vogel.
2. Organic Chemistry by Finar Volume-II, 5th edition.
3. Analytical Chemistry by G.D. Christian 6th edition.
4. Vogel's Textbook of Quantitative chemical analysis 6th edition R.C. Denney, J.D. Barnes, M.J.K. Thomas

S. Y. B. Sc.: (CBCS 2018 Course)

Semester – IV

B – 41: PLANT BIOTECHNOLOGY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. Know the transgenic technology for the improvement of quality and quantity of plant and thereby product.
2. understand the advantages of in vitro propagation in various areas.
3. realize the application and importance ,fermentation, biogas, nanotechnology etc.
4. understand the basic concepts of genome organization in plants and molecular markers.
5. have a clear knowledge of plant tissue culture techniques
6. have a basic understanding of the plant genetic transformation methods.
7. aware of the basics and applications of plant biotechnology.
8. Understand the fundamentals of plant tissue culture techniques.

Course Content:

1. Introduction to Plant 06L

- a. Definition, concept & scope
- b. Multidisciplinary nature of Biotechnology

Fermentation Technology 09L

- a. Fermentation – Definition with one example, importance.
- b. Organisms involved.
- c. Substrate used.
- d. Products and byproducts.
- e. Concept of scaling up.
- f. Types – batch culture and continuous culture.
- g. Types of Bioreactors – Tubular tower bioreactor, digestive bioreactor, stirred tank bioreactor
- h. Various steps in manufacture of citric acid.

2. Single Cell Protein Production 9L

- a. Need of proteins in diet.
- b. Advantages and disadvantages of microbes as a source of proteins.
- c. Sources of SCP.

Wastes

Algal Biomass (*Spirulina*)

Fungal Biomass (Yeast)

4. Biological Fuel Generation 04 L

- a. Importance of biological fuel.
- b. Brief account of petrocrops.
- c. Gaseous and liquid fuels.
- d. Biogas – plant- design, operation, substrate used, biogas production, process and organisms involved.

- 5. Environmental Biotechnology** **05 L**
 - a. Concept
 - b. Principles of biological treatment of sewage / industrial waste water
- 6. Biotechnology in Agriculture** **07 L**
 - a. Tissue culture – General techniques, methods & applications of tissue culture.
 - b. Biofertilizers – Definition, necessity, types – BGA, *Azotobacter*, *Rhizobium*.
- 7. Genetic Engineering** **12L**
 - a. Meaning
 - b. Restriction enzymes. Plasmids, Phages.
 - c. Outline of technique of genetic engineering.
 - d. Transfer of genes in to plants vectors, transformation, microinjection, nuclear transplantation.
- 8. Nano – biotechnology** **08 L**
 - a. Definition and concept.
 - b. Chemical vs biological synthesis of nano materials.
 - c. Lipid based nanobricks.
 - d. Protein based nanostructure formation

Reference books:

1. Nanobiotechnology, Concepts, Applications and perspectives, C.M. Niemeyer and C.A. Mirkin ; 2004; WILEY-VCH,.
2. Bionanotechnology: concepts, Lessons from Nature”, David.S. Goodsell, 2004 Wiley-Liss
3. Nanobiotechnology Protocols; Sandra J Rosenthal, David W Wright 2005, Humana Press Inc
4. Nanoscale Technology in Biological Systems; R.S. Greco, F.B.Prinz and R.L.Smith 2005 CRC press,.
5. Fundamental Molecular Biology ; Allison LA; 2007
6. Recombinant DNA, Watson et al ; 5th Ed; 2006
7. Techniques for Engineering Genes ; Curell BR et al;2004
8. Techniques for Molecular Biology ; Tagu D & Moussard C; INRA; 2006
9. Gene Cloning and DNA Analysis ; 5th Ed ; Brown TA ; 2006
10. Analysis of Genes and Genomes ; Reece RJ ; Wiley; 2004
11. Recombinant DNA and Biotechnology ; 2nd Ed ; Kreuzer H and Massey A ;ASM;2006
12. Text book of biotechnology, R.C.Dubey, 2009, S.Chand, Delhi

S. Y. B. Sc.: (CBCS 2018 Course)

Semester – IV

B - 42: PLANT PHYSIOLOGY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On Completion of this course, students are able to:

1. know importance and scope of plant physiology.
2. understand the plants and plant cells in relation to water.
3. Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.
4. Understand the physiological details of photosynthesis and respiration
5. Understand lipid metabolism in plants
6. Understand the stress of plants and its adaptations.
7. Learn and understand about mineral nutrition in plants.
8. Understand the growth and developmental processes in plants.
9. Understand the process of translocation of solutes in plants.
10. Know the nitrogen metabolism and its importance..

Course Content:

Plant Physiology

1. Plant water relations

8L

Diffusion and osmosis– Definition, Process, Diffusion Pressure, DPD, OP, water potential and Chemical potential. Mechanism of water absorption, water transport through xylem,

2. Transpiration

11 L

Definition , types, mechanism of stomatal movement, factors affecting transpiration - atmospheric and edaphic factors, antitranspirants- concept and types. significance of transpiration.

3. Mineral Nutrition

08 L

Criteria of essentiality of elements, macro & micronutrients, role of essential elements, mineral deficiency symptoms and plant disorders, nutrient uptake and transport mechanism , role of cell membrane, ion pumps and carriers. Assessment of fertilizer need of the plants.

4. Transport of organic substances

04 L

Transport of photosynthates; Source-sink relationship, mechanism of translocation in phloem, assimilation process.

5. Photosynthesis

07 L

Definition and significance. Structure of photosynthetic apparatus, photosynthetic pigments, quantasomes, accessory pigments and photoprotective carotenoids; reaction center complexes , photochemical reactions, electron transport pathway in chloroplast membrane , photophosphorylation, the Calvin cycle, C4 carbon cycle, Crassulacean Acid Metabolism, Synthesis of starch and sucrose, Photorespiration.

6. Respiration

06L

Glycolysis, TCA Cycle and its regulation, electron transport in mitochondria , oxidative phosphorylation, pentose phosphate Pathway, cyanide-resistant respiration, respiratory substrates, R.Q.value.

7. Nitrogen metabolism

06L

Biological nitrogen fixation, reduction of N₂ into ammonia, *nif* genes, relation of nitrate reductase and nitrogenase, nitrate and ammonium assimilation.

8. Growth and Development

10 L

General aspects-definition, phases of growth , kinetics of the growth , physiology of seed dormancy and seed germination, concept of photoperiodism, physiology of flowering , the florigen concept & role of hormones, vernalization , senescence and fruit ripening, physiological role and mechanism of action of hormones, Auxins, Cytokinins, Gibberellins, Absciscic acid and Ethylene.

Reference books:

1. Galston,A.W. 1989, Life Processes in plants, Scientific American Library, Springer-Verlag, New York, USA.
2. Hooykaas,P,J,J, Hall, M.A. and Libbenga, K.R.(eds) 1999. Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam, The Netherlands.
3. Hopkins, W.G. 1995. Introduction to plants Physiology. John Wiley and Sons, inc., New York, USA.
4. Moore. T.C.1989. Biochemistry and Physiology of Plant Hormones (2nd edition) Springer-Verlag, New York, USA.
5. Salisbury, F.B. and Ross, C.W.1992. Plant Physiology (4th edition) Wadsworth Publishing Co. California, USA.
6. Taiz,L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc.,Publishers, Masachusetts, USA.

S.Y.B.Sc. (CBCS – 2018 Course)
SEMESTER - IV
B 43 - Botany Practical course IV
(Practical based on paper: B-41, B-42 (SEM - IV))

Core Course – Practical; Credits- 02

Contact hours per practical – 04 h

(ANY-10)

Course Learning Outcomes :

On Completion of this course, students are able to:

1. determine the DPD by using the potato tuber
2. determine the rate of photosynthesis · Determination of RQ using Ganong's respirometer
3. understand osmosis by curling experiment, Imbibition pressure, Thistle funnel, Ringing experiment, Relative transpiration, CO₂ necessary for photosynthesis, Kuhen's Tube experiment, Cyclosis in Hydrilla
4. determine the absorption spectrum of chlorophyll pigments and estimate the amount of Chl-a, Chl-b and total Chlorophylls by spectrophotometer method.
5. Study extraction and separation of free amino acid of germinating seed by circular paper chromatography.
6. Extraction and Detection of secondary plant metabolites from suitable plant material.
7. study the activity of enzyme lipase in germinating seeds.

Course content:

PLANT BIOTECHNOLOGY

1. Demonstration of DNA Model. **D**
2. Demonstration of comparison of GM Plants with Non- GM Plants.
(BT cotton, BT Tomato) **D**
3. Estimation of citric acid by assay method. **E**
4. Cultivation of *Spirulina* and Study of its commercial products. **E**
5. Plant tissue culture technique. **E**
A) Instrumentation, Sterilization, Media preparation
B) Inoculation of Explants / Meristem / Nodal sector / Embryo
6. Visit to biotechnology institute and submission of visit report with respect to design of PTC lab.
7. Demonstration of synthetic seeds. **D**
8. Visit to waste water treatment plant and submission of its report.

PLANT PHYSIOLOGY

9. To study the permeability of plasma membrane using different concentrations of organic solvents. (Potato tuber experiment) **E**
10. To extract enzymes and study their activity, e.g. amylase, lipase, acid Phosphatase, Catalase, Peroxidase – **E**
11. To extract and separate chloroplast pigments by solvent method and demonstrate fluorescence in chloroplast extracts.- **E**
12. To determine stomata index, stomatal frequency and percentage of leaf area open through stomata. **E**
13. To determine the rate of transpiration in different conditions (sunlight, shade, wind) by using students potometer. **E**

D – Demonstration, E – Experiment

Suggested Readings (for laboratory exercises)

- Copeland, R.A 1996, Enzymes: A Practical introduction to Structure, Mechanism, and Data Analysis. VCH Publisher, New York.
- Dryer, R.L. and Lata, G.F. 1989, Experimental Biochemistry. Oxford, University Press, New York .
- Moore, T.C. 1974. Research Experience in plant Physiology. A Laboratory Manual. Springe-Verlag, Berlin.
- Wilson, K. and Goulding , K.H. (Eds)1986. A Biologists Guide to Principles and Techniques of Practical Biochemistry. Edward Arnold, London, Uk.
- Practical Botany-S. B. Agarwal
- A Mannual in Plant Physiology Practical –Vaidya&Kulkarni
- Practical Botany- By S C Santra, Vol. 1, Vol. 2, New Central Book Agency (P) Ltd., Kolkata.

N.B.

- Visits to Agriculture college/ Horticulture college/ Research centers / Biofertilizer industries/ Mushroom cultivation centre.
- Botanical collections. (One in each term).
- Students should submit tour and visit reports .

S.Y.B.Sc. (CBCS – 2018 Course)
SEMESTER - IV
Z 4 1 : Functional Anatomy of Chordates-II

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Understand the systematic position and external morphology of *Scoliodon*.
2. Understand and study the various systems like digestive system, respiratory system, nervous system in *Scoliodon*.
3. Study and understand the classification and characters of animals in various classes- Reptiles, Aves and Mammals.
4. Gain knowledge about diversity of animals in class Reptiles, Aves and Mammals.
5. Study and understand aerial adaptations in birds.
6. Impart and understand knowledge about poisonous and non-poisonous snakes.
7. Understand and study beak and leg modifications in birds.
8. Study and understand dentition in mammals, dental formula in with some examples.
9. Gain knowledge about animal ethics, animal protection act and its applications.

Course Content

UNIT I

Study of *Scoliodon*

20L

- i) Systematic position, habit and habitat.
- ii) External characters of *scoliodon*
- iii) Digestive system, food and feeding
- iv) Respiratory system
- v) Blood vascular system – Heart, Its structure and working
- vi) Nervous system -Brain its structure and functions
- vii) Sense organs – Olfactory organs, eye, membranous Labyrinth, Ampulla of lorenzini
- viii) Urinogenital system – Male and Female
- ix) Economic importance of *Scoliodon*

UNIT II

15L

Salient features of the following classes and its subclasses with suitable two examples of each

- i) Reptilia: Subclasses- Anapsida, Diapsida
- ii) Aves: Subclasses- Neornithes- Superorders- Palaeognathae, Neognathae
- iii) Mammalia: Subclasses-Prototheria, Theria- Metatheria, Eutheria

UNIT III

20L

General topics

- i) Poisonous and Non- poisonous snakes (Two examples each)
- ii) Beak and Feet modifications in birds
- iii) Aerial adaptations in birds
- iv) Dentition in mammals

UNIT IV

05L

Animal Ethics

- i) Introduction and Concept
- ii) Animal Protection Act
- iii) Laboratory animal model and application(Any four)

Reference books :

1. Chordate Zoology (1988) – C.Dalela.
2. Chordate Zoology (1996) , Kishor Pawar.
3. Zoology of chordates – H.C. Nigam.
4. The diversity of life – E.O.Wilson.
5. The biology of diversity – M.kato.
6. Modern text book of zoology – vertebrates (1992) – Kotpal ,Agarwal and Khetarpal.
7. Text book of Modern Zoology (1991) – P.S. Verma and P.C. Shrivastava.
8. Mannual of practical zoology – vertebrates – P.S. Verma.
9. The Life of Vertebrates – Younge J. Z.
10. A Textbook of Zoology –Parker T.J. and Haswell W. A..
11. A Textbook of vertebrate Zoology – Prasad S. N.
12. Introduction to chordates – Manjupuria T. C.
13. A Textbook of vertebrate Zoology- Agarwal and Dalela.
14. Vertebrates – Kotpal R. C.
15. Chordates – Dhami and Dhami.
16. Wild life conservation: Negi S.S (Natraj Publishers)
17. Guidelines for breeding and care of laboratory animals: World Health Organization (WHO) and International Council For Laboratory Animal Science (ICLAS).

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER IV
Z 4 2 : Physiology of Mammals

Total Credits: 04

Total lectures: 60

Course Outcomes:

On completion of the course, students are able to:

1. Impart the knowledge about various metabolic and physiological mechanisms of the human body.
2. Understand the physiology at the cellular and system level and describe the role and functions of different systems.
3. Understand the structure and function of carbohydrates, proteins, amino acids, lipids, vitamins and minerals as a constituents of balanced diet.
4. Describe and study the physiology of digestive system, respiratory system, circulatory system, endocrine and reproductive system to define normal and abnormal functions.

Course Content

UNIT I

15L

Nutrition

- i) Constituent of balanced diet-
Carbohydrates, Fats, Proteins, Essential Amino acids, Vitamins, Mineral Salts, Water
- ii) Brief outline of sources of energy –
Carbohydrates and carbohydrate requirements, Fats and its requirements, Protein and its requirements.
- iii) Physiology of digestion –
Peristaltic movement, digestion, actions of digestive juices and enzymes on different foods, absorption, assimilation, defecation.

UNIT II

06L

Circulation

- i) Process of coagulation of blood
- ii) Neurogenic and myogenic heart, cardiac cycle, cardiac output
- iii) Control of heart beats – Nervous, Hormonal and Ionic

UNIT III

10L

Respiration

- i) Ventilation
- ii) Nervous control of breathing action
- iii) Exchange of gases between lung and plasma, erythrocytes and tissues
- iv) Basal metabolic rate and respiratory quotient

UNIT IV

08L

Excretion

- i) Formation and composition of urine
- ii) Counter current multiplier theory
- iii) Blood supply of kidney
- iv) Hormonal control of kidney

UNIT V

08L

7. Reproduction

- i) Oestrous cycle and Menstrual cycle
- ii) Pregnancy
- iii) Parturition
- iv) Hormonal control

UNIT VI

13L

9. Vertebrate endocrinology

- i) Pituitary gland hormones :
 - Pars distalis – S. T. H. / G. H, Prolactin, TSH, FSH, LH, ICSH, ACTH
 - Pars intermedia – MSH
 - Pars nervosa – Oxytocin, ADH
- ii) Thyroid gland – Thyroxin, Calcitonin
- iii) Adrenal gland hormones :
 - Adrenal cortex – Mineralocorticoid, Glucocorticoid
 - Adrenal medulla – Adrenalin, Nonadrenalin
- iv) Pancreas (Islets of Langerhans) – Insulin, Glucagon.
- v) Kidney (JG Complex)– Renin, Erythropoietin
- vi) Testis (Cells of Leydig) – Testosterone.
- vii) Ovary : Theca interna Oestrogen, Corpus luteum -Progesterone

Reference books :

1. General & Comparative Physiology – By Hoar W.S.
2. An introduction to physiology – Davson (Vol.I & II)
3. Human Physiology – Chatterjee C C (vol. I & II)
4. Textbook of animal physiology – Hmkat & Mathur.
5. Human physiology – Guyton and Hall.
6. Mammalian Physiology – Athavale M.V.
7. Zoology – General Physiology – Pradip Jabde (vol. I &II)
8. Physiology of Reproduction – Hogarth.
9. General & Comparative endocrinology – E.J. W. Barrington.
10. Text book of Endocrinology –R.H. Williams.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER IV
Z 43 : Zoology Practical course
(Practical based on paper: Z-41, Z-42)

Total Credits: 02

Contact hours per practical – 04 h

Course Outcomes:

On completion of the course, students are able to:

1. Understand the classification, characters and diversity of animals in various classes- Reptiles, Aves and Mammalia with the help of museum specimens.
2. Understand the systematic position and external morphology of *Scoliodon*.
3. Understand and study the various systems like digestive system, respiratory system, nervous system in *Scoliodon*.
4. Understand and study beak and leg modification in birds with the help of museum specimens.
5. Identify characters of poisonous and non- poisonous snakes with the help of museum specimens and photographs.
6. Study and understand dental formula, dentition in mammals.
7. Study and understand effect of enzyme on food material like carbohydrates, proteins with the help of biochemical tests.
8. Study measurement of Hb % of human (mammalian) blood.
9. Study and counting W.B.Cs and R.B.Cs of human (mammalian) blood.

Course Content

Functional anatomy of chordates-II

1. Study of general and distinguishing characters and classification of chordates upto order level with one example of each order. **D**
(Sketches/Photographs may be used)
 - a. Class – Reptilia (Order : Chelonia, Squamata- Lacertilia, Ophidia, Crocodilia)
 - b. Class- Aves (Order : Struthioniformes, Anseriformes, Falconiformes, Psitaciformes, Passeriformis and Columbiformes)
 - c. Class – Mammalia (Order : Monotremata, Marsupialia, Chiroptera, Rodentia and Primates)
2. Study of systematic position, external features and digestive system of *Scoliodon*. **D**
3. Study of brain of *Scoliodon*. **D**
4. Study of placoid scales and ampullae of Lorenzini. **D**
5. Study of a) Arterial system of *Scoliodon* (excluding head arteries) **D**
b) Eye ball muscles **D**
6. Identification of poisonous and non- poisonous snakes with the help of identification key with two examples of each **D**
7. Study of modifications of beaks and feet in birds. **D**
 - a. Beaks: tearing and piercing, fruit eating, mud probing, fish catching, wood chiselling and flower probing.
 - b. Feet: perching, raptorial, climbing, swimming, running.
8. Dentition in mammals. **D**

Physiology of Mammals

9. Action of Enzymes .	E
a. Digestion of starch by saliva/ proteins by pepsin.	
b. Effect of temperature and dilution on enzyme action.	
c. Specificity of enzyme.	
10. Quantitative estimation of hemoglobin in blood and study of colour index.	E
11. Study of total count of R. B. C. in mammalian blood.	E
12. Study of total count of W. B. C. in mammalian blood.	E
13. Study of clotting time by capillary experiment. in mammalian blood.	E
14. Compulsory submission of field visit report along with at least five photographs/ models/ sketches of insect pest/fishes/any animal corresponding to theory courses.	
15. Compulsory study tour/visit to sea coast/fishery institute/sericulture farm/ apiculture institute / agricultural farm.	

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

*E – Experiments

*D – Demonstration Practical

Reference books :

1. A Manual of Practical Zoology Chordata Vol. 2 : P. K. G. Nair and K. P. Achar.
2. A Manual of Practical Vertebrate Zoology and Physiology, 1990. V. B. Rastogi, Kedarnath, Ramnath, Meerut, Delhi.
3. Experimental Physiology: V.V. Kulshreshtha, Vikas Publishing House Pvt. Ltd, New Delhi.
4. Practical Zoology, Vertebrate : S.S. Lal Rastogi Publications, Meerut.

S. Y. B.Sc. (CBCS - 2018 Course)

SEMESTER IV

MB –41 Principles of Disease, Epidemiology and Immunology

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand principles of disease, epidemiology and immunology.
2. Understand different modes of transmission of diseases.
3. Know different components of immune system and their functions.

Course Content

No. of lectures

I)	Microorganisms and Disease	(16)
	i) Distribution and Occurrence of the normal flora ii) Pathogenicity, virulence and infection iii) Types of infectious diseases iv) Role of host in infectious Diseases Types of carriers: Convalescent, healthy, casual and chronic v) Airborne Transmission of the diseases a) Concept of Droplets & Droplet Nuclei b) Aerosols vi) Waterborne Transmission of the diseases vii) Food borne Transmission of the diseases viii) Transmission by Direct Contact ix) Arthropod borne Transmission	
II)	Immune Response Mechanisms:	
	i) Types of Immunity:	(07)
	a) Innate or natural immunity b) Acquired immunity – Active Immunity, Passive Immunity	
	ii) Components of Immune system:	(25)
	a) Phagocytic cells, Eosinophils, Neutrophils, Macrophages, Natural Killer Cells b) Antigens : Definition , Haptens, Carrier Proteins, Sequential Epitopes, Conformational Epitopes, Continuous Epitopes, Discontinuous Epitopes. c) Antibodies: Structure & functions of IgG, IgM, IgA, IgD and IgE d) Monoclonal antibodies: Definition and applications.	
	iii) Adjuvants	(02)
III)	Complement System:	(10)
	i) Classical Pathway ii) Alternative Pathway iii) Biological Significance of Complement Factors	

References :-

1. Robert F. Boyd 1995, General Microbiology Times Mirror/Mosby College Publishing(Topic No.II)
2. Michael J. Pelzar ‘ Microbiology’ 11th reprint Tata McGraw Hill Delhi(Topic No.I)
3. Abul K. Abbas 2006 Cellular & Molecular Immunology 5th Edition S.awnders, Philadelphia(Topic No.III)
4. David Male , Jonathan Brostorr, davidB.Roth Nan Roitt 2006, Immunology 7th Edition Elsevier UK/ USA(Topic No.III)
5. R.Anantnarayan, C.K.JayaramPaniker (2009), ‘Text Book of Microbiology’ ,8th Edition, University Press India Pvt.Ltd. India. (Topic III)

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER IV
MB – 42 Applied Microbiology

Total credits 04

Total 60 Lectures

Course Outcomes:

At the end of this course the students will be able to:

1. Understand different aspects of microbial pollution of water.
2. Know different ways of water treatments.
3. Understand basics of microbial fermentation techniques.

Course Content

No. Of lectures

I)	Water Microbiology i) Water related illnesses associated with microorganisms a) Bacteria, Blue – green Algae, Parasites – Protozoa, Nematodes, b) Cestodes, Trematodes. Emerging pathogens, Viruses c) Opportunistic Bacterial pathogens ii) Indicator microorganisms: a) Concept of Indicator organisms b) Standard and Criteria for indicators c) Fecal coliforms d) Fecal <i>Streptococci</i> , <i>Clostridium perfringens</i> , <i>Bifidobacterium bifidus</i> e) Bacteriophages iii) Total coliforms: The most Probable numbers (MPN) Test, The Presence Absence (P-A) test iv) Domestic waste water treatment a) Domestic Wastewater: composition b) Modern Wastewater Treatment: Primary Treatment, Secondary c) Treatment, Tertiary Treatment: Activated sludge and Trickling Filter d) Removal of BOD and COD by sewage Treatment Processes e) Sludge Processing, Oxidation Ponds, Septic tanks v) Potable water treatment and distribution a) Water Treatment Processes-Physical and Chemical b) Thermal Destruction, Factors Affecting Disinfectants c) Disinfection by different agents: Halogens, Ozone, d) Metal ions, Ultraviolet Disinfection, Photodynamic Inactivation e) Gamma and High Energy inactivation	30
II)	Industrial Microbiology i) Introduction and history: Fermentation – concept ii) Fermenter and its parts a) Vessels Used for fermentation, b) <i>In situ</i> Sterilization of Fermenter and its parts iii) Organisms used in fermentations a) Primary and Secondary screening, b) Stock Culture and Inoculum preparation	30

- iv) Media used in fermentation
 - a) Different Raw materials used as a substrate
 - b) Screening, Pretreatment and Sterilization of media
- v) Control of contamination in fermentations
- vi) Buffers and antifoam agents
- vii) Different types of fermentations –
 - a) Dual and multiple b) Batch and continuous
- viii) Production of antibiotics: - Organisms, Medium Composition, Precursors, Process and Flow sheet, Recovery & purification.
 - a) Streptomycin
 - b) Penicillin and Semi synthetic Penicillins

Reference:

1. Casida L.E. Jr. (1983) – Industrial Microbiology. Wiley eastern limited, New Delhi.
2. Maier R.M., I.L. Pepper, C.P. Gerba (2000) Environmental Microbiology Academic Press. Chapter No. 19, 20,21,22,23.
3. Patel A.H. (1985) – Industrial Microbiology Mac Milan India Ltd.
4. Peppler H. H. (Ed) (1979) – Microbial Technology Vol I & UU Academic Press, New York.
5. Peppler periman II (Ed) (2004) – Microbial Technology. Microbial Processes Vol I & II Academic Press: Published by Elsevier. Chapter 3 (Vol.II)
6. Prescott S. C. & C. G. Dunn (1983) Industrial Microbiology 4th edition edited by Gerald Reed. AVI Tech Books USA. Chapter 13, (Vol. I)
7. Stanbury P.F. & A Whitaker (1984) – Principles of Fermentation Technology. Pergamon, New York. Chapter No. 4,5,6,7,9.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER IV
MB- 43: Practical Course
(based on MB 41, MB 42)

Total credits: 02

Course Outcomes:

At the end of this course the students will be able to:

1. Develop the skills for detecting drug resistance among bacteria.
2. Improve the skills for blood grouping and blood banking procedures.
3. Develop the skills for detecting potability of water and water pollution.

Course Content:

I. Study of Medical Microbiology and Immunology. (06)

- i) Antibiotic sensitivity test.
- ii) Isolation of micro flora of skin
- iii) Isolation of oral micro flora.
- iv) Detection of 'Human Chorionic Gonadotrophic Hormone from urine.
- v) Detection of blood group antigens using appropriate antibodies and its clinical significance.
- vi) Visit to blood bank and submission of report.

II. Microbiology of Water. (15)

- i) Bacteriological examination of water (Qualitative test)
 - a) Presumptive
 - b) Confirmed
 - c) Completed test.
- ii) Standard Plate Count test (Quantitative)
- iii) Determination of Most Probable Number (MPN)
- iv) Determination of DO.
- v) Determination BOD.
- vi) IMViC tests:-
 - a) Indole production
 - b) Methyl Red Test.
 - c) Vogues Proskauer test.
 - d) Citrate Utilization test.

References:–

1. Bradshaw L. Jack (1979) Laboratory Microbiology, 3rd Edition W.B. Saunders co Philadelphia, London, Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
3. Cappuccino J.G. and N. Sharma (2004) Microbiology A Laboratory manual Sixth Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
5. Pelczar M.J. and E.C. Schwann (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata McGraw Hill) Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Anne Book New Delhi.

S. Y. B.Sc. (CBCS - 2018 Course)
SEMESTER IV
M-41 : Vector Calculus

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

1. At the end of this course students are expected to be able to:
2. Understand the concepts of vector functions of one and several variables, partial derivatives etc.
3. Understand the concepts of Gradient of scalar point function, Divergence and curl of a vector point function.
4. Surface integral, line integral, volume integral, Green's theorem, Gauss's divergence theories, Stoke's theorem.

Course content:

Unit-01: VECTOR FUNCTIONS OF ONE VARIABLE :

1. Vector valued functions.
2. Limits and continuity of vector valued functions.
3. Differentiability of vector valued functions.
4. Theorems on derivatives.
5. Curves in space.
6. Tangent vector and normal plane.

Unit-02: VECTOR FUNCTIONS OF SEVERAL VARIABLES

1. Vector functions of several variables.
2. Limit and continuity of vector functions.
3. Partial derivatives for vector functions of two and three variables.
4. Total Differential.

Unit-03: DIFFERENTIAL OPERATORS. :

1. Scalar field, vector field, level surfaces.
2. Gradient of scalar point function and its geometrical interpretation.
3. The directional derivative of a scalar point function.
4. Divergence of a vector point function.
5. Physical Interpretation of divergence.
6. Curl of a vector point function.
7. Physical interpretation of curl.
8. Properties of gradient, divergence and curl
9. Solenoidal and irrotational vector fields.

Unit-04: VECTOR INTEGRATION.

1. The vector integration.
2. Line integrals.
3. Conservative vector field and theorems based on conservative vector fields.
4. Surface integrals.
5. Volume integrals.

6. Green's theorem in the plane (with proof)
7. Gauss's divergence theorem (without proof)
8. Stoke's theorem (without proof)
9. Examples of integrals and theorems based on sphere cube, cylinder, square.

Reference Books :-

1. Shanti Narayan, A Course of Mathematical Analysis.
2. M.R. Spiegel; Advanced Calculus, Schaum series.
3. David V. Wider, Advanced Calculus, second edition; Prentice Hall of India, New Delhi.
4. John M.H.Olmsted, Advanced Calculus, Euresia Publishing House, New Delhi.
5. T.M. Apostol; Calculus, Vol - 2 , 2nd Edition, John Wiley.
6. Shanti Narayan; A text Book of Vector Analysis.
7. W.Kaplan; Advanced Calculus; Addison - Wiley, Reading Mass 1952.
8. J.E. Marsdan and A.J. Tromba, Vector Calculus, fourth Ed; W.H. Freoman and Co. New York.
9. Monty J.Strauss, Gerald L. Bradley, Karl J Smith, Calculus (3rd Edition); Pearson Education

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S.Y.B.Sc. (CBCS 2018 Course)
Semester – IV
M-42 : Complex Variables

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

1. At the end of this course students are expected to be able to:
2. Understand the concepts of functions of complex variables, Cauchy Riemann equations.
3. Understand the concepts of complex integrals, Cauchy theorem, Cauchy's integral formulae etc.
4. Concepts of Calculus of residues.

Course content :

Unit-01: FUNCTIONS OF COMPLEX VARIABLES :

1. Definition and examples, Limit, theorems on limits, Continuity, theorems on continuity.
2. Derivative : Differentiable functions, Algebra of differentiable functions.
3. Chain rule (without proof).
4. Analytic functions.
5. Cauchy - Riemann equations. Necessary condition (with proof). sufficient condition (without proof)
6. Harmonic functions : Real and imaginary parts of an analytic functions are harmonic (proof)
7. To find an analytic function if either real or imaginary parts are given.
8. Milne - Thomson Method for construction of analytic function.

Unit-02: COMPLEX INTEGRALS :

1. Contour integration. Simple arc. Line integral.
2. Statement of Cauchy Goursat theorem and examples for verification.
3. Simply and multiply connected regions, Antiderivatives and independence of path definition and examples.
4. Statements of Cauchy's integral formulae (without proof).
5. Taylor series and Laurent's Series (statements only).
6. Zeros of an analytic functions

Unit-03: CALCULUS OF RESIDUES :

1. Definition and examples of residues of a function.
2. Poles of a function. Simple and double pole.
3. Residue of a pole.
4. Residue of $f(z)$ at $z=a$ is $\lim_{z \rightarrow a} (z - a) f(z)$ (proof).
5. Cauchy's residue theorem (With proof)
6. Evaluation of contour integrals of the following form.
 - a) Examples using Cauchy's residue theorem.
 - b) $\int_0^{2\pi} f(\cos \phi, \sin \phi) d\phi$, integration round the unit circle.

- c) Evaluation of definite integral of the type $\int_{-\infty}^{\infty} f(x) dx$, where $f(x) = \frac{P(x)}{Q(x)}$ and $P(x)$ and $Q(x)$ are polynomials in x .
- d) Evaluation of $\int_0^{\infty} f(x) dx$, when $f(x)$ is even.
- e) Evaluation of $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx dx$ and $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx dx$ where $P(x)$ and $Q(x)$ are polynomials.
(Note - Examples involving simple poles only)

Reference Books :-

1. Shanti Narayan : Theory of Functions of Complex variables S. Chand & Co.
2. R.K.Gupta, J.N.Sharma : Complex Analysis; Krishna Prakashan Mandir, Meerat (U.P.)
3. M.L. Khanna : Complex Analysis.
4. R.V. Churchill ; Complex Variable and Applications; McGraw Hill (1984)
5. Agashe, Kulkarni, Chiruptkar : Complex Variables, Narendra Prakashan.

S.Y.B.Sc. (CBCS 2018 Course)
Semester – IV
M-43: Mathematics Practical Course – IV
(Practicals based on the applications and Problems of articles in M-41 and M-42)

Total Credit :02

Course Learning Outcomes:

1. At the end of this course students are expected to be able to:
2. Finding the partial derivatives of functions of two and three variables.
3. Finding curl, div and gradient of scalar functions.
4. Use of Green's theorem, Gauss divergence theorem and Stokes theorem.
5. Finding analytic functions and verification of analyticity of function.
6. Solving the integrations using the Cauchy's integral formula.
7. Finding the Taylor's and Laurent series of complex valued functions.

List of Practicals:

- 1) Partial derivatives for vector functions of two and three variables.
- 2) Gradient of scalar point function, divergence of vector point function and curl of vector point function.
- 3) Obtaining scalar point function at given point whose gradient is given.
- 4) Volume Integrals.
- 5) Green's theorem, Gauss's divergence theorem and Stoke's theorem.
- 6) Obtain an analytic function if either real or imaginary parts are given.
- 7) Cauchy's integral formulae.
- 8) Taylor's and Laurent's series.
- 9) Contour integration by Cauchy's residue theorem.
- 10) Evaluation of $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx \, dx$ and $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx \, dx$.

S.Y.B.Sc(CBCS 2018 Course)

Semester – IV

S-41:Probability Distributions and Statistical Inference-II

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students will acquire:

1. Knowledge of tests of hypothesis and its associated concepts.
2. Concept of Fisher's Z transformation and its applications.
3. Concept of confidence interval and confidence coefficient.
4. Knowledge about time series data, its applications to various fields and components of time series.
5. Introduction and advantages of most important tools of statistics of statistical quality control mostly used in industry at various stages.

Course content:

Unit - 1 : Test of significance.

1.1 Notion : Statistical hypothesis, null and alternative hypothesis, one sided two sided alternatives. Test of hypothesis, critical region, Type I error and Type II error level of significance.

1.2 Large sample tests for.

$$H_0 : \mu = \mu_0 \text{ against } H_1 : \mu \neq \mu_0.$$

$$H_0 : \mu_1 = \mu_2 \text{ against } H_1 : \mu_1 \neq \mu_2.$$

$$H_0 : P = P_0 \text{ against } H_1 : P \neq P_0.$$

$$H_0 : P_1 = P_2, \text{ against } H_1 : P_1 \neq P_2.$$

1.3 Examples

Unit - 2 : Application of Fisher's Z transformation.

2.1 Fisher's Z – transformation.

2.2 Testing of hypothesis :

i) $H_0 : \rho = \rho_0$ against $H_1 : \rho \neq \rho_0$.

ii) $H_0 : \rho_1 = \rho_2$ against $H_1 : \rho_1 \neq \rho_2$.

2.3 Examples

Unit - 3 :Interval Estimation .

3.1 Concept of confidence interval and confidence coefficient.

3.2 Confidence intervals for the parameters of univariate normal, two independent normal, confidence interval for proportion.

3.3 Examples

Unit - 4 : Time Series

- 4.1 Meaning and usefulness of time series analysis.
- 4.2 Components of a time series : trend, seasonal, cyclical and irregular.
- 4.3 Methods of estimating trend.
 - i) Method of moving averages.
 - ii) Method of least squares.
- 4.4 Methods of estimating seasonal component.
 - i) Method of averages.
 - ii) Ratio to trend obtained by moving average.
- 4.5 Examples and problems.

Unit - 5 : Introduction to Statistical Quality Control (S. Q. C.)

- 5.1 Introduction and need of SQC.
- 5.2 Concept of control charts, construction of $\bar{x}$ and R charts when standards are given and not given.
- 5.3 Advantages of Statistical Quality Control.
- 5.4 Examples.

Books Recommended

- 1. Hogg R. Y and Craig A. J. Introduction of Mathematical Statistics.
- 2. Snedecor & Cochran - Statistical methods.
- 3. D. Montgomery (Wiley & Sons) Introduction of Statistical Process Control.
- 4. BIS - Publication - Statistical Quality Control (Hand Book).
- 5. Mood A. M., Graybill F. A., Bose F. A. - Introduction to theory of Statistics (Third Edition).
- 6. Duncon A. J. - Quality control and Industrial Statistics.
- 7. Kelkar M. K. - Mathematical Methods (Narendra Prakashan, Pune).
- 8. A. R. Chandekar - Statistical Methods.
- 9. Meyer P. L. - Introductory Probability and Statistical Applications.
- 10. Kenney and Keeping - Mathematics of Statistics.
- 11. Gupta S. C. and Kapoor V. K. - Fundamental of Applied Statistics.
- 12. B. R. Bhat, T. Srivenkataramana Mahava Rao - Statistics (Vol - I and II) (New Age International Published).
- 13. Rao C.R. (1973); Linear Statistical inference and its Applications, Revised Edition, Wiley Eastern.
- 14. Rohatgi V.K. : (1986) : An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern.
- 15. Hanagal David D. (2009). Introduction to Applied Statistics: A non - calculus based approach. Narosa Publishing House.

S.Y.B.Sc(CBCS 2018 Course)

Semester – IV

S-42:Probability Distribution and Statistical Methods-II

Total Credit: 04

Total Lectures: 60

Course Learning Outcomes:

After completion of this course students will acquire:

1. Knowledge of multiple linear regression.
2. Knowledge of multiple correlation coefficient and partial correlation coefficient including their properties and its applications.
3. Knowledge of important continuous distributions such as t-distribution and F-distribution.
4. Acumen to apply t-distribution and F-distribution to different situations.
5. Idea about the table value of t-distribution and F-distribution.

Course content:

Unit - 1 : 't' Distribution and Application of t distribution.

1.1 Definition of t with p. d. f. in the form

$$t = \frac{U}{\sqrt{\chi_n^2/n}}, \quad \text{where } U \sim N(0,1) \text{ and } \chi_n^2 \text{ is a } \chi^2$$

with n. d. f. are independent random variables.

1.2 Derivation of p. d. f. and nature of probability curve.

1.3 Mean, variance and moments. Statement of Normal approximation.

1.4 Use of t table for calculation of probabilities.

1.5 Test for

- i) $H_0 : \mu = \mu_0$ against $H_1 : \mu \neq \mu_0$.
- ii) $H_0 : \mu_1 = \mu_2$ against $H_1 : \mu_1 \neq \mu_2$.
- iii) $H_0 : \rho = 0$, against $H_1 : \rho \neq 0$

1.6 Paired Comparison.

1.7 Examples and problems.

Unit - 2 : 'F' Distribution and Application of F distribution.

1.1 Definition of F with n_1 and n_2 degrees of freedom as

$$F_{n_1, n_2} = \frac{\chi_{n_1}^2/n_1}{\chi_{n_2}^2/n_2} \quad \text{where } \chi_{n_1}^2 \text{ and } \chi_{n_2}^2$$

are independent chi - square variate with n_1 and n_2 d. f. respectively.

1.2 Derivation of p. d. f., and nature of probability curve.

1.3 Mean, variance, mode and moments.

1.4 Use of F tables for calculation of probabilities.

1.5 Interrelations among normal, Chi - square, t and F variates.

1.6 F – test for

$$H_0 : \sigma_1^2 = \sigma_2^2 \text{ against } H_1 : \sigma_1^2 \neq \sigma_2^2$$

1.7 Examples and problems.

Unit - 3 : Multiple Linear Regression and Multiple and Partial Correlation.

- 3.1 Notation of multiple linear regression, Yule's notation.
- 3.2 Fitting of regression planes by method of least square, obtaining, normal equations, solution of normal equations by Cramer's rule, representation in determinant form, definition of partial regression coefficient $b_{ij.k}$.
- 3.3 Residuals : definition, order, derivation of variance and covariance.
- 3.4 Interpretation of partial regression coefficients.
- 3.5 Definition of multiple correlation coefficient $R_{i.jk}$ as the correlation coefficient between a variable and its best linear predictor.
- 3.6 Derivation of the formula for the multiple correlation coefficient in terms of cofactors of correlation matrix.
- 3.7 Properties of multiple correlation coefficient.
- 3.8 Interpretation of (a) $R_{i.jk}$ as proportion of variation explained by the linear regression. (b) $R_{i.jk} = 1$ (c) $R_{i.jk} = 0$.
- 3.9 Definition of partial correlation coefficient $r_{ij.k}$ as correlation coefficient between residuals.
- 3.10 Derivation of the formula for $r_{ij.k}$ in the terms of the cofactors of the correlation matrix.
- 3.11 Properties of partial correlation coefficient.
a) $-1 \leq r_{ij.k} \leq 1$ b) $b_{ij.k} b_{ji.k} = r_{ij.k}^2$
- 3.12 Examples and Problems.

Books Recommended

1. Hogg R. Y and Craig A. J Introduction of Mathematical Statistics.
2. Snedecor & Cochran - Statistical methods.
3. D. Montgomery (Wiley & Sons) Introduction of Statistical Process Control.
4. BIS - Publication - Statistical Quality Control (Hand Book).
5. Mood A. M., Graybill F. A., Bose F. A. - Introduction to theory of Statistics (Third Edition).
6. Duncon A. J. - Quality control and Industrial Statistics.
7. Kelkar M. K. - Mathematical Methods (Narendra Prakashan, Pune).
8. A. R. Chandekar - Statistical Methods.
9. Meyer P. L. - Introductory Probability and Statistical Applications.
10. Kenney and Keeping - Mathematics of Statistics.
11. Gupta S. C. and Kapoor V. K. - Fundamental of Applied Statistics.
12. B. R. Bhat, T. Srivenkataramana Mahava Rao - Statistics (Vol - I and II) (New Age international Published).
13. Rao C.R. (1973); Linear Statistical inference and its Applications, Revised Edition, Wiley Eastern.
14. Rohatgi V.K. : (1986) : An Introduction to Probability Theory and Mathematical Statistics Wiley Eastern.
15. Hanagal David D. (2009). Introduction to Applied Statistics: A non - calculus based approach. Narosa Publishing House.

S.Y.B.Sc. (CBCS 2018 Course)
Semester – IV
S-43. : STATISTICS PRACTICAL COURSE –IV

Total Credit: 02

Course Learning Outcomes:

After completion of this course students will acquire:

1. Knowledge to solving the problems based on Chi-square test, Large Sample test.
2. Knowledge of solving the problems related to test based on t-distribution, F-distribution and construction of R-chart, fitting of multiple regression planes.
3. Knowledge of solving the problems using widely available software.

List of Practical

Sr. No.	Title of the Experiment
1	Test Based on Chi - square distribution. a) Test for independence of attributes. b) Goodness of fit. c) Test of variance.
2	Large sample tests for means and proportion.
3	Fisher's 'Z' transformation.
4	Confidence interval for means and proportions.
5	Tests based on t - distribution.
6	Tests based on F- distribution.
7	Construction of $\bar{x}$ and R charts. (Standards are given).
8	Fitting of multiple regression planes.
9	Calculation of multiple correlation coefficient and partial correlation coefficient
10	Applications of CLT

S. Y. B. Sc.: (CBCS 2018 Course)

Semester – IV

ENG 41: English – II

Course Outcomes:

At the end of this course, a student shall be able to:

- get exposed to the prose passages, grammar units and communicative skills
- read and interpret the various types of texts on their own and discuss them among peers
- communicate effectively by developing their proficiency in language
- understand their language abilities and facilitate them to with the necessary online & offline resources

Course content:

60 Lectures

a) Text - *Pleasant Prose Selection* by Oxford University Press

1. Half-A-Rupee Worth	-	R.K. Narayan
2. The Last Leaf	-	O. Henry
3. A Cup of Tea	-	Katherine Mansfield
4. The Letter	-	Gaurishankar Joshi
5. The Lady or the Tiger? Part I -		Frank Stockton
6. The Lady or the Tiger? Part II-		Frank Stockton

b) English Writing:

1. Curriculum Vitae	2. E-mail Messages
3. Informal Letter Writing	4. Precis Writing

c) Grammar:

1. Verbs	2. Tenses

The books recommended:

1. Chettur G. K.: *English Grammar, Composition and Essay*.
2. M.L. Tickoo: *A Remedial Grammar, Usage and Grammar* (Orient Longman, 1976)
3. Thomson A.J. & Martinet A.V.: *Practical English Grammar* (OUP, 1986).
4. Tickoo C. & Shashikumar J.: *Writing With Purpose* (Oxford University Press, 1979).

S.Y.B.Sc. (CBCS 2018 Course)

Semester-IV

SEC42: MARATHI - II

अध्ययन निष्पत्ती :

१. मराठीतील विज्ञान साहित्याच्या प्रेरणा, उगम, वाटचाल आणि विकास जाणून घेण्यास मदत झाली.
२. वैज्ञानिक साक्षरता व वैज्ञानिक दृष्टिकोन विकसित झाला.
३. विज्ञानाचा प्रसार स्वभाषेतून करण्यासाठी आवश्यक ती भाषिक क्षमता वाढीस लागली.
४. मराठीतील विज्ञान कथांचा स्थूल स्वरूपात परिचय झाला.

Total Credit :- 04

तासिका - ६०

घटक-विश्लेषण :

१. संकरित (विज्ञानकथासंग्रह) - डॉ. संजय ढोले, मेहता पब्लिशिंग हाऊस, पुणे
(१) अस्तित्व (२) उद्ध्वस्त (३) अखेर तो परतला (४) सॉकर (५) विचारवहन (६) दुर्गम्य
२. वैज्ञानिक परिभाषा निर्मितीची आवश्यकता, वैज्ञानिक परिभाषेचे स्वरूप व विशेष
३. प्रसारमाध्यमांसाठी लेखन
मुद्रित माध्यम, आकाशवाणी व दूरदर्शन
विविध आकृतिबंधांची ओळख - भाषण, लेख, संवाद, चर्चा व रूपक

संदर्भ - साहित्य

१. विज्ञान : उदय व विकास-डॉ. प्र. न. जोशी, सन पब्लिकेशन्स, पुणे
२. श्रद्धा-अंधश्रद्धा-डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
३. भ्रमनिरास-डॉ. नरेंद्र दाभोळकर, राजहंस प्रकाशन, पुणे
४. व्यावहारिक मराठी (द्वितीय वर्ष विज्ञान)-पुणे विद्यापीठ प्रकाशन
५. मराठी विज्ञान साहित्य- संपा. म. सु. पगारे, प्रशांत प्रकाशन, पुणे
६. विज्ञान कथा : स्वरूप आणि समीक्षा - श्री. विश्वेश्वर सावदेकर, शलाका प्रकाशन, मुंबई
७. विज्ञान साहित्य आणि संकल्पना- व. दि. कुलकर्णी, निरंजन घाटे, निहारा प्रकाशन, पुणे
८. विज्ञान युग- वार्षिक दिवाळी अंक १९८६, विज्ञान कथा विशेषांक
९. विज्ञान कथा विशेषांक,- महाराष्ट्र साहित्य पत्रिका, ऑक्टोबर-डिसेंबर २००६.
१०. विज्ञान वेध- मोहन आपटे, राजहंस प्रकाशन, पुणे
११. वैज्ञानिक दृष्टीकोण आणि आपण- सुधीर पानसे, लोकवाङ्मय गृह, मुंबई
१२. विज्ञान साहित्यविश्व- निरंजन घाटे, अभिनुजा प्रकाशन, पुणे

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SEMESTER - V
T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)

P – 51: MATHEMATICAL METHODS FOR PHYSICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Ability to explain different coordinate system to describe the motion of particle
- Understanding of different types of equations and special function utilized mathematically to explain the physical phenomenon
- Student will get detailed information and understanding about the special theory of relativity and a lot many important concepts associated with it.

Course Content:

- 1. Curvilinear coordinates: (18)**
Introduction to Cartesian (x, y, z), spherical polar (r, θ , ϕ) and cylindrical (ρ , ϕ , z) coordinate systems and transformation equations, General curvilinear coordinates, coordinate surfaces, coordinate lines, length element, surface element and volume element in curvilinear coordinate system, Metric coefficients Orthogonal curvilinear coordinate system; expressions for gradient, divergence, Laplacian and curl, special cases of the above for Cartesian, spherical polar and cylindrical coordinate systems
- 2. Equations and special functions: (14)**
Introduction to partial differential equations, frequently occurring partial differential equations, (degree, order, linear/nonlinear, homogeneous/non-homogeneous), Method of separation of variables, singular points of differential equations, point of infinity, Fuchs's theorem (statement with proof) Frobenius's method of series solution. Series solution of Legendre, Hermite and Bessel differential equations
- 3. Special functions: (12)**
Generating functions for Legendre $P_n(x)$, Hermite $H_n(x)$ Polynomials and Bessel functions of first kind $J_n(x)$ and their properties
- 4. Special theory of relativity: (16)**
Introduction, Newtonian relativity Galilean transformation equation, Michelson-Morley experiment, Postulates of special relativity, Lorentz transformations, Kinematic effects of Lorentz transformation, Length contraction, Proper time, Transformation of velocities, Variation of mass with velocity, Mass-energy relation. Four vectors.

Reference Books

- (1) Mathematical physics - Joshi, Wagh, Mandke and Agashe, G. Y. Prakashan, Pune.
- (2) Mathematics for physics - Bhat, Panat, Ogale, Rane (SuvicharPrakashan)
- (3) Mathematical methods for physicists, Arfken and Weber, Acadmic press Newyork.
- (4) Vector analysis - Spiegel (Schaum series)
- (5) Mathematical methods in the physical sciences – Marry L. Boas, John Willy and sons publication
- (6) Applied mathematics for engineers and physicists - L. A. Pipes (McGraw Hill)
- (7) Introduction to special relativity, Robert Resnick, willyeastrn Ltd.

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T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-52: QUANTUM MECHANICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of historical basics of quantum mechanics
- Student will be able to understand the Schrodinger's wave equation and its application
- Explanation of hydrogen atom and significance of quantum numbers
- Student will have understanding of how operators in quantum mechanics works

Course Content:

1. Background of Quantum Mechanics: (16)

Historical Background, a) Review of Black body radiation, b) Review of photoelectric effects, Matter waves, De Broglie hypothesis. Davisson and Germer experiment, Wave particle duality, Wave function of a particle having definite momentum, Concept of wave packet, phase velocity, group velocity and relation between them, Dual nature of matter, phase velocity, Heisenberg's uncertainty principle, different forms of uncertainty principle (statement only), Heisenberg's gamma ray microscope, electron diffraction experiment.

2. Schrodinger's wave equation: (14)

Physical interpretation of wave function, formulation of time dependent and time independent Schrodinger's wave equation (one, two and three dimensional). Boundary conditions, energy eigen values and eigen functions, expectation values, Ehrenfest's theorem with proof Equation of continuity (probability density, probability current density).

3. Applications of Schrodinger's equation: (10)

Step potential of finite depth, potential barrier, particle in one dimensional rigid box (infinite depth), one dimensional harmonic oscillator, three dimensional harmonic oscillators.

4. Operators: (12)

Hermitian operator, Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian), Commutator brackets- Simultaneous Eigen function, Commutator algebra, Commutator brackets using position, momentum and angular momentum operator, Raising and lowering angular momentum operator, Concept of parity, parity operator and its Eigen values.

5. Hydrogen atom: (08)

Schrodinger's wave equation for hydrogen atom, separation of radial and angular parts, solutions of radial part to obtain energy eigenvalues, Significance of quantum numbers n , l , m_l , m_s .

Reference books

1. Introduction to quantum mechanics - by P. T. Mathew.
2. Quantum mechanics - by J. Powell and B. Craseman.
3. Introduction to quantum mechanics - by R. H. Dicke and J. P. Wittke.
4. Introduction to quantum mechanics - by Ogale, Panat, Bhide etc.
5. Perspective of modern physics - by Beiser.
6. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-53: SOLID STATE PHYSICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Understanding of basic concepts required in solid state Physics
- Information about the crystallite state of matter and concept of lattices and their properties
- Student will be able to understand about the X-ray diffraction
- Ability to analyze different magnetic properties of materials

Course Content:

- 1. The crystalline state: (18)**
Translational vectors and lattices, symmetry operations, two and three dimensional lattice types, Miller indices, interplaner distances, simple crystal SC, BCC and FCC structural, packing fraction, concept of reciprocal lattice and its properties. Problems
- 2. Diffraction of x-rays by crystals: (16)**
Introduction, Crystal as a grating for x-rays, Bragg's law of diffraction in reciprocal lattice, Bragg's diffraction conditions in direct and reciprocal lattice, Ewald's construction, Experimental method of X-ray diffraction:- cubic crystals by powder method. Problems
- 3. Magnetism: (12)**
Diamagnetism, Langevin theory of diamagnetism, application of diamagnetic material, superconductivity, superconductor, critical magnetic field and Meissner effect, paramagnetism, Langevin theory of paramagnetism, ferromagnetism, ferromagnetic domain, hysteresis, Curie temperature, ferrites and its applications.
- 4. Free Electron and Band Theory of Metals (14)**
Free Electron model, Energy levels and Density of orbital in 1D and 3D, Bloch theorem (statement only), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Origin of energy gap, Energy bands in Solids, Effective mass of electron (with derivation), Distinction between metal, semiconductor and insulator, Problems

Reference books

1. Solid State Physics-S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999)
2. Solid State Physics – Kakani and Hemrajani, S. Chand Publication
3. Solid State Physics By Saxena, Gupta and Saxena, PragatiPrakation.
4. Introduction to Solid State Physics- Charles Kittel, John Wiley and Sons, 7th Edition.
5. Solid State Physics-A.J.Dekker, Macmillan India Ltd, (1998)
6. Solid State Physics- R.K. Puri, V.K. Babbar, S. Chand Publication
7. Problems in Solid State Physics-S.O. Pillai, New Age International (P) Ltd.
8. Solid State Physics-Palanyswamy.
9. Solid State Physics- David, Snoke, Pearson Publication

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-54: ADVANCED ELECTRONICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Student will be able to develop the understanding of application of fundamental laws of physics in different areas such as telecommunications and power electronics for automation in industries
- Acquire essential laboratory skills in designing experiments, assembling standard tools power electronics and analyzing acquired data
- Identify the critical areas in application levels and derive typical alternative solutions, select suitable electronic devices as per the requirement
- A thorough understanding of integrated circuits (ICs) and their applications
- Develop understanding of Basic circuit in electronics and their practical applications

Course Content:

- 1. Electronic devices: (10)**
Introduction, classification, principle, working and IV characteristics of FET, MOSFET (D-MOSFET and E-MOSFET). Problems on FET, SCR and UJT principle, working and applications of each
- 2. Power supplies: (8)**
Principle of electronically regulated power supply, Series and shunt regulated power supply, electronically regulated power supply using IC 723 (both low voltage and high voltage)
- 3. Amplifiers: (8)**
Idea of A.C. and D.C. load lines, graphical analysis of transformer coupled amplifier and impedance coupled amplifier.
- 4. A. Power amplifiers: (8)**
Class A, Class B, Class C and Class AB amplifiers, calculation of efficiency in case of class A amplifier with resistive load and transformer coupled amplifier
B. Push-pull amplifiers: (6)
Class A and Class B push pull amplifiers, idea of cross over distortion, and calculation of efficiency in class B push-pull amplifiers.
C. Differential amplifier: (4)
Circuit, operations, common mode, differential mode, CMRR, need for constant current source (No mathematical derivations)
D. Operational amplifiers: (6)
IC 741, inverting and non-inverting configurations, concept of virtual ground, parameters, offset, operational amplifier as adder, subtractor, comparator, integrator and differentiator. Problems based on above theory.
- 5. IC Versions: (4)**
Block diagram of IC 555 and its applications as astable multivibrator

6. Oscillators:**(6)**

Theory of oscillator, RC and LC oscillators - Phase shift, Weinbridge, Colpitt and Hartly oscillator. Problems based on theory.

Reference books:

1. Solid state electronics devices- by B. G. Streetman
2. Integrated electronics - by Millmun-Halkais.
3. Basic electronics - by Grob
4. Digital electronics: principles and applications- by Malvino-Leach.
5. Electronic fundamentals and applications - John D. Ryder.
6. Electronic Devices and Circuits - Allen Mottershed

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-55: CLASSICAL MECHANICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Students will understand the discipline specific knowledge in classical mechanics such as application of Newton's laws Lagrange's equations, Hamiltonian equations of motion etc.
- Students will be able to understand the concepts of classical mechanics and demonstrate a proficiency in the fundamental concepts in this area of science
- This course will enhance the ability of critical thinking to formulate and solve quantitative problems in applied physics

Course Content:

- 1. Newton's laws and constant fields: (18)**
Conservation laws and mechanics of particles, equation of motion of a particle, applications of Newton's laws to the motion of charged particles under constant electric, magnetic fields and electromagnetic field, Mechanics of system of particles, concept of center of mass, Conservation of angular momentum of the particle, energy of the system., Problems
- 2. Motion in a central force field: (12)**
concept of the central force, Equivalent one body problem, motion of a particle in a central force field, general features of motion like constancy of angular momentum, motion in an inverse square law of force, qualitative discussion of the orbits, equation of orbit, Kepler's laws of planetary motion with proof, problems
- 3. Lagrangian and Hamiltonian formulation: (16)**
General Idea about Lagrangian and Hamiltonian formulation, Constraints, generalized coordinates, D'Alembert's principle, Lagrange's equation from D'Alembert's principle, symmetric and conservation laws, cyclic coordinates, Hamiltonian and Hamilton's equation of motion, simple applications of Hamilton's and Lagrange's equations of motions such as simple pendulum, compound pendulum, projectile motion. Linear harmonic oscillator, Atwood's machine
- 4. Moving coordinate system: (14)**
Coordinate systems with relative translation motions, Galilean relativity and invariance of Newton's laws under Galilean transformations, rotating coordinate system, derivation of $(\frac{d}{dt})_f = (\frac{d}{dt})_r + \omega \times r$ - is expected, Coriolis's force, effect of motion on the Earth, freely falling body in a rotating frame, effect of Coriolis's force, problems

Reference books

1. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd.
2. Classical Mechanics, N. C. Rana, P. S. Joag, Tata McGraw Hill Publishing company Ltd.
3. Principles of mechanics, J. L. Synge, B. A. Griffith, TataMcGraw Hill Publishing company Ltd.
4. Classical Mechanics, Herbert Goldstein, Narosa Publishing House
5. Classical Mechanics by J.C. Upadhyaya, Himalaya publishing Houses.
6. Problem solution of classical mechanics by P.V.Panat

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-56: PRACTICAL COURSE – V

Total Credits: 02

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

1. Measurement of surface tension by Quink's and Fergusson method
2. Study of phenomenon of Hall effect and its demonstration
3. Measurement of different physical quantities such as Young's Modulus, viscosity of liquid, moment of inertia, thermal conductivity etc.
4. Ability to understand the characteristics of Thermostat

A GENERAL PHYSICS:

1. Surface tension by Quink's method
2. Surface tension by Fergusson method
3. γ by Newton's rings
4. Determination of coefficient of viscosity of a liquid by rotating cylinder method.
5. To study coupled oscillations and hence to determine the coefficient of coupling
6. Moment of Inertia by Bifilar suspension
7. Young's modulus by Newton's rings Young's modulus by Koenig method
8. Hall Effect
9. Kater's pendulum
10. Joyll's steam calorimeter.
11. Verification of Stefan's law of radiation.
12. Thermal conductivity of a metal by Forbe's method
13. Thermal continuity of rubber by rubber tubing method.
14. Thermal conductivity of glass.
15. Determination of pressure coefficient of air by constant volume thermometer
16. To study the characteristics of thermostat.
17. Platinum resistance thermometer

Note: At least 8 experiments should be performed from the course

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-57: PRACTICAL COURSE –VI

Total Credits: 02

Course Learning Outcomes:

1. Understanding of self and mutual inductance
2. Study of Inverse square law
3. Understanding of measuring techniques of quantities such as band gap energy (E_g), Zeeman shift (d), inductance etc.
4. Ability to understand the working of Transformer
5. Understanding of characteristics of FET, SCR, operational amplifier, electromagnetic pendulum etc.
6. Understanding of basics in C-programming.

Course Content:

1. To find unknown inductance by Maxwell's Induction Bridge or Anderson bridge
2. To determine the core losses in transformer by C.R.O.
3. Hysteresis by ballistic galvanometer (Determination of B and H).
4. To study self and mutual inductance.
5. Electromagnetic pendulum.
6. Core losses in transformers
7. To determine energy gap (E_g) of a semiconductor.
8. Building of E. R. P. S. by using transistor
9. Designing, Building and testing of E. R. P. S. by using IC 723
10. Astablemultivibrator using IC 555
11. Characteristics of FET
12. Characteristics of SCR
13. Applications of Opamp as adder and differentiator
14. To determine a plateau voltage of G. M. tube
15. To determine e/m by Thomson's method.
16. To study the emission spectra of H₂ atom and determination of Rydberg's constant.
17. To determine Zeeman shift (d) by using constant deviation spectrometer.
18. Inverse square law (γ -rays)
19. Write a program to find Factorial of a given number
20. Write a program for conversion of Temperature from $^{\circ}\text{C}$ to $^{\circ}\text{F}$
21. Write a program to find roots of differential equation.

Note: At least 8 experiments should be performed from the course

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2018)
P-58: PRACTICAL COURSE – VII
(PROJECT WORK)

Total Credits: 02

T.Y.B.Sc. (PHYSICS)

SEM.-V (CBCS-2018)

Elective I (Student should select any one of the following subject)

P-59 A: Elective I (A) Elements of Materials Science

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

- Students will review physics and chemistry in the context of materials science
- Ability to describe the different types of bonding in solids.
- Ability to describe and demonstrate diffraction, including interpretation of basic x-ray data.
- Student will understand metals, ceramics, polymers, and electronic materials in the context of molecular level.
- Student will also get familiar with the processing, structure, and physical properties of smart materials and their applications in the different fields.

Course Content:

1. Defects in Solids (12)

Introduction of materials science, Material Properties – Mechanical, Electrical and thermal, Impurities in solids, Solid solutions in metals, Rules of solid solubility, Imperfection in crystals, Defects in solids point, line, surface and volume, Atomic diffusions definition, mechanism, Fick's laws.

2. Single Phase Metals (10)

Single phase compound, Deformation, Elastic Deformation and Plastic Deformation, Mechanism of plastic Deformation by slip, Critical resolved shear stress (CRSS), Plastic deformation in poly crystalline materials

3. Molecular Phases (10)

Introduction, Polymers, Polymerization, Molecular weight of polymers, linear polymers addition and condensation, Cross linked polymer vulcanization of rubber

4. Ceramic Materials (10)

Ceramic Phases, Classification of ceramic materials, Ceramic crystals (AX), Mechanical behavior of ceramics, Electromagnetic behavior of ceramics – a) Electric properties dielectrics, semiconductors, piezoelectric b) Magnetic Properties Magnetic Ceramics, hard and soft ferrites

5. Phase Diagrams (10)

Basic terms System, Surrounding, Component, Coordinates, Phase, Equilibrium, Phase Diagram definition, importance and objective, Lever rule, Gibb's phase rule, Phase diagram of a) Sugar water b) NaCl water, Types of phase diagrams with construction a) Type I En type CuNi phase diagram, b) Type II Only introduction c) Type III Eutectic type PbSn phase diagram, Isothermal cuts

6. Introduction to smart materials (08)

Definition of smart materials, types and structure of smart materials, Properties of smart Materials, Applications of smart materials

Reference books

1. Elements of materials science and Engineering I.H. Vanvlach (4th Edition)
2. Materials science and Engineering - V. Raghvan

List of experiments

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of FeCl₃
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material

T.Y.B.Sc. (PHYSICS)

SEM.- V (CBCS-2018)

Elective I (Student should select any of the following subject)

P-59 B: Elective I (B): Medical Electronics

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Ability to explain different biosensors and their principal of working
- Understanding of how medical equipments works and their analysis
- Use of amplifiers in medical field
- Study of spectrometry, photometer required in medical diagnosis
- Understanding of pressure and volume measurement of body fluid

Course Content:

1. Introduction: (14)

Terminology of medical instrumentation, Physiological system of body, Sources of bioelectric signals, Origin of bioelectric signals, Analysis of ECG pattern, Nernst equation, Various types of bioelectric signals, Basic medical instrumentation system, Introduction to man instrument system, Problems Reference: 1

2. Bio potential Electrodes and sensors: (14)

Electrode-electrolyte interface Polarizable and non-polarizable electrodes, Electrodes for ECG, EEG, EMG, Resistive sensor, Capacitive sensor, Inductive sensor, Piezoelectric sensor, Radiation sensor, Temperature sensor Problems Reference: 2

3. Amplifiers and Signal Processing: (12)

Introduction, Basic amplifier requirements, The Differential amplifier, Common mode rejection, Instrumentation amplifier, Isolation amplified, Patient safety, Cardiac monitor Problems Reference:- 2

4. Clinical Laboratory Instrumentation: (10)

Spectrophotometry, Spectrophotometer type instruments, Calorimetry and calorimeter, Clinical flame photometer Problems Reference: 1

5. Measurements of Pressure and Volume Flow of Blood: (10)

Direct measurements of blood pressure, Indirect measurements of BP., Heart sounds, Phonocardiography, Ultrasonic blood flow meter, Laser Doppler blood flow meter Problems Reference 1

Reference Books:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur
2. Medical Instrumentation application design, John G Webster, Houghon Mifflin Co.
3. Introduction to Biomedical Electronics, Joseph DfuBovy, McGraw Hill.
4. Clinical Biophysics, P. Narayanan
5. Introduction to Biomedical equipment technology, 4th edition, by Joseph J. Carr and John M. Brown

Practicals:

1. Measurement of BP using Mercury sphygmomanometer and digital BP meter
2. Recording of ECG and its analysis
3. Absorbance using calorimeter/ Absorption spectra using Spectrophotometer
4. Pulse oxymetry
5. Use of biosensor.

T.Y.B.Sc. (PHYSICS)
SEM.- V (CBCS-2018)
P-59 C: Elective I (C): Digital Electronics I

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Ability to analyze different types of digital electronic circuits using various mapping and logic tools
- Design different types with and without memory element digital electronic circuits for particular operation, performance, user friendly devices etc.
- Apply the fundamental knowledge of analog and digital electronics to get different types of analog to digitized signals.
- Access and understanding of nomenclature of different memory devices and circuits

Course Content:

- 1. Karnaugh maps (10)**
Significance of Karnaugh's map, Concept of fundamental product, SOP and POS method, Simplification of 2, 3 & 4 variables.
- 2. Application of gates (10)**
Half and full adders, Four bit adder, four bit adder Subtractors, Parity checkers, Inter conversions of logic gates
- 3. Flip-flops (12)**
Revision of flip-flops, JK flip-flop, Race around condition D and T flip-flop., Edge triggering and level triggering in flip-flops., Examples of commonly used flip-flops and their applications.
- 4. Logic families (08)**
Classification, DTL families, MOS Families, Comparison of logic families
- 5. Counters: (10)**
Synchronous counters, Asynchronous counters, Modular counters, Study of IC 7490 and IC 74192 / 193.
- 6. Clock Generating circuits (10)**
Study of IC 555, Working of IC 555 as a clock generator, Working of IC 741 as a clock generator (no derivations expected for the above, only formula and problems)

Reference Books

- 1) Digital Electronics by R.P.Jain
- 2) Basic Electronics by B.L.Theraja
- 3) Electronic Principles by Malvino

List of Experiments:

- i) Study of Half and Full adder
- ii) Study of R-S flip- flop
- ii) Study of J-K flip- & lop.
- iv) Study of IC 7490 as MOD2, MOD5 & MOD10.
- v) Implementation of Boolean equations.

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)

SEMESTER - V

C - 51 : PHYSICAL CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand the fundamentals of quantum chemistry.
2. Know the use of surface chemistry in chemical reactions.
3. Solve the numerical based on Nernst equations .
4. Develop new concepts of absorption spectroscopy.

Course content

1. Surface Chemistry (14 Lectures)

Adsorption isotherm.

- (i) Langmuir adsorption isotherm with derivation and its limitations.

Types of physical adsorption isotherms.

BET equation (derivation not expected).

Determination of surface area of adsorbent using.

- (i) B.E.T. equation.

- (ii) Harkin and Jura method.

[Ref, 2: Pages 928-938, Ref 3: Pages 171-180]

2. Electromotive force. (18 lectures)

Introduction, (Convention: Reduction potentials to be used) Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities, Types of electrodes: Description in terms of construction, representation, half cell reaction and emf equation for i) Metal – metal ion electrode, ii) Amalgam electrode, iii) Metal – insoluble salt electrode, iv) Gas – electrode, Oxidation –Reduction electrode, Reversible and Irreversible cells, i) Chemical cells without transference, ii) Concentration cells with and without transference, iii) Liquid – Liquid junction potential : Origin, elimination and determination, Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG , ΔH and ΔS , Applications of emf measurements: i) Determination of pH of solution using Hydrogen electrode. ii) Solubility and solubility product of sparingly soluble salts (based on concentration cell).

Numerical problems.

[Ref, 1: Pages 471-486, 492-519]

3. Introduction to Absorption Spectrophotometry (14 Lectures)

Principles of colorimetry, nature of radiation, interaction of radiation and matter, Laws of absorptivity, factors governing absorptivity, deviations and limitations of absorption laws. Additivity of absorbances, simultaneous determinations, photometric titrations.

[Ref, 4: Pages 2.107-2.147]

4. Elementary Quantum Mechanics.

(14 lectures)

Introduction, Black body radiation, Planck's radiation law, Photoelectric effect, Compton effect, De Broglie hypothesis, The Heisenberg's uncertainty principle, Schrodinger wave equation and its importance (no derivation), Physical interpretation of the wave function.

[Ref. 11. Quantum Chemistry second edition by Manas Chandra-Relevant Pages
Ref. 12. Physical Chemistry a molecular approach by Donald A. McQuarrie, John D. Simon-Relevant pages]

Reference Books:

1. Principles of Physical Chemistry by S.H. Marron and C.F. Prutton. 4th edition. Oxford and IBH Publishing Co. Pvt Ltd.
2. Essentials of Physical Chemistry by B. S. Bahl, G. D. Tuli and Arun Bhal Edition 2000 S Chand and Company Ltd.
3. Physical Chemistry by R.L. Madan and G. D. Tuli, 5th edition 2009, S. Chand & Co Ltd.
4. Instrumental methods of Chemical Analysis by Chatwal and Anand, Enlarge edition 2011, Himalaya Publications.
5. Elements of Physical Chemistry by S. Glasstone and D. Lewis. 2nd edition. McMillan Education.
6. Physical Chemistry by N. Kundu and S.K. Jain, S. Chand and Co. Ltd. 1987.
7. University General Chemistry, C.N.R. Rao, MacMillan.
8. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
9. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
10. Physical Chemistry Through problems, S.K. Dogra and S. Dogra, Walley Eastern Ltd.
11. Quantum Chemistry Second Edition by Manas Chandra
12. Physical Chemistry a Molecular Approach by Donald A. McQuarrie, John D. Simon

T.Y.B.Sc (CHEMISTRY) (CBCS-2018)
SEMESTER - V
C - 52 : INORGANIC CHEMISTRY –I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand IUPAC nomenclature of coordination compounds .
2. Study Werner's coordination theory .
3. Distinguish between geometrical and optical isomerism.
4. Know the concept of Sedgwick model.
5. Analyze critically Pauling's valence bond theory.
6. Explain prevention of corrosion and passivity.

Course Content:

1. Coordination Chemistry

(10 Lectures)

- a. Introduction to coordination chemistry
- b. Double salts and Coordination compounds
- c. Basic terms involved in coordination chemistry- Coordinate bond, central metal atom or ion, complex compound, complex ion etc , charge on complex ion, calculation of oxidation number of metal, coordination number, Ligands: Classification of ligands, definitions, Chelates and chelating agents.
- d. IUPAC nomenclature of coordination compounds
- e. Applications of metal complexes in different fields

Ref. 2: pages 194-195, 230-232

Ref.12: pages 620-685

2. Werner's Theory of Co-ordinations compounds

(10 Lectures)

Postulates of Werner's coordination theory, Werner's formulation of Coordination compounds, Physical and chemical test to support his formulation of ionizable and non-ionizable complexes, Stereoisomerism in complexes with C.N.4 and C.N. 6 to identify the correct geometrical arrangement of the complexes.

Ref.2: pages 234-238

3. Isomerism in Coordination Complexes (Coordination No 8 and 6) (08 Lectures)

- a. Structural isomerism (Ionisation, hydrate, linkage, Ligand, Co-ordination Position. Polymerisation isomers)
- b. Geometrical isomerism and optical isomerism.

Ref-14: pages 205-230

4. Sidgwick model:

Introduction to Sidgwick's model, Scheme of arrow indication for M-L bond suggested by Sidgwick, Concept of Effective Atomic Number rule (EAN), Calculations of EAN value for complexes and stability of complexes, Advantages and Drawbacks of Sidgwick's theory.

Ref 9: pages 411-415, Ref.14: pages 229-2315.

5. Pauling's Valence Bond Theory:

(08 Lectures)

- a. Introduction
- b. Assumptions
- c. Concept of hybridization
- d. Bonding in Tetrahedral, Square Planar and Octahedral complexes with examples.
- e. Inner and outer orbital complexes.
- f. Electro neutrality Principle.
- g. Multiple bonding
- h. Limitations

Ref 3: pages 77-78, Ref.14: pages-231-241

6. Crystal Field Theory: (CFT):

(12 Lectures)

- a. Introduction
- b. Assumptions
- c. Degeneracy of 'd' orbitals
- d. Application of CFT to octahedral, tetrahedral & Square planar complexes
- e. CFSE, Calculation of CFSE in Weak field and Strong field complexes.
- f. Evidences of CFSE
- g. Factors Affecting $10 Dq$
- h. CFT and magnetic properties
- i. Spectrochemical series
- j. Nephelauxetic effect
- k. Jahn Teller Distortion, Merits and Limitation of CFT.

Ref 9: pages 421-434

7 (A) Corrosion:

(12 Lectures)

Definition, Electrochemical theory of corrosion, Factors affecting the corrosion, Position of elements in the electrochemical series, Purity of metal, Effect of moisture, Effect of oxygen, Physical state of metal, Methods for protection of the metals like, alloy formations, coating of the metals such as electroplating, hot dipping, metal spraying, cladding, Cathodic protection and use of inhibitors.

(B) Passivity :

Definitions, theories of passivity, electrochemical passivity and its applications.

Ref-13: pages 211-234.

Reference Books:

1. Introduction to Electrochemistry by Glasstone - 2nd edition.
2. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
3. Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS - 2nd edition.
4. Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.
5. Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3rd edition.
6. Chemistry by Raymond Chang - 5th edition
7. New Guide to Modern Valence Theory by G.I. Brown - 3rd edition
8. Co-ordination Compounds by Baselo and Pearson.
9. Theoretical Inorganic Chemistry by Day and Selbin.
10. Inorganic Chemistry by A. G. Sharpe - 3rd Edition.
11. Coordination Chemistry by A. K. De.
12. General and Inorganic Chemistry, Part-II by R. Sarkar, New central book agency
13. Applied inorganic Chemistry, T.W. Swaddle pp211-234 corrosion
14. Modern inorganic chemistry, P.R. Shukla, Ed 1st, 2002, Himalaya publishing House.

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)

SEMESTER - V

C - 53 : ORGANIC CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Learn Kinetics, mechanism and stereo chemistry of SN^1 & SN^2 reactions.
2. Understand E_1 & E_2 elimination reaction.
3. Know mechanism of nitration, sulphonation, halogenation, Friedel Craft alkylation & Friedel Craft acylation
4. Write electrophilic addition reactions to Carbon – Carbon double bond. .
5. Explain stereochemistry of cyclic compounds.

Course Content:

1. Nucleophilic substitution at Saturated carbon. (12 Lectures)

- (a) Nucleophilic aliphatic substitution.
- (b) Nucleophiles and leaving groups.
- (c) Rate of reactions.
- (d) Kinetics of first order and second order reactions.
- (e) Duality of mechanism.
- (f) SN^1 reaction : - Kinetics, mechanism and stereo chemistry.
- (g) SN^2 reaction: - Kinetics, mechanism and stereo chemistry.
- (h) Comparison between SN^1 & SN^2 reactions.

Ref .1: Sections: - 5.7 to 5.21, 5.23

Pages - 172 to 203 and 208 to 210

2. Elimination Reactions (10 Lectures)

- (a) 1, 2 elimination reactions.
- (b) Kinetics (duality of mechanism)
- (c) E_2 mechanism with evidence.
- (d) Orientation and Reactivity.
- (e) E_1 mechanism with evidence
- (f) Orientation in E_1 reaction.
- (g) Elimination Vs substitution.

Ref.1 – Sections: - 8.13 to 8.25

Pages - 290 to 310

3. Aromatic Electrophilic substitution.

(14 Lectures)

- (a) Introduction.
- (b) Effect of substituent group (orientation)
- (c) Determination of orientation and relative reactivity.
- (d) Classification of substituent groups.
- (e) Orientation in disubstituted benzene.
- (f) Mechanism of nitration, sulphonation, halogenation, Friedel Craft alkylation, Friedel Craft acylation.

Ref. 1- Sections: 15.1 to 15.19, 16.8, 16.9 & 18.5 Pages: -517 to 544, 666 to 667

Ref.4 Sections: - 6.10.2 : Pages: - 169 to 173

4. Electrophilic addition to Carbon – Carbon double bond.

(12 Lectures)

- a) Introduction.
- b) Reactions at Carbon – Carbon double bonds: -
 - (i) Addition of halogens.
 - (ii) Addition of halogen acids.
 - (iii) Addition of water.
 - (iv) Addition of KMnO_4 .
 - (v) Addition of OsO_4 .
 - (vi) Addition of H_2SO_4 .
 - (vii) Addition of per acid.
 - (viii) Ozonolysis.

Ref. 1 Section: - 9.1 – 9.2, 9.5 to 9.14, 9.17 to 9.21, 9.25, 9.26

Pages: - 317 to 323, 327 to 343, 346 to 355, 357 to 360.

5. Stereochemistry of cyclic Compounds.

(12 Lectures)

Introduction, Disubstituted cyclohexane – 1,1 disubstituted cyclohexane, 1,2 disubstituted cyclohexane, 1,3 disubstituted cyclohexane and 1,4 disubstituted cyclohexane. Geometrical and optical isomers & their relative stabilities.

Reference books:

- 1) Organic Chemistry by Morrison and Boyd - 6th Ed. 1996.
- 2) Organic Chemistry by John McMurry – 5th Ed. Assian books 1999.
- 3) Organic Chemistry by Graham Solomans and Craig Fryhle - 7th Ed. 2002.
- 4) A guide book to reaction mechanism by peter sykes - 6th Ed.
- 5) Organic chemistry by I.L.Finar vol.II – 6th Ed. 1975.
- 6) Absorption spectroscopy of organic molecules by V.M.Parikh (1974).
- 7) Designing organic synthesis by stuart warron (1983).
- 8) Organic Chemistry by pine 5th ed. 1987.

T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)

SEMESTER - V

C - 54 : ANALYTICAL CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Analyse the ppt. of SO_4^{2-} and CT gravimetrically.
2. Understand the principles of TGA and DTA.
3. Know theory of Nephelometry and Turbidimetry.
4. Know the qualitative and quantitative estimation of elements by AAS.

Course Content:

1. Gravimetric Analysis:

(14 Lectures)

Introduction, Common ion effect and solubility product principles, solubility of precipitates, effect of acids, temperature and solvents upon solubility of precipitates. Super saturation and precipitate formation. co-precipitation and post-precipitation, precipitation from homogeneous solution, optimum conditions for precipitation, filtration of precipitates, washing of precipitates, Drying and Ignition of precipitates, Numerical problems.

Ref. 1.Pg. 22-28, 30-33, 95, 107-114, 169-171, 403-404, 407-415

Ref. 3.Pg. 527-532

2. Thermal methods of analysis:

(12 Lectures)

Principle of thermal analysis, classification of thermal techniques, Principle, instrumentation and applications of TGA and DTA, factors affecting the thermal analysis, numerical problem.

Ref. 1.Pg. 515-527,531-537

Ref. 6 Pg. 732-737

3. Nephelometry and Turbidimetry:

(12 Lectures)

Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis, Difference between Nephelometric and Turbidimetric measurements, Choice between Nephelometry and Turbidimetry, Factors affecting Nephelometric and Turbidimetric measurements, Quantitative Applications, Numerical Problems

Ref.1. Pg.781-785

Ref.3. Pg.380-390

4. Polarimetry:

(12 Lectures)

Introduction, polarization of radiation, essential terms, Nicol prism, Optical activity, Types of optically active substances, Instrumentation-Polarimeter-construction, working of polarimeter and applications of Polarimetry. numerical problems.

Ref.6. 691-734

5. Atomic Absorption Spectroscopy:

(10 Lectures)

Introduction and theory of atomic absorption spectroscopy, Instrumentation of single beam atomic absorption Spectrophotometer, Measurement of absorbance of atomic species by AAS, Spectral and Chemical Interferences, Qualitative and Quantitative Applications of AAS.

Ref. 3.Pg. 321-342

Reference Books:

Ref. 1 Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel

Ref. 2 Principles of Physical Chemistry 4th edition – Prutton and Marron

Ref. 3 Instrumental Methods of Chemical Analysis- Chatwal and Anand

Ref. 4 Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar

Ref. 5 Vogel's textbook of Quantitative Inorganic Analysis-4th edition Besset Denney, Jaffrey, Mendham

Ref. 6 Instrumental Methods of Chemical Analysis- 6th edition Willard, Merritt, Dean and Settle

Ref. 7 Analytical Chemistry by Skoog

Ref. 8 Introduction to Instrumental Analysis- R.D. Braun

T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - V
C - 55 : INDUSTRIAL CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Learn modern approach to chemical industry.
2. Know manufacture of basic chemicals.
- 3 . Understand various processes involved in manufacture of sugar from sugar cane.
4. Write aspects in food and starch industry.
5. Study manufacturing of cement & glass industry.
6. Explain manufacturing of some small-scale industry products.

Course Content:

1. Modern Approach to Chemical Industry (12 Lectures)

Introduction, basic requirements of chemical industries, chemical production, raw materials, unit process and unit operations, Quality control, quality assurance, process control, research and development, pollution control, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy right act, patent act, trademarks.

Ref. No. 1

2. Manufacture of Basic Chemicals (10 Lectures)

a) Ammonia: Physicochemical principles involved, Manufacture of ammonia by modified Haber- Bosch process, its uses.

b) Sulphuric acid: Physicochemical principles involved, Manufacture of sulphuric acid by contact process, its uses.

c) Nitric acid: Physicochemical principles involved, Manufacture of nitric acid by Ostwald's process, its uses.

Ref.No.1: P.No. 571 to 588, 618 to 664

3. Sugar Industry. (12 Lectures)

Introduction, manufacture of cane sugar, Details of various steps, Extraction of juice, purification of juice, Defecation, Sulphitation & Carbonation, concentration, Crystallization, separation of crystals, Dying, Refining, Recovery of sugar from molasses, Bagasse, Manufacture of sucrose from Beet root, Testing of sugar, sugar Industry in India.
Ref. 1 – page 664, 674

4. Food and Starch Industry

(12Lectures)

Food Industry:

(a) Definition and scope, nutritive aspects of food constituents, , food deterioration factors and their control; (b) Preservation and processing: Heat and cold preservation and processing, cold storage, food dehydration and concentration, various foods, their processing and preservation methods, fruits, beverages, cereals, grains, legumes and oil seeds; (c) Food additives: Enhancers, sugar substitutes, sweeteners, food colors,

Ref.6

Starch industries:

Chemistry of starch, manufacturing of industrial starch and its applications, characteristics of some food starches, non-starch polysaccharides-cellulose-occurrence.

Ref. 5

5. Cement and Glass industry

(08Lecture)

Cement industry:

Introduction, Importance, composition of portland cement, raw materials, proportioning of raw materials, setting and Hardening of cement, reinforced concrete.

Ref.1: P.No. 313-333 Ref. 2: P.No173-176, Ref. 4: P.No.188-192

Glass industry

Introduction, importance, physical and chemical properties of glass, chemical reaction, annealing of glass Special glasses: colored, safety, hard, borosilicate, optical, photosensitive, conducting, glass laminates.

Ref.1: P. No.160-171;Ref. 2: P. No. 247-265; Ref.3: P. No. 197-212

6. Some small scale Industries

(06 Lectures)

7. Safety matches, Agarbattis, Naphthalene balls, wax candles, shoe polish, Gum paste, plaster of Paris, chalk crayons, fountain pen ink.

Ref. 1 - page. sect. IV 1 – 8

Reference Book:

- 1) Industrial Chemistry – B.K.Sharma.
- 2) Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
- 3) Riegel's hand book of Industrial chemistry, 9th Edition, Jems A. Kent
- 4) Industrial chemistry –R.K. Das, 2nd Edition, 1976.
- 5) Chemistry and industry of starch, New York, N.Y., Academic Press, incby Kerr, Ralph Waldo Emerson
- 6) The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
- 7) Industrial Chemistry. Arora & Singh

T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - V
C-59A ENVIRONMENTAL CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Explain composition, evolution , chemical and photochemical reactions in the atmosphere
2. Study air pollutants & its effects on the atmosphere.
- 3 . Learn aspects involved in the Hydrosphere.
4. Know water pollutants, Sampling, Preservation, Monitoring techniques , methodology and total hardness .
5. Understand origin of life

Course Content:

1. Evolution and Structure of Atmosphere (12 Lectures)

Composition of the atmosphere; Atmospheric structure; Evolution of the atmosphere; Earth's radiation balance; Particles, ions and radicals in the atmosphere; Chemical and photochemical reactions in the atmosphere; Green house effect; Ozone hole; The earth's mechanism and global climate; El Nino Phenomenon

Reference 1 : Pages 13-51.

2. Air Pollution and Air Pollution disasters (12 Lectures)

Air pollutants (carbon monoxide, Nitrogen oxides, Hydrocarbons and Photochemical smog, sulphur dioxide, Acid rain, Particulates, Radioactivity), Effects of atmospheric pollution, TCDD accident, Bhopal disaster, Chernobyl disaster); Air quality standards; Sampling; Monitoring (CO, SO_x, NO_x, H₂S, SPM, HC).

Reference 1: Pages 107-167.

3. Hydrosphere (12 Lectures)

Water resources; The hydrologic cycle; Physical chemistry of sea water; composition; Sea water equilibrium, pH, pE, Complexation in natural water and waste water; Nitrogen transformation by bacteria.

Reference 1: Pages 52-65.

4. Water Pollution and monitoring (12 Lectures)

Aquatic environment; water pollutants (Organic pollutants- pesticides, detergents, marine pollution); Inorganic pollutants; Acid mine drainage; Sediments; Thermal pollution; Eutrophication; Trace elements in water; Chemical speciation and environmental chemistry of Cu, Pb, Hg and As; water quality parameters and standards; Sampling; Preservation; Monitoring techniques and methodology of D.O., NH₃, NO₃, and NO₂, F, CN, PO₄, Cl, Total hardness, As, Cd, Cu, Pb, Hg, COD, BOD, TOC, E.Coli (Principle and necessary equations and procedures are expected).

Reference 1: Pages 172-279

5. Origin of Life

(12 Lectures)

The atmosphere and hydrosphere of primitive earth; synthesis of building block molecules; formation of biopolymers; the second stage of atmospheric evolution; The third stage of atmospheric evolution.

Reference 2: Pages 40-61.

Reference Books:

1. Environmental Chemistry, A. K. De, Fourth Edition, New age International (P) Ltd., Publishers, New Delhi, 2000.
2. Environmental Chemistry, John W. Moore and Elizabeth A. Moore, Academic Press, New York, 1976.
3. Environmental Chemistry, S. E. Manahan, Willard Grant Press, Boston, Third Edition, 1983.
4. Chemistry and Man's Environmental, E. D. Fuller, Houghton Mifflin Co., Boston, Third edition, 1974.
5. Environmental Pollution, A. M. Dix, John Wiley, New York, 1980

T.Y.B.Sc. (CHEMISTRY) (CBCS- 2018)

SEMESTER - V

C – 59B : NUCLEAR CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Study Difference between simple compounds and polymers.
2. Understand Terms-Monomer, Polymer, Polymerisation.
3. Explain Mechanisms of polymerization & Polymerisation techniques.
4. Learn Physical parameters of polymers & Ingredients added to polymers.

Course Content:

1. The atomic nucleus, properties of nucleons and nuclei (10 Lectures)

The atom, elementary particles, subnucleons, quarks, classification of nuclides, nuclear stability-even odd nature , N/Z ratio, binding energy.

Nucleus, its size and shape, mechanical effects due to orbiting and spinning of nucleons, Magnetic quantum numbers, principal and radial quantum number.

Ref.1: pages 1 to 4, 7 to 15 , 22 to 30.

2. Nuclear Models (16 Lectures)

The Shell model, the periodicity in nuclear properties, salient features of Shell Model, merits of shell model, the liquid drop model, semiempirical binding energy equation, limitations of liquid drop model.

Ref.1 pages 76 to 107

Ref.2 pages 464 to 469

3. Radioactivity (17 Lectures)

Types of radioactive decay, general characteristics of decays, decay kinetics, Alpha decay: Alpha active nuclides, the alpha energy spectrum, Geiger-Nuttall's law The theory of alpha decay.

Beta decay: Types of beta decay, absorption and range through matter Fermi theory Of beta decay (mathematical details are not expected)

Gamma decay: Nuclear isomerism and isomeric transitions, internal conversion, Auger effect.

Ref.1 pages 117 to 124, 140 to 144, 148 to 151, 174 to 179

4. Nuclear Reactions (17 Lectures)

Bethes notation, types of nuclear reactions, conservation of nuclear reaction
Reaction cross-section, the compound nucleus theory, photonuclear reactions,
Thermonuclear reactions.

Ref.1 pages 185 to 206, 222 to 226

References:

1. Essentials of Nuclear Chemistry: Prof. H.J. Arnikar, 4TH Edition, Wiley Eastern
2. Source book of Atomic energy : Samuel Glasstone, 3rd edition, East -West press

T.Y.B.Sc. (CHEMISTRY) (CBCS- 2018)

SEMESTER - V

C – 59C : POLYMER CHEMISTRY-I

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Know The atom, elementary particles, subnucleons and the quarks, Classification of nuclides, isotopes, isobars, isotones and isomers. Nuclear stability on the basis of even-odd nature of Z and N, N/Z ratio.
2. Understand The Shell model & the liquid drop model.
3. Explain types of radioactive decay, decay kinetics and their general characteristics.
4. Learn Bethes notation & Different types of Nuclear reactions.

Course Content:

1. Introduction to Polymer Chemistry

(06 Lectures)

Brief History, Polymer definition, Preparation, Classification, Chemical bonding & Molecular forces in Polymers.

Ref 1 : Pages 1-14, Ref 2 : Pages 1-16

Ref 3 : Pages 1-12, Ref 7 : Pages 1-6

2. Mechanism and Nomenclature of Polymers

(06 Lectures)

- a) Polymerisation Mechanism
- b) Nomenclature of Polymers
 - i) Based on sources
 - ii) Based on structure (Non IUPAC)
 - iii) IUPAC structure-based nomenclature system
 - iv) Trade names

Ref 7 : Pages 6-17

3. Chemistry of Polymerisation

(12 Lectures)

- i) Introduction
- ii) Chain Polymerisation : Free radical Polymerisation, Ionic polymerisation, Ionic polymerisation, Co-ordination polymerisation- Ziegler-Natta catalyst
- iii) Step Polymerisation : Polycondensation, Polyaddition- polymerisation, Ring opening polymerisation.

Ref. 1 : Pages 15-64

Ref. 2 : Pages 25-32, 49-56, 82-86, 88-89, 91-94

Ref. 3 : Relevant Pages, Ref. 5 : Pages 14-17, 273-289, 342-349

4. Polymerisation Techniques (12 Lectures)

Bulk polymerisation, Solution polymerisation, Suspension polymerisation, Emulsion polymerisation, Melt polymerisation, Solution polymerisation, Interfacial condensation, Electrochemical polymerisation, Salient features of different polymerisation techniques.

Ref. 1 : Pages 71-79, 82-84, Ref. 2 : Pages 126-132

Ref. 5 : Pages 196-198, Ref. 7 : Pages 335-341, 173-175

5. Polymer Additives (09 Lectures)

Filters & Reinforcement, Plasticisers, Antioxidants & Thermal Stabilizers, Ultraviolet stabilizers, Fire retardants, Colourants & other additives.

Ref. 3 : Pages 170-176

Ref. 4 : Pages 250-282

6. Molecular Weights of Polymers (07 Lectures)

c) Average Molecular weight, Number Average & Weight Average Molecular weight, Molecular weight & degree of polymerisation, Practical significance of polymer molecular weights.

d) Molecular weight determination – End Group Analysis, Viscosity

e) Problems based on Number Average & Weight Average Molecular weight Ref. 1 : Pages 86-89, 92, 96-98, 402-409

7. Polymer Reactions (08 Lectures)

Introduction, Hydrolysis, Hydrogenation, Addition and Substitution reactions, Cross -linking reactions, Cure reactions.

Ref. 1 : Pages 291-297, 306-308, 311-321

Ref. 3 : Relevant Pages

REFERENCE BOOKS

1. Polymer Science by V.R.Gowarikar, N.V.Vishvanathan, Jaydev Shreedhar New Age International Ltd. Publisher 1996.
2. Textbook of Polymer Science by Fred Billmeyer, 3rd Edn. A Wiley-Interscience Publication John Wiley & Sons New York 1984.
3. Introductory Polymer Chemistry by .S.Misra New Age International Ltd. Publisher 1996.
4. Introduction to Polymer Chemistry by Raymond Saymour International Student Edn. 1971.
5. Polymer Chemistry by Malcom P. Stevens Oxford University Press 1990.
6. Inorganic Polymers by G.R.Chatwal Himalaya Publishing House 1st E dn.1996
7. Principles of Polymerisation by George Odian 3rd Edn. John Wiley & Sons New York.

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - V
C-56: PRACTICAL COURSE - V
(PHYSICAL CHEMISTRY)

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Determine the order of the reaction.
2. Study the CST of phenol-water system.
3. Find out the transport nos. of cations and anions.
4. Calculate the $\lambda_{\max}$ and concentration of KMnO_4 .
5. Measure the molar & specific refractivities of given liquids.

Course Content:

GROUP-I

NON - INSTRUMENTAL EXPERIMENTS

A Chemical Kinetics

1. To study the effect of concentration of the reactants on the rate of hydrolysis of an ester.
2. To determine the first order velocity constant of decomposition of H_2O_2 by volume determination of oxygen.
3. To determine the energy of activation for the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI for unequal initial concentration.
4. To study the effect of addition of electrolyte (KCl) on the reaction between $\text{K}_2\text{S}_2\text{O}_3$ and KI . (Equal Concentration)
5. Determine the order of reaction of a given reaction.
(Any three experiments)

B Phenol-Water

1. To study the mutual solubility of phenol and water at various temperatures and hence determine the critical solution temperature.

C Transport Number

1. To determine the transport number of cation by moving boundary method.

GROUP-II

INSTRUMENTAL EXPERIMENTS

A Potentiometry

1. Titration of strong acid with strong alkali.
2. Determine the formal redox potential of ferrous/ferric system by potentiometry.
(Any one experiment)

B Colorimetry.

1. Determine the $\lambda_{\max}$ and concentration of the given solution of KMnO_4 in $2\text{N H}_2\text{SO}_4$.

C Conductometry

1. To determine the dissociation constant of a weak acid conductometrically.
2. To determine the strength of the given acid conductometrically using standard alkali solution.
3. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conductometrically.
4. Titration of a mixture of weak and strong acid with strong alkali.
(Any two experiments)

D pH Metry.

1. Determination of degree of hydrolysis of aniline hydrochloride.

E Refractometry.

1. Determination of molar refraction of the given liquids A,B,C and D.
2. To verify law of refraction of mixtures(e.g., glycerol and water) using Abbe's refractometer.
(Any one experiment)

G Polarimetry.

1. To determine the specific rotation of a given optically active compound.

Reference Books:

1. Experiments in Chemistry Dr.D.V.Jahagirdar, Himalaya Publishing House.
2. Systematic Experimental Physical Chemistry by S.W.Rajbhoj and Dr.T.K.Chondhekar, Anjali Publication Aurangabad.
3. Experimental Physical Chemistry, Daniel.Alberts.7th Edition.
4. Findlay's Practical Physical Chemistry B.P.Levitt.9th Edition.
5. Experiments in Physical Chemistry, R.C.Das and .Behra. Tata McGrawHill.
6. Advanced Practical Physical Chemistry, J.B.Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol1-Physical, J.N.Gurtu and R.Kapoor, S.Chand & Co.
8. Selected Experiments in Physical Chemistry N.G.Mukherjee. J.N.Ghose & Sons.
9. Experiments in Physical Chemistry, J.C.Ghosh, Bharti Bahavan.

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - V

C-57: PRACTICAL COURSE - VI
(INORGANIC CHEMISTRY)

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Perform binary mixture of inorganic compound.
2. Prepare various inorganic complexes .
3. Study binary mixtures with borates and phosphates.

Course Content:

A) Inorganic Qualitative Analysis(Six mixtures)

- a) Water soluble mixture – any one
- b) Water insoluble mixture-any one
- c) Mixtures containing Borate-any two
- d) Mixtures containing Phosphate-any two

B) Inorganic preparations (Any Three)

1. Preparation of Potassium trioxalatoaluminate(III) trihydrate
2. Preparation of Reinecke's salt.
3. Preparation of Tris(Thiourea)Copper (I) Chloride $[\text{Cu}(\text{Thiourea})_3]\text{Cl}$.
4. Preparation of Manganese (III) acetylacetonate $[\text{Mn}(\text{acac})_3]$.
5. Preparation of Potassium Trioxalatoferrate (III), $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$.

Reference Books:

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
2. Quantitative Chemical Analysis S. Sahay (S. Chand & Co.).
3. Quantitative Analysis R.A. Day, Underwood (Prentice Hall).
4. General Chemistry Experiment – Anil J Elias (University press).
5. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
6. Vogel's Textbook of Quantitative Chemical Analysis.
7. "Experimental Methods in Inorganic Chemistry." Tanaka, J. and Suib, S.L., Prentice Hall

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - V

C-58: PRACTICAL COURSE - VII
(ORGANIC CHEMISTRY)

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Perform Organic Estimations.
2. Prepare Organic derivatives.
3. Carry out single stage preparations.

Course Content:

1. Organic Estimations (Any three)

- (i) Estimation of Iodine value.
- (ii) Estimation of Glucose.
- (iii) Estimation of Ethyl benzoate.
- (iv) Determination of Molecular weight of Mono and Dibasic acids by Volumetric Methods
- (v) Determination of acid value of the given oil.

2. Preparation of derivatives (Any Two)

- (i) 2, 4 DNP derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.
- (ii) Semicarbazone derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.
- (iii) Oxime derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.

3. Single stage preparations (Any Three)

- (i) Hydroquinone to Quinone.
- (ii) Acetanilide to p-Nitroacetanilide.
- (iii) p - Nitroaniline to p - Iodonitrobenzene.
- (iv) Sulphanilic acid to Methyl orange.
- (v) m - Dinitrobenzene to m - Nitroaniline.

Note:

- (i) Starting Compound should not be given more than 1 gm.
- (ii) The purity of preparation and derivative products should be checked by TLC.
- (iii) The crystalline sample should be submitted and M.P. must be reported to the examiner

Reference Books:

- 1) Practical Qualitative Analysis by A.I. Vogel.
- 2) Advanced Practical Organic Chemistry by O.P. Agarwal.
- 3) Laboratory Manual in Organic Chemistry by R.K. Bansal, Wiley Eastern.
- 4) Experimental Organic Chemistry I & II by P.R. Singh, D.S. Gupta and K.S. Bajpal (Tata McGraw Hill)

(C.B.C.S. 2018 Course) SEMESTER-V

B – 51: BIOLOGY OF CRYPTOGRAMS (ALGAE & FUNGI)

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On completion of this course, students are able to:

- Know the salient features of Cryptogams plants.
- Become aware of the status of cryptogams as a group in plant kingdom.
- Understand the life cycles of selected genera.
- Learn about the economic and ecological importance of Cryptogams plants.

Course Content:

A) ALGAE

1) Occurrence and distribution.	03 L
2) Criteria for classification of Algae	07 L
(i) Cell organization, flagellation, pigmentation, reserve food	
(ii) Smith's system of classification	
3) Thallus organization and evolutionary tendencies and life histories of selected forms.	
(marked by bold type)	06 L
(i) Chlorophyta..... e.g. <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Chlorella</i> , <i>Hydrodictyon</i> , <i>Ulothrix</i> , <i>Stigeoclonium</i> , <i>Coleochaete</i> , <i>Ulva</i> , <i>Acetabularia</i> , <i>Spirogyra</i> , <i>Oedogonium</i> .	
(ii) Charophyta..... e.q. <i>Chara</i> .	02 L
(iii) Phaeophyta..... e.q. <i>Sargassum</i> .	02 L
(iv) Rhodophyta..... e.q. <i>Batrachospermum</i> .	02 L
(v) Cyanophyta..... e.q. <i>Oscillatoria</i> , <i>Nostoc</i> .	02 L
4) Ultrastructure of algal cells Prokaryotic	
(Cyanophyceae) & Eukaryotic (<i>Chlamydomonas</i>)	02 L
5) Role of algae in human welfare	06 L
(i) Biofertilizers, single cell proteins (s c p).	

(ii)Phycocolides – agar-agar, carragenin, alginic acid.

(iii)Medicine and food.

(iv)Algal blooms.

(v)Aquaculture.

B) FUNGI

6) Occurrence and distribution. 3 L

7) Ultrastructure of fungal cell – cell wall composition, seputum,flagella, cytoplasm, other cell organelles and spores. 3 L

8) Nutrition and reproduction. 2 L

9) Modern concept and classification of fungi. 2 L

10) Characters of main groups of fungi & life histories of some forms.(marked by bold type) 8 L

(i) Chytridiomycotina – **Synchitrium**, *Allocymes*.

(ii) Zygomycota – **Rhizopus**, *Entemophthora*.

(iii) Ascomycotina – *Saccharomyces*, *Aspergillus*, **Clavicep**, *Zylaria*,*Erysiphae*.

(iv) Basidiomycota – *Agaricus*, *Puccinia*, **Ustilago**.

(v) Oomycota – **Saprolegnia**, *Albugo*, *Plasmophora*.

(vi) Plasmodiophoromycota – **Plasmodiophora**.

(vii) Deteromycetes – general consideration.

11) Types of fungal spore & mode of liberation. 3 L

12) Role of fungi in human welfare -fungal metabolites, fermentation, pharmaceutical products, VAM fungi, biofertilizers, biodegradation, mushrooms & antibiotics. 7 L

Reference Books:

1. Bold & Wynne - Introduction to algae 4th Edition 1996.
2. B.R.Vashishta – Botany for degree students – algae.
3. C.I. Alexopoulos, C.W. Mims, M.Blackwell– An introduction to mycology. 4th Edition1996
4. J.G.Vaidya – Biology of fungi.
5. Dube, H.C. 1990. An Introduction to Fungi.Vikas Publishing House Pvt. Ltd. Delhi.
6. Gilbert, M.S. 1985. Cryptogamic Botany, Vol. I & II (2nd Edition). Tata McGraw HillPublishing Co. Ltd., New Delhi.
7. Kumar, H.D. 1988. Introductory Phycology.Affiliated East-West Press Ltd., York.

T.Y.B.SC. (BOTANY)
(C.B.C.S. 2018 Course) SEMESTER-V
B – 52: BIOLOGY OF SEED PLANTS (ANGIOSPERMS)

Core Course – Theory; Credits- 04 Total lectures- 60 L

Course Learning Outcomes :

On completion of this course, students are able to:

- Understand the status of angiosperms in plant kingdom.
- Realize the origin of Angiosperms with respect to time, place, origin and probable ancestors.
- Know the Pre-Darwinian and Post- Darwinian systems of Classification.
- Understand various angiosperm families emphasizing their morphology, distinctive features and biology.
- Know the role of cytology and Phytochemistry in Taxonomy.

1) Introduction 05 L

Salient features of angiosperms and probable causes of their evolutionary success.
Differences between angiosperms and gymnosperms.

2) Anatomy 10 L

(a) Organography and anatomy of root, stem and leaf
(b) Leaf – venation; - distribution and functions of veins, concept of vein islet, vein termination number, stomatal number, stomatal index and types of stomata. Nodal anatomy and wood anatomy, General Concept of floral anatomy.

3) Flower structure 08L

(a) Concept of flower as a modified shoot – evidences.
(b) Genetic control of floral organs and functions of flower.
(c) Evolution of flower.

4) Structure of anther 09 L

(a) Ovule – structure and types.
(b) Megasporogenesis.
(c) Development and structure of female gametophyte (embryo Sac) in *Polygonum* and *Allium*.

6) Classification

03 L

Details account of Hutchinsion's and Taktajan's system of of classification with merits&demerits.

7) Bentham & Hooker's system of classification

14 L

Study of following plants according to Bentham & Hooker's system of classification with reference to systematic position, morphological characters, distinguishing features, floral formulae, floral diagram, pollination & economic importance of (any ten families).

- (i) Magnoliaceae
- (ii) Papaveraceae
- (iii) Myrtaceae
- (iv) Combretaceae
- (v) Cucurbitaceae
- (vi) Sapotaceae
- (vii) Apocynaceae
- (viii) Asclepidaceae
- (ix) Verbenaceae
- (x) Bignoniaceae
- (xi) Labiatae
- (xii) Convolvulaceae
- (xiii) Euphorbiaceae
- (xiv) Cannaceae

Reference Books:

- 1) Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson(Printers) Ltd., London & Edinburgh.
- 2) Delevoryas Th. 1965. Plant Diversification. modern biology series, Halt, Rinehart & Winston, New York.
- 3) Foster, A.S. and Gifford, A.E.M., Jr. 1967. Comparative Morphology of Vascular Plants. Vakils. Peffer & Simons Pvt. Ltd.
- 4) Spome, K.R. 1977. The Morphology of Angiosperms. B.I. Publication, Bombay.
- 5) Bhowani. S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas publishing house, Deihi.
- 6) Johri B.M. 1984, Embryology of Angiosperms. Springer-Verlag, Berlin.
- 7) V.N. Naik, 1985. Taxonomy of Angiosperms.
- 8) P. Shukla and S. Mishra, 1979. An Introduction to taxonomy of Angiosperms.

T.Y.B.Sc. (BOTANY) (C.B.C.S. 2018 Course) SEMESTER-V
B – 53: PLANT PATHOLOGY AND PLANT PROTECTION
Core Course – Theory; Credits- 04 **Total lectures- 60 L**

Course Learning Outcomes :

On completion of this course, students are able to:

- Understand and study concepts of plant protection, host, pathogen, disease and classification of plant diseases based on symptoms and causal agents like fungi, bacteria, mycoplasma and viruses.
- Study various methods of studying plant diseases.
- Impart knowledge about role of environmental factors in determining the extent of inoculums, penetration, infection, development.
- Understand pathogen attack, defense mechanisms and plant disease epidemiology.
- Gain knowledge about principles of plant protection, management of plant diseases and general account of application of information technology in plant pathology.

1) Introduction

10 L

- i) Concepts of plant protection, host, pathogen and disease.
- ii) Importance of plant diseases and their control.
- iii) Few important mile stones in the development & plant pathology.
- iv) Classification of plant diseases based on symptoms and causal agents like fungi, bacteria, mycoplasma and viruses.
- v) Symptoms and types of fungal bacterial, mycoplasma diseases.
- vi) Symptoms transmission & control of plant – virus diseases.

2) Methods of studying plant diseases

07 L

- i. Field diagnosis of plant diseases. Laboratory diagnosis of plant diseases. Cock's postulates.
- ii. Principles of infection, development and spread of plant diseases. Concept of plant disease clinic..

3) Role of environmental factors in determining the extent of inoculums, penetration, infection, development

And epiphytotics – like temperature, relative humidity, rainfall and wind.

05 L

4) Pathogen attack and defense mechanisms

05 L

- i) Morphological structural / physical.
- ii) Physiological.
- iii) Biochemical and molecular

5) Plant disease epidemiology

13 L

- i) Definition, disease triangle and general account of sporadic, endemic, severe and epiphytotics.
- ii) Pathogenesis, disease cycle and control measures of the following diseases --

- a. Downy mildew of grapes.
- b. Black stem rust of wheat.
- c. Tikka disease of groundnut. (leaf spot)
- d. Black arm of cotton.
- e. Little leaf of Brinjal.
- f. Yellow mosaic of papaya.

6) Principles of plant protection and management of plant Diseases

10 L

i) Exclusion:

- a) Tuber indexing.
- b) Seed certification
- c) Quarantine laws.

ii) Eradication:

- a) Roguing and cutting
- b) Crop - rotation
- c) Modern cultural practices
- d) Sanitary measures

iii) Protection:

- a) Chemical
- b) Biological and biopesticides
- c) Antibiotics
- d) IMP systems
- e) Development of transgenics

7) Molecular plant pathology

05 L

- i) Molecular diagnosis – concept.
- ii) Identification of genes and specific molecules in disease development.
- iii) Molecular manipulation of disease resistance.

8) General account of application of information technology in Plant Pathology

05 L

- i) Simulation of epidemics.
- ii) Remote sensing and image analysis for ecosystem level effects.
- iii) Prediction of disease control decisions.

Reference Books :

1. R.S.Singh - Introduction to principles of Plant Pathology.
2. M.N.Kamat - Introductory Plant Pathology
3. M.K.Rangaswami - Diseases of crop plants in India.
4. Meherhotra – Plant diseases
5. D.A.Robert and C.W.Bootheroyd – Fundamentals of Plant Pathology.
6. R.S.Mathur – Plant diseases.
7. M.K.Dasgupta – Principles of Plant Pathology.
8. Dr.Wani&Dr.Pingle – A text book of plant protection and plant pathology.
9. M.K.Mundkur : Plant diseases

T.Y.B.Sc. (BOTANY) (C.B.C.S. 2018 Course) SEMESTER-V

B – 54: GENETICS AND BIOSTATISTICS

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning outcomes :

On completion of this course, students are able to:

- know the basic principles of biostatistics and computer applications in biology.
- understand the fundamental concepts of biostatistics.
- learn about the computer and imbibe computer skills for biological data management and graphical presentation.
- enlightened about the need for computer applications, programs and techniques for biology.
- gain knowledge about “Cell Science
- understand Cell wall Plasma membrane, Cell organelles and cell division
- learn the scope and importance of genitics & biostatistics
- understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.

1. Mendel’s experiments and principles of inheritance

09 L

- (a) Mendel’s Laws of heredity.
- (b) Monohybrid ratio and dihybrid ratio.
- (c) Back cross and test cross.
- (d) Gene interactions and modified dihybrid ratios – Complementary, supplementary, duplicate and epistatic factors.

2. Multiple allelism

08 L

- a) Concept and characters of multiple alleles.
- b) Multiple alleles in *Drosophila* (eye colour).
- c) Multiple alleles in Man (blood groups).
- d) Multiple alleles in plants (self incompatibility)

3. Quantitative genetics

06 L

- a) Quantitative traits and quantitative genetics.
- b) The multiple factor hypothesis.
- c) Descriptive statistics.

4. Linkage and recombination

08 L

- a) Theories of linkage & detection of linkage.
- b) Linkage in Maize.

- c) Coupling and repulsion phases
- d) Two and three point test crosses with their significance in chromosome mapping.
- e) Interference and co-efficient of coincidence

5. Cytoplasmic inheritance 08 L

- a) Concept and definition.
- b) Cytoplasmic inheritance and plastid transmission in plants. (*Mirabilis jalapa*).
- c) Male sterility in plants.
- d) Cytoplasmic inheritance in Yeast (Mitochondria).

6. Alterations in genetic makeup:- change at genetic level 08 L

- a) Spontaneous and induced mutations.
- b) Mutagens – types and mode of action.
- c) Transitions, transversions and frame-shift mutations.
- d) Detection of mutations.

7. Alterations in genetic makeup: - change in chromosome structure 06 L

- a) Origin, types and effects of duplications.
- b) Deletions, inversions and translocations.
- c) Meiosis in structural heterozygotes.

8. Biostatistics 07 L

- a) Central value and dispersion.
- b) Mode, median, mean, range, mean deviation and standard deviation.
- c) Coefficient of variation and standard error.

Reference Books:

1. Atherly, A.G., Girton, J.R. and McDonald. 1999. The Science of Genetics. Saunders College Publishing Co., Fort Worth, USA.
2. Gardener, J., Simmons, H.J. and Snustad. D.P. 1991. Principles of Genetics (8th Edition). John Wiley & Sons, New York.
3. Sinnott Dunn – Principles of genetics.
- 4.. Arora and Sandhu – Genetics.
5. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th Edition). Jones & Bartlett Publishers, Massachusetts, USA.
6. Gupta, P.K. 1994. Genetics. Rastogi Publications. Shivaji Road, Meerut
7. Gupta, P.K. 1995. Cytogenetics. Rastogi Publications, Meerut.

T.Y.B.Sc. (BOTANY)
(C.B.C.S. 2018 Course)

SEMESTER-V

B – 55: MOLECULAR BIOLOGY & BIOCHEMISTRY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Learning Outcomes :

On completion of this course, students are able to:

- Understand structural organization and variation in chromosome as well as karyotype analysis.
- Learn about the extra-chromosomal inheritance in plant system.
- Know the molecular biology in relation to genetic material, its inheritance, modification, replication and repair.
- Understand transcription, translation post translation modification of protein.
- Know gene regulation in prokaryotes and eukaryotes and to understand concept of Biochemistry..

Course Content:

Molecular Biology

1) Nucleic Acid structure

09 L

Synthesis of nucleotides. DNA as a genetic material. Forms of DNA (A, B & Z). DNA replication. RNA structure, forms and role.

2) Recombinant DNA technology

12 L

Restriction endonucleases. Cloning vectors & choice of vectors. Gene cloning principle & technique.

Construction of Genomic and cDNA libraries. Southern and Northern blotting technique. DNA fingerprinting. DNA sequencing (Maxam, Gillbert & Sangers method) Polymerase chain reaction (PCR).

3) Genetic engineering of plants.

10 L

Concept of genetic engineering. Transfer of genes in plants. Agrobacterium the natural genetic engineer.

Transgenic plants (BT cotton & Golden rice). Chloroplast transformation and its significance.

Biochemistry

4) Amino acids **06 L**

Definition, structure and functions, properties, synthesis of amino acids.

5) Proteins **08 L**

Definition, classification according to structure, functions of proteins, Protein synthesis, importance of proteins.

6) Carbohydrates **07 L**

Introduction, classification, functions of monosaccharides, oligosaccharides, Polysaccharides including starch, cellulose & pectins.

7) Lipids – definition, classification, properties, functions **03 L**

8) Enzymes **05 L**

Definition, Classification, properties, mechanism of enzyme action, Lock-key hypothesis, active sites, coenzymes, factors affecting enzyme activity, pH, temp, inhibitors, substrates & activators.

Reference books:

1. Alber B. Bray, D. Lewis, J. Ralston, M. Roberts, Watson J.D... 1999 – Molecular biology of cell
2. M.L. Gupta, M.L. Jangir – The cell and biotechnology
3. L.M. Narayanan, A.M. Selva Raj, A. Mani Padmalatha Singh – Molecular and Genetics engineering
4. Anna C. Pai – Foundation of genetics
5. B.K. Jain – A Text book of Genetics
6. Karvita B. Ahluwalia – Genetics
7. Lea P.J. and Leegood R.C. – 1999-plant Biochemistry and Molecular biology
8. Old R.W and Primrose S.B. – 1999 – Principles of Gene Manipulation.
9. T.N. More, K.N. Dhumal et.al-2003, A Text book of Botany – Plant Biotechnology

T.Y. B.Sc. (BOTANY)
C.B.C.S. 2018 Course)
B – 56: PRACTICAL COURSE V
(Based on B- 51: Biology of Cryptogams & B-52: Biology of Seed Plants)

Core Course – Practical's; Credits- 02 (Any 10 practical's to be covered)

Learning Outcomes :

On completion of this course, students are able to:

- The range of thallus structure in algae.
- Understand the salient features of Algae and Fungi..
- .Study of morphological and biological peculiarities of plants
- Study of the families with respect to morphological characters using botanical terms,floral formula, floral diagram.
- Identification of genus and species with the help of flora of the plant materials.
- Preparation of artificial, bracketed/indented dichotomous keys based on vegetative and reproductive characters.

Course Content:

1. Study of thallus organisation in algae e.g. *Chlorella*, *Volvox*, *Ulothrix*,
Hydrodictyon, *Cladophora*, *Frittschiella* *Vaucheria*, *Polysiphonia* and *Ulva*. 1P
2. Study of Life histories of *Chara* and *Batrachospermum* 1P
3. Study of life histories of *Rhizopus* & *Synchytrium*. 1P
4. Study of life history of *Agaricus*. 1P
5. Study of life cycle of Rust of wheat. (*Puccinia*) 1P
6. 6 to 10 Study of the following plants families with helps of locally available specimens. Myrtaceae, Cucurbitaceae, Sapotaceae, Apocynaceae, Solanaceae, Acanthaceae, Labiatae, Ephorbiaceae, Liliaceae & Cannaceae. **8P**
11. Preparation of dichotomous key and identification of genus & species by using floras 1P
12. Field visit: students should be taken for field visits to study flora to collect plant specimens & to prepare herbaria.
13. Study of – Stomatal number. Stomatal index and Vein - islet number with suitable examples. 1P
14. To study the types of ovule, megasporogenesis, structure of the *Polygonum* type and *Allium* type embryo sac with help of permanent slides. **1 P**

T.Y. B.Sc. (BOTANY)
(C.B.C.S. 2018 Course)
B-57 - PRACTICAL COURSE – VI

(Based on B-53: Plant Pathology and Plant Protection & B-54: Genetics and Biostatistics)

Core Course – Practical's; Credits- 02

(Any 10 practical's to be covered)

Learning Outcomes :

On completion of this course, students are able to:

- study of plant pathogens representing different diseases in angiosperms
- Study different types of enzymes and its significance-Pectolytic enzymes
- Principle working and uses of laminar air flow hood, autoclave, hot air oven, electrophoresis and centrifuge.
- understand MS media preparation. & concept of genetics
- understand preparation of chromosomes maps & to determine mean, mode & median

1. Study of important plant pathogens (symptoms and host parasite relationship).	1 P
2. Effect of pathogens on physiology of a host.	1 P
3. Study of following plant diseases. Black stem rust of wheat. Downy mildew of grape. Powdery mildew of Cucurbita / Tectona. Tikka disease of ground-nut. Yellow Mosaic of papaya.	3 P
4. Isolation of pectolytic enzymes from diseased plants.	1 P
5. Isolation of cellulase from diseased plants.	1 P
6. Demonstration of biopesticides (essential oils, neem, turmeric and garlic) against some pathogens.	1 P
7. Determination of chromosome count from dividing pollen mother cells, root tips and pollen grains.	1 P
8. Determination of intraspecific variation in chromosome number from locally available taxa	1 P
9. Preparation of chromosome maps from 3-point test cross data.	1 P
10. To determine the mode, median and mean of the specimens.	1 P

T.Y. B.Sc. (BOTANY)
(C.B.C.S. 2018 Course)
B-58- PRACTICAL COURSE – VII
(Based on B- 55 Molecular biology and Biochemistry B-59 (A) Aerobiology / B-59 (B)
Medico botany / B-59 (C) Conservation of Medicinal Plants)
Core Course – Practical's; Credits- 02 **(Any 10 practical's to be covered)**

Learning Outcomes :

On completion of this course, students are able to:

- Students should understand, molecular biology in detail
- To know biochemical view of every experiment & to understand concept of aerobiology
- Student should understand aerospora, allergic pollen grains.
- Preparation of cotton blue, permanent algal slides, phenol and culture medium – PDA.
- Study fungi with respect to vegetative, reproductive structures and classification with reasons.

Practical course content;

1. Chemical tests to demonstrate the presence of starch, sugar, fat and protein in plant material **1 P**
2. To identify the amino acids in a mixture by resolving through paper Chromatography or T **1 P**
3. Colorimetric estimation of RNA using orcinol. **1 P**
4. Colorimetric estimation of DNA using diphenyl amine. **1 P**
5. Study of amino acid, proteins, lipids & carbohydrates **2 P**

Practicals based on B-59 (A) Aerobiology

6. Study of construction and working of Volumetric Tilak air sampler & Andersen air sample **1 P**
7. Preparation of culture media and culturing of airborne fungal forms by petriplate exposure method **1 P**
8. Preparation of mountant – glycerine jelly, scanning and identification of fungal spores. **1 P**
9. Air monitoring for pollen grains and identification of pollen grains. **2 P**

Practicals based on B-59 (B) Medicobotany

1. Study of any six drug plants from theory syllabus (Macroscopic and Microscopic) **2 P**
2. Study of ethno botany of any two locally available Plants **1 P**
3. Study and preparation of ayurvedic formulations - Asav, Arishtia, Churna **1 P**
4. Visit to pharmaceutical industry where plant formulations are prepared **1 P**
5. Extraction and Qualitative analysis of Alkaloid, Glycoside and Tannin **1 P**

Practicals based on B-59 (C) Conservation of Medicinal Plants:

1. Study of identification of genus and species of plants by preparing key with the help of Cook's flora. **1 P**

2. To study morphological characters of rare, endangered and threatened plants with suitable examples. **1P**
3. Study of cultivation practices of *Aloe / SafedMusali*. **1P**
4. Study of cultivation practices of important medicinal plants by in situ conservation. **1P**
5. Visit to local medicinal plant garden. **D**

T.Y.B.Sc. (BOTANY) (C.B.C.S. 2018 Course)

SEMESTER– V

(Elective Courses): Choose any one course of the following

B – 59 (A): AEROBIOLOGY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes:

On completion of this course, students are able to:

- Know the nature and its co-relation with human society.& to understand concept of aerobiology
- Realize the impact of human activities on environment.
- Understand global issues concerned with aerospora & allergic pollen grains
- Know the sustainable development and care of environment.

1. Introduction 08 L

i) Definition and importance of Aerobiology. ii) Brief history and progress of Aerobiology

in India. iii) Scientific contributions of Prof. P. H. Gregory, Prof. K. C. Meheta, Prof. T.Sreeramulu and Prof. S. T. Tilak. iv) Multidisciplinary approach

2. Methods of sampling 06 L

i) Principles. ii) Qualitative and quantitative sampling. iii) Intramural and extramural sampling. iv) Utility of intramural and extramural sampling.

3. Types of air samplers and working of following air samplers 05 L

i) Volumetric Tilak air sampler. ii) Rotorod air sampler. iii) Andersen air sampler

4. Airborne Biological materials 09 L

i) General survey and classification. ii) Concept of aerobiopollutants. iii) Study of the following biological materials. Algae (b) Fungi (c) Bacteria (d) Pollen (e) Mites

5. Analysis of Aerospora 07 L

i) Identification methods. ii) Vertical and horizontal distribution. iii) `Statistical analysis of aeromicrobiota. iv) Logical interpretation of data.

6. Meteorological parameters and aerospora 06 L

i) Temperature, humidity and rainfall. ii) Diurnal periodicity. iii) Day and Night (nocturnal) aerospora.

7. Impact of Aerobiopollutants on living systems 07 L

i) On human – Allergy and Skin diseases. ii) On animal – Skin diseases. iii) On plants – Plant diseases.

8. Plant disease forecasting and aerobiology 05 L

i) Principles. ii) Methods. iii) Model in brief.

9. Concept of bio-deterioration and biodegradation with reference to airborne microbes. 02 L

10. House Dust mites 05 L

i) General account and types. ii) Relevance of House Dust mites in house dust. iii) Culturing of any one organism. iv) Human health hazards.

Reference Books :

S.T.Tilak – Aerobiology

S.T.Tilak – Environmental Ecology and Aerobiology.

S.T.Tilak – Airborne pollen & Fungal Spores.

S.T.Tilak – Aerobiology (Revised edition 2000)

P.H.Gregory – Microbiology of Atmosphere.

S.N.Agashe – Recent Advances in Aerobiology.

T.Y. B.Sc. (BOTANY)

(C.B.C.S. 2018 Course)

SEMESTER - V

B – 59 (B): MEDICO BOTANY

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On completion of this course, students are able to:

- Know about history and relevance of herbal drugs in Indian system of medicine
- Learn the macroscopic and microscopic characters, chemical constituents, adulterants,
- Understand the techniques for drug evaluation (Chemical, Physical and Biological),
- Phytochemical investigations, standardization and quality control of herbal drugs
- Know the technique of medicinal gardening - Cultivation practices, marketing and utilization of selected medicinal plants
- Get knowledge on pharmacological importance of medicinal plants and its bioactive compounds.
- Set up process of harvesting, drying and storage of medicinal herbs

1) Study of Crude drugs with reference to macroscopic and microscopic characters, active principles, therapeutic action and medicinal use of – 14 L

a) Root and rhizome drugs – *Rauwolfia serpentina*, *Glycyrrhiza glabra*, *Zingiber officinalis*.

b) Stem drugs :- *Tinospora cordifolia*, *Ephedra* SP.

c) Bark drugs – *Holarrhena anti dysenterica*, *Cinnamomum zeylanicum*.

d) Leaf drugs – *Cassia angustifolia*, *Datura metel*.

2) Study of Crude drugs with reference to macroscopic and microscopic characters, active principles, therapeutic action and medicinal use of – 09 L

a) Flower drugs – *Eugenia caryophyllum*, *Rosa indica*.

b) Seed drugs – *Plantago ovata*, *Myristica fragrans*.

c) Fruit drugs – *Terminalia belarica* (Behada), *Aegle marmelos*.

3) Medicinal use of common household crude drugs - 12 L

a) *Adhatoda vasica* b) *Acorus calamus* c) *Gardenia gumifera* d) *Helicteris isora*

e) *Curcuma longa* f) *Terminalia belarica* g) *Terminalia chebula* h) *Emblica officinalis*

i) *Ocimum sanctum* j) *Allium sativum*

4) Study of important Medicinal plants used as spices and condiments – 12 L

a) *Curcuma longa* b) *Zingiber officinale* c) *Cinnamomum verum* d) *Cinnamomum tamala*

e) *Coriandrum sativum* f) *Murraya koenigii* g) *Eugenia caryophyllata* h) *Carum copiticum*

i) *Elettaria cardamomum* j) *Myristica fragrans*

5) Ayurvedic concept of preparation of crude drugs

08 L

a) Churne b) Asava c) Arishta d) Gutti e) Kadha

6) Lower plants in medicine

05 L

Sources and uses of *Chlorellin* and *Penicillin* and *Ergotine*.

Medicinal uses of bryophytes and pteridophytes.

References

- 1) Pharmacognosy: Trease and Evans
- 2) Pharmacognosy :Gokhale, Kokate and Purohit
- 3) Pharmacognosy: Wallis
- 4) Medicinal plants: Jain S.K.
- 5) Practical pharmacognosy: Khandelwal and Pawar et al.
- 6) Indian Medicinal plants: Kirtikar and Basu

T.Y. B.Sc. (BOTANY)
(C.B.C.S. 2018 Course)
SEMESTER - V

B – 59 (C): Conservation of Medicinal Plants

Core Course – Theory; Credits- 04

Total lectures- 60 L

Course Learning Outcomes :

On completion of this course, students are able to:

- understand medicinal plants are considered as a rich resources of ingredients which can be used in drug development either pharmacopoeial, non- pharmacopoeial or synthetic drugs.
- understand some plants and their derivatives are considered as important source for active ingredients which are used in aspirin and toothpaste.

1. BASIC STUDIES

14 L

• Traditional knowledge and the use of plants in health care

1. Introduction to traditional knowledge.
2. Importance and significance of this knowledge to local people.
3. Communities involved in traditional knowledge about medicinal plants, application of traditional knowledge with examples.

• Identification and classification of medicinal plants

4. Concept of identification and classification, system used presently for identification, Botanical approach for identification and classification of the plants
5. The classification for medicinal plant used by Ayurveda – basic principles and system
6. Field identification technique for the medicinal plants

• Outline of medicinal plants distribution and their abundance

7. List of plants required in large quantity from various parts of India
8. Distribution of the important medicinal plants in Maharashtra and India.
9. Threatened / Endemic / medicinal plants of India

2. UTILIZATION

16 L

• Whenever possible to cultivate the medicinal plants as a source of supply

1. Cultivation of the medicinal plants, principles and concept, methods of cultivation.
2. Scenario of highly cultivating medicinal plants; demand and supply ration
3. Existing sources of medicinal plants for cultivation.
4. Status of medicinal plants available in wild, in Pune and surrounding regions. Major areas of Maharashtra from where medicinal plants are collected from wild

• Improved techniques for harvesting, storage and production

5. Pre processing and post processing techniques for harvesting and recent techniques for the storage of the medicinal plant parts.

6. State level and National level policies for harvesting, storage and production of medicinal plants Introduction to ADMA – Ayurvedic Drug Manufacture Association, role in collection of medicinal plants from various parts of India
7. Status of medicinal plant product companies in Maharashtra, India and at International level
8. Opportunities to the students for initiating a business in medicinal plants

3. CONSERVATION

14 L

• Conserve population of medicinal plant sciences in natural habitat

1. What is conservation? In-situ & ex-situ conservation, concept & introduction
2. Important parameters for the conservation, viz. Community involvement, dependence of communities on the natural resources, availability of resource
3. Identification of existing threats to the natural resources / medicinal plants

• Conserve population of medicinal plant species ex-situ

4. Ex-situ conservation technique and its significance, Need of ex-Situ Conservation and its application
5. Successful stories of Ex-Situ conservation of medicinal plants – 4 case studies

National and International policies on conservation and current scenario of conservation

Tools available for the conservation of medicinal plants at local level – e.g. MPCA

6. Government policies under NMPB and SMPB
7. Government funding at village level for cultivation practices of medicinal plants; role of District Krishi Vigyan Kendra for giving training for conservation
8. Forest Department – on Protected and non-protected areas
9. Method of collection of medicinal plants and their conservation

4. COMMUNICATION AND CO-OPERATION

16 L

• Built public support for conservation of medicinal plants

1. Market requirement for the medicinal plants and availability on ground, Co-operative cultivation of medicinal plant – A model
2. Which are the major companies in drug productions
3. Role of National Medicinal Plant Board (NMPB) and State medicinal Plant Board in marketing of the raw products
4. What is buy-back mechanism; its significance and implementation in other states
5. National Medicinal Plant Board and Maharashtra Medicinal Plant Board, Department of Biotechnology

• **Involvement of Non-Governmental Organization (NGO) in cultivation, conservation and marketing of medicinal plants**

1. List of NGOs at local and at national level
2. Discussion of case studies of any 4 organizations

References

- 1) Pharmacognosy: Trease and Evans
- 2) Pharmacognosy: Gokhale, Kokate and Purohit
- 3) Pharmacognosy: Wallis
- 4) Medicinal plants: Jain S.K.
- 5) Practical pharmacognosy: Khandelwal and Pawar et al.
- 6) Indian Medicinal plants: Kirtikar and Basu

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
SEMESTER-V
MB 51 Medical Microbiology

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Explore the types of infectious diseases**
- **Know the etiology, symptoms and mode of transmission of human diseases and veterinary diseases**
- **Study the human diseases including AIDS**
- **Identify the Medical and Cosmetic uses of certain toxins.**
- **Know the health insurance policies & limitations of Customer courts**

Course Content

I]	Introduction to important Medical Terminologies.	02
II]	Outline studies of the following human diseases w.r.t. Etiology, symptoms and mode of transmission.	15
	i. Dengue	
	ii. Japanese Encephalitis	
	iii. Herpes	
	iv. Common-cold	
	v. Viral Diarrhoea	
	vi. Rabies	
	vii. Typhoid	
	viii. Cholera	
	ix. Gonorrhoea	
	x. Plague	
	xi. Amoebiasis	
	xii. Leptospirosis	
III]	Outline studies of the following veterinary diseases w.r.t. etiology, symptoms, mode of transmission & treatment.	08
	i. Mastitis	
	ii. Ranikhet	
	iii. Marek's Disease	
	iv. Brucellosis	

IV] Detailed study of following Human Diseases.

25

1. AIDS

2] Poliomyelitis:

- a) Structure of HIV
- b) ICTV Classification of HIV
- c) Difference between HIV 1 and HIV 2
- d) Mode of transmission
- e) Significance of CCR5 AND CXR4 receptors in the Pathogenesis of AIDS
- f) Apoptosis of CD₄ cells following HIV infection.
- g) ELISA, Western Blott, for Diagnosis of HIV infection.
- h) Morphology
- i) Antigenic Propertie
- j) Pathogenesis
- k) Prophylaxis
 - Injectable Polio Vaccine (IPV)
 - Live Polio Vaccine (Oral Polio Vaccine)

3] Bacillary Dysentery:

- a) Morphology
- b) Cultural characteristics
- c) ochemical properties
- d) Toxic activities of *Shigelladysenteriae* Type 1 in terms of Neurotoxicity, Enterotoxicity, Cytotoxicity
- e) Classification
- f) Pathogenicity
- g) Epidemiology

4] *Helicobacter pylori* a resourceful gastric pathogen:

- i) Morphology of *H. pylori*
 - ii) Unusual features of flagella of *H. pylori*
 - iii) Mechanism of colonization in the stomach mucosa
 - iv) Eliciting an inflammatory response by *H. pylori*
 - v) LPS- Immune Mimicry of *H. pylori*

5] *Clostridium difficile* and Pseudomembranous colitis:

- i) Concept of Pseudomembranous colitis
 - ii) Characteristics of *C. difficile*
 - iii) Virulence factors of *C. difficile*
- iv) Unexplained resistance of Babies to toxins of *C. difficile*

V] Medical Microbiology and Community:

10

1. Botulism:

- i) Concept of Botulism
 - ii) Botulinum toxin
 - iii) Medical and cosmetic uses of Botulinum toxin

2. Microbiology and Health Insurance:

- Permanent exclusions in Medical Policies
- a) Microbial Infections
- b) Hereditary Conditions
- Comparative claim settlement ratios of prime health insurance companies in India
- Limitations of consumer courts in the context of violation of terms and conditions of health policy documents in India

References:-

1. Anthony T., Diplock (1995), Fat soluble vitamins, First edition, Heinemann: London (Topic V)
2. Chakraborty P. 2009, Textbook of Medical Parasitology, Central Publications, Kolkata, India. (Topic I..pt.12, Topic IV..pt.4)
3. Cruickshank K.R., 2005, Medical Microbiology Vol I & II Livingstone, Longman. (Topic II AND IV)
4. Dornald 2010, Dornalds Pocket Medical Dictionary, Oxford & IBH New Delhi. (Topic I)
5. N.I.V. handbook, 1993 PUNE NIV PUNE. (Topic II)
6. Panikar^{9th} edition 2015 Textbook of Microbiology Orient Longman Bombay. (Topic II AND IV)
7. Rajan S. 2012, Medical Microbiology, MJP Publishers, Chennai, India. (Topic I)
8. Sharma J.B., 2014, Medical Microbiology, A Clinical Perspective, Paras Medical Publishers, Hyderabad, India. (Topic I and IV)
9. Shastry G. A. 1998, Veterinary Pathology 6th edition, CSB publishers, New Delhi. (Topic III)
10. Abigail A. Salyers and Dixie D Whitt 2018, Part 2, Bacterial Pathogenesis A Molecular Approach, ASM Press, Washington (Topic IV- Point 4 and 5, Topic V- Point- I)

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 52 Clinical Pathology

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Identify the role of blood cells & their significance**
- **Have a conceptual knowledge about lipids & clinical pathology**
- **Know the clinical relevance of hepatic system**
- **Develop the skills to perform the various renal& liver function tests**
- **Understand the community health services**

Course Content

I. Haematology :-

20

- i. Cytology and significance of Eosinophil,
- ii. Cytology and significance of Basophil,
- iii. Cytology and significance of Neutrophil,
- iv. Cytology and significance of Macrophages
- v. Cytology and significance of NK Cells.
- vi. Plasma electrolytes and their importance in human health,
- vii. Significance of hemoglobin,
- viii. Anticoagulants used in laboratories,
- ix. Anticoagulants used as therapeutic agents,
- x. Nomenclature of Procoagulants,
- xi. Formation of Platelet plug,
- xii. Intrinsic Pathway for Blood Coagulation,
- xiii. Extrinsic pathway for Blood Coagulation.

II. Lipids & Clinical Pathology:-

10

- i. HDL & LDL cholesterol & their diagnostic significance,
- ii. Docosaheanoic acid & it's clinical significance,
- iii. Lipid hypothesis of schizophrenia. .

III. Clinical Relevance of Hepatic system:- 10

- i. Bilirubin metabolism,
- ii. Conjugate & Unconjugate bilirubin,
- iii. Overproductive jaundice,
- iv. Obstructive jaundice,
- v. Hepatocellular jaundice,
- vi. Congenital jaundice,

IV. Organ Function Tests: 10

A. Renal Function Tests:

- i. Creatine Clearance Test
- ii. Urea Clearance Test
- iii. Phenol Sulfonaphthalein (PSP) Test

B. Liver function tests

- i. SGOT,
- ii. SGPT,
- iii. Total Serum Bilirubin,
- iv. Van Den Bergh Test,
- v. Bromosulphalein Excretion Test

V. Community Health services & Measures:- 10

- i. Blood – grouping
 - a) ABO
 - b) Rh,
- ii. Methods of blood grouping,
- iii. ‘Blood Banking’,
- iv. Rh-incompatibility (HDN).

References

1. Berne, Levy 2014, Principles of Physiology, C.V. Mosby Company USA. (Topics III)
2. David male, Jonathan Brostoff, David B Roth, Ivan Roitt, 2006 Immunology 7th edition (Topic I)
3. E. Roy Skinner (Ed.) 2002, brain lipids and Disorders in Biological Psychiatry, ELSEVIER. (Topics II)
4. Sengupta, “1992 Synopsis of clinical pathology & Microbiology” Hilton & company kolkotta. (Topics III and IV)
5. Sood Ramnik Fifth Edition 2003, Hematology for students & practioners. Jaypee Brothers, Medical publishers. (Topics I and V)
6. Stites D.P. & A.I. Terr 1990 Basic & Clinical Immunology Prentice hall. (Topics I)
7. World Health Organization Blood Transfusion Services 2015,(Authorized reprint by B.I. Churchill Livingstone. (Topic V)

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 53Virology

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Focus on the study of viruses that includes the origin, structure & nucleic acids**
- **Know the methods of isolation ,cultivation & enumeration of viruses**
- **Identify the life cycles of bacteriophages& genetic recombination in phages**
- **Master the techniques in the reproduction of specific animal & plant viruses**

Course Content

I Introduction

05

- i. Discovery and definition of a Virus
- ii. Importance of Viral nucleic acids
- iii. Properties of Viruses
- iv. Origin of Viruses
- v. Classification of viruses

II Structure of Viruses

12

A. Subunits of viruses

B. Structure of various viruses (one example each)

- i. Filamentousviruses
- ii. Isometricviruses
- iii. Icosahedralviruses
- iv. Picornaviruse
- v. Bacteriophages
- vi. Adenoviruses
- vii. Envelopedviruses

C. Viral Nucleic acids

- i. DNA Viruses – Single and Double stranded
- ii. RNA viruses- Single and Double stranded

D. SubviralInfectious agents

- i. Satellite viruses
- ii. Viroids
- iii. Prions

III. Isolation, cultivation and enumeration of viruses 15

A. Isolation and cultivation of viruses

- i. Animal virus - tissue culture, chick embryo and live animals.
- ii. Plant virus – plant tissue culture and protoplast formation
- iii. Bacteriophages – plaque method.

B Enumeration of viruses

- i. Latex droplet method (Direct Microscopic count)
- ii. Haemagglutination assay
- iii. Plaque and pock method.
- iv. LD 50 or ID50 assays (50% end point method.)

IV] T even phages and T odd phages. comparison 02

V] Gene regulation in bacteriophages 16

A. Life cycles of Bacteriophages: T Even phages (T₂ T₄ T₆) and λ

- i. One step growth curve
- ii. Single burst experiment
- iii. Doermann's experiment
- iv. Features Of The T₄ Life cycle
 - a. Taking over the cell
 - b. Replication of T₄ DNA
 - c. Production of T₄ phage particles

B. Genetic Mapping of Phage T₄

- i. The genetic map of T₄ is circular
- ii. Possible explanations for the T₄ circular map

C. Life cycles of Phage λ

- i. λ DNA and its gene organization
- ii The Lytic cycle of λ
 - a. DNA replication and phage production
 - b. DNA replication and maturation: coupled processes

- c. Particle assembly
- iii. Lysogenic establishment of λ
- iv. Immediate Early, Delayed Early and the Late genes
- v. Essential and Nonessential genes
- vi. Establishment and Maintenance of Lysogeny
- vii. C_I, C_{II}, C_{III} and Cro proteins-Role as inducers and repressors
- viii. A delicate balance: lysogeny versus lysis

D. Phage Mutants

F. Genetic Recombination in Phages

- i. Effect of the parental ratio on recombination frequencies
- ii. Reciprocity in genetic recombination
- iii. Recombination by breakage and rejoining of DNA molecule

VII Specialized Transduction 05

- i. Other Lysogenic phages
- ii. Lysogenic phages and bacterial pathogenesis

VIII Reproduction of Plant and Animal viruses 05

A. Animal Viruses

- i. Adenovirus
- ii. Influenza virus

B Plant virus

TMV (Tobacco Mosaic Virus)

References

1. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
2. Dimmock N.J. A. J. Easton and K.N. Leppard (2001) Introduction to Modern Virology Blackwell Science.
3. Hart. D.L. E.W. Jones. (1999) Essential Genetics, 2nd Edition. Jones and Bartlett publishes. Sudbury Massachusetts.
4. Lewin B. (2004) Genes VIII International Edition. Pearson. Prentice Hall.
5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and Company, New York.
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9. Stanley R. Maloy, John E. Cronan, David Freifelder (1994) . Microbial Genetics Jones and Bartlett Publishers.
10. Tamarin R.H. (2003) Principles of Genetics, 2nd Edition. Tata McGraw Hill Edition.
11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell publishing.
12. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford-

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 54 Genetics of Prokaryotes

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to

- **Understand the different modes of Recombination in Bacteria**
- **Get knowledge of operon & regulation of gene expression in bacteria**
- **Identify the transposable elements & their significance**
- **Know the properties of Fertility factor & their importance in bacterial recombination**

Course Content

I Recombination in bacteria

A. Bacterial Transformation

10

- i. Discovery of Transformation
- ii. Steps in Transformation
 - a. Competence development
 - b. Uptake of DNA during Natural Transformation.
 - c. Integration
- iii. Transformation in Gram positive and Gram negative bacteria
- iv. Molecular mechanism of Transformation.
- v. Uses of Transformation
- vi. Transformation In nature
- vii. Artificial Transformation (Transfection)

B. Bacterial Conjugation

10

- i. F^+ cells. Properties of F^+ cells. Cross between F^+ and F^- cells
- ii. Transfer of Plasmid DNA
 - a. Stages in transfer process
 - b. Effective contact and pilli
 - c. Mobilization and transfer
 - d. Fertility inhibition
 - e. *tra* genes of F
 - f. Host restriction in transfer

- iii. Formation of Hfr cells. Hfr Transfer: Cross between Hfr and F⁺ F⁻ Phenocopies (Lethal zygotis)
- iv. Chromosome transfer mediated by F⁺ Plasmid (F-duction)
 - a. Conjugation in *Streptococcus faecalis* system
 - b. Conjugation in *E.coli.* system

C. Bacterial Transduction

10

- i. Generalized Transduction
- ii. Specialized Transduction
 - a. Formation of specialized transducing particles from a λ lysogen
 - b. Specialized transduction of a nonlysogen
 - c. Specialized transduction of a lysogen
 - d. High frequency transducing lysates
- iii. Specialized Transducing Phage as a cloning vehicle
- iv. Transduction and phage conversion

II Regulation of Gene Expression in Bacteria.

i Concept of Operon

02

ii. Lactose Operon

08

- a. Structure of Lactose operon
- b. Regulation of *lac* system : Repression, Allolactose, role of cAMP
- c. Lac mutants
- d. Isolation of mutants in *lac* operon
- e. Differential Translation of the genes in *lac* m RNA
- f. Positive and negative regulation of the *lac* operon

iii. Arabinose Operon

04

- a. Structure of Arabinose n operon
- b. Regulation of *Ara* system: Repression
- c. Regulation of *Ara* system at different concentration of arabinose
- d. Positive regulation of the *Ara* operon
- e. Double regulation by repressor

iv. Typtophan Operon

06

- a. Regulation of a biosynthetic pathway
- b. Structure of Tryptophan operon
- c. Regulation of *Trp* system at different conc of tryptophan
- d. Autoregulation
- e. Repression Vs Attenuation
- f. Antitermination

III Transposable Elements

10

- i. Insertion sequences
- ii. Structure of Transposable elements
- iii. Transposon terminology
- iv. Types of bacterial transposones
- v. Transposition
- vi. Simple transposition
- vii. Duplication of a target sequence at an insertion site
- viii. Replicative transposition
- ix. Mechanism of replicative transposition (J. Shapiro's Model)
- x. Excision of transposons
- xi. Genetic phenomena mediated by transposons in bacteria
- xii. Transposons and evolution

References

1. Norris, J.R. and D.W. Ribbons. (1972).Methods in Microbiology, Volume 7, Part Academic Press.
2. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
3. David A. Jackson, Stephen P. Stitch, (1979). Recombinant DNA Debate
4. Hartl. D.L. E.W. Jones. (1999) Essential Genetics, 2nd Edition. Jones and Bartlett publishes. Sudbury Massachusetts.
5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and company, New York.
6. Russel. P.J. (2006) Genetics: A molecular Approach. 2nd Edition. Pearson Benjamin Cummings.
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9. Stanley R. Maloy, John E. Cronan, David Freifelder (1994) . Microbial Genetics Jones and Bartlett Publishers.
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11. Trun N and J Trempey (2004) Fundamental Bacterial Genetics. Blackwell publishing.
12. Watson, J. D. (2007) Recombinant DNA: Genes and Genomes: A Short Course Publisher, W. H. Freeman, Edinburgh: Blackwell Scientific Publications.
13. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford- by Prentice Hall.

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 55 Enzyme Kinetics and Regulation

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Have conceptual knowledge of properties, Structure & function of Enzymes, Types of Enzymes**
- **Have knowledge about Enzyme Kinetics & their Regulation**
- **Specify the application of enzymes in large scale Industrial process**
- **Understand the applications of Biochip, Enzyme Electrodes & Biosensors**
- **Learn the enzyme immobilization & Industrial application**

Course Content

I.	Enzymes as biocatalysts: review	03
II.	Types of enzymes	07
	i. Monomeric enzymes- Characteristics, function of monomeric enzymes - Serine proteases. ii. Oligomeric enzymes. Characteristics and functions of oligomeric enzymes -Tryptophansynthetase, Lactose synthase iii. Multimeric enzymes Characteristics and functions of multimeric enzyme, Pyruvate dehydrogenase	
III.	Regulatory enzymes and mechanism of regulation.	16
	A. Allosteric enzymes	
	i. Structure ii. Co-operativity iii. MWC mode (concerted model), KNF model(sequential model) iv. Kinetic behavior of allosteric enzymes, K- enzymes and M-enzymes v. ATPase.	

B.	Covalently modulated regulatory enzymes	
i.	Glycogen phosphorylase enzymes	
ii.	Glutamine synthetase	
C.	Covalent activation of zymogens.	
D.	Fee back inhibition- Concerted, Cumulative, Sequential regulation	
E.	Isoenzymes	
i.	Concept and functioning	
ii.	Identification of isozymeforms	
iii.	Lactate dehydrogenase	
IV.	Coenzymes.	10
i.	Riboflavin coenzymes.	
ii.	Thiamine coenzymes	
iii.	Pantothenic acid and Coenzyme A.	
iv.	Pyridoxine coenzymes	
V.	Kineticsofsingle substrate enzyme catalyzed reaction.	10
i.	The concept and use of initial velocity	
ii.	The Michaelis – Menten equation for initial velocity, Michaelis Menten plot and its significance	
iii.	Brigg’s and Haldane modification of Michaelis – Menten equation.	
iv.	Transformations of the Michaelis Menten equation for plotting kinetic data. The Lineweaver & Burk plot, Edie-Hofstee Plot, Hanes Plot.	
VI.	Enzyme inhibitions	06
i.	Reversibile inhibition	
a)	Competitive inhibition	
b)	Uncompetitive inhibition	
c)	Noncompetitive inhibition	
ii.	Irreversible inhibition	
VII	Applications of enzymes in Biotechnology	08
i.	Production of enzymes on large scale	
ii.	Enzymes in DNA technology	
iii.	Systems Biology and Microarrays	
iv.	Preparation properties applications of immobilized enzyme	
v.	Biosensors and biochips, Enzyme electrode	

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B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 56 Practical Course – V

Total credits 02

Total number of Experiments: 15

Course Learning Outcomes:

On completion of Course Students are able to -

- **Identify common infectious agents & diseases that they cause**
- **Evaluate methods used to identify infectious agents in the Clinical Microbiology Laboratory**
- **Articulate Diagnostic, Clinical reasoning skills in all major disciplines**
- **Recognize & Diagnose common infectious diseases from the clinical presentation & associated Microbiology**

Course Content

1. Isolation and Identification of pathogenic <i>Staphylococci</i> .	3
a. Coagulase Test.	
b. DNA ase Test.	
2. Isolation and Identification of Gram negative Intestinal pathogens- <i>E.coli, Salmonella</i> .	4
3. Isolation and Identification of Urinary Tract pathogens- <i>Proteus, Pseudomonas</i> .	4
4. Slide Agglutination Test: Serological typing.	3
a. Blood grouping ABO and Rh.	
b. Tube Agglutination Test: The WidalTest	
c. Rapid Plasma Reagin Test (for diagnosis of Syphilis)	
5. Enzyme Linked Immunosorbent Assay (Demonstration)	1

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
2. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
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6. Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
7. Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
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9. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 57 Practical Course – VI

Total credits 02

Total number of Experiments: 15

Course Learning Outcomes:

On completion of Course Students are able to -

- **Study the Micro-Organisms that are associated with milk & milk products in all aspects**
- **Understand the basic Microbiology of Food & Dairy products**
- **Evaluate the Microbiology quality of raw milk**
- **Have the information on the microbial content of milk can be used to judge its sanitary quality & the conditions of production.**
- **Study the Micro-Organisms that inhibit, Create or Contaminate food**

Course Content

A]	A Milk Microbiology	5
	1. Dye Reduction tests – Methylene Blue and Resazurin	
	2. Test for Mastitis.	
	3. TVC of milk.	
	5. Specific gravity of milk.	
	6. Direct microscopic count.	
	7. Estimation of fat content of milk.	
B]	Microbiology of Food.	6
	1. TVC of food.	
	2. Preparation of fermented products (Curd, Idli batter) and Isolation of Lactic cultures.	
	3. Isolation of anaerobes	
C]	Plant Pathology.	4
	1. Enrichment of <i>Xanthomonas</i> spp.and its isolation.	
	2 Spot test to detect the presence of plant pathogenic bacteria	
	a) Detection of PHB granules – Nile blue staining, Sudan Black staining.	
	b) Detection of EPS	

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
2. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th Edition.
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6. Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
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9. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 58 Practical Course – VII

Total credits 02

Total number of Experiments: 15

Course Learning Outcomes:

On completion of Course Students are able to -

- **Review the Coliphages as possible indicators of fecal contamination**
- **Interpret the UV survival curve of *E-Coli***
- **Know the protocol for determining & analyze activity**
- **Understand the importance & concentration of niacin in food items**

1. UV survival curve.	2
2. Isolation of bacteriophage	2
3. Detection of iron in food stuff by α, α' dipyridyl method	2
4. Detection of niacin in food stuff.	1
5. Assessment of antibiotic like substances from culture filtrate	2
6. Amylase assay.	3
7. Effect of different parameters on amylase activity.	3

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
2. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.

5. Dubey, R.C. and Maheshwari, D. K. (2002). Practical Microbiology. S Chand and Company Pvt Ltd.
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7. Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
8. Sawhney, S.K. and Singh, R. (1999). Introductory Practical Biochemistry. Narosa Publishing House.

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 59-A Food and Dairy Microbiology

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Understand the basic microbiology of foods. Processing & Importance of Microbes in food**
- **Get the beneficial activities of microbes in food & spoilage of food**
- **Acquire the skills of preservation of milk, milk products & food**
- **Have awareness of preservation & microbiology of fermented milk products**

Course Content

I. Microbes in food.	
A. Evolution of Food Microbiology	01
B. Micro-organisms and food materials.	03
i. Principles that influence microbial growth, survival and death of microbes in food:-	
ii. Intrinsic factors and substrate limitations: Nutrient content, pH & Antimicrobial barriers.	
iii. Environmental limitations: temperature & gaseous environment.	
C. Processing of food	10
i. Asepsis	
ii. Heat Processing	
a. Pasteurization, Appertization & Sterilization	
iii. High pressure processing	
iv. Irradiation – traditional method, UV and Ionizing Radiations	
v. Role of FDA	
D. Importance of Microbes in food	12
1. Food Borne Infections and Intoxications.	
i. Gram negative bacteria – Salmonellosis	
ii. Gram positive bacteria – Staphylococcal food poisoning	

2. Beneficial Activities of Microbes in food:-

- i. Microbial metabolism of food components.
- ii. Fermented foods:
 - a. General methods of production
 - b. Starter cultures, enzymes
 - c. Traditional fermented foods
 - d. Microbiology of process
 - e. Fermented food – Idli
 - f. Fermented milk and milk products – Curd, Yoghurt
 - g. Concepts of genetically modified foods

E. Spoilage of Food

08

- i. General Principles underlying spoilage
- ii. Important food spoilage bacteria
- iii. Sequence of events in spoilage
- iv. Factors governing spoilage of food.
 - a. Number and type of microbial load.
 - b. Type of food
 - c. Succession.
 - d. Storage conditions – Temperature & humidity.

F. Spoilage of food commodities:-

- i. Meat – Structure and composition, primary processing, spoilage of fresh meat.
- ii. Fish – Structure and composition, primary processing, spoilage of fresh fish.
- iii. Plant Products – Fruits and vegetables.
- iv. Canned foods.
- v. Fermented foods.

G. Preservation and storage

08

- i. Low temperature storage, Chilling, Freezing.
- ii. Chemical Preservatives.
 - a. Natural antimicrobials.
 - b. Organic acids.
- iii. Hurdle Technology.
- iv. Aseptic packaging, modified atmosphere packaging, controlled atmosphere packaging.
- v. Detection of microbes in food.
- vi. Indicator micro-organisms and microbiological criteria.

II Microbiology of milk

18

A. Microbiology of market milk

- i. Market milk industry in India & abroad
 - ii. Indian standards of market milk
 - iii. Common microorganisms in market milk
 - iv. Detrimental effects of microbial growth in market milk
- B. Microbiology of special milk
 - i. Sterilized milk – Method of manufacture
 - ii. Homogenized milk- Method of manufacture
 - iii. Soft curd milk - Method of manufacture
- C. Cheese – Types & microbial spoilage
- D. Microbiology of fermented milk products
 - i. Starter Lactic acid bacteria – Mesophilic & Thermophilic
 - ii. Secondary flora of fermented dairy products
 - iii. Bacteria, Moulds, Yeasts examples
 - iv. Acidification , texture development & flavor contribution by starter Lactic acid bacteria
 - v. Significance of secondary flora

References :

- 1 Adam M.R. and Moss M.O. (2003) Food Microbiology, 2nd edition, Panima Publishing Corporation, New Delhi.
- 2 Banwart G.J. (1987) Basic food Microbiology CBS Publishes, New Delhi.
- 3 Day. S. (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.
- 4 Doyle M.P.,Beuchet Z.R.& Montville T.J. (1997) Food Microbiology Fundamental and Frontiers, ASM Press, Washington D.C.
- 5 Frasier W.C. and Westhoff D.C. (1996) Food Microbiology 4th edition, Tata Mac Graw Hill, New Delhi.
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B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
Semester V
MB-59B Applied Microbiology-I

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Analyze the role of bio control agents & understand the bioremediation techniques**
- **Develop a broader perspective of the discipline of microbial diversity**
- **Have ability to acquire the art of publishing the new micro-Organisms & knowing microbial culture collection centers**
- **Have awareness of biomarkers, biosensors, nanotechnology & space microbiology**

Course Content

I Biopesticides	06
a. Historical Background.	
b. Bio-control agents – Bacteria, fungi and viruses	
c. Preparation and application of Biopesticides	
II Bioremediation	08
i. Nature of environmental contaminants	
ii. Bioremediation techniques	
iii. Microbes involved in bioremediation	
iv. Degradation of Xenobiotics.	
III Environmental Genomics	07
i. Discovery of Novel microorganisms and genes from extreme environments	
ii. Exploring & exploiting the uncultivable microbial diversity	
IV Microbial Diversity	08
i. Determination of microbial diversity	
ii. Potential applications in bioremediation	
iii. Bioremediation of radioactive waste from nuclear power reactor effluents – Present status & future perspectives	
V Microbial Culture Collection Centers	08
i) Overview of global culture collection centers	
ii) Overview of National Culture Collection Centers	

iii)	Introduction to MALDI-TOF & its significance	
VI.	Art of publishing the new microorganisms for its inclusion in Bergey's Manual	03
VII.	Environment Impact Assessment	05
i.	Environmental monitoring	
VIII	Space Microbiology	04
i.	Aims and objectives of Space research.	
ii.	Studies on microorganisms in spacecraft, list of microorganisms tested in outer space	
iii.	Monitoring of astronauts microbial flora:	
iv.	Alterations in the load of medically important microorganisms,	
v.	Organizations associated in space research	
IX	Nanotechnology	04
	Application of nanoparticles in molecular biology, industry agriculture and environment	
X.	Biosensors	04
	Biosensors in food,	
ii.	Environmental impacts and their assessments using bio indicators, biomarkers,	
iii.	Biosensors and toxicity testing	
iv.	Environmental laws and policies in India	03

References:

1. Lindsay G. Stevenson Rapid Identification of bacteria in positive blood culture broths by MALDI-TOF Mass Spectrometry 2010, Journal of Clinical Microbiology vol 48(2)(444-447)
 2. Maheshwari D.K. & R.C. Dubey (2001), Innovative Approaches in Microbiology. Gajendra Singh Gahlot Dehra Dun, India.
 3. Rajendran P., P. Gunasekaran (2006), Microbial Bioremediation . MJP Publishers, Chennai.
 4. Satyanarayana .T., B. N. Johri (2005), Microbial diversity Current Perspectives & Potential Applications . I.K. International Pvt. Ltd. Mumbai.
 5. Understanding the biological diversity act 2002 - explanatory notes
http://nbaindia.org/content/565/56/1/explanatory_note.html
 6. PubMed. Microbes in the Upper Atmosphere and Unique Opportunities for Astrobiology Research Article in Astrobiology · October 2013 DOI: 10.1089/ast.2013.1074 ·
 7. Microbiology And Molecular Biology Reviews, 2010, p. 121–156 Vol. 74, No. 1, American Society for Microbiology. 8 Gerda Horneck, 1 David M. Klaus, 2 and Rocco L. Mancinelli 3
- *Space Microbiology

B. Sc. Part III (T.Y.B.Sc.) MICROBIOLOGY
To Be Implemented From Academic Year 2020 – 2021
SEMESTER-V
MB 59-C Advanced Techniques in Microbiology-I

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- **Present the knowledge of mapping of genes in bacteria, bacteriophages & certain eukaryotes**
- **Apply the tools in molecular biology for the diagnosis of diseases**
- **Adapt the skill of DNA sequencing**
- **Diagnose the Transmissible agents**

Course Content

I Mapping of Genes

A. Mapping of Genes in Bacteria i. Mapping by Transformation ii. Cotransduction And Linkage iii. Mapping by Cotransduction iv. Interrupted mating and Time-Of –Entry Mapping v. Rate of chromosome transfer vi. Hfr mapping: Mapping of selected and “Unselected” markers	10
B. Mapping of Genes in Bacteriophages. i. Fine structure Analysis of a Bacteriophage Gene – Benzer’s spot test ii. Recombination Analysis of T₄ r II mutants iii. Deletion mapping iv. Defining Genes by complementation Tests	06
C. Mapping of Genes in <i>Streptomyces coelicolor</i> i. Life cycle of <i>Streptomyces coelicolor</i>. ii. Three fertility types of <i>Streptomyces coelicolor</i>. iii. Characters of different crosses iv. Different plasmids of <i>Streptomyces coelicolor</i>. v. Preliminary detection of linkage vi. 4 on 4 Test	

D. Linkage and mapping in Eukaryotes (Haploid mapping)	10
i. Tetrad Analysis in <i>Neurospora crassa</i>.	
a. Life cycle of <i>Neurospora crassa</i> .	
b. Cross over events: single and double	
c. Arrangement of ascospores with respect to mating types	
d. Calculating Gene – centromere distance in organisms with linear Tetrads : Based on PD's, NPD's, and T's Strands	
e. Two, Three and Four strand double cross overs	
f. segregation pattern revealed by tetrad analysis	
g. Using Tetrad Analysis to map Two Linked Genes	
ii. Mitotic Recombination in <i>Aspergillus nidulans</i>	
a. Parasexual cycle	
b. Mechanism of mitotic crossing over.	
c. Mapping by Mitotic Recombination in <i>Aspergillus nidulans</i> .	
II. Tools in molecular biology and diagnostic applications	10
A. Molecular Techniques used for diagnosis of diseases	
i. Polymerase Chain Reaction	
ii. R.F.L.P. [Restriction Fragment Length. Polymorphism]	
iii. RAPD [Randomly Amplified Polymorphic DNA Technique.]	
iv. 16S-rRNA Gene sequencing	
v. Fluorescence <i>In Situ</i> (FISH) in diagnostic Microbiology	
B. Sequencing and mutagenesis	08
i. Basic DNA sequencing	
ii. DNA sequencing techniques	
iii. Analyzing sequence data	
iv. Changing genes-site directed mutagenesis.	
C. Microbial Infection Imaging, a novel diagnostic approach	04
D. Diagnosis of 'Transmissible Spongiform Encephalopathy Agents'	06

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1. Norris, J.R. and D.W. Ribbons. (1972). Methods in Microbiology, Volume 7, Part Academic Press .
2. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
3. David A. Jackson, Stephen P. Stitch, (1979). Recombinant DNA Debate
4. Hartl. D.L. E.W. Jones. (1999) Essential Genetics, 2nd Edition. Jones and Bartlett publishes. Sudbury Massachusetts.

5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and company, New York.
6. Russel. P.J. (2006) Genetics: A molecular Approach. 2nd Edition. Pearson Benjamin Cummings.
7. Russet P.J. (1998) Genetics fifth. Edition. Addison Wesley Longman. Inc.
8. Snyder L and W. Champness (2003) Molecular Genetics of Bacteria Second Edition. ASM Press. Washing ton D.C.
9. Stanley R. Maloy, John E. Cronan, David Freifelder (1994). Microbial Genetics Jones and Bartlett Publishers.
10. Tamarin R.H. (2003) Principles of Genetics, 2nd Edition. Tata McGraw Hill Edition.
11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell publishing.
12. Watson, J. D. (2007) Recombinant DNA: Genes and Genomes: A Short Course Publisher, W. H. Freeman, Edinburgh: Blackwell Scientific Publications.
13. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford- by

**T.Y.B.A.; B.Sc.; B.Sc. Computer Science and Commerce
(CBCS 2018 COURSE) SEMESTER – V: Foundation Course
UGF 51: Soft Skills**

Credits: 02

Lectures : 30

Course Learning Outcomes:

After completion of this course students should be able to:

Course Content:

Soft Skills: Meaning and definition; Employability skills, Life skills, Corporate skills.

1. Developing positive attitude: Ethics, Values, Manners & Etiquettes
2. SWOT analysis and Career Planning: Strengths, Weaknesses, Opportunities and Threats
3. Communication: Concept of communication; Written as well as Spoken; body language
4. Curriculum Vitae, Resume, Bio-Data: Types of personal and educational information, preparing CV according to the job requirements
5. Interview Techniques: Types of interviews, Personal appearance, basic research, Confidence, knowledge preparation, interview style
6. Time Management: Competency-building skills; identifying use of time, management of on-time task, identifying reasons for poor time management, and taking corrective action; overall time-planning; and learning where to go for information or guidance
7. Stress Management: coping with stress and anger; recognizing/understanding others' point of view; problem solving; peer negotiation and resistance; conflict management; active listening and effective communication; acceptance and/or tolerance of diversity groups; and telephone skills
8. Teamwork and Leadership: Group discussion, effective communication skills, Group behaviour, helping nature
9. Developing work culture: sincerity, negotiation techniques, summarizing information; summarizing information about specific points; organizing studies

* * *

Reference

1. Covey Sean, *Seven Habits of Highly Effective Teens*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
3. Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006
4. Fredrick H. Wentz, *Soft skills Training – A workbook to develop skills for employment*
5. Barun K. Mitra *Personality Development and Soft skills*, Oxford University Press

T.Y.B.Sc. PHYSICS (CBCS-2018)
SEM.- VI
P-61: CLASSICAL ELECTRODYNAMICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Students will know the concepts of classical electromagnetism and demonstrate a proficiency in the fundamental concepts in this area of Physics
- Students will have strong physical reasoning and problem solving skills and apply these skills to the solution of theoretical and applied problems
- Student will be able to use classical electrodynamics to understand modern science
- Ability to formulate and solve electrodynamics problems
- Student will acquaint with the technique of deriving and evaluating formulae for the electromagnetic fields from very general charge and current distributions

Course Content:

1. Electrostatics: (24)

Electrostatic field in vacuum, principles of superposition, electrostatic potential, potential produced by continuous charge distribution

Gauss Law the average potential over a spherical surface in a charge free region, fields produced by some simple charge distribution such as (1) spherical surface (2) infinite sheet of charge on conducting plate and (3) electric dipole.

Poisson's and Laplace's equations, boundary conditions on potentials and field, solution of boundary value problem in Cartesian and spherical coordinate system. Method of images: a point charge near a conducting grounded infinite plane, a point charge near a grounded conducting sphere and insulated charged sphere

Concept of displacement vector, polarization vector, electric field vector at exterior and interior points of dielectric medium, concepts of true and induced charge density, electric susceptibility and dielectric constant

Boundary conditions at the interface of two dielectric media, Boundary value problems in dielectrics. Calculations of electrostatic field involving dielectric e.g. parallel plate capacitor and sphere.

2. Magnetostatics: (22)

Lorentz force on a point charge moving in magnetic field, Biot-Savart law, magnetic induction B due to a current in long straight wire and a circular loop, magnetic induction between two long current carrying wires and Helmholtz's coil. Axial magnetic field of a solenoid. Magnetic force between two current carrying loops, Ampere circuital theorem, long cylindrical current carrying wire and coaxial cable

Magnetic vector potential A , magnetic energy in terms of B , J , A , V and magnetization vector M , calculation of magnetic field at a point inside and outside the sphere placed in magnetic field.

3. Electrodynamics:**(14)**

Faraday's laws of induction in integral and differential form, modified amperes circuital law, Maxwell's equations in differential and integral form

Wave equations in free space, solution of wave equation for plane wave in free space. Poynting vector in free space, electromagnetic energy, Reflection and refraction of plane wave from nonconducting boundaries (normal incidence only)

Reference Books:

1. Foundation of electromagnetic theory - by Reitz and Milford.
2. Introduction to electrodynamics - by D. J. Griffiths.
3. Electrodynamics - by Gupta, Singh and Kumar.
5. Electrodynamics - by B. B. Laud.
4. Electrodynamics - by Chopra, Agrawal.
6. Feynman lectures series No. II - by B. J. Publication
7. Classical Electrodynamics – by J. D. Jackson.

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****P-62: ATOMIC & MOLECULAR PHYSICS****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Students will understand the comparing between atomic emission spectroscopy and atomic absorptionspectroscopy
- Concept of Raman Spectroscopy
- Concept of X-ray Spectroscopy
- Student will be able to apply approximation techniques involved in the calculations concerning energy level corrections
- Understand the autoionization process
- Understand the nature of the various internal molecular degrees of freedom

Course Content:

- 1. Atomic structure: (12)**
Rutherford model of atom, Electron orbits, Bohr atom, Energy levels and spectra (1 to 4 evision), Vector atom model (Concepts of space and quantization and electron spin), Atomic excitation and atomic spectra, Problems Ref 1 ch4
- 2. One and two valence electron systems (12)**
Pauli Exclusion principle and electron configuration, quantum states, Spectral notations of quantum states, Spin-Orbit Interaction (Single valence electron atom), Energy levels of Na atom, selection rules, spectra of sodium atom, sodium Doublet.
- 3. Two valence electron systems (10)**
Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ coupling schemes, Singlet Triplet separation for interaction energy of LS coupling. Lande's Interval rule, spectra of Helium atom, Problems Ref 1 ch7 Ref. 2 ch8 and ch12
- 4. X ray spectroscopy (08)**
Nature of Xrays, Discrete and continuous Xray spectra, Daune and Hunt's Rule, X-ray emission spectra, Mosley's law and its applications, Auger effect, Problems Ref 2 ch16
- 5. Molecular spectroscopy (08)**
Rotational energy levels, Vibration energy levels, Rotational and Vibrational spectra, Electronic spectra of molecules Problems Ref 1 ch8
- 6. Raman spectroscopy (10)**
Classical theory of Raman Effect, Molecular polarizability, Quantum theory of Raman Effect Experimental set up for Raman Effect, Applications of Raman spectroscopy Ref 3 ch4

Reference Books

1. Concepts of Modern Physics 4th edition Arthur Baiser (McGraw Hill International edition)
2. Introduction to Atomic spectra White.H.E (McGraw Hill International edition)
3. Fundamentals of Molecular spectroscopy, C.N.Banwell and E.M McCash (McGraw Hill International edition)
4. Modern Physics, J.B.Rajam

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****P- 63: NUCLEAR PHYSICS****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Student will be able to understand the basic properties of nuclei and the atomic nucleus
- Describe the radioactivity and related phenomena
- Explain the various interactions of nuclear radiation with matter
- Understand the fission and fusion reactions and their applications
- Understand nuclear interactions and elementary particles involved in the interactions
- Student will also attain practical skills to evaluate specific nuclear physics parameters
- Student will gain basic knowledge about nuclear physics concepts as well as about different possibilities of nuclear physics applications in technology and medicine.

Course Content:

- 1. Understanding of Nucleus (14)**
Composition, charge, size, density of nucleus, Nuclear Angular momentum, Nuclear magnetic dipole moment, Electric quadrupole moment, parity and symmetry, Mass defect and Binding energy, packing fraction, classification of nuclei, stability of nuclei (N Vs Z Curve) and problems.
- 2. Radioactivity: (14)**
Radioactivity disintegration, concept of natural and artificial radioactivity, Properties of α , β , γ rays, laws of radioactive decay, half-life, mean life, specific activity and its units, successive disintegration and equilibria and radioisotopes, applications of radioactivity (mechanical, biological etc.) Problems Ref 1 ch (8), Ref 2 – ch (15) Problems Ref 4 ch (27, 29)
- 3. Nuclear reactions: (10)**
Theories of nuclear reactions based on nuclear models, conservation laws, Q-value equation, exoergic and endoergic reactions, threshold energy in endoergic reactions,
- 4. Nuclear energy: (10)**
Nuclear fission, nuclear fusion, energy available from fission, controlled chain reactions, nuclear reactors (heterogeneous, swimming pool, breeder reactors)
- 5. Particle Accelerator and Detectors (12)**
Introduction to particle Accelerators, Linear (electron/proton Linac) Cyclic (Cyclotron), Classification of Nuclear Detector, Gas filled Detectors (G. M. counter), Solid state detectors (NaI(Tl) scintillation counter) Problems Ref 1 ch (7, 12)

Reference books

1. Introduction to Nuclear Physics H.A. Enge (Addison Wesley co.)
- 2 The Atomic Nucleus R.D. Evans (Tata McGraw Hill co.)
- 3 Concepts of Nuclear Physics – B.L. Cohen (Tata McGraw Hill co.)
- 4 Schaum's Outline Series Modern Physics R. Gaur (McGraw Hill co.)
- 5 Introduction to Nuclear Physics, S. B. Patel
- 6 Atomic and Nuclear Physics Shatendra Sharma (Pearson Education, 1st Edition)
- 7 Nuclear Physics Kaplan (Narosa Publishing House)
- 8 Introduction to Nuclear Physics Y.R. Waghmare (Oxford IBH.)

T.Y.B.Sc. PHYSICS (CBCS-2018)
SEM.- VI
P-64: COMPUTATIONAL PHYSICS

Total Credits: 04

Total Lectures: 60

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

- Student will gain the basic knowledge of numerical methods
- Understand the basic programming skills
- Understanding of the applicability of numerical methods for modeling physical systems and its advantages and disadvantages
- Demonstrate skills to use numerical methods for modeling physical systems
- Demonstrate the ability to estimate the errors in the use of numerical methods
- Demonstrate skills to write and develop simple programs in MATLAB

Course Content:

- 1. Introduction: (14)**
 Introduction to computer, block diagram of computer, introduction to algorithm and flow chart Programming languages (1) lower level languages (machine and assembly language), higher level languages (need and utility against lower level languages, various higher level languages and their applications), History of 'C' language, introduction to C programming language
- 2. C fundamentals: (12)**
 Structure of 'C' program, C character set, identifies and keywords, data types, constants and variables, array declaration, expressions statements, symbolic operators, Types of operators, library functions.
- 3. Data input and output: (04)**
 Single character input/output functions - print(), scan(), getchar(), single character function, putchar(), get(n), gets(), puts()
- 4. Control statements: (10)**
 The WHILE statement, DO-WHILE statement, FOR statement, nested loop, IF-ELSE statement, BREAK statement, CONTINUE statement, SWITCH statement, GOTO statement, 'C' programming based on control statements
- 5. Array and pointers: (10)**
 Defining an array, declaring an array, 1D and 2D, processing an array, passing an array to function, multidimensional array, string (character array), fundamentals of pointers, pointer declaration, passing a pointer to a function
- 6. Functions and program structure: (04)**
 Definition of function, accessing a function, passing an argument to a function, functions prototypes, recursion, storage classes
- 7. Computer graphics: (02)**
 Introduction to graphics, some simple graphic commands
- 8. Computational Physics: (04)**
 To find the roots of an algebraic equation, Bisection method, errors in computation, Iterative methods: Discussion of algorithms and flow charts, Writing 'C' programs.

Reference books

1. The C programming language - by B. W. Kerningham and D. M. Ritchie.
2. Programming with C - by Schaum's outline series.
3. Introduction to methods of numerical analysis - by S. S. Shastri.
4. Let us C - by Y. Kanetkar.
5. Computer orientation numerical methods:- V. Rajaraman

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****P-65: THERMODYNAMICS & STATISTICAL PHYSICS****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Student will have thorough knowledge on different classical and quantum mechanical distribution functions
- Can explain the procedures for deriving the relation between thermodynamic parameters such as pressure, temperature, entropy and heat capacity from the distribution functions.
- Can explain phase transitions and magnetization in magnetic systems
- Can analyze phase diagrams, phase transitions and explain the different concepts in statistical Physics
- Can apply the methods of statistical physics in other fields of physics and related fields.

Course Content:

- 1. Kinetic Theory of Gases (12)**
Introduction, Fundamental assumptions of Kinetic theory of gases, kinetic interpretation of temperature, Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion, Problems
- 2. Maxwell's thermodynamic relations: (12)**
Basic ideas of thermodynamic functions- internal energy, enthalpy, helmholtz free energy fuction, Gibb's potential energy fuction, Maxwell's relations, applications of Maxwell's relations- first, second and third Tdsequations, Energy equations, difference in heat capacity foe ideal gas and real gas, ratio of heat capacities, variation of Cp with volume and variation of Cv with pressure, Problems
- 3. Joule-Thomson effect: (12)**
Joule- Thmoson effect and its applications- Production of low temperature, Porousplug experiment, observations and theory for J-T expansion (cooling effect) for ideal gas, expression of inversion temperature real gas, Liquefaction of gases- principle of regenerative cooling, air liquifier, liquification of Helium, strides toward the asolute Zero-adiabatic demagnetization, experimental set up and thermodynamics of the process, Problems
- 4. Elementary Concepts of Statistics: (10)**
Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem, Calculation of mean values, Probability distribution for large-scale N, Gaussian probability distributions,
- 5. Statistical Distribution of System of Particles: (08)**
Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions
- 6. Statistical Ensembles: (08)**
Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of Canonical ensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble

Reference books

1. Heat and thermodynamics - by Zeemansky.
2. Heat and thermodynamics - by Brijlal and Subramaniam
3. A text book of heat and thermodynamics - by Shah and Shrivastav.
4. Fundamental of statistical physics and thermal physics - by Reif.
5. Statistical physics - by Laud.
6. Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.
7. Statistical and Thermal physics, By Lokanathan, R.S. Gambhir,
8. Perspectives of modern physics, - By A. Beiser
9. A primer of Statistical Mechanics, - By R.B. Singh
10. Statistical Mechanics, - By Gupta, Kumar

T.Y.B.Sc. PHYSICS (CBCS-2018)
SEM.- VI
P-66: PRACTICAL COURSE – VIII

Total Credits: 02

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

1. Understanding of working of microphone/speaker
2. Study of measurement of unknown frequency of typical tuning fork
3. Determination of wavelength of LASER by grating and cylindrical obstacle method
4. Concept of double refraction using Prism
5. To measure the refractive index of glass and liquid
6. Understanding of concepts of cardinal points and focal length in optics

Course Content:

1. Determination of velocity of sound in liquid by ultrasonic interferometer.
2. Determination of unknown frequency of tuning fork/AC
3. Characteristics of microphone/loudspeaker
4. Frequency response of loudspeaker (twitter, woofer, mid-range)
5. Determination of wavelength of He-Ne laser by using grating.
6. Study of double refraction phenomenon of prism.
7. Determination of wavelength of He-Ne laser by cylindrical obstacle.
8. Study of the characteristics of a laser beam.
9. R.I. of glass and liquid by total internal reflection.
10. Determination of unknown wavelength of a given source using Lloyd's single mirror.
11. To determine the resolving power of grating.
12. To estimate the temperature of sodium flame.
13. Determination of cardinal points of given lens by Searle's Goniometer.
14. Determination of various focal lengths of zone plate and wavelength of light used.
15. Determination of refractive index of liquid using hollow prism.
16. Study of interference by Quinck's method

Note: At least 8 experiments should be performed from the course

T.Y.B.Sc. PHYSICS (CBCS-2018)
SEM.- VI
P-67: PRACTICAL COURSE – IX

Total Credits: 02

Course Learning Outcomes:

By the end of this course student will be able to have following learning outcomes,

1. Understanding of X-ray diffraction technique
2. Understanding of Einstein's photo-electric relation using photocell.
3. Basics of C-programming for calculation of prime numbers, matrix addition and multiplication, numbers, graphics etc.
4. Study of Nano-particles

Course Content:

1. Study of XRD spectra of any matter
2. Study of optical absorption of nanoparticles.
3. Write a program to find out the first 100 prime numbers
4. Write a program to find Matrix multiplication / addition
5. Verification of Einstein's photo-electric relation using photocell (Determination of h)
6. Position time data using kinematic equations
7. To Find the pressure using Vander Waals' equation of state
8. Write a program to find maximum/minimum number in a set of given numbers.
9. Write a program to sort an array in ascending/descending order
10. Write a program to find the sum of digits.
11. Write a program to find Decimal to binary conversion.
12. Write a program to display the string in reverse order.
13. Write a program to find out whether given number is prime number or not.
14. Write a program for Graphics (line, circle, arc, ellipse, bar, draw poly)
15. **COMPUTER INTERFACED PHYSICS EXPERIMENTS/INSTRUMENTATION**
 1. Charging and discharging of capacitor and RC time constant
 2. Measurement of g using simple pendulum
 3. Velocity of sound
 4. Radiation detection
 5. IV Characteristics of diode
 6. Temperature controller using AD590
 7. Study of IC 7490 as mod 2, mod 5, mod 7 and mod 10 counter

Additional Activities (Any One)

1. One educational tour with report equivalent to two experiments
2. Demonstrations: any two demonstrations equivalent to two experiments
3. Mini project equivalent to two experiments
4. Use of plagiarism software to find plagiarism in research work.

Note: Students have to perform at least one additional activity in addition to eight experiments.

T.Y.B.Sc. PHYSICS (CBCS-2018)
SEM.- VI
P-68: PRACTICAL COURSE – X
(PROJECT WORK)

Total Credits : 02

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****Elective II (Student should select any one of the following subject)****P-69A: Elective II (A) Renewable Energy Sources****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Describe the environmental aspects of non-conventional energy resources
- Understanding the need of renewable energy resources, historical and latest developments
- Describe the use of solar energy and the various components used in the energy production
- Understanding the need of wind energy and the various components used in energy generation
- Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

Course Content:

- 1. An Introduction to Energy Sources: (14)**
Conventional and non-conventional sources of energy, Structure and characteristics of sun, Solar Constant, Electromagnetic energy spectrum, Solar radiations outside earth atmosphere, Solar radiation at the earth surface, problems.
- 2. Photothermal Applications: (14)**
Liquid flat plate collector, construction and working, Energy balance equation (without thermal analysis) , Concentrating collectors, Advantage and disadvantage, Solar distillation, Solar drying, Solar cooker(box type), Solar water heating systems.
- 3. Photovoltaic systems: (12)**
Introduction , Photovoltaic principle, Power output and conversion efficiency, Limitation to photovoltaic efficiency, Basic photovoltaic system for power Generation, Advantages and disadvantages, Types of solar cells, Application of solar photovoltaic systems.
- 4. Energy from Biomass: (10)**
Introduction , Bio -mass conversion technologies , Bio-gas generation Factors affecting bio-digestion (list of factors) , Methods for obtaining energy from biomass, Thermal gasification of biomass , Working of downdraft gasifier , Advantages and disadvantages of biological conversion of solar energy
- 5. Wind Energy (06)**
Introduction, Classification and description of wind machines, Wind data
- 6. Photocatalysis: (04)**
Introduction, Concept of Photocatalysis, Photocatalysis materials its advantages.

Reference Books:

1. Non-conventional Energy sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc.Graw Hill Ltd, New Delhi.
3. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.

List of Experiments:

1. Fuel value of wood/charcoal.
2. Study of sensible heat storage using liquid.
3. Selective and Non-selective coatings – Determination of Selectivity ratio.
4. Thermal efficiency of liquid – flat plate collector.
5. Study of box type solar cooker.
6. Determination of instantaneous thermal efficiency of parabolic collector.
7. Efficiency and fill factor of solar cells.

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****P-69B: Elective II (B) Physics of Nanomaterials****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Students will be able to explain the effects of quantum confinement on the electronic structure and corresponding physical and chemical properties of materials at nanoscale.
- Choose appropriate synthesis technique to synthesize quantum nanostructures of desired size, shape and surface properties.
- Ability to correlate properties of nanostructures with their size, shape and surface characteristics.
- Will be able to appreciate enhanced sensitivity of nanomaterial based sensors and their novel applications in industry.
- Student will gain understanding of different characterization techniques

Course Content:

- 1. Introduction to nanomaterials: (14)**
Introduction to nano-sized materials and structures, Brief history of nanomaterials and challenges in nanotechnology, Significance of nano-size and properties, classification of nanostructured materials
- 2. Methods of synthesis of nanomaterials: (14)**
Bottom-up and Top-down approaches, Physical methods: High energy ball milling, Physical vapour deposition, Ionized cluster beam deposition, sputter deposition, Ultrasonic spray pyrolysis etc. Chemical methods: colloidal method, co-precipitation and sol-gel method Hybrid method: Electrochemical and chemical vapour deposition.
- 3. Characterization techniques: (12)**
UV- visible spectroscopy, X-ray diffraction, Scanning electron microscopy, Transmission electron microscopy
- 4. Properties of nanomaterials: (08)**
Mechanical, Electrical, Thermal, Optical, solubility, melting point and Magnetic properties
- 5. Special nanomaterials: (06)**
Carbon nanotubes, quantum dots, Nanocrystalline ZnO and TiO₂
- 6. Applications: (06)**
Nanoelectronics, Medical, Biological, Automobiles, Space, Defense, Sports, Cosmetics, Cloth industry etc

Reference Books:

1. Nanotechnology: Principles and Practices: Sulbha Kulkarni, Capital Publishing Co. New Delhi.
2. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Ownes, Willey Publications.
3. Origin and development of nanotechnology: P.K.Sharma, Vista International publish house.
4. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao, Imperials College Press, London.

List of experiments:

1. Synthesis of metallic nanoparticles by wet chemical method.
2. Study of optical absorption of nanoparticles.
3. Determination of nanoparticles size from X-ray diffraction spectra.
4. Synthesis of silver nanoparticles from silver nitrate by reduction using surfactant

T.Y.B.Sc. PHYSICS (CBCS-2018)**SEM.- VI****P-69C: Elective II (C): Digital Electronics II****Total Credits: 04****Total Lectures: 60****Course Learning Outcomes:**

By the end of this course student will be able to have following learning outcomes,

- Students will be able to distinguish between analog and digital systems
- Understand the various registers used in the circuits and their operation
- Understanding of how memory devices works
- Knowledge of analog to digital conversion concepts and mechanism

Course Content:

- 1. Memory devices and memory Organization (16)**
Types of Memory – volatile and nonvolatile, SRAM and DRAM, Classification and Working principle of memory devices; RAM, ROM, PROM, EPROM, and EEPROM, UVEPROM, Flash RAM; Concept of Diode Matrix ROM, speed and cost range of memory devices, Memory organization - building the required memory size by using available memory chips, memory address map
- 2. Registers (08)**
Buffer, left shift, right shift, SISO, SIPO, PISO, PIPO Registers Study of IC 74194, 74195, 74198
- 3. Information in digital form (08)**
bit, nibble, byte, word concepts, problems in communication of digital data, codes –Straight binary code, Natural BCD code, Excess-3 ,gray, alphanumeric code, Error detection and correction code
- 4. Encoders (08)**
Construction, working and application, Decoders construction, working and application, Study of encoder & decoder IC
- 5. Need and advantages of Digital system (20)**
Need of analog to digital, digital to analog converters, Parameters for converter, DAC-weighted Resistor and its limitations, R-2R ladder, specification of D/A converter. Calibration of DAC circuit .Study of DAC IC ADC-principle of conversion, sampling theorem, quantization and encoding, parallel comparator A/D , Successive-approximation A/D, Counting A/D, Dual slop, Specifications of A/D converter, calibration, Study of A/D ICs ,

Reference Books

- 1) Digital Electronics by R.P.Jain
- 2) Basic Electronics by B.L.Theraja
- 3) Electronic Principles by Malvino
- 4) Computer architecture and organization by Rifiqzaman and Chandra
- 5) The Intel Microprocessor by Barry.B.Brey

List of Experiments:

- i) Study of diode matrix ROM
- ii) Study of Analog to Digital Convertor
- ii) Study of Encoder
- iv) Study of IC 7495 as Shift Register.
- v) Study of R-2R Digital to Analog Convertor

T.Y.B.Sc. (CHEMISTRY) (CBCS-2018 Course)**SEMESTER - VI****C - 61 : PHYSICAL CHEMISTRY-II****Credits: 04****Lectures : 60****Course Learning Outcomes:**

After completion of this course students should be able to:

1. Study the rotational, vibrational, electronic and Raman spectra.
2. Write various nuclear reactions and kinetics of each reaction.
3. Analyse the crystal system.

Course Content:**1. Physical Properties and Molecular Structure. (14 Lectures)**

Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment – temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties – paramagnetism, diamagnetism and ferromagnetism.

2. Molecular Spectroscopy (18 Lectures)

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum

Infrared spectrum : energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of difference functional groups.

Raman Spectrum:

Concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

[Ref, 1: Pages 691-710, Ref, 2: 398-424]

3. Solid State Chemistry (14 Lectures)

Introduction, space lattice, lattice planes, unit cells.

Laws of crystallography: (i) Law of constancy of interfacial angles(ii) Law of rational indices. (iii) Law of crystal symmetry.

Weiss indices and Miller indices.

Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacings of lattice planes.

Diffraction of X-rays, derivation of Bragg's equation.

Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

[Ref, 1: Pages 67-85]

4. Nuclear Structure and Radioactivity**(14 Lectures)**

The atom, its nucleus and outer sphere, classification of nuclides, nuclear stability, binding energy, discovery of radioactivity, types of radioactivity, general characteristics of radioactive decay, decay kinetics.

Measurement of radioactivity, gaseous ion collection method, proportional counter, G.M.counter.

Radiochemical principles in the use of tracers, typical applications of radio isotopes as tracers : (a) Chemical investigation (b) Reaction mechanism (c) Structure determination (d) Age determination.

[Ref, 4: Pages 4-15, 117-119, 121-125, 371-378]

Reference Books:

1. Principles of Physical Chemistry by S.H.Marron and C.FPrutton. 4thedition.Oxford and IBH Publishing Co. Pvt Ltd.
2. Elements of Physical Chemistry by S.Glasstone and D.Lewis. 2ndedition.McMillan Education.
3. Physical Chemistry by N. Kundu and S.K. Jain, S. Chand and Co. Ltd. 1987.
4. Essentials of Nuclear Chemistry by Prof. H.J. Arnikar, Willey Eastern Ltd.
5. University General Chemistry, C.N.R. Rao, MacMillan.
6. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
7. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
8. Physical Chemistry Through problems, S.KDogra and S. Dogra, Walley Eastern Ltd.

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T.Y.B.Sc (CHEMISTRY) (CBCS-2018)
SEMESTER - VI
C - 62 : INORGANIC CHEMISTRY –II

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Get the knowledge of MOT.
2. Know the electronic of metals and semiconductors.
3. Understand the role catalyst in various chemical reactions.
4. Study the chemistry at Lanthanides and Actinides.
5. Analyze the effect of toxic chemicals and biochemical reactions.

Course Content:

1. Molecular Orbital Theory: (15 Lectures)

L. C. A. O. method (Approach), Combination of s-s, s-p, p-p, p-d and d-d orbitals, Nonbonding atomic orbitals, combination of orbitals, Rules for linear combination of atomic orbitals, Qualitative M.O. energy level diagrams for homonuclear diatomic molecules of first row and second row elements, M.O. energy diagrams for three centre - two electron (3c - 2e) bond, M.O. energy diagrams for heteronuclear diatomic molecules like NO, CO and HCl, M. O. energy level diagrams for CO₂, Comparison of V. B. and M. O. bond approach.

Ref. 2: Pages 89-112, 106-117

Ref. 4: Pages 55-72

2. Molecular Orbital Theory (MOT) of Coordination complexes (10 Lectures)

Introduction, M.O. treatment of Bonding in Octahedral complexes without pi bonding, Metal orbitals and Symmetry symbols, M.O. energy level diagram of complexes without pi bonding, Octahedral complexes with pi bonding, Ligand field theory, charge transfer spectra, Merits and Limitations of M.O.T. comparison of VBT, CFT & M.O.T.

Ref. 2: Pages 194 -236

Ref. 8: Relevant Pages

Ref. 9: Relevant Pages

3. Metals and Semiconductors (12 Lectures)

Introduction, metallic properties, Nature and theories of bonding in metals, Band theory of metals with respect to Na, Electronic energy bands, $n(E)$ and $N(E)$ curves,. Electronic conductivity of metals (monovalent, bivalent, trivalent), semiconductors and their types, effect of temperature and impurity on semiconductivity n-type and p-type semiconductors, semiconductivity in ZnO and NiO, Applications of semiconductors.

Ref. 7: Pages 209-221

Ref. 6: Related Pages

Ref. 13: Pages 73-85

4. Homogeneous Catalysis

(10 Lectures)

Introduction definition, types of homogeneous catalysts, properties of homogeneous catalysts, Catalytic Reactions such as:

- Wilkinson's Catalysis
- Zeigler Natta Catalysis
- Monsanto acetic acid synthesis

Ref. 3: 588-591

Ref. 6: Related Pages

Ref. 12: Pages 650-652 and 656-661

5. Chemistry of f block elements

(08 Lectures)

A) The Lanthanides:

Introduction, Position of Lanthanides in the periodic table, Electronic configuration, oxidation states, Lanthanide contraction & its effect, Occurrence & separation of Lanthanides by ion exchange method & solvent extraction method, Applications of Lanthanides, Misch metal.

B) The Actinides:

Introduction, Position of Actinides in periodic table, Electronic configuration, oxidation states, General methods of preparation of transuranic elements. Nuclear fuels, Gas mantle.

Ref. 2: Pages 859-863, 865-866, 874 – 875, 879-886, 891-893, 898-900

Ref.13: Pages, 632-642, 645-662

6 Chemical Toxicology:

(05 Lectures)

Introduction, Toxic chemicals in environment, Impact of toxic chemicals on enzymes, Biochemical effects of arsenic, cadmium, lead and mercury, Biological methylation

Ref.14: pages 158-167

Reference Books:

1. Introduction to Electrochemistry by Glasstone - 2nd edition.
2. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
3. Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS - 2nd edition.
4. Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.
5. Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3rd edition.
6. Chemistry by Raymond Chang - 5th edition
7. New Guide to Modern Valence Theory by G.I. Brown - 3rd edition
8. Co-ordination Compounds by Baselo and Pearson
9. Theoretical Inorganic Chemistry by Day and Selbin
10. Inorganic Chemistry by A. G. Sharpe - 3rd Edition
11. Principles of Bioinorganic Chemistry by S. J. Lippard and J. M. Berg, Panima Publishing Corporation, 1st Edn.
12. Inorganic Chemistry by J.E. Huheey, 4th Edn, Pearson Education.
13. Modern aspects of Inorganic Chemistry by H.J. Emeleus, A.G. Sharpe, 4th Edn, 6th Indian reprint.

T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)**SEMESTER - VI****C - 63 : ORGANIC CHEMISTRY-II****Credits: 04****Lectures : 60****Course Learning Outcomes:**

After completion of this course students should be able to:

1. Learn addition of carbanions to Carbonyl (C = O) group.
2. Study UV, IR & NMR spectroscopy.
3. Determine structure of compound by spectroscopic methods.

Course Content:**1. Addition of Carbanions to Carbonyl (C = O) group. (12 Lectures)**

- (a) Carbanion formation and stabilisation.
- (b) Carbanion reactions: -
 - (i) Aldol Condensation.
 - (ii) Henry reaction.
 - (iii) Perkin's reaction.
 - (iv) Claisen – ester Condensation.
 - (v) Dieckmann Condensation
 - (vi) Wittig reaction.

Ref.4 Sections: - 8.4.1, 8.4.4, 8.4.5, 8.4.6, 8.4.8, 8.4.11, 10.1 & 10.2 Pages: 219-231, 233, 234, 271–275

2. Introduction to Spectroscopy. (06 Lectures)

- (a) Meaning of spectroscopy, Nature of electromagnetic radiation, wavelength, amplitude, wave number and their relationship, frequency, different regions of electromagnetic spectrum.
- (b) Interaction of radiation with matter, excitation of molecules with different energy levels such as rotational, vibrational and electronic level.
- (c) Types of spectroscopy and advantages of spectroscopic methods.

Ref.6: - Sections: - 1.2, 1.3, 1.6, 1.7, 1.8, & 1.10

Pages: - 1 to 3, 7 to 11

3. Ultraviolet (UV) Spectroscopy. (10 Lectures)

- (a) Introduction: - Nature of UV spectrum, Beer's law, absorption of UV, radiations by organic molecules leading to different excitations.
- (b) Terms used in UV spectroscopy: - Chromophore, Auxochrome, Bathochromic Shift, Hypsochromic Shift, Hyperchromic and Hypochromic shifts.
- (c) Effect of Conjugation on a position of UV band.
- (d) Calculation of λ_{max} by Woodward and Fisher rule for dienes and enone systems.
- (e) Applications of UV Spectroscopy: -
 - (i) Determination of structure.
 - (ii) Determination of stereo chemistry (Cis & trans).

Ref. 6: - Section:- 2.1, 2.3, 2.7 to 2.15 ; Pages: - 13 to 15, 18 to 38

4. Infrared (IR) spectroscopy**(12 Lectures)**

- (a) Introduction: - Principles of IR, spectroscopy, fundamental modes of vibrations, types of vibrations.
- (b) Conditions for absorption of IR radiations, vibration of diatomic molecules.
- (c) Parts of I.R. Spectrum.
- (d) Characteristics of IR absorption of following functional groups such as alkanes, alkenes, alkynes, alcohols, halides, carbonyl compounds, amines, amides, aromatic compounds etc.
- (e) Effect of following factors on IR absorption: - Inductive effects, resonance effects & hydrogen bonding.
- (f) Applications of I.R. Spectroscopy: -
 - (i) Determination of structure.
 - (ii) Study of chemical reactions.
 - (iii) Hydrogen bonding.

Ref.6: Sections – 3.1, 3.4, 3.7., 3.8.

Pages: 46-51, 53, 54, 72 to 81, 86; Ref. 8 Pages : 1095 to 1103

5. Nuclear Magnetic Resonance (NMR) Spectroscopy.**(14 Lectures)**

- (a) Introduction: - Principles of PMR spectroscopy, magnetic & non magnetic nuclei, precessional motion of nuclei without mathematical details, nuclear resonance, chemical shift, molecular structure, shielding & deshielding.
- (b) Measurement of chemical shift.
- (c) TMS as reference & its advantages.
- (d) Spin – spin splitting and coupling constants.
- (e) Areas of signals.
- (f) Applications of PMR spectroscopy.

Ref. 6 Sections: 4.1 to 4.4 & 4.9

Pages: 95 to 98, 106 to 108

Ref. 8 Pages: 1065 to 1083

6. Spectral problems based on UV, IR & NMR**(06 Lectures)**

Spectral problems based on UV, I.R., NMR data and relevant problems from Ref. 1 & 8

Note:

- (i) Spectral data such as λ_{max} value, IR frequency, chemical shift and coupling constant should be provided to the students.
- (ii) Actual UV, IR, NMR spectra of some molecules should be shown to the students.

Reference books:

- 1) Organic Chemistry by Morrison and Boyd - 6th Ed. 1996.
- 2) Organic Chemistry by John McMurry – 5th Ed. Assian books 1999.
- 3) Organic Chemistry by Graham Solomans and Craig Fryhle - 7th Ed. 2002.
- 4) A guide book to reaction mechanism by peter sykes - 6th Ed.
- 5) Organic chemistry by I.L.Finar vol.II – 6th Ed. 1975.
- 6) Absorption spectroscopy of organic molecules by V.M.Parikh (1974).
- 7) Designing organic synthesis by stuart warron (1983).
- 8) Organic Chemistry by pine 5th ed. 1987.

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T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - VI
C - 64 : ANALYTICAL CHEMISTRY-II

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Study the principle, construction and working of GC.
2. Know the extended applications of chromatography.
3. Understand the theory of solvent extraction.
4. Solve the numerical on chromatography.

Course Content:

1. Solvent Extraction (12 Lectures)

Introduction, Principle of solvent extraction, Distribution coefficient, distribution ratio, Relation between Distribution coefficient and distribution ratio, factors affecting solvent extraction, percentage extracted, solvent extraction method, separation factor, batch extraction, counter current extraction, application of solvent extraction, numerical problems.

References: 3,4,7 relevant pages

2. Chromatography (12 Lectures)

Introduction and classification of chromatographic methods, Principle of chromatographic analysis with match box model, Theoretical plates and column efficiency, Theory, Principle, technique and applications of-Column Chromatography, Thin layer Chromatography, Paper Chromatography, Numerical Problems

Ref. 6,7,8 Relevant pages

3. **Gas Chromatography** (12 Lectures)

Introduction, Theory, Principle, GSC and GLC, Separation mechanism involved in GSC and GLC, Instrumentation of Gas chromatography, Working of gas chromatography, Gas chromatogram and qualitative-quantitative analysis, Applications of gas chromatography

Ref. 1.Pg. 167-174

Ref. 4.Pg. 454-464

Ref. 5 Pg. 624-640

4. **High Performance Liquid Chromatography** (12 Lectures)

Introduction, Need of liquid chromatography, Separation mechanism involved in adsorption and partition HPLC, Instrumentation and working of HPLC, Applications of HPLC, Introduction to super critical fluid chromatography

Ref. 6.Pg. 529-545

5. **Flame Emission Spectroscopy :** (12 Lectures) ³

Introduction, Principle, Theory, Instrumentation, Flame Photometers
– single beam & double beam instruments, Evaluation methods,
Applications in Qualitative & Quantitative analysis.

Ref. 3, Relevant pages

Reference Books:

Ref. 1 Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel

Ref. 2 Principles of Physical Chemistry 4th edition – Prutton and Marron

Ref. 3 Instrumental Methods of Chemical Analysis- Chatwal and Anand

Ref. 4 Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar

Ref. 5 Vogel's textbook of Quantitative Inorganic Analysis-4th edition Besset Denney, Jaffrey, Mendham

Ref. 6 Instrumental Methods of Chemical Analysis- 6th edition Willard, Merritt, Dean and Settle

Ref. 7 Analytical Chemistry by Skoog

Ref. 8 Introduction to Instrumental Analysis- R.D. Braun

T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - VI
C - 65 : INDUSTRIAL CHEMISTRY-II

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Learn classification, preparation of some commercial polymers and their importance.
2. Know chemistry of pharmaceutical industry .
- 3 . Understand various processes involved in manufacture nitrogen, phosphate and mixed fertilizers.
4. Study classification& manufacturing of various dyes.
5. Explain manufacturing of soap & types of detergents.

Course Content:

1. Polymer chemistry

(12 Lectures)

Classification of Polymers: Organic and Inorganic polymers

(a) Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamic and transport properties of polymer

b) Commercial polymers and their importance: (a) Nylon, polyesters (terylene and dacron), rubber, vulcanization of rubber, synthetic rubber, Bun 2-N rubber, copolymers of butadiene, PVC, acrylic, teflon, polyethylene and acrylonitrile; (b) Silicone polymers: silicone oils, rubber, grease and resin;

(c) Resins: Phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins, melamine-formaldehyde resins.

Ref. 2,3

2. Chemistry of pharmaceutical industries

(12 Lectures)

a. General aspects of drug action: Introduction, classification, nomenclature, structure-activity relationship, action of drugs, factors affecting drug action, metabolism of drugs, chemical structures, methods of production and pharmacological activity.

b. Meaning of the terms: Prescriptions, doses, analgesic, antipyretic, diuretic, anesthetics, antibiotics, anti-inflammatory, anti-viral, tranquilizer, antiulcer, antialergic and bronchodilators, cardiovascular, cold preparations, anti-hypertensive, cough preparation, anti-neoplastic, sedative and hypnotics, steroidal, contraceptive, histamine and antihistamine.

c. Synthesis and uses: Paracetamol, Aspirin, Sulphanilamide, Diazepam, Phenobarbital, Synthetic Penicilline.

Ref.1: P. No.762-775; Ref.4: P. No.803-804, 818-822 ; Ref.5: P. No.987-1011

3. Fertilizer Industry

(12 Lectures)

Definition, Importance of fertilizers, N.P & K ratio, Numerical problems on percentage of elements and percentage of purity, various nitrogenous fertilizers, manufacture of urea with flow sheets, various phosphate fertilizers, manufacture of triple super phosphate with flow sheet, mixed fertilizers, manufacture with flow-sheet diagram.

Ref.1 pages 590 – 612

4. Dyes

(12 Lectures)

- i) Introduction, Nomenclature, Fibers to be dyed, Basic operations of dyeing.
- ii) classification of dyes, Classification according to mode of application, Classification according to constitution.
- iii) Nitroso dye, Nitro dye, Azo dye, Acid Azo dye, methyl orange, methyl red, Basic azo dyes, Direct azo dye, mordant dye..

Ref. 1: P.No. 8-92; Ref.6: P.No. 15-30;

Ref. www.wikipedia.org/atom economy

5. Soaps & Detergents

(12 Lectures)

Soaps: - Introduction, Raw materials, manufacture of soap, varieties of soaps, cleansing action of soaps.

Detergents: - Introduction, classification, Anionic detergents, cationic detergents, Non-ionic detergents, Amphoteric detergents, Builders & Additives.

Ref. 1 and 6

Reference Book:

- 1) Industrial Chemistry – B.K.Sharma.
- 2) Chemistry and industry of starch, New York, N.Y., Academic Press, inc by Kerr, Ralph Waldo Emerson
- 3) The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
- 4) Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
- 5) Riegel's hand book of Industrial chemistry, 9th Edition, James A. Kent
- 6) Emergency Medicine: Chapter 146 Insecticides, Herbicides & Rodenticides, by James Adams
- 7) Industrial Chemistry. Arora & Singh.

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T.Y.B.Sc (CHEMISTRY) (CBCS-2018 Course)
SEMESTER - VI
C-69A ENVIRONMENTAL CHEMISTRY-II

Credits: 04

Lectures : 60

Course Learning Outcomes:

After completion of this course students should be able to:

1. Understand Composition, Micro-and Macronutrients;

Nitrogen pathways and NPK in soil; Wastes and pollutants in soil.

2. Study details about energy and environment.

3. Learn aspects food quality; The Green revolution; Pest control; Persistence of pesticides; Toxicity of pesticides; Mode of action of pesticides etc.

4. Know solid waste management.

5. Explore role of industries on water pollution

Course Content:

1. Our earth-Lithosphere

(10 Lectures)

Composition of Lithosphere/ Soil; Water and air in Soil; Inorganic and organic components in soil; Acid-base and ion exchange reactions in soil; Micro-and Macronutrients; Nitrogen pathways and NPK in soil; Wastes and pollutants in soil; Waste classification and disposal.

Reference 1; Pages 69-79.

2. Energy and Environment

(12 Lectures)

Mineral resources; Metals and non-metals; Wood-a major renewable resource; Fuel and energy resources (Coal, Petroleum and natural gas, nuclear fission and fusion, Solar energy, Hydrogen, Gasohol); World energy resources-consumption and conservation; Environmental management.

Reference 1; Pages 328-346.

3. Food and the Sustenance of Life

(12 Lectures)

Food Quality; The Green revolution; Pest control; Persistence of pesticides; Toxicity of pesticides; Mode of action of pesticides; Integrated pest management; Energy and agriculture; Carcinogenicity awareness.

Reference 2; Pages 440-469.

4. Solid Waste Management

(12 Lectures)

Population X Affluence X Technology; Municipal wastes; Sanitary landfills; Incinerators; Incineration of plastics; Pyrolysis; Biodegradation; Reclamation; Recycling; Reuse; Paper and cellulose fiber; Garbage; Grass and organic matter; Textiles, Plastics and rubber; Glass and ceramics; metals; The entropy ethics and solid waste; Beverage container industry; Automobile industry.

Reference 2; Pages 317-345.

5. Industries and Pollution**(14 Lectures)**

Sources of industrial water pollution; Heavy metals; Mercury; Minamata diseases, Bioamplification; The mechanism of mercury poisoning; Detection and abatement of mercury pollution; Chlor-alkali production; Paper mills and other industries like sugar industry. Concept of ISO 14000; Environmental clearance;

Reference 1; Pages 298-304, 316-317.

Reference Books:

1. Environmental Chemistry, A. K. De, Fourth Edition, New age International (P) Ltd., Publishers, New Delhi, 2000.
2. Environmental Chemistry, John W. Moore and Elizabeth A. Moore, Academic Press, New York, 1976.
3. Environmental Chemistry, S. E. Manahan, Willard Grant Press, Boston, Third Edition, 1983.
4. Chemistry and Man's Environment, E. D. Fuller, Houghton Mifflin Co., Boston, Third Edition, 1974.

T.Y.B.Sc. (CHEMISTRY) (CBCS- 2018)**SEMESTER - VI****C – 69B : NUCLEAR CHEMISTRY-II****Credits: 04****Lectures : 60****Course Learning Outcomes:**

After completion of this course students should be able to:

1. Understand Discovery of nuclear fission, process of nuclear fission, charge distribution, Fission energy & Theory of nuclear fission.
2. Study natural Uranium reactor, The breeder reactor , four factor formula & Classification of reactors.
3. Explain Principle and working of various accelerators.
4. Know Principle and working of Scintillation Counters , Semiconductor detectors & Neutron detectors.
5. Explore Probing by isotopes, typical reactions involved in the preparation of radioisotopes & Analytical applications.

Course Content:**1. Nuclear Fission****(12 Lectures)**

Discovery of Nuclear fission, The process of Nuclear fission, fission fragments, their mass distribution, fission energy ,fission cross-section and thresholds, fission neutrons,

Theory of Nuclear fission.

Ref.1: pages 240 to 259

2. Nuclear Reactors**(10 Lectures)**

Fission energy, the natural Uranium reactor,the four factor formula, classification of reactors. Breeder reactors, Ref.1: pages 266 to 277,

3. Nuclear Accelerators**(10 Lectures)**

Electrostatic Accelerators, The cockcroft-walton Accelerator,The Vande-Graft Accelerator, Cyclic Accelerator, linear Accelerator.

Ref: 2 Pages 290 to 305,325 to 330

4.Detection and measurement of Nuclear radiations .**(10 Lectures)**

Scintillation Counters , Semiconductor detectors, Neutron detectors.

Ref.2 Pages 211 to 222.

5.Applications of Radioactivity**(13 Lectures)**

Probing by isotopes, Typical reactions involved in the preparation of radioisotopes,Szilard- Chalmer reaction, Cow and milk system, Use of charged plates in the collection of radioisotopes, radiochemical principles in the use of tracers,

Analytical applications – Isotope Dilution Analysis, Neutron Activation Analysis, Radiometric Titrations

Ref.1 Pages 358 to 372, 391 to 397, 400 to 401

6. Radiation Safety precautions (05 Lectures)

Safety standards, safe working methods, biological effects of radiations

Ref.3 Pages 322 to 328

References :

1. Essentials of Nuclear Chemistry: Prof. H.J. Arnikaar, 4TH Edition, Wiley Eastern
2. Source book of Atomic energy : Samuel Glasstone, 3rd edition, East - West press
3. Nuclear Physics by Irving Kaplan 2nd edition
4. Introduction to Nuclear physics and chemistry B.G. Harvey

T.Y.B.Sc. (CHEMISTRY) (CBCS- 2018)**SEMESTER - VI****C – 59C : POLYMER CHEMISTRY-II****Credits: 04****Lectures : 60****Course Learning Outcomes:**

After completion of this course students should be able to:

1. Understand Polymer degradation.
2. Know Chemical & Geometrical structures of polymers.
3. Explain crystallinity in polymers.
4. Explore manufacturing of some important polymers & polymer processing.

Course Content:**1. Polymer Degradation (05 Lectures)**

Introduction, Types of degradation, Thermal degradation, Mechanical degradation, Photo degradation.

Ref 1 : Pages 262 – 277

2. Chemical and Geometrical structures of Polymer Molecules (03 Lectures)

Ref 1 : Pages 136 – 140 , 142 – 149

3. Glass Transition Temperature and Heat Distortion Temperature (05 Lectures) (Softening Point)

Definition, Factors influencing the Glass transition temperature, Glass transition temperature and molecular weight, Glass transition temperature and plasticizers, Glass Transition Temperature and Crystalline melting point (T_m), Importance of Glass transition temperature.

Ref 1 : Pages 150, 163 – 169 , 171 – 172, 219

Ref 5 : Relevant

pages Ref 9 : Page 06

Ref 10 : Pages 98,205

4. Crystallinity in polymers (05 Lectures)

Introduction, Degree of Crystallinity, Crystallisability, crystallites, Factors affecting crystallisability, Effect of crystallinity on the properties of polymers. Ref 1 : Pages 173-177, 180-183, 189-191

5. Analysis and testing of polymers (09 Lectures)

- a) Chemical analysis of polymers, degradation.
- b) Spectrochemical methods : IR, NMR
- c) Thermal analysis
- d) Physical testing : mechanical properties, Thermal properties, Optical properties, Electrical properties, Chemical properties.

Ref 2 : Pages 141-143, 229-237, 242-252

6. Some Important Polymers (10 Lectures)

Polypropylene, Polyacrylonitrile, Polyvinyl acetate and Polyvinyl alcohol, Polyisoprene, Polychloroprene, Phenol formaldehyde resin (Novalac), Urea formaldehyde & Melamine formaldehyde resins, Polyethylene glycol & Polypropylene glycol, Polyurethanes, Epoxy polymers. Silicone Polymers.

Ref 1 : Pages 217-218, 220, 229-231, 242-256

Ref 3 : Relevant Pages.

7. Some Special Polymers (05 Lectures)

Polymer blends, Biomedical polymers, Biodegradable polymers, Liquid crystalline polymers, Thermally Stable polymers, Conducting polymers.

Ref.9 : Pages 718-720

Ref.10 : Pages 262-284, 281-283, 285-299

Ref 11 : Pages 179,185,197

8. Polymer Processing (18 Lectures)

a) Plastic Technology

- 1) Molding 2) Extrusion 3) Other processing methods –
Calendering, Casting, Coating, Foaming, Forming, Laminating & low pressure molding, Compounding.

Ref 2 : Pages 457-469, 474-475.

Ref 1 : Relevant pages

b) Fibre Technology

- 1) Introduction, Textile & Fabric properties
- 2) Spinning- Melt spinning, Dry spinning, Wet spinning, Other spinning methods.
- 3) Fibre after treatments : Scouring, Lubrications, Sizing, Dyeing, Finishing,

Texture yarns, Nonwoven fabrics.

Ref 2 : Pages 486-501

Ref 1 : Relevant pages

c) Elastomer Technology

- 1) Introduction, Vulcanisation
- 2) Reinforcement

Ref 1 : Pages 506-518

Ref 2 : Relevant pages

REFERENCE BOOKS

1. Polymer Science by V.R.Gowarikar, N.V.Vishvanathan, Jaydev
Shreedhar New Age International Ltd. Publisher 1996.
2. Textbook of Polymer Science by Fred Billmeyer, 3rd Edn.
3. A Wiley-Interscience Publication John Wiley & Sons New York 1984.
4. Introductory Polymer Chemistry by G.S.Misra New
Age International Ltd. Publisher 1996.
5. Introduction to Polymer Chemistry by Raymond Seymour
International Student Edn. 1971.
6. Polymer Chemistry by Malcom P. Stevens
Oxford University Press 1990.
7. Inorganic Polymers by G.R.Chatwal Himalaya
Publishing House 1st Edn.1996
8. Principles of Polymerisation by George Odian 3rd
Edn. John Wiley & Sons New York.
9. Polymer Chemistry by M.G.Arora, M.Singh.
10. Introduction to Polymer Science and Technology by S.D. Dawande.
11. Principle of Polymer Science by P. Bahadur, N.V.Sastry.
12. Polymer Science – A Text Book by V.K.Ahluwalia, A. Mishra

**T.Y.B.Sc. (CHEMISTRY) (CBCS-2018
Course) SEMESTER - VI**

**C-66: PRACTICAL COURSE - VIII
(PHYSICAL CHEMISTRY)**

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

Course Content:

1. Compare the strength of HCl and H₂SO₄.
2. Determine molecular wt. of high polymer.
3. Use the modern instruments such as colorimeter, potentiometer, conductometer etc.
4. Determine the effect of addition of salt on CST.

GROUP-I

NON - INSTRUMENTAL EXPERIMENTS

A Chemical Kinetics

1. To compare the relative strength of HCl and H₂SO₄ by measuring the rates of hydrolysis of an ester.
2. To investigate the kinetics of hydrolysis of acetate using a dilatometer.
3. Investigate the influence of ionic strength on the rate constant between potassium persulphate and potassium iodide.
4. To study the energy of activation of second order of reaction between K₂S₂O₈ and KI.
(Equal concentration)
(Any two experiments)

B Viscosity

1. To determine the molecular weight of a high polymer using its solutions of different concentrations.

C Phenol-Water

1. To study the effect of addition of salt on critical solution temperature of phenol-salt system.

GROUP-II

INSTRUMENTAL EXPERIMENTS

A Potentiometry

1. Determination of P^H of unknown buffer solutions by potentiometric measurements.
2. Determination of dissociation constant of given monobasic acid by potentiometric titration.
(Any one experiments)

B Colorimetry.

1. Determine the λ_{max} and concentration of given CuSO_4 - NH_3 complex.

C Conductometry

1. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
2. To study the effect of substituent on dissociation constant of weak acid w.r.t. acetic acid & monochloroacetic acid.

D. pH Metry.

1. Determination of the dissociation constant of given weak acid by pH metric titration.

E Refractometry.

1. Determination of molar refraction of the given liquids A,B,C and D.
2. To verify law of refraction of mixtures(e.g., glycerol and water) using Abbe's refractometer.

G Polarimetry.

1. Study of kinetics of inversion of cane sugar using same strength of two acids.

Reference Books:

1. Experiments in Chemistry Dr.D.V.Jahagirdar, Himalaya Publishing House.
2. Systematic Experimental Physical Chemistry by S.W.Rajbhoj and Dr.T.K.Chondhekar, Anjali Publication Aurangabad.
3. Experimental Physical Chemistry, Daniel.Alberts.7th Edition.
4. Findlay's Practical Physical Chemistry B.P.Levitt.9th Edition.
5. Experiments in Physical Chemistry, R.C.Das and .Behra. Tata McGrawHill.
6. Advanced Practical Physical Chemistry, J.B.Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol1-Physical, J.N.Gurtu and R.Kapoor, S.Chand & Co.
8. Selected Experiments in Physical Chemistry N.G.Mukherjee. J.N.Ghose & Sons.
9. Experiments in Physical Chemistry, J.C.Ghosh, Bharti Bahavan.

**T.Y.B.Sc. (CHEMISTRY) (CBCS-2018
Course) SEMESTER - VI**

**C-67: PRACTICAL COURSE - IX
(INORGANIC CHEMISTRY)**

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

1. Study the gravimetric and volumetric analysis..
2. Estimate Mn by Volhard's method .
3. Determine Cu in CuSO_4 using std. 0.1N AgNO_3 solution

Course Content:

A) Gravimetric Estimations (Any Three)

1. Estimation of Ni as Ni – DMG
2. Estimation of Pb as PbCr_2O_4
3. Estimation of Al as Aluminum oxide
4. Estimation of Ba as BaSO_4 using homogeneous precipitation method.
5. Estimation of Fe as Fe_2O_3

B) Volumetric Estimations (Any Three)

1. Estimation of Mg from talcum powder
2. Analysis of Brass-Estimation of copper by Iodometry
3. Estimation of % purity of given sample of Sodium Chloride
4. Estimation of Mn by Volhard's method
5. Estimation of Copper in the given CuSO_4 crystals using standard 0.1N AgNO_3 solution.

C) Colourimetric Estimations (Any One)

1. Iron by thiocyanate method.
2. Cobalt by using R-nitroso salt method.

D) Column Chromatography (Any Two mixtures)

To separate cations of a given binary mixtures by Column chromatography.

Reference Books:

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset. 2 .Quantitative Chemical Analysis S. Sahay (S. Chand & Co.).
3. Quantitative Analysis R.A. Day, Underwood (Prentice Hall).
- 4.General Chemistry Experiment – Anil J Elias (University press).
- 5.Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
- 6.Vogel's Textbook of Quantitative Chemical Analysis.
- 7."Experimental Methods in Inorganic Chemistry." Tanaka, J. and Suib, S.L., Prentice Hall

**T.Y.B.Sc. (CHEMISTRY) (CBCS-2018
Course) SEMESTER – VI
C-68: PRACTICAL COURSE - X
(ORGANIC CHEMISTRY)**

Credits: 02

Course Learning Outcomes:

After completion of this course students should be able to:

- 1.Perform Binary mixtures

Course Content:

1. Organic Qualitative Analysis of Binary Mixtures (Minimum 8 mixtures)

(i) Solid – Solid (4) (ii) Solid – liquid (2) (iii) Liquid – liquid (2)

At least one mixture from each of the following types

(Acid-Base, Acid – Phenol, Acid – Neutral, Base – Neutral, Neutral - Neutral)

Note:

Students should report – nature, type, separation of mixture, physical constants of purified compounds, detection of elements, functional group tests (Name and structure of compound is not expected)

Reference Books:

- 1) Practical Qualitative Analysis by A.I. Vogel.
- 2) Advanced Practical Organic Chemistry by O.P.Agarwal.
- 3) Laboratory Manual in Organic Chemistry by R.K.Bansal, Wiley Eastern.
- 4) Experimental Organic Chemistry I & II by P.R.Singh, D.S.Gupta and K.S.Bajpal (Tata McGraw Hill)

**T.Y.B.Sc.
(BOTANY)
(C.B.C.S. 2018
Course)**

SEMESTER- VI

B-61: BIOLOGY OF CRYPTOGRAMS(BRYOPHYTES AND PTERIDOPHYTES)

Core Course – Theory; Credits- 04

Total lectures-

60 L Course Learning Outcomes :

On completion of this course, students are able to:

- Become aware of the status of higher cryptogams as a group in plant kingdom.
- Understand the habit and habitat of the higher cryptogams in the field.
- Understand the distinguishing features, interrelationships, phylogeny and evolutionary
- To understand tendencies of selected orders with their affinities.
- Realize the economic importance of higher cryptogams plants.

1. Bryophytes

24 L

Classification of Bryophytes.

Comparative account of classes of Bryophytes.

Evolution of gametophyte and sporophyte.

Ecological and economic importance of

Bryophytes. Study of life histories

of.....

- *Marchantia* (ii) *Anthoceros* (iii) *Polytrichum*

2. Pteridophytes

24 L

Origin of vascular

cryptogams. Classification

of Pteridophytes.

Study of life histories of *Psilotum*, *Lycopodium*, *Equisetum*, *Marsilea* and *Adiantum*.

Heterospory and seed habit.

Alternation of generations.

Telome theory and stelar

evolution

3. Fossil Pteridophytes

12 L

(a) Fossil – Definition and types; Process of fossil formation.

(b) Study of external and internal morphology of following fossil Pteridophytes.

(i) *Rhynia*(ii) *Lepidodendron*(iii) *Lepidostrobus*

(iv) *Lepidocarpon*(v) *Calamites*

- Pteridosperms - characters and significance

Reference Books:

1. Gifford, E.M. and Foster, A.S. 1989. Morphology and Evolution of Vascular Plants.W.H. Freeman &Co., New York.
2. Puri. P. 1985.Bryophytes.Atmaram& Sons, Delhi.
3. Parihar, N.S. 1991. Bryophyta.Central Book Depot. Allahabad.
4. Parihar, N.S. 1996. Biology & Morphology of Pteridophytes. Central Book Depot,Allahabad.
5. Sporne, K.K. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd.,Bombay.
6. Stewart, W.N. and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants.Cambridge University Press.

**T.Y.B.SC.
(BOTANY)
(C.B.C.S. 2018
Course)**

SEMESTER- VI

B – 62: BIOLOGY OF SEED PLANTS (GYMNOSPERMS AND PALEOBOTANY)

Core Course – Theory; Credits- 04

Total lectures-

60 L Course Learning Outcomes :

On completion of this course, students are able to:

1. Understand Gymnosperms with respect to distinguishing characters, comparison with Angiosperms, economic importance and classification.
2. Understand the life cycles of *Pinus* and *Gnetum*.
3. Know the scope of Paleobotany, types of fossils and geological time scale
4. Understand the various fossil genera representing different fossil groups
5. Understand the diversity of Gymnosperms in India.
6. Know the evolutionary trends and affinities of living gymnosperms with respect to external and internal characters .
7. Understand the important fossil types in different groups of plants and Indian fossil records.
8. Understand the important fossil types in different groups of plants and Indian fossil records.
9. Realize the applied aspects of Paleobotany.

Course Content:

1. Phanerogams: The seed bearing plants. General characters and types	06 L
2. Introduction to gymnosperms	13 L
General characters.	
Distribution in India.	
Classification according to Birbal Sahani and Chamberlain. Structure of ovule, megasporogenesis female gametophyte.	
Pollination, fertilization, embryogeny, maturation of seed & structure of seed.	
3. The living cycads	11 L
Distribution.	
Vegetative organography & anatomy.	
Reproductive cycle upto seed development with reference to <i>Cycas</i> & <i>Zamia</i> .	
4. Fossil Cycads: - Cycadeoidea (Bennettites)	07 L
Important characters.	
Morphology and anatomy of vegetative and reproductive structures.	
5. The Coniferales	10 L
General organography and anatomy.	
Reproductive cycle upto seed development with reference to <i>Pinus</i> & <i>Thuja</i>	

6. The Gnetales

13 L

- a) Habit and distribution.
- b) Reproductive cycle and advanced features with reference to *Gnetum*

Reference Books:

- 1) Bhatnagar S.P. and Moitra A. 1996. Gymnosperms, New age international Pvt. Ltd. New.Delhi.
- 2) K.R.Sporne. The morphology of Gymnosperms.
- 3) P.C.Vashishta – Gymnosperms.
- 4) Coulter J.M. & Chamberlain C.J. Morphology of Gymnosperms.
- 5) Cronquist, A. 1968. The evolution and classification of flowering plants. Thomas Nelson(Printers) Ltd., London & Edinburgh.
- 6) Delevoryas Th. 1965. Plant Diversification.modern biology series, Halt, Rinehart &Winston, New York.
- 7) Foster, A.S. and Gifford, A.E.M., Jr. 1967. Comparative Morphology of Vascular Plants.Vakils.Peffer& Simons Pvt. Ltd.
- 8) Spome, K.R. 1977. The Morphology of Angiosperms. B.I. Publication, Bombay.
- 9) Bhowani. S.S. and Bhatnagar, S.P. 2000. The Embryology of Angiosperms, 4th revisedand enlarged edition. Vikas publishing house, Deihi.
- 10) Johri B.M.1984, Embryology of Angiosperms. Springer-Verlag, Berlin.

T.Y.B.Sc. (BOTANY) (C.B.C.S. 2018 Course) SEMESTER-VI

B -63: ENVIRONMENTAL BOTANY

Core Course – Theory; Credits- 04

Total lectures-

60 L Course Learning Outcomes :

On completion of this course, students are able to:

- Know the nature and its co-relation with human society.
- Realize the impact of human activities on environment.
- Understand global issues concerned with
- Know the sustainable development and care of environment.
- Understand the connection between material wealth & resources exploitation.
- Worth the relationship between economic growth and environmental degradation.

1. Introduction	06 L
a) Inter-relationship between the living world and environment b) The components and dynamism c) Homeostasis, relevance to man	
2. The environment	10 L
a) Soil - general account and adaptations b) Water – general account and adaptations c) The atmosphere – general account and adaptations d) Living world – biotic components of environment e) Types of biotic interactions f) Fire as an ecological factor	
3. Organism ecology (Biotic components)	03 L
a) Individuals, species, populations b) Communities and their characteristics	
4. Ecosystem	07 L
a) Concept of ecosystem, homeostasis b) Structure and function of ecosystem c) Transfer of energy and minerals via grazing and detritus chains and role of microorganisms d) Cycles (hydrologic and gaseous) e) Role of human in maintaining biogeochemical cycle.	
5. Diversity of ecosystem	06 L
a) Aquatic (Freshwater) b) Terrestrial (Forest / grass land) c) Manmade ecosystem	
6. Phytogeography	05 L
a) Introduction b) Endemism c) Static and dynamic plant geography d) Short account of vegetation of India	
7. Human Ecology and ecological Management	07 L
a) The human population, renewable and non- renewable natural	

- b) Resources and their management
- c) Conservation of biodiversity, endangered species
- d) Conventional and non-conventional energy sources

8. Impact of human activities **06 L**

- a) Pollution of air, water & soil.
- b) A brief account of environmental toxicology
- c) Evidences of noise, thermal and radioactive pollution
- d) Control of pollution
- e) Global warming, desertification and ozone depletion

9. Role of national international organization in environmental management **04 L**
Formulation of optimal models.

10. Bio-indicators – concept, types and examples. **03 L**

11. Environmental impact assessment - A brief account

03 L Reference Books:

1. Ambasht, R.S. 1988. A text book of plant Ecology. Students Friends Co. Varanasi.
2. Botkin, D.B. and Keller, E.A. 2000. Environmental Planet (2nd ed.) John.Wiley&SonsInc. New York.
3. Chapman, J.L. and Resis.M.J. 1995. Ecology; Principal and application. CambridgeUniversity Press.
4. Cunningham W.P. and Saigo, S.W. 1997.Environmental Science; A Global Concern.WCB McGraw Hill.
5. Dash, M.C. 1993.Fundamental of Ecology.Tata McGraw Hill Publication Co. Ltd. NewDelhi.
6. Daubermire, R.F.1974. Plant and Environmental – a text book of Ecology (3rdEd.). JohnWiley & Sons,
i. New Delhi.
7. Kendeigh,S.C.1980. Ecology with special Reference to animals and Man. Prentice Hallof India Pvt Ltd.
i. New Delhi.
8. Kumar,H.D. 1996. Modern concept of Ecology (4thed.)Vikas Publication House Pvt.Ltd., Delhi.
9. Kumar,H.D. 1997. General Ecology Vikas Publication House Pvt. Ltd., Delhi.
10. Kormondy, E.J. 1996. Concept of Ecology Prentice Hall of India Pvt Ltd. New Delhi.

11. Miller, W.R. and Donahue, R.L. 1992. *Soils- An introduction of soil and Plant a Growth* (6th Ed.) Prentice
i. Hall of India Pvt Ltd. New Delhi.
12. Odum, E.P. 1996. *Fundamental of Ecology*. Natraj Publisher, Dehradun.
13. Pickering K.T. and Owen L.A. 1997. *An introduction to Global Envionmental Issues* (2nd)
Butter and
i. Tanner Ltd. Great Britain.
14. Smith L.R. 1996. *Ecology and field Biology* (5th Ed.) Harper Collins College
Publisher, USA.
15. Smith L.R. and Smith, T.M. 1998 *Elements of Ecology* (4th Ed.) An imprint of
Addison Wesley,
i. Longman Ink., California.
16. Tylar, M.G., Jr. 1997. *Environmental science ; Working with Earth* (6th ed.) Wadsworth
Publication
i. Co. Weaver J.E. and Clements, S.E. 1996. *Plant Ecology* Tata McGraw Publication Co.
Ltd. Bombay.

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course) SEMESTER-VI
B – 64: PALYNOLOGY AND PLANT BREEDING

Core Course – Theory; Credits- 04

Total lectures-

60 L Course Learning Outcomes :

On completion of this course, students are able to:

- Understand the science of plant breeding.
- Know branch of plant breeding for the survival of human being from starvation.
- study the techniques of production of new superior crop varieties.
- Understand the modern strategies applied in Genetics and Plant Breeding to sequence and analyze genomes
- Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pureline Selection and Clonal selection.
- Know about exploitation of Heterosis, hybrid and variety development and their release through artificial hybridization.
- Understand the role plants in human welfare. . .

Palynology

1. Pollen and Spore Morphology -

08 L

size and shape, polarity, apertures (NPC), exine stratification, exine excrescences, construction of a palynogram.

2. Study of different types of pollen grains with the help of acetolysis method (Any four locally available materials).

04 L

3. Application of Palynology in honey industry, coal and oil exploration and forensic science. Aeropalynology and pollen allergy.

06 L

4. Pollen viability and storage – Causes for loss of pollen viability, Tests for pollen viability, Pollen storage.

07 L

5. Germination and growth of the pollen tube, factors affecting pollen tube growth. 04 L

PLANT BREEDING

6. Types of plant reproduction

06 L

- a) Vegetative, sexual reproduction and apomixis.
- b) Their effect on generating and fixing genotypic variation.

7. Methods of plant improvement

11 L

- a) Pure line and mass selection, clonal selection advantages and disadvantages.
- b) Hybridization in self and cross pollinated crops – steps in hybridization, various methods and their advantages. Pedigree method, bulk method, back-cross method, multiple or composite cross method, single cross method, three way cross method, double cross method, top cross method,

8. Mutations and polyploidy as methods of plant improvement

07 L

- a) Applications of mutation in plant improvement.
- b) Polyploidy – types and characters, role of polyploidy in evolution of new species.
- c) Achievement in rice, wheat and tobacco.

9. Plant tissue culture for crop improvement

07 L

- a) General aspects – somaclonal and gametoclonal variant selection.
- b) Genetic variations and crop improvement.
- c) Source, material and culture conditions.
- d) Forms of somaclonal variation.
- e) Detection and isolation of somaclonal variants.
- f) Applications in plant breeding.
- g) Cybrid production and its advantages.

Reference books:

1. Poehimann, J.M. and sleeper, D.R. 1995. Breeding field Crops. PanimaPublishingHouse, New Delhi.
2. Russel, P.J. 1998. Genetics (5th Edition).The Benjamin/Cummings Publishing Co., Inc.,USA.
3. Simmonds, N.W. 1979. Principles of Crop Improvement.Longman, London and NewYork.
4. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd Edition).John Wiley& Sons, Inc., USA.
5. Sharma.J.R. 1994. Principles and Practice of Plant Breeding. Tata McGraw-HillPublishing Co. Ltd., New Delhi.
6. Purohit S.S. – 2003. Plant tissue culture.
7. S.Narayanswamy – 1994. Plant cell and tissue culture.
8. Chaudhary R.C. – Introduction to plant breeding.
9. Chaudhary A.K. – Elementary principles of plant breeding.

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course) SEMESTER-VI

B – 65: INDUSTRIAL BOTANY- II

Core Course – Theory; Credits- 04

Total lectures-

60 L

Course Learning Outcomes :

On completion of this course, students are able to:

- Understand the importance and scope of botanical science in the industries.
- Understand the role of microbial plants in fermentations process.
- Understand technique of plant tissue culture and its application.
- Gain thorough knowledge about various plant groups from primitive to highly evolved plants.
- Become aware of applications of different plants in various industries.
- highlight the potential of these studies to become an entrepreneur.
- equip with skills related to laboratory as well as industries based studies.

1. Introduction	04 L
Idefinition& scope of biotechnology.	
2. Micropropagation	12 L
a) Concept and history.	
b) Totipotency and cell differentiation.	
c) Somatic embryogenesis.	
d) Protoplast isolation and culture.	
e) Applications of plant tissue culture.	
3. Fermentation Technology	10 L
a) Types of bioreactors.	
b) Process of fermentation.	
c) Manufacture of Citric acid, Vit. B-12, Penicillin.	
d) Products and byproducts of fermentation.	
4. Agriculture Biotechnology	09 L
a) Haploids in agriculture.	
b) Green house technology.	
c) Commercialization of micropropagation.	
d) Organic farming, Biofertilizers.	
5. Industrial Biotechnology	08 L
a) Biotechnology based Business.	
b) Hybridoma technology.	
c) Applications of enzymes in Industry & Medicine.	
d) Immobilization of enzymes and application.	
e) Intellectual property rights, patents, Applications for patent andsignification.	
6. Biofuels	09 L
a) Concept and types.	

- b) Biogas production, merits, demerits and types of Biogas plants.
- c) Bioethanol & Applications.
- d) Petrocrops – a brief account.

7. Environmental Biotechnology

08 L

- a) Degradation of wastes & oil spills.
- b) Concept of bioplastic.
- c) Conservation of genetic resource.
- d) Plants for pollution control.

Reference books:

1. Collins, H.A. and Edwart S. 1998. Plant cell culture.
2. Bhojwni, S.S. 1990. Plant tissue culture and limitations.
3. Vasil, I.K. and Thorpe, T.A. 1994. Plant cell and tissue culture.
4. Kaylan Kumar De. Plant tissue culture.
5. M.J.K.Jons. Plant biotechnology in Agriculture.
6. Rev. Fr. Dr.S.Ignacimuthu, S.J. Applied plant biotechnology.
7. T.N.More, K.N.Dhumal, et.al. 2003. A Text book of Botany – Plant Biotechnology.
8. Cheris Lewis – Biological fuels.
9. K.C.Khandelwal, S.S.Maheli. Biogas technology volume 1.
10. L.E.Casita Jr. Industrial Microbiology.
11. W.C.Frazier and D.C.WestfoodFoodmicrobiology.
12. E.E.Conn, P.K.Stumpt. – Outlines Biochemistry.

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course) SEMESTER-VI
B-66- PRACTICAL COURSE – VIII
(Based on B-61 Biology of Cryptogams & B- 62 Biology of Seed Plants) (Any 10
Practical's to be covered)

Course Learning Outcomes:

On completion of this course, students are able to:

- Study qualitative assessment of microelements in plant ash.
- understand few higher cryptogams with suitable examples and effect of hormones on germinating seeds..
- Study Demonstration, working and uses of ecological instruments.
- Study morphological and anatomical adaptation in locally available hydrophyte and xerophyte.
- Measure water quality based on – hardness, Dissolved oxygen, free CO₂, Chloride, total alkalinity.
- Study *Pinus* & *Gnetum* life cycle
- Study factors promoting self-pollination & cross pollination

Practical course ;

- 1) Study of life cycle of *Anthoceros* and demonstration of vegetative and reproductivestructures of *Marchantia*. **1 P**
2. Study of life cycle of *Polytrichum*. **1 P**
3. Comparative study of Morphology, Anatomy and reproductive structure in *Psilotum*, *Lycopodium*, *Equisetum* and *Marsilea* with help of specimens and permanent slides. **2 P**
4. Study of life history of *Adiantum*. **1 P**
5. Study of fossil pteridophytes with the help of specimens and permanent slides (As per syllabus) **1 P**
6. & 7. Study of Life history of *Cycas* **2 P**
 - (a) Morphological and anatomical characters (T.S. of leaflet & rachis – double staining)
 - (b) Structure of reproductive bodies – megasporophyll, ovule, male cone & pollengrain.
8. & 9. Study of Life history of *Pinus*. **2 P**
 - (a) Morphological & anatomical characters (T.S, T.L.S. & R.L.S. of stem, T.S. of needle by double staining technique)
 - Structure of Reproductive bodies – male cone, female cone, ovule & pollen grains.
10. & 11. Study of Life history of *Gnetum*. **2P**
 - (a) Morphological & anatomical characters (T.S. T.L.S. & R.L.S. of stem, T.S of leaf by double staining technique).
 - Structure of reproductive bodies – male cone, female cone & ovule. **2P**

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course) SEMESTER-VI

- PRACTICAL COURSE – IX

(Based on B-63 Environmental Botany & B-64 Palynology and Plant Breeding) (Ant 10 Practical's to be covered)

Course Learning Outcomes :

On completion of this course, students are able to:

- study the effect of temperature on activity of enzyme amylase.
- study the principle and working and uses of spectrophotometer, calorimeter, centrifuge, Autoclave, Laminar air flow, Hot air oven, Incubator etc.
- Study Isolation and estimation of lipids from oil seeds by using Soxhlet apparatus.
- study the lipase activity by using germinating oily seeds.
- Study detection of adulteration in plant products using suitable tests.
- Study preparation of *Aloe vera* gel & Jaswand jel.
- Understand and study botanical name and uses of plant material in forensic science

Course Content:

1. Mechanical analysis of soils by sieve method. **1 P**
2. Determination of soil porosity and density (sand and pit method). **1 P**
3. Determination of water holding capacity and field capacity of soil. **1 P**
4. Titrimetric estimation of total carbonates of soil samples. **1 P**
5. Quantitative determination of soil organic matter by Walkley and titration method. Black's rapid
1 P
6. Analysis of the herbaceous vegetation for frequency, density and abundance. **1 P**
7. Study the height spectrum of herbaceous vegetation by line transect method. **1 P**
8. Estimation of biomass of aerial parts of herbaceous plants (fresh weight and dry weight). **1 P**
9. Analysis of different water samples for pH, oxygen, carbon-dioxide (titrimetric estimation), turbidity and temperature. **1 P**
10. Study of pollen morphology (NPC Analysis) of the following by Chitley's Method
a) *Hibiscus* b) *Datura* c) Labiatae d) *Crinum* e) *Pancratium* f) *Canna*
11. Determination of pollen viability
12. Pollen analysis from honey sample – unifloral and multifloral honey
13. Field exploration for detection of male sterile plants and estimation of their pollen fertility in locally grown crop plants e.g. *Sorghum*, *Lycopersicum* (tomato) and *Linum*. **1 P**
14. Estimation of pollen ovule ratio and its bearing on pollination system. **1 P**
15. Emasculation and bagging of flowers of Brassicaceae / Poaceae / Papilionaceae / Malvaceae / Linaceae, pollinating them manually and estimating fruit and seed setting. **1 P**

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course) SEMESTER-VI

B- 68 PRACTICAL COURSE – X

**(Based on B-65 Industrial Botany II & B-69 (A) Horticulture & Gardening /
B-69(B) Pharmacognosy / B-69 (C) Seed Technology) (Any 10 Practical's to be
covered)**

Course Learning Outcomes :

On completion of this course, students are able to:

- Understand the preparation of tissue culture media, sterilization and inoculation of plant material.
- Understand the techniques of in vitro culture of various explants.
- Understand technique of plant tissue culture and its application.
- Gain thorough knowledge about raising of spawn for mushroom cultivation and cultivation of Dhingri (Oyster) mushroom.

1. Preparation of tissue culture media, sterilization and inoculation of plant material.	1 P
2. Demonstration of techniques of in vitro culture of various explants. (shoot tip culture, Excised root culture, nodal sector culture).	2 P
3. Raising of spawn for mushroom cultivation.	1 P
4. Cultivation of Dhingri (Oyster) mushroom.	1 P
5. Demonstration of fermentation process and study of organism involved in it	1 D
6. Demonstration of Petrocrops and working of biogas plant (field visit)	1 D

PRACTICAL COURSE content

B-69 (A) Horticulture & Gardening Course Learning Outcomes :

On completion of this course, students are able to:

- Understand garden implements and their uses.
- understand propagation practices by seed, cutting, layering, budding, grafting.
- Gain knowledge about preparation of Bonsai, Bottle garden / Terrarium / Hanging baskets.
- Know how to carry Indian, Japanese and Western style flower arrangement.
- Study how to prepare Jams, Jellies, Squashes / Syrups, Pickle.

Course Content:

7. Garden implements and their uses.	1P
8. Propagation practices by seed, cutting, layering, budding, grafting.	1 P
9. Method for preparing Bonsai, Bottle garden / Terrarium / Hanging baskets.	1 P
10. Flower arrangements – Indian, Japanese and Western.	1 P
11. Preparation of Jams, Jellies, Squashes / Syrups Pickle.	1 P
12. Study of varieties of the following fruits and vegetables :	1 P

Vegetables : Tomato, Okra, Brinjal Spices / Condiments –
Chilli Fruits:- Banana, Grapes, Mango, Watermelon.

Practicals based on B-69 (B) Pharmacognosy Course Learning Outcomes :

On completion of this course, students are able to:

- Understand and study determination of extractive value of a crude drug.
- Understand and study determination of ash value, total ash value, acid insoluble ash value and water soluble ash value of a crude drug.
- Study determination of the length and width of fibers in powdered crude drug.
- Study determination of moisture (Loss on drying) of a powdered crude drug and swelling factor.

Course content:

1. Determination of extractive value of a crude drug.	1P
2. Determination of ash value of a crude drug.	1P
3. Determination of total ash value of a crude drug.	1P
4. Determination of acid insoluble ash value of a crude drug.	1P
5. Determination of water soluble ash value of a crude drug.	1P
6. Determination of the length and width of fibers in powdered crude drug.	1P
7. Determination of moisture (Loss on drying) of a powdered crude drug.	1P
8. Determination of swelling factor.	1P

Practical's based on B-69 (C) Seed Technology

Course Learning Outcomes :

On completion of this course, students are able to:

- study the methods of treatments used for breaking of dormancy in seed.
- determine seed viability by tetrazolium test

1. To study the methods of treatments used for breaking of dormancy in seeds	1P
2. To determine seed viability by tetrazolium test.	1P Project:

Each student should individually present a project related to any horticulture topic. It should be duly certified presented for at practical examination.

Visits:

To Gardens / Parks / Nurseries / Exhibitions / Horticulture industries / Research Stations and record of visits should be duly certified and presented at the time of practical examination.

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course)

SEMESTER-VI

(Elective Courses): Choose any one course of the following

B – 69 (A): HORTICULTURE & GARDENING

Course Learning Outcomes :

On completion of this course, students are able to:

- understand scope , importance & disciplines of horticulture.
- familiar with horticultural zone of Maharashtra & India.
- understand different horticultural practices & methods.
- study role played by green & playhouses in horticulture.
- understand production technology, harvesting techniques.
- understand methods of preservation & preparation of preserve product.
- Study of Garden tools and Equipments.

1. Landscape Gardening

07 L

Principles of landscaping and garden design. Important garden features. Paths and Avenues, hedges and Edges, Lawn, flower beds, Arches and pergolas, Fencing, Waterbodies, rocks,.Plants suitable for different locations and climates. Indoor Garden Terrarium, Soil less garden, Bottled dish garden.

2. Artificial methods of plant propagation

07 L

- a) Layering – Definition, Types:- simples, compound (Serpentine) Air.
- b) Grafting – Definition, Advantage / disadvantage, types Stem – detached scion – aplice, whip / tongue, slide, veneer, cleft, bark, attached scion, approach, inarching, bridge, bracing, root grafting, epicoty, stone grafting. Budding – Definition, advantage, disadvantage type – T –
- c) Budding, shield, patch, ring / angular, skin budding in situ, After care of budded plants.

3. Different styles of Gardens

08L

Hindu, Buddhist, Mughal, English, Japanese , Important Gardens of India – Shalimar (Shrinagar), Vrindavan (Mysore), Dnyaneshwar Udyan (Paithan), Jayakwadi Nagar (Paithan), Veer Jijamata Udyan (Mumbai); P.L.Deshpande, Udyan (Pune).

4. Floriculture

09 L

Scope and importance, Soil and climatic requirement And cultivation practices for Gladiolus, Gerbera, Rose and Marigold. Propagation technique, packaging and marketing, enhancing and delaying period of bloom by special methods.

5. Commercial production of the following

10 L

- i) Tubers - Potato and Arum
- ii) Vegetables - Tomato & Okra (Lady's finger)
- iii) Fruits - Mango & Grapes
- iv) Spices / Condiments - Chilly and Ginger
- v) Aromatic Plants - Citronella and Mint

6. Post – Harvest Technology

08 L

- i. Maturity – Factors responsible for maturity and ripening, methods used for delaying ripening.

- ii. Harvest – Time of Harvest, harvesting and handling of harvested products.
- iii. Storage - Types of storages preservation of fruits and vegetables – canning, freezing, drying
(Dehydration) picking, food preservatives, anti-oxidants,
- iv. Marketing – Grading, packing and transportation. Ways of increasing the market value and shelf life of horticulture produce.

7. Horticulture business, management and entrepreneurship development 08 L

- i. Horticulture, as a business definition and nature, organization,
- ii. Planning and operations of horticulture farm business.
- iii. Recycling of farm wastes.
- iv. Entrepreneurship development

8. Lawn 03 L

- (i) Purpose of preparation of Lawn & Lawn Plants.
- (ii) Production and use – purpose and preparation, management.

Reference Books:

1. Fundamental of Horticulture – J.D.Edmond et al.
2. Some beautiful Indian c limbers & Shrubs – M.L.Bor&M.B.Raizada
3. Floriculture in India – G.S.Randhawa&A.Mukhopadhyay.
4. Plant propagation – H.T.Hartmann et al.
5. The Rose in India – B.P.Pal
6. Horticulture and Gardening – M.R.Khan.
7. Hand book of Horticulture – K.L.Chanda (ICAR).
8. Commercial Flowers – Bose & Yadav.
9. Lawn & Gardens – S.L.Gindal.
10. Gardening – J.Erickson.
11. Manual of Soil, Plant, Water & fertilizer analysis – R.M.Upadhyay&M.L.Sharma.
12. Flowering Shrubs in India – S.L.Gindal
13. Floriculture – Chatterji& Bose

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course)

SEMESTER-VI

B – 69 (B): PHARMACOGNOSY

Core Course – Theory; Credits- 04

Total Lectures-

60 L Course Learning outcomes:

On completion of this course, students are able to:

- understand concept of active principle, and major metabolic pathway leading to the production of therapeutically active chemical constituents.
- understand concept of active ayurvedic and therapeutically active chemical constituents.
- understand the cultivation, collection and processing of herbal drugs
- understand importance of pharmacognosy.

1. Introduction to Pharmacognosy

12L

History, definition and Scope of Pharmacognosy. Traditional and alternative systems of medicine Classification of crude drugs. Concept of active principle, and major metabolic Pathway leading to the Production of therapeutically active Chemical Constituents.

2. Ayurvedic Pharmacy

10 L

Introduction, Tridosha concept, Humoral, Indigenous Systems of medicine (Ayurveda, Siddha, Unani, Tibi) Ayurvedic principles- Ras, Guna, Vipaka, Virya, Prabhava, Ayurvedic formulations –Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Vatika, Taila, Bhasma, Nutraceuticals & Cosmeuticals

3. Analytical Pharmacognosy

07L

Drug adulteration. Methods of drug evaluation- Morphological, Microscopic, Chemical and Physical methods. Biological and chemical evaluation of drugs.

4. Cultivation, collection and processing of herbal drugs

0

9 L Cultivation- Methods, Factors affecting cultivation. Collection and Processing. Collection, harvesting, drying, garbling, packing, storage of crude drugs.

5. Study of drugs

12 L

Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of the following.

Root Rhizome drugs :- *Glycyrrhiza* , *Asparagus*

Stem drugs: - *Ephedra*,

Tinospora Bark drugs: -

Cinnamon, *Cinchona* Leaf

drugs: - *Aloe*, *Adathoda* Flower

drugs: - *Woodfordia*, Clove
 Fruit drugs: - *Coriandrum*,
 Amla Seed drugs: - *Myristica*,
 Isabgol, Unorganized drugs :-
Acacia.

6. Ethno botany

10 L

Introduction, Definition, concepts and relevance. Branches of Ethno botany. Methodology, importance of Ethnobotany in research and conservation. Ethnic Societies of India and world & their contribution. Ethnobotany of *Aegle marmelos*, *Butea monosperma*, Neem (*Azadirachta indica*) *Ficus bengalensis* w.r.t. Taxonomic description, distribution, phytochemistry and uses, Social & religious practices.

References:-

- A Pharmacognosy and Pharmacobiotechnology. New Age international (P) Limited, Publishers (formerly Wiley Eastern Limited)
- 2. Kokate C.K. Practical Pharmacognosy, Vallabhprakashan, New Delhi,
- 3. Kokate C.K. Purohit A.P. and Gokhale S.B. Pharmacognosy, Nirali Prakashan Pune
- 4. Trease G.E. and Evans. W.C. Pharmacognosy ELBS Twelfth Edition
- 5. Tyler V.E Brady L,R and Robbers J.E. Pharmacognosy Lea and Febiger. Philadelphia. 8th edition KM Varghese and Co. Mumbai,
- 6. Vaidya S.S. and Dole. V.A. Bhaishyajakalpana, Anmol Prakashan, Pune
- 7. Wallis, T.E. Test books of pharmacognosy CBS publishers and distributors New Delhi (Latest Edition)
- 8. Ashalota Razario et al. A Hand Book of Ethno biology Kalyani Pabishes 1999
- 9. Sinha R.R. & Sinha, 2005 Ethnobiology.

T.Y.B.Sc. BOTANY (C.B.C.S. 2018 Course)

SEMESTER-VI

B – 69 (C): SEED TECHNOLOGY

Core Course – Theory; Credits- 04

Total lectures-

60 L

Course Learning outcomes:

On completion of this course, students are able to:

- Understand the theoretical orientation of seed development
- Analyse the different ways of seed processing in different plants
- Examine the various methods of Seed testing
- Understand the method of seed production in different plants
- Explain the concept of hybrid seed production

1. Introduction	05 L
a) Concept of seed technology. b) Objectives of seed technology. c) Seed industries in India and its present status.	
2. Seed	06 L
a) Structure b) Texture c) Types d) Collection and selection of seeds.	
3. Seed processing	10 L
a) Seed drying – sundry forced air drying and its advantages. b) Seed cleaning – principles and methods. c) Seed treatment – i) Importance and necessity. ii) Types of seed treatment and precautions in seed treatment.	
4. Seed storage	09 L
a) General principles and stages. b) Factors affecting on seeds during storage. c) Pest and diseases in seed storage and their control measures. d) Quality control in seed storage.	
5. Seed testing methods	09 L
a) Objectives. b) Equipments for seed testing. c) Methods – i) Purity test. ii) Germination test – (According to ISTA rules). d) Methods for inducing seed germination.	
6. Seed viability	08 L
a) Definition. b) Topographical, tetrazolium test. c) Embryo exigent test	
7. Seed health testing	08 L
a) Important methods. b) Examination without incubation. c) Examination after incubation.	
8. Seed certification	05 L
a) Objectives. b) Steps in seed certification.	

Reference Books

- 1) Seed technology- Agarwal R.L.
- 2) Viability of seeds- Roberte E.H.
- 3) Germination of seeds- Mayor, Polgakoff, Mayber
- 4) Physiology and Biochemistry of seeds- Bewley and Black

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)
SEMESTER-VI
MB 61-Chemotherapy and Biomedical Instrumentation.

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- Acquire the knowledge of Gene Therapy
- Know the principles of Chemotherapy, mode of action of Drugs & Drug resistance
- Generate a detailed study of human micro-Organisms
- Have awareness on using various biomedical instruments

Course Content

I.	Gene Therapy	10
	i. Gene Therapy of Severe combined Immunodeficiency	
	ii. Gene therapy of Alzheimer Disease	
II.	Introduction to chemotherapy.	20
	A. General Principles of Chemotherapy.	
	B. Mode of Action of following	
	i. Penicillin	
	ii. Tetracyclin	
	iii. Acyclovir	
	iv. Rifampicin	
	v. Actinomycin D	
	vi. Griseofulvin	
	vii. Nystatin	
	viii. Sulfonamides	
	ix. Sulphated polysaccharides	
III.	Mechanism of the drug resistance for the above drugs.	05
IV.	Causes of variable and unpredictable drug response.	05
V.	Detailed study of following organisms:	08
	1. <i>Staphylococcus spp.</i>	
	2. <i>Streptococcus spp.</i>	
	3. <i>Treponema pallidum</i>	
	4. <i>Mycobacterium tuberculosis</i>	

V. Biomedical instrumentation & measurements:-

Principle and use of following biomedical instruments –

12

- i. Blood cell counter,
 - a) Conductivity (Coulter) type.
 - b) Dark field type.
- ii. Electrocardiograph (ECG Transducer)
- iii. EEG Transducer
- iv. Sphygmomanometer.

References:-

1. Bernard R. Hick, Terry L. Delvitch, Cherryl L. Patten 2014, Medical Biotechnology, ASM Press Washington D.C. (Topic I)
2. David H. Persing et.al. Molecular Microbiology:, Diagnostic Principles and Practice 2004, ASM Press Washington DC,USA. (Topics IV and V)
3. Hugo W.B., Russell A.D. Ninth Edition, 2014, Pharmaceutical Microbiology, Blackwell Science Ltd. USA. (Topics II and III)
4. Leslie Cromwell, Fred, Weibell, Erich A Pfelffer 2004, Biomedical Instrumentation & measurements, 3rd edition Pearson education Inc. Singapore. (Topic VI).
5. P. Primoo 2015, A Textbook of Medicinal Chemistry, CBS Publishers and Distributors New Delhi, India. (Topic II)

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 62 : Immunology

Total credits 04

Total 60 Lectures

Course Learning Outcomes :

On completion of Course Students are able to -

- Understand the antigens, antibodies & the various theories related to antibody formation
- Have a detailed knowledge about the cells of the immune system
- Know the role of cytokines, monoclonal antibodies, their production & applications
- Understand the mechanism of Hypersensitivity

Course Content

I. Antigen: -	10
i. Concept of Epitope, ii. Types of Epitope, iii. Carrier molecule, iv. Factors affecting antigenicity.	
II. Antibody: -	15
i. Concept of paratope, ii. Allotypes of immunoglobulin, iii. Concept of idiotopes and idiotypes, iv. Early hypothesis for antibody formation, v. Direct template theory for antibody formation, vi. Indirect template theory for antibody formation, vii. Burnet's clonal selection theory for antibody formation, viii. Cellular mechanism of antibody formation a. Antigen presentation b. Cytokine signaling for antibody formation c. Antibody production	
III. Cells of the immune system: -	06
i. Cytology & functions of Microphages, ii. Cytology & functions of a) T cells, b) B cells, c) NK cells.	
IV. Cytokines: -	10
i. Interleukin 1, ii. Interleukin 10, iii. Tumor Necrosis Factor (TNF), iv. Interferons a) α Interferons	

b) β Interferons

c) γ . Interferon

V. Hypersensitivity:- 14

Mechanism & examples of

- i. Type – I Hypersensitivity
- ii. Type – II Hypersensitivity,
- iii. Type – III Hypersensitivity,
- iv. Type – IV Hypersensitivity.

VI. Concept of Monoclonal antibodies, their production and Applications 05

References

1. Abul K. Abbas, 2006, Cellular and Molecular Immunology 5th Edition, ELSEVIER Saunders Publications, An imprint of Elsevier, Philadelphia., USA, (Topics IV, VI and VII)
2. David Male, Jonathan Brostoff, David B Roth, Ivan Roitt, 2006, Immunology, 7th edition Mosby ELSEVIER, Canada. (Topics I, II and III)
3. Ian R Tizard 2004, Immunology, An introduction, 4th Edition, Saunders College Publishing. U.K. (Topics III, IV and VI)
4. Ivan M. Roitt, Peter J. Delves, 2001, Roitt's Essential Immunology, 10th Edition, 2001, Blackwell publishing Company, USA. (Topics III and VI)
5. Keith Wilson & John Walker (Ed.) 2005, Principles & Techniques of Biochemistry and Molecular Biology, Cambridge University Press, New York, USA. (Topic VII)
6. Shetty Nandini 2006, Immunology... Introductory Textbook, New Age International Publishers New Delhi, India. (Topic II)
7. Stites D.P. & A.I. Terr 1990, Basic & Clinical Immunology, Prentice Hall, New York (Topics III)
8. Thomas J. Kindt et.al.2007, Kuby Immunology, Sixth Edition, W.H. Freeman and Company, New York, USA. (Topics IV and VI)

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 63 Biotechnology

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to -

- Develop the skills in Strain Improvement
- Study the production of solvents, Organic Acids, Vitamins & Amino Acids
- Detect & assess the various fermentation products
- Understand the role of Quality control department in testing of products & the concept of patents

Course content

I	Classical Fermentations	20
	i. Alcohol (Ethyl alcohol) ii. Wines iii. Organic Acid – Citric acid, iv. Microbial enzyme – Amylases v. Vitamin – Vitamin B₁₂ vi. Amino acid – Lysine vii. Biomass production: yeast Biomass, Baker's and Distillers Yeast	
II	Strain Improvement (Techniques with suitable examples)	12
	i Mutation approach a. Use of auxotrophic, b. Resistant mutants for the production of primary and secondary metabolites c. Revertant mutants for the production of primary and secondary metabolites. ii Recombination techniques a. Protoplast fusion technique. b. Genetic manipulation technique.	
III	Detection and assay of fermentation products.	08
	i. Chromatographic assays. ii. Biological assays.	
IV	Quality Control.	12
	i. Chemical assay ii. Pyrogen testing iii. Sterility testing iv. Carcinogenicity testing-Ames Test v. Toxicity testing vi. Allergy testing	

V Fermentation Economics**08**

- i. Market potential.
- ii. Fermentation and Product recovery costs.
- iii. Patents and Secret Processes.
 - a. History of patent concept.
 - b. Subject matter and characterization of a patent.
 - c. Inventor.
 - d. Patents in India and other countries.

References:

- 1 Casida L.E. Jr. (1983) – Industrial Microbiology, Wiley Eastern Limited, New Delhi.
- 2 Hunt, R and J Shelly (1995) – Computer and common sense, 4th edition, Prentice – Hall of India Private Ltd., New Delhi.
- 3 Mousami Debanth (2005) – Tools and Techniques in Biotechnology, Pointer Publishers, New Delhi.
- 4 Patel A.H. (1985) – Industrial Microbiology Mac Millan India Ltd., New Delhi.
- 5 Peppler H.H. (Ed) (1979) – Microbial Technology Vol. I and II, UU Academic Press, New York.
- 6 Peppler Periman II (Ed) (2004) – Microbial Technology, Microbial Processes: Vol I and II Academic Press: Published by Elsevier.
- 7 Presscott S.C. and C.G. Dunn (1983) Industrial Microbiology, 4th edition, Edited by Genald Reed. AVI Tech Books USA.
- 8 Rajaraman V. (1996) – Fundamentals of Computers, 2nd edition, Prentice – Hall of India Private Ltd., New Delhi.
- 9 Stanbury P.F. and A Whiteker (1984) – Principles of Fermentation Technology, Pergamon, New York.
- 10 Subbarao, N.S. (1993) – Biofertilizers in Agriculture and Forestry, 3rd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- 11 Rutledge C.R. and Kristiansen science, Basic Biotechnology, 2ndEdn., Cambridge University Press.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 64 Genetics of Eukaryotes and Gene Manipulation

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to –

- Develop broader perspective in Non Mendelian Inheritance
- Know the recent developments in DNA technology & their applications
- Understand the role of cloning vectors & joining DNA Molecules
- Get equipped with the procedure of Electrophoresis & PCR

Course content

I. Extra nuclear Inheritance.

A. In Eukaryotes. (Non Mendelian inheritance.)

10

- i. Rules of extra nuclear inheritance.
- ii. Organization of extra nuclear genomes.
- iii. Origin of mitochondria and chloroplast.
- iv. Mitochondrial genome.
- v. Chloroplast genome.
- vi. Other Examples of extra nuclear inheritance.
 - a. Chloroplasts in 4'o clock plant and corn.
 - b. Streptomycin resistance in *Chlamydomonas*
 - c. Respiratory deficiencies—Petites in yeast *Saccaromyces cerevisiae*
 - d. Poky mutants in *Neurospora crassa*.
 - e. Human genetic diseases and mitochondrial DNA defects

B Infectious heredity

04

- i. Killer yeast.
- ii. Killer Paramecia

C Maternal effect. Examples:

06

- i. Pigmentation in Flour moth,
- ii. Inheritance of coiling in some snails
- iii. Maternal effects in humans

II. Recombinant DNA technology.

A. Introduction-Historical: Asilomer conference and NIH guidelines

01

B .Cutting DNA molecules

- i. Nucleases cut Nucleic Acids.
- ii. Restriction and modification of DNA.
- iii. Recognition of DNA by Restriction Endonucleases.
- iv. Naming of restriction enzymes
- v. Cutting of DNA by restriction enzymes
- vi. Types of restriction enzymes

C. Joining DNA molecules

- i. Joining of DNA fragments by DNA ligases
- ii. Joining of DNA fragments by addition of homopolymers
- iii. Blunt end ligation-T4 ligase

07

iv. Linkers and Adaptors

D. Cloning vectors.**10****I. Plasmids**

- a) Plasmid detail studies
- b) General properties of plasmids
- c) Detection of plasmids
- d) Purification of plasmid DNA
- e) *In Vitro* Plasmid Transfer: chemical transformation, Electrotransformation
- f) Plasmid Replication : Use of host proteins in plasmid replication,
- g) Control of copy number , control of copy number by antisense RNA
- h) Concept.-Plasmid families and Incompatibility, *The par systems*
- i) Replication inhibition by acridines
- j) Properties and Advantages Of Particular Bacterial Plasmids:
 - i. F plasmid, Drug resistance plasmid, Colicinogenic plasmids,
 - ii. *Agrobacterium* plasmid (Ti plasmid), broad host range plasmids, other plasmids

II. Inserting Genes into Vectors.**III. Detecting Insertions in vectors.****IV. Moving genes between organisms: Shuttle vectors****V. Bacteriophage Lambda vectors.****VI. Cosmid vectors****VII. Yeast Artificial Chromosomes.****VIII. Bacterial and P1 Artificial Chromosomes.****E. Cloning Strategies****04**

- I. Cloning genomic DNA
- II. cDNA cloning
- III. Genomic library and c DNA library
- IV. Screening Strategies

F. Basic Techniques**06**

- I. Agarose gel electrophoresis
- II. Blotting techniques
- III. Transformation in suitable host
- IV. Polymerase Chain Reaction.

G. Applications of Recombinant DNA Technology.**07**

- I. Nucleic acid sequences as diagnostic tools
- II. Biotechnology: Commercial Products.
- III. Synthetic and edible vaccines
- IV. Genetic Engineering of plants and animals
 - Plants as bioreactors
 - Animals as bioreactors

References.

1. Norris, J.R. and D.W. Ribbons. (1972). Methods in Microbiology, Volume 7, Part Academic Press.
2. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
3. David A. Jackson, Stephen P. Stitch, (1979). Recombinant DNA Debate
4. Hartl. D.L. E.W. Jones. (1999) Essential Genetics, 2nd Edition. Jones and Bartlett

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5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and company, New York.
 6. Russel. P.J. (2006) Genetics: A molecular Approach. 2nd Edition. Pearson Benjamin Cummings.
 7. Russet P.J. (1998) Genetics fifth. Edition. Addison Wesley Longman. Inc.
 8. Snyder L and W. Champness (2003) Molecular Genetics of Bacteria Second Edition. ASM Press. Washing ton D.C.
 9. Stanley R. Maloy, John E. Cronan, David Freifelder (1994). Microbial Genetics Jones and Bartlett Publishers.
 10. Tamarin R.H. (2003) Principles of Genetics, 2nd Edition. Tata McGraw Hill Edition.
 11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell publishing.
 12. Watson, J. D. (2007) Recombinant DNA: Genes and Genomes: A Short Course Publisher, W. H. Freeman, Edinburgh: Blackwell Scientific Publications.
 13. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford-by Prentice Hall.
 14. Jackson A. Stephen P. Stitch. (1979). Recombinant DNA Debate by David Prentice Hall.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)
SEMESTER-VI
MB 65 Microbial Metabolism and Biochemical Evolution

Total credits 04

Total 60 Lectures

Course Learning Outcomes:

On completion of Course Students are able to –

- Understand the Microbial transport systems
- Have knowledge regarding the laws of Thermodynamics, Concept of Entropy, Enthalpy, free energy changes in Biological systems
- Understand the various modes of respiration & Intermediary mechanisms involved
- Have conceptual knowledge of the biosynthetic & degradative pathways
- Discuss the Evolutionary aspects of Biomolecules

Course Content

I. Introduction to metabolism	02
II. Biological membrane & transport mechanisms.	08
A. An overview of Biological membrane structure	
B. Functions of Membrane	
i. Transport mechanisms.	
a) Passive transport – Diffusion, osmosis, facilitated transport.	
b) Active transport – Transport systems in bacteria.	
c) Group translocation – Group translocation of sugars into bacteria.	
d) Ionophores.	
ii. Signal transduction: concept	
III. Bioenergetic considerations	10
i. Laws of thermodynamics, free energy, standard free energy change, additive nature of standard free energy charge, enthalpy and entropy.	
ii. High energy compounds	
iii. Electron transport chain components and electron flow:	
iv. Electron carriers in respiratory chain : Complex I, II, III, IV-structure Oxidative phosphorylation, Chemiosmotic control mechanism	
v. Bioluminescence, biochemistry of bioluminescence and applications in biosensors	

IV. TCA cycle as central metabolic pathway	08
i. Stoichiometry and energetics of citric acid cycle	
ii. Control of TCA cycle	
iii. Anaplerotic reactions	
iv. Amphibolism	
v. Stickland reaction.	
V. Metabolism of biomolecules	25
A. Nucleotide metabolism	
i. Synthesis of purine nucleotides.	
ii. Synthesis of pyrimidine nucleotides.	
iii. Degradation of nucleotides	
B. Lipid metabolism	
i. Role of Acetic acid as precursor of lipids	
ii. Acyl carrier protein and β - keto acyl synthase	
iii. Synthesis of triacylglycerol	
iv. Synthesis of glycerophospholipids	
v. Degradation of fatty acids - β oxidation	
vi. Fate of acetyl CoA derived from fat breakdown	
vii. Peroxisomal oxidation of fatty acids	
C. Metabolism of Amino acids	
i. The synthesis of Amino acids	
a. Synthesis of glutamic acid	
b. Synthesis of aspartic acid	
c. Synthesis of glycine	
d. Synthesis of serine	
e. Synthesis of valine	
f. Synthesis of isoleucine	
g. Synthesis of aromatic amino acids by 'Shikimic acid pathway'	
h. Deamination of amino acids	
i. Fate of keto acids formed after deamination	
ii. Synthesis of proteins.	
a. Initiation	
b. Elongation	
c. Termination	
d. Antibiotics inhibiting protein synthesis	

D. Carbohydrate metabolism

i. The synthesis of oligosaccharides and polysaccharides

- a. Synthesis of starch
- b. Synthesis of glycogen
- c. The synthesis of peptidoglycan, Antibiotics inhibiting peptidoglycan synthesis

E. The synthesis of isoprenoids

- i. Isoprene formation
- ii. Polyprenyl compounds
- iii. Carotene formation
- iv. Synthesis of heme v.

VI. Biochemistry of biological nitrogen fixation.

02

- i. Biogenesis of Ammonia
- ii. Nitrogen fixation mechanism
- iii. Nitrogenase complex

VII. Biochemical Evolution.

05

- i. The primordial cloud theory.
- ii. Primitive atmosphere & primitive seas.
- iii. Monomer formation.
- iv. Periodic condensing agents.
- v. Periodic formation of polypeptides.
- vi. The periodic origin of enzymatic activity.
- vii. The prebiotic origin of nucleotides & nucleic acids.
- viii. Coacervate droplets.
- ix. The gene hypothesis : Life without proteins

References:-

1. Conn, E.E. P.K., Stumpf, G. Bruening & R.H. Dol (1995) Outlines of Biochemistry 5th Edition, John Wiley & sons.
2. David E. Metzler, (2006), Biochemistry The chemical Reactions of living cells, Vol I & II 2nd edition Academic Press
3. David Nelson & Michael M. Cox (2013) Lehninger, Principles of Biochemistry, 6th edition Publisher – Sara Tenney W.H. Freeman & Company.
4. Doelle, H.M. (1975) Bacterial Metabolism Academic Press. Inc. Ltd. London.
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7. Stryer L. (1995) Biochemistry, 4th Edition, W.H. freeman & company New York.
8. Subbarao, N.S. (1979) Recent advances in biological Nitrogen fixation. Oxford IBH Publishing Co. Private ltd, New Delhi.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 66 Practical Course – VIII

Total credits 02

Total number of

Experiments: 15 Course Learning Outcomes:

On completion of Course Students are able to –

- Measure the rate of fall & increase of erythrocytes & PCV
- Identify the Antigen, Antibody reactions
- Get the significance of total blood count & differential blood count
- Determine Koch's postulates & its importance

1. Identification of an Antigen – Antibody complex by	2
a. Gel diffusion analysis (Immunodifusion or Ouchterlony plate method)	
b. The Ring Test	
2. Total Blood cell count – WBC, RBC, platelet.	3
3. Differential blood count	1
4. Estimation of Total Hemoglobin	1
5. Determination of ESR and PCV	1
6. RBC indices and its significance	1
7. Determination of Koch's postulates by using a pathogen either on plant or animal.	3
8. Determination of antibiotic peak levels attained in body fluids.	3

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
2. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th i. Edition.
4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
5. Dubey, R.C. and Maheshwari, D. K. (2002). Practical Microbiology. S Chand and Company Pvt Ltd.
6. Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
7. Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd i. Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
8. Sawhney, S.K. and Singh, R. (1999). Introductory Practical Biochemsitry. Narosa Publishing House.
9. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 67

Practical Course – IX

Total credits 02

Total number of

Experiments: 15 Course Learning Outcomes:

On completion of Course Students are able to –

- Get the advantages of Biofertilizers over Chemical Fertilizers & their preparation methods
 - Have the information about the standardization of many Therapeutic agents, which either inhibit the growth of Micro-Organisms or are essential for their growth by assay method
 - Identify the Fungi & observing various aspects by slide culture techniques
 - Have knowledge of applications of yeast in various industries
 - Get equipped with an overview of citric acid production from *Aspergillus niger*
- | | |
|---|---|
| 1. Microbiology of soil. | 7 |
| 1. TVC : estimation of R:S ratio | |
| 2. Isolation of <i>Rhizobium</i> sp from root nodules. | |
| 3. Isolation of <i>Azotobacter</i> sp | |
| 4. Preparation of bio fertilizers. | |
| 2. Study of Fungi | 2 |
| 1. Culture of Baker's yeast – with different carbon and energy sources. | |
| 2. Slide culture technique | |
| 3. Industrial Microbiology. | 6 |
| 1. Production, estimation and tests of Citric acid or wine | |
| 2. Microbiological Assays of | |
| a) Vitamin- B ₁₂ | |
| b) Antibiotic- Penicillin and or Streptomycin | |

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
2. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
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5. Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
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9. Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
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T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)

SEMESTER-VI

MB 68 Practical Course – X

Total credits 02

Total number of

Experiments: 15 Course Learning Outcomes:

On completion of Course Students are able to –

- Understand the method for the determination of total cholesterol, Urea, glucose, protein, Billrubin in serum
- Know the principle & practice of Agarose Gel electrophoresis & its application
- Have significance of conjugation & transformation, its application.
- Get the knowledge of the principle & applications of electrophoresis.

1. Gel Electrophoresis – Isolation of DNA and Plasmids (demonstration)	2
2. Polyacrylamide Gel electrophoresis-Isolation of protein (demonstration)	1
3. Bacterial conjugation (demonstration)	1
4. Bacterial transformation (demonstration)	1
5. Polyploidy (demonstration)	1
6. Phosphatase test.	1
7. Estimation of serum Glucose.	1
8. Estimation of serum Urea.	1
9. Estimation of serum Cholesterol	1
10. Estimation of serum Protein	1
11. Estimation of serum Bilirubin and or SGOT/SGPT	3
12. Estimation of Riboflavin in human urine	1

References:–

1. Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
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4. Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Chruchill Livingstone Edinburgh, London and New York.
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6. Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
7. Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
9. Sawhney, S.K. and Singh, R. (1999). Introductory Practical Biochemsitry. Narosa Publishing House.
10. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)
SEMESTER-VI
MB (69-A) Agricultural and Environmental Microbiology.

Total credits 04

Total 60 Lectures.

Course Learning Outcomes:

On completion of Course Students are able to –

- Generate the basic skills in the preparation of Bioinoculants
- Know the importance of Biomonitoring & recycling of Agricultural wastes
- Understand the scope of Geomicrobiology & production of Biogas
- Have an awareness on taking efforts in controlling the water & marine pollution

Course Content

I. Agricultural Microbiology.	28
i. Biomonitoring	
a. A concept – basis of biomonitoring.	
b. Advantages and disadvantages of biomonitoring.	
ii. Marker methods for ecological studies of soil microorganisms	
a. Microscopic visualization	
b. Phage markers	
c. Resistance markers	
d. Nutritional and enzymatic markers	
iii. Recycling of agriculture waste	
a. Composting – Materials for composting, types of composting, composting process and Methods	
iv. Bioinoculants	
a. Concept and different types	
b. Examples: Azo and Rhizo, Azospirillum, Mycorrhiza, Phosphate solubilizers	
c. Methods of preparation	
d. Methods of Inoculation	
v. Microbes as plant pathogens	
a. Historical background	
b. Host parasite relationship	
c. Diseases – Citrus canker & TMV:- Causative agent, Symptoms and physiology of disease, Mode of entry of pathogen and Control measures.	
II. Environmental Microbiology.	
A .Geomicrobiology	08
i. Scope of Geomicrobiology	
ii. <u>In-situ</u> process	
iii. Bioleaching and beneficiation processes	
B. Biogas production	08
i. Concept	
ii. Biochemistry underlying production	
iii. Methods of production	
iv. Energy generated	
v. Role in pollution control	

D. Water	08
Definition and types of pollution	
i. Effect of various pollutants on water	
ii. Organic pollutants	
iii. Inorganic pollutant	
iv. Radioactive pollutants	
v. Petroleum and oil pollutants	
E. Marine pollution	08
i. Sources of marine pollution	
ii. Point sources.	
iii. Non point sources	
iv. Types of marine pollution.	
v. Efforts to control and protect marine environment	
vi. Microbial approach in remediation of oil contaminated marine sites.	

References:–

- 1 Mukherjee N and T Ghosh (1995) Agricultural Microbiology – 1stedn. Kalyani publishers, New Delhi.
- 2 Maier R.M. Pepper I.L. Gerba C.P. (2004), Environmental Microbiology, Academic Press.
- 3 Ranade D.R. & Gadre R.V. (1988) Microbiology: Laboratory aspects of anaerobic digestion, Laboratory Manual, MACS, Pune.
- 5 Rao. C.S. (1991), Environmental pollution control engineering, Widely Eastern Limited, New Delhi
- 6 Rana SVS, (2006), Environmental Pollution, Health and Toxicology, Narosa publishing House, New Delhi.
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- 9 Thakur Indu (2006) Environmental Biotechnology., I.K. International Pvt. Ltd., New Delhi.
- 10 Rittmann B.E. and Mccarty L. (2001) Environmental Biotechnology – Principles and Application, McGrawHill International Editions, Biological Sciences Series.
- 11 Subba Rao, N.S. (1999), Soil Microbiology 4th Edn Soil Microorganisms and Plant growth, Oxford and IBH publishers, New Delhi.

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)
SEMESTER-VI
MB 69-B Applied Microbiology-II

Total credits 04

Total 60

Lectures

Course Learning Outcomes:

On completion of Course Students are able to –

- Understand the various guidelines & basic principles of Quality Control ,Quality Assurance & Concepts of NABL Accreditation
- Study the safety guidelines in the laboratory & introduction to code of practice
- Analyze the policy documents regarding micro-organisms
- Develop the fundamentals of clinical trials &

knowing the theories of Bioethics **Course Content**

I. Introduction to the role of regulatory bodies and basic principles of Quality control & Quality assurance	02
II. NABL (National Accreditation Board for Testing and Calibration Laboratories) Guidelines	10
i. Concept of Accreditation	
ii. Need of Accreditation	
iii. Introduction to NABL	
iv. Significance tasks for NABL Accreditation	
III Laboratory Bio safety: W.H.O. views & guidelines	10
i. Introduction to code of practice	
a) Access guidelines in laboratories	
b) Personal protection	
c) Procedures	
d) Laboratory working areas	
ii. Laboratory design & facilities	
iii. Introduction to biological safety cabinets & types of biological safety cabinets (Introductory level only)	
iv. Chemical germicides for cleaning of laboratory materials	

v. Risk assessment for GMO (Genetically Modified Organisms)

IV. Policy Documents regarding Microorganisms

- i. National Biodiversity Authority & its role in conservation & exploitation of microorganisms
- ii. Patenting microorganisms in India
 - a. Introduction
 - b. Subject matters of patentability
 - c. Invention Vs. Discovery
 - d. Patenting in the perception of TRIPS agreement & Patent Act , 1970 as amended in June 2002
 - e. Legal sustainability of the microbial patent

V Fundamentals of Clinical Trials

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- a) Phase I
- b) Phase II
- c) Phase III
- d) Phase IV

VI. Bioethics

08

- i. Introduction
- ii. Theories of bioethics: Deontology theory, Virtue theory
- iii. Experiments of animals

References:–

1. Friedman Lawrence M, Curt D. Furberg, David l. DeMets (1998), Fundamentals of Clinical Trials. 3rd Edition Springer International
2. Kanagasabapathy A.S & Pragna Rao
Laboratory accreditation - Procedural Guidelines, Indian Journal of Clinical Biochemistry, 2005, 20 (2) 186-188
3. Mephram Ben (2013), Bioethics an Introduction for the Biosciences. Oxford University Press U.K.
4. World Health Organization, Laboratory biosafety manual. – 3rd ed. Wiley Int

T.Y.B.Sc. MICROBIOLOGY (C.B.C.S. 2018 Course)
SEMESTER-VI
MB 69-C Advanced Techniques in Microbiology-II

Total credits 04

Total 60

Lectures.

Course Learning Outcomes:

On completion of Course Students are able to –

- Acquire the techniques in the enumeration of viruses & serology
- Adapt the techniques in the purification & characterization of Enzymes
- Understand the process of recovery & purification of fermentation products
- Get an in depth Knowledge of the Enzyme assay methods

Course Content

I. Techniques In Immunology

A. Enumeration of viruses

- i. Latex droplet method (Direct Microscopic count)
- ii. Haemagglutination assay
- iii. Plaque and pock method.
- iv. LD 50 or ID50 assays (50% end point method.)

06

B. Serology

- i. Agglutination
- ii. Immunodiffusion
- iii. Oudin Tube Technique
- iv. SRID
- v. Ouchterlony Technique
- vi. Immunoelectrophoresis
- vii. Radioimmunoassay and its applications
- viii. Immunofluorescence
- ix. ELISA: Direct, Indirect

20

II. Techniques In Enzymology

A. Purification and characterization of enzymes

10

- i. Methods of purification based on Molecular size:
 - a. Dialysis
 - b. Gel exclusion chromatography
 - c. Centrifugation based on Solubility differences.
- ii. Electric charge.
 - a. Ion exchange chromatography
 - b. IEF
- iii. Specific binding property and selective adsorption.
 - a. Affinity chromatography
- iv. Criteria for purity.
- v. Determining molecular weight of protein

B. Enzyme assays 10

- i. Principles of enzyme assays.
- ii. Assay techniques with suitable examples.
 - a. Electrode method
 - b. Manometric
 - c. Spectrophotometric
 - d. Fluorescence spectroscopic
 - e. Radiochemical assay
- ii. Coupled kinetic assay

C. Purification of viruses 04

- i. Differential centrifugation.
- ii. Density gradient centrifugation.
- iii. Precipitation.

III. Recovery and purification of fermentation products. 10

- i. Foam separation.
- ii. Precipitation.
- iii. Filtration and Ultrafiltration.
- iv. Centrifugation.
- v. Solvent extraction.
- vi. Solvent recovery.
- vii. Adsorption and elution.
- viii. Drying
- ix. Crystallization

References

- 1) Abul K. Abbas, 2006, Cellular and Molecular Immunology 5th Edition ,ELSEVIER Saunders Publications ,An imprint of Elsevier, Philadelphia., USA, (Topics IV, VI and VII)
- 2) Conn, E.E. P.K., Stumpf, G. Bruening& R.H. Dol (1995) Outlines of Biochemistry 5th Edition, John Wiley & sons.
- 3) David E. Metzler, Vol I & II 2nd edition (2006) Biochemistry "The Chemical Reactions of Living cells", Academic Press
- 4) David Male, Jonathan Brostoff , David B Roth, Ivan Roitt, 2006, Immunology, 7th edition Mosby ELSEVIER, Canada. (Topics I, II and III)
- 5) David Nelson & Michael M. Cox Lehniger, A.L. (1975), (2013) Biochemistry 2nd , 6th edition. Kalyani publisher, New Delhi.
- 6) Dimmock N.J. A. J. Easton and K.N. Leppard (2001) Introduction to Modern Virology Blackwell science
- 7) Foster, R.L. (1980) The Nature of Enzymology, Croon Helm Ltd. London.
- 8) Ian R Tizard 2004, Immunology, An introduction, 4th Edition, Saunders College Publishing. U.K. (Topics III, IV and VI)
- 9) Ivan M. Roitt, Peter J. Delves, 2001, Roitt's Essential Immunology, 10th Edition, 2001, Blackwell publishing Company, USA. (Topics III and VI)
- 10) Keith Wilson & John Walker (Ed.) 2005, Principles & Techniques of Biochemistry and Molecular Biology, Cambridge University Press, New York, USA. (Topic VII)

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- 12) Stanbury P.F. and A Whiteker (1984) – Principles of Fermentation Technology, Pergamon, New York.
- 13) Stites D.P. & A.I. Terr 1990, Basic & Clinical Immunology, Prentice Hall, New York (Topics III)
- 14) Stryer L. (1995) Biochemistry, 4th edition, W.H. Freeman & Company New York.



**BHARATI VIDYAPEETH
(DEEMED TO BE UNIVERSITY), PUNE**

**Faculty of Science
(B.Sc.) - Bachelor Of Science
Old Syllabus**

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,

PUNE – 411 038

Accredited with 'A+' Grade (2017) by NAAC

‘A’ Grade University Status by MHRD, Govt. of India

Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF SCIENCE (B.Sc. CHEMISTRY) PROGRAMME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

To Be Implemented From Academic Year 2016-17

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE

COURSE STRUCTURE AND SYLLABUS OF

THREE YEARS INTEGRATED

CHOICE BASED CREDIT AND GRADING SYSTEM (CBCS – 2016)

FOR THREE YEARS

BACHELOR OF SCIENCE (B.SC.) DEGREE COURSE

The Bachelor of Science (B.Sc.) degree of three years integrated choice based credit and grading system (CBCS-2015) course is being implemented from the academic year 2016-2017. Thus, first year B.Sc. CBCS-2015 course will commence from 2016-2017 and will be implemented in successive years.

Objectives of the Course:-

The objectives of the B.Sc. (CBCS-2016) Course shall be to :-

1. Offer choice to the students in the curriculum to have freedom in selecting his / her own choice in completing UG program.
2. Introduce the activities which support the curriculum such as seminars, field trips, discussion etc.
3. Mix different learning environment such as traditional face to face classroom method with modern computer mediated activities.
4. Develop the human resource for industry as well as education sector which the need of hour.
5. Create several self-employment opportunities in various fields of science.
6. Develop the skills necessary in the chemical, pharmaceutical, analytical, agriculture, technology fields.
7. Inculcate scientific temper among the students.

ELIGIBILITY FOR ADMISSION :

1. Higher Secondary School Certificate Examination (10+2) of the Maharashtra State Board or its equivalent examination of any other statutory Board/University with English and with any three Science subjects such as (i) Physics (ii) Chemistry (iii) Biology (iv) Mathematics (v) Geography (vi) Geology etc
2. Higher Secondary School Certificate Examination (10+2) with English and with any one of the following vocational subjects in technical group of +2 levels.

Subject code	Subject
79	Auto Electrical
A1	Electrical Maintenance
A2	Mechanical Maintenance
A4	General Civil Engg.
C2	Electronics
C3	Chemical Plant Operation
C5	Elementary Laboratory Technology
D9	Computer Science
J1/J2/J3	Electronics Technology
J4/J5/J6	Maintenance & Repairs of Electrical Domestic Appliances
K1/K2/K3	Auto Engg. Technician
P1/P2/P3	Medical Lab. Technician
P4/P5/P6	X-ray Technician
P7/P8/P9	Ophthalmic Technician
T1/T2/T3	Repair, Maintenance & Rewinding of Electrical Motors.

Admission process:

1. Admissions will be given as per the selection procedure/policies adopted by the college, in accordance with conditions laid down by Bharati Vidyapeeth Deemed University, Pune.
2. Reservation and relaxation will be as per the Government rules and Bharati Vidyapeeth Deemed University, Pune.

Intake Capacity:

The intake capacity of the course will be 120 seats every year.

Course Structure and Scheme of Credits:

Course	Semester	Credits	Total of Semester	Grant Total of the year
F.Y.B.Sc.	I	Theory (Core) - 24	34	66
		Practical – 08		
		Foundation - 02		
	II	Theory (Core) - 24	32	
		Practical – 08		
S.Y.B.Sc.	III	Theory (Core) -24	36	70
		Practical – 06		
		Elective – 04		
		Foundation -02		
	IV	Theory (Core) – 24	34	
		Practical-06		
		Elective-04		
T.Y.B.Sc.	V	Theory (Core) -20	32	62
		Practical-06		
		Elective-04		
		Foundation-02		
	VI	Theory (Core) -20	30	
		Practical-06		
		Elective-04		
Grand Total of the Course (All Semester)			198 (192+6)	198

BHARATI VIDYAPEETH
DEEMED UNIVERSITY, PUNE (INDIA)
Board of Studies in Chemistry
COURSE STRUCTURE OF B. Sc. (CHEMISTRY)

(CBCS-2016 Course)

F. Y. B. Sc. (Sem. I and II)

CORE GROUPS (SELECT ANY ONE GROUP FROM THE FOLLOWING)

Group I :- Physics, Chemistry, Mathematics and Statistics (PCMS)

Group II :- Physics, Chemistry, Botany and Zoology (PCBZ)

Group III :- Chemistry, Botany, Zoology and Microbiology (CBZM)

Group IV :- Chemistry, Zoology, Microbiology and Geography (CZMG)

Semester I (From the Academic Year 2016-17)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-11	Physical and Inorganic Chemistry – I	03	03	03	40	60	100
	C-12	Organic and Inorganic Chemistry – I	03	03	03	40	60	100
	C -13	Practical course – I	04	02	03	40	60	100
Foundation Course	This course is compulsory for all the students.							
	UGF-12	Youth Development	02	02	02	20	30	50

Semester II (From the Academic Year 2016-17)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-21	Physical and Inorganic Chemistry – II	03	03	03	40	60	100
	C-22	Organic and Inorganic Chemistry - II	03	03	03	40	60	100
	C - 23	Practical Course-II	04	02	03	40	60	100

S. Y. B. Sc. (Sem. III and IV)

CORE GROUPS (SELECT ANY ONE GROUP FROM THE FOLLOWING)

Group I :- Physics, Chemistry and Mathematics (PCM)

Group II :- Chemistry, Botany and Zoology (CBZ)

Group III :- Chemistry, Botany and Microbiology (CBM)

Group IV :- Chemistry, Zoology and Microbiology (CZM)

Semester III (From the Academic Year 2017-18)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-31	Physical and Analytical Chemistry – I	04	04	03	40	60	100
	C-32	Organic and Inorganic Chemistry - III	04	04	03	40	60	100
	C - 33	Practical Course-III	04	02	03	40	60	100
Elective Course	Any one of the following.							
	SEC-31	English –I	04	04	03	40	60	100
	SEC-32	Marathi – I	04	04	03	40	60	100
Foundation Course	This course is compulsory for all the students.							
	UGF-32	Cyber Law	02	02	02	20	30	50

Semester IV (From the Academic Year 2017-18)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-41	Physical and Analytical Chemistry – II	04	04	03	40	60	100
	C-42	Organic and Inorganic Chemistry - IV	04	04	03	40	60	100
	C - 43	Practical Course-IV	04	02	03	40	60	100
Elective Course	Any one of the following.							
	SEC-41	English –II	04	04	03	40	60	100
	SEC-42	Marathi - II	04	04	03	40	60	100

ENVIRONMENTAL STUDIES :

As per the order of Honorable Supreme Court of India, this course is compulsory for every undergraduate student. The college is implementing this module course in Environment Studies in the second year (Sem. III and IV) of all degree courses. There will be 50 lectures for this course. The examination will be conducted at the end of Semester IV and will carry 50 marks. It is mandatory for every student, to pass this course before he / she completes the degree course, failing which the degree result will not be declared .

T. Y. B. Sc. (Sem. V and VI)
Semester V (From the Academic Year 2018-19)

The student should select any one subject from the core group which he / she has opted at S.Y.B.Sc.

(Sem. III and IV) as Principle subject.

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-51	Physical Chemistry –I	04	04	03	40	60	100
	C-52	Inorganic Chemistry – I	04	04	03	40	60	100
	C-53	Organic Chemistry – I	04	04	03	40	60	100
	C-54	Analytical Chemistry – I	04	04	03	40	60	100
	C-55	Industrial Chemistry - I	04	04	03	40	60	100
	C-56	Practical Course – V	04	02	03	40	60	100
	C-57	Practical Course – VI	04	02	03	40	60	100
	C-58	Practical Course - VII	04	02	03	40	60	100
Elective Course	Any one of the following.							
	C – 59A	Environment Chemistry-I	04	04	03	40	60	100
	C – 59B	Nuclear Chemistry-I	04	04	03	40	60	100
	C – 59C	Polymer Chemistry-I	04	04	03	40	60	100
Foundation Course	This course is compulsory for all the students.							
	UGF-51	Soft skills	02	02	02	20	30	50

Semester VI (From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Chemistry						
	C-61	Physical Chemistry-II	04	04	03	40	60	100
	C-62	Inorganic Chemistry-II	04	04	03	40	60	100
	C-63	Organic Chemistry-II	04	04	03	40	60	100
	C-64	Analytical Chemistry-II	04	04	03	40	60	100
	C-65	Industrial Chemistry-II	04	04	03	40	60	100
	C-66	Practical Course – VIII	04	02	03	40	60	100
	C-67	Practical Course – IX	04	02	03	40	60	100
	C-68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	C – 69A	Environment Chemistry-II	04	04	03	40	60	100
	C – 69B	Nuclear Chemistry-II	04	04	03	40	60	100
	C – 69C	Polymer Chemistry-II	04	04	03	40	60	100

SCHEME OF TEACHING:

Class	Subjects/courses to be offered by student	No. of contact hours / week	Work Load / Week			
			Theory	Tutorial	Total	Practical
F.Y.B.Sc.	13	42	2	1	03	04
S.Y.B.Sc.	11	42	3	1	04	04
T.Y.B.Sc.	10	38	3	1	04	04

MEDIUM OF INSTRUCTION:

The medium of instruction and examination shall be English.

UNIVERSITY TERMS:

The dates for the commencement and conclusion of the First and the Second terms shall be fixed by the University authorities. The terms can be kept by students, who have registered their names with the University.

SCHEME OF EXAMINATION:

The Assessment of Regular students of Bachelor of Science (B.Sc.) course in the academic session 2015-16 and thereafter shall be based on

- (a) University Examinations (UEX),
- (b) Continuous Internal Assessment (CIA),
- (c) Choice Based Credit System (CBCS), and
- (d) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average system (CGPA)

For each core and elective paper of 100 marks, there will be Continuous Internal Assessment of 40 marks and the University Examination of 60 marks/3 hours duration at the end of each semester. The 04 credit will be given to a student who secures at least 40% of marks allotted to each paper. A candidate who does not pass the examination in any subject or subjects in one semester will be permitted to reappear in such failed subject or subjects along with the papers of following semesters.

The Continuous Internal Assessment (CIA) for each paper will be of 40 marks. The Continuous Internal Assessment may be in the forms as follows:

- a) Attendance 10 Marks
- b) Home Assignment/Tutorial/Test/Presentation 15 Marks
- c) Mid Semester Examination 15 Marks

A student who completed / passes in the Continuous Internal Assessment (CIA) but fails in the University Examination of the course shall reappear for the University Examination of that course. However, his/her marks of the CIA shall be carried over and shall be included in the grade obtained by him/her on passing.

If a student passes in the University Examination but fails in the Continuous Internal Assessment of the course, he/she will not be allowed to reappear for the Continuous Internal Assessment of that course. He/she has to obtain the required grade points to pass by reappearing for the University Examination only. However, his/her grade points obtained in the Continuous Internal Assessment shall be carried over and shall be included in the total grade obtained by him/her for that particular course.

At the end of each semester, a cumulative grade point average (CGPA) and also Semester grade point average (SGPA) will be calculated as a weighted average of the GPI of all courses in which the student has passed till that semester.

A candidate shall be permitted to proceed further from the First Semester up to Fourth Semester irrespective of his/her failure in any of the Semester examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (subsequent) semester subjects. However, he/she should have cleared all the papers at F.Y.B.Sc. Semester I & II when he/she gets admission to T.Y.B.Sc. Semester V.

GRACING:

The gracing shall be done as per existing rules of the University.

VERIFICATION AND REVALUATION:

There is provision for verification and revaluation of the result of the university examination.

A student can apply for the verification and revaluation of the result within the two weeks from the declaration of the results with the prescribed fee. The verification and revaluation shall be done as per the existing rules of the University.

STANDARD OF PASSING:

A candidate shall be declared to have passed in the paper provided he/she has secured minimum GP of 4.5 in the University Examination and a GPA of 4.0 in aggregate of University Examination and Continuous Internal Assessment taken together.

A student who passes in all the courses will be declared to have passed B.Sc. degree. However, the class awarded for B.Sc. degree will be based on his/her performance in Semester III, Semester IV, Semester V and Semester VI taken together and the degree will be awarded with the following honours.

CGPA in [4.00, 4.99] -- Pass Class

CGPA in [5.00, 5.49] -- Second Class

CGPA in [5.50, 5.99] -- Higher Second Class

CGPA in [6.00, 7.99] -- First Class

CGPA in [8.00, 10.00] -- First Class with Distinction

GRADE POINT SCHEME:

The 10-point scale would be used to convert marks out of 100 to grades and grade points according to the following table:

Marks as Percentage	Grade	Grade Point
[75.0, 100]	O	10.0
[70.0, 74.9]	A+	9.0
[65.0, 69.9]	A	8.0
[60.0, 64.9]	B+	7.0
[55.0, 59.9]	B	6.0
[50.0, 54.9]	C+	5.5
[45.0, 49.9]	C	5.0
[40.0, 44.9]	D	4.5

STRUCTURE OF TRANSCRIPT:

At the end of each semester, student will be given a transcript showing the performance and result in each course. The transcript shows, for each course the title of the course, credit values, grade in UE, grade in IA, Grade point index, result as pass or fail. Also, the Semester grade point average and cumulative grade point average will be shown. Further, the equivalent percentage of marks corresponding to SGPA and CGPA will be shown. The formula to convert SGPA or CGPA to equivalent percentage is given by:

$$\text{Equivalent percentage marks} = \begin{cases} 10 \times \text{CGPA} & \text{if CGPA/SGPA is in [4.00, 6.00]} \\ 05 \times \text{CGPA} + 30 & \text{if CGPA/SGPA is in [6.00, 9.00]} \\ 25 \times \text{CGPA} - 150 & \text{if CGPA/SGPA is in [9.00, 10.00]} \end{cases}$$

The above formula computes to the following table:-

Range in % of marks	Range of CGPA	Letter grade	Division
[75.0, 100]	[9.00, 10.00]	O	First class with Distinction
[70.0, 74.9]	[8.00, 8.99]	A+	
[65.0, 69.9]	[7.00, 7.99]	A	First class
[60.0, 64.9]	[6.00, 6.99]	B+	
[55.0, 59.9]	[5.50, 5.99]	B	Higher second class
[50.0, 54.9]	[5.00, 5.49]	C+	Second class
[45.0, 49.9]	[4.50, 4.99]	C	Pass class

[40.0,44.9]	[4.00,4.49]	D	
[00.0, 39.9]	[0.00,3.99]	F	Fail

Thus, the percentage of marks can be obtained by using the following table:

CGPA	% of Marks	CGPA	% of Marks	CGPA	% of Marks	CGPA	% of Marks
4.0	40.0	5.5	55.0	7.0	65.0	8.5	72.5
4.1	41.0	5.6	56.0	7.1	65.5	8.6	73.0
4.2	42.0	5.7	57.0	7.2	66.0	8.7	73.5
4.3	43.0	5.8	58.0	7.3	66.5	8.8	74.0
4.4	44.0	5.9	59.0	7.4	67.0	8.9	74.5
4.5	45.0	6.0	60.0	7.5	67.5	9.0	75.0
4.6	46.0	6.1	60.5	7.6	68.0	9.1	77.5
4.7	47.0	6.2	61.0	7.7	68.5	9.2	80.0
4.8	48.0	6.3	61.5	7.8	69.0	9.3	82.5
4.9	49.0	6.4	62.0	7.9	69.5	9.4	85.0
5.0	50.0	6.5	62.5	8.0	70.0	9.5	87.5
5.1	51.0	6.6	63.0	8.1	70.5	9.6	90.0
5.2	52.0	6.7	63.5	8.2	71.0	9.7	92.5
5.3	53.0	6.8	64.0	8.3	71.5	9.8	95.0
5.4	54.0	6.9	64.5	8.4	72.0	9.9	97.5
						10.0	100.0

CLASS IMPROVEMENT:

The rules regarding the improvement of the class of B.Sc. course will be as follows, as notified by Bharati Vidyapeeth University:

1. The candidate who has passed UG and PG degree examinations of this university with class as shown in column no. 1 and who desires to improve the class as shown in column no. 2 below will be permitted at his/her option to appear for the same examination without being required to keep any terms.

Column no. 1	Column no. 2
Pass Class or Second Class or Higher Second Class or First Class as the case may be	Second Class or Higher Second Class or First Class or First Class with Distinction as the case may be

2. For improvement of class, the candidate will be required to apply and allowed to appear only for the theory examinations.
3. A candidate shall have to reappear for minimum 1/3 and/or maximum of all the theory papers at a time, on which the class is awarded. Candidate should ensure that the examination time table for the subject he is appearing will not clash.
4. Performance of the candidates reappearing for the subject less than 1/3 of the total theory examinations mentioned above will not be considered. However, his/her appearance will be counted as an attempt.
5. If the candidate, who has reappeared for the final year examination under the provisions for his/her class, is successful in improving his/her class by such reappearance, he/she will have to surrender to the university the original degree and the statement of marks that he/she had obtained in that course/subject. Unless original degree and the statement of marks are returned to the university by the candidate, the new degree certificate and statement of marks cannot be issued to the candidate. In the revised degree certificate/statement of marks to be given to the candidate a mention will be made of the fact that he/she improved his/her class under class improvement attempt.
6. A candidate appearing for the improvement of the class/grade shall not be entitled to get benefit of any other rules/orders of the university regarding condonation /grace marks.
7. A candidate appearing for the improvement of class/grade shall not be entitled to get any prize/medal/scholarship/award etc.
8. A candidate who has reappeared for the above examination/s under the provision fails to improve his/her class/grade, his/her performance at such reappearance at such reappearance shall be ignored.
9. If the candidate makes no improvement in the class, then earlier performance will be retained.
10. A candidate will be allowed to reappear for the examination for improvement of class/grade within a period of three years from the date of his/her passing the degree examination.
11. The candidate will be given maximum of three attempts for the improvement of his/her class.
12. The candidate who desires to apply for improvement of class should submit his/her application form for improvement of class from the College/School of Distance Education, Study Centre through which he/she has undergone the course. Form should be submitted for improvement before 31st August for the October/November examination and 28th February for April/May examination season. No form for improvement of class shall be accepted after the prescribe dates for the respective/corresponding examination season.
13. Revised grade sheet will be issued with remark '**Under improvement attempt**'.

C-11 **PHYSICAL & INORGANIC CHEMISTRY-I**
Total Lectures: 36
Total Credits: 03

1. Chemical Kinetics (8)

Ref. 8 Page No. 548-564

2. Distribution Law (8)

Ref. 10 Page No. 743-772

3. Basics of Chemical Mathematics (8)

Ref. 11 Page No. 93-187

REFERENCES:

1. Physical Chemistry by G. M. Barrow
Fifth Edition (McGraw-Hill) (2007)
2. Physical Chemistry by Robert G Mortimer
Third Edition, Elsevier (2008)
3. Physical Chemistry by Atkins and Paula
8th Edition (2008)
4. College Chemistry by Barua, Bijoy and Y. R. Sharma
Kalyani Publishers (1995)
5. Principles of Physical Chemistry by Puri, Sharma and Pathania,
Vishal publishing Company (2008)
6. Physical Chemistry by Dr. S. Pahari
New Central book agency (P) Ltd. (2007)
7. Physical Chemistry by Ira N. Levine
Fifth Edition Tata McGraw-Hill (2004)
8. Principles of Physical Chemistry by Maron and Prutton
4th Edition (2008)
Oxford IBM Publishing Co. Pvt. Ltd.
9. Advanced Physical Chemistry by D. N. Bajpai
S. Chand (2011)
10. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl and
G. D. Tuli
S. Chand (2012)
11. The Chemistry of Maths Book by Erich Steiner,
Oxford University Press, 2nd edition, Reprint (2011)
12. Physical chemistry N. Kundu and S.K.Jain,S.Chand & company Ltd
New Delhi. First edition 1984, reprint 1990
13. Physical Chemistry, A Molecular approach.Donald A. Mc Quarrie and
John D.Simon, Published by University Science Books CA, USA.First
edition 1998, reprint 2006

SECTION – II (INORGANIC CHEMISTRY)

1. Mole Concept and Stoichiometry

(6)

Mole concept-Determination of mol. Weight by gram molecular volume relationship, problems based on mole concept. Methods of expressing concentrations, strength, normality, molarity, molality, %w/v, %v/v, ppm, standardization of solutions, primary & secondary standard substances, Preparation of standard solution of acids & bases, problems related to acid base titrations only.

[Ref. 1,2]

2. Oxidation & reduction

(6)

Definitions of the related terms like oxidation, reduction, oxidizing agent, reducing agent, oxidation number, Balancing of redox reactions using oxidation number method & ion electron method, problems based one equivalent weight of oxidant & reluctant.

[Ref.1,2]

REFERENCES:

1. General Chemistry - Raymond Chang, Kenneth A. Goldsby, McGraw-Hill ; 11th edition (2012)
2. General and Inorganic Chemistry, R.P. Sarkar, Part-I, New Central book agency LTD, London, Third Edn (2011), P 383-461.

**F. Y. B.Sc. CHEMISTRY
(C.B.C.S.) (2016 COURSE)
SEMESTER - I**

C-12 ORGANIC & INORGANIC CHEMISTRY-I
Total Lectures: 36
Total Credits: 03

SECTION – I (ORGANIC CHEMISTRY)

1) INTRODUCTION TO ORGANIC CHEMISTRY (6)

Development of Organic Chemistry: -

Unique properties of organic compounds, sources of organic compounds and applications of organic compounds.

Structural effects: -

Inductive, Resonance, Hyper conjugative and steric effects and their effects on strength of acids and bases.

Bond fission: -

Homolysis & Heterolysis.

Types of Organic Reaction: -

Substitution, Addition, Elimination and Rearrangement with one example of each.

Types of Reagents: -

Electrophilic and Nucleophilic reagents (Definition & examples)

[Ref. 3, Pages 18-25.]

2) FUNDAMENTALS OF ORGANIC REACTION MECHANISM (6)

Reactive Intermediates:

Carbocation : Introduction, generation, structure, stability, elimination of a proton, reaction with nucleophiles, addition to unsaturated compounds and molecular rearrangement.

Carbanions: Introduction, generation, structure, stability, reactions-, displacement and rearrangement.

Free Radicals: Introduction, generation-photolysis, thermolysis and redox Reaction, stability, reaction - recombination, disproportionate, reaction with olefins and rearrangements.

[Ref. 4, Pages. 78 – 121]

3) AROMATIC COMPOUNDS (6)

Aliphatic and Aromatic Compounds, Structure of Benzene, Kekule's structure, stability of benzene, Aromatic character, Huckel's rule, Reactions and mechanism of Nitration, Sulphonation, Halogenation and Friedel – craft reaction.

[Ref. 1, Pages 209-216.]

4) ALDEHYDES AND KETONES (6)

Synthesis of Aldehydes:- From alcohols, methyl benzenes, acid chlorides and phenols. Synthesis of ketones from alcohols, carboxylic acids, acid chlorides & nitriles.

(i) Grignard reagent

(ii) Wittig reaction

(iii) Reduction reactions – Catalytic reduction, LiAlH_4 , NaBH_4 , Clemmensen, Wolf – Kishner.

(iv) Cannizzaro's reaction

(v) Perkins reaction

(vi) Aldol Condensation

(vii) Analysis of aldehydes and ketones.

[Ref. 1, Pages 291-236.]

REFERENCES:

1. Organic Chemistry (Sixth Edition) by Robert Morrison and Robert Boyd.
Prentice Hall of India Pvt. Ltd. New Delhi (1989).
2. Guide book to mechanism in organic chemistry (Sixth Edition) by Peter Sykes, Orient Longman (1981).
3. Organic Chemistry by Francies A. Carey (Sixth Edition), McGraw Hill book Company (1987).
4. Organic Reaction Mechanism (Third edition), by V.K. Ahluwalia, Narosa publishing house, Mumbai.
5. Textbook of Organic Chemistry (Fifth Edition) by Raj K. Bansal - New Age International (P) Ltd. Publishers, Mumbai (2007)

SECTION – II (INORGANIC CHEMISTRY)

1. Chemistry of s-block Elements (12)

Recapitulation of periodic table, special position of hydrogen in the long form of the periodic table, properties of s-block elements w.r.t. electronic configuration, extraction, trends and properties, Introduction to crown ethers and cryptans, separation of s-block elements using crown ethers, Compounds of s-block elements: oxides, hydroxides, peroxides, superoxides. Application of s-block elements in industrial, biological and agricultural fields.

[Ref. 1,2,3]

REFERENCES:

1. Concise Inorganic Chemistry-J.D. Lee, Wiley- India 5th Edition (Reprint 2009), Chapter 8, P 241-242, Chapter-9, P 276-324, Chapter-11, 326-356.
2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, P.L. Gaus, Wiley-India 3rd Edition, (Reprint 2008), P 273-287, 288-307.
3. Concept & model of Inorganic Chemistry-B.E. Douglas D.H. Mc Doniels, Wiley, 3rd Edn (1994), p 8-32.

F. Y. B.Sc. CHEMISTRY
(C.B.C.S.) (2016 COURSE)
C-13 : PRACTICAL COURSE - I
Total Credits: 02

PHYSICAL CHEMISTRY EXPERIMENTS (Any 2)

1. Instructions in first-aid and safety measures in the laboratory.
2. Determine the heat of solution of the salt, Potassium nitrate/Ammonium Chloride.
3. Determine the relative viscosity of the liquids A and B. hence find by graphical method, the percentage composition of A and B in the given unknown mixture C, using viscosity data.
4. Determination of heat of neutralization and heat of ionization.

REFERENCES:

1. Systematic Experimental Physical Chemistry by Rajbhoj and Chondhekar, Anjali Publication. 1st Edition, 1990.
2. Experiments in Chemistry by D.V. Jahagirdar, Himalaya Publishing House. Rerpint (2013).

INORGANIC CHEMISTRY EXPERIMENTS

Qualitative Analysis: (Three mixtures)

A) Qualitative Analysis of Inorganic Mixture containing two basic and two acidic radicals (other than phosphates & borates)

B) Inorganic Preparation (Any One)

- i) Preparation of tris ethylenediaminenickel (II) thiosulphate
 $[\text{Ni}(\text{en})_3]\text{S}_2\text{O}_3$
- ii) Preparation of Tetrammine Copper (II) sulphate monohydrate

REFERENCES:

- 1) Inorganic Qualitative Analysis.- by A.I. Vogel, 7th Edition, Pearson Education (2002)
- 2) Inorganic Quantitative Analysis. - by A.I. Vogel, 6th Edition Prentice Hall; (April 7, 2000)

ORGANIC CHEMISTRY EXPERIMENTS

A) Organic preparations: (Any one)

- (i) Aspirin from salicylic acid.
- (ii) Phthalimide from Phthalic anhydride.

B) Qualitative Analysis: (Any Three)

Detection of type, elements, functional group and M.P. /B.P. of an organic compound.

The 3 compounds analyzed are to be selected from:

- a) Acids: - Benzoic acid, salicylic acid, oxalic acid & Cinnamic acid.
- b) Phenols: - a - Naphthol & b - Naphthol
- c) Bases: - p - Toluidine, Aniline, & m - Nitroaniline.
- d) Neutrals: - m - dinitrobenzene, Acetanilide, Acetone, Nitrobenzene.

REFERENCES:

- 1) Organic qualitative analysis by A.I. Vogel, (Fourth Edition), Longman group Ltd., England (1996)
- 2) Laboratory Manual of Organic Chemistry by R.K. Bansal, (Second Edition), Wiley Eastern Ltd., New Delhi (1990)

C-21 PHYSICAL & INORGANIC CHEMISTRY-II
Total Lectures: 36
Total Credits: 03
SECTION – I (PHYSICAL CHEMISTRY)

[Ref. 8 Page No. 57-61 and Ref. 11]

Introduction, Ideal and non-ideal gases, Effect of pressure, Effect of temperature, Vander Waals equations, Critical phenomena, The law of corresponding states and reduced equation of state, Liquefaction of gases, Joule Thomson effect, Numericals.

[Ref. 8 Page No. 5 -56]

Introduction, Difference between photochemical and ordinary chemical reactions, Different laws of photochemistry, Quantum efficiency, Fluorescence, Phosphorescence, Experimental study of photochemical reactions, Numericals.

[Ref. 8 Page No. 775-786]

REFERENCES:

1. Physical Chemistry by G. M. Barrow, 5th Edition (McGraw-Hill) (2007).
2. Physical Chemistry by Robert G Mortimer, 3rd Edition, Elsevier (2008).
3. Physical Chemistry by Atkins and Paula 8th Edition (2008).
4. College Chemistry by Barua, Bijoy and Y. R. Sharma, Kalyani Publishers (1995).
5. Principles of Physical Chemistry by Puri, Sharma and Pathania (2008).

6. Physical Chemistry by Dr. S. Pahari, New Central book agency (P) Ltd. (2007).
7. Physical Chemistry by Ira N. Levine Fifth Edition Tata McGraw-Hill (2004).
8. Principles of Physical Chemistry by Maron and Prutton, 4th Edition (2008), Oxford IBM Publishing Co. Pvt. Ltd.
9. Advanced Physical Chemistry by D. N. Bajpai, S. Chand (2011).
10. Essentials of Physical Chemistry by Arun Bahl, B. S. Bahl and G. D. Tuli, S. Chand (2012).
11. Mathematical Preparation of Physical Chemistry by F. Daniel's, McGraw Hill Book Comp.Inc.
12. Chemistry 9th edition ,8th edition 2010 by Raymond Chang. McGraw-Hill companies Inc. New York Published by Tata McGraw –Hill Education Private Limited, New Delhi. 9th edition, 8th reprint 2010.
13. Physical chemistry N. Kundu and S.K.Jain,S.Chand & company Ltd New Delhi. First edition 1984, reprint 1990.
14. Physical Chemistry, A Molecular approach.Donald A. Mc Quarrie and John D.Simon, Published by University Science Books CA, USA.First edition 1998, reprint 2006.

SECTION – II (INORGANIC CHEMISTRY)

1. Chemical bonding (12)

Attainment of stable configuration, Types of bonds ionic, covalent, co-ordinate & metallic, Types of overlaps: s-s, p-p, s-p, p-d, d-d and their examples, Formation of sigma & pi bonds, Theories of bonding- a) valence bond theory, b) Heitler London theory and c) Pauling Slater theory, Concept of hybridization: Definition & need of hybridization, steps involved in hybridization, explanation of covalency of atoms in the moles based on hybridization, types of hybridization involving s, p, & d orbitals. Applications of hybridization geometries of molecules like i) BeH_2 ii) BF_3 iii) $[\text{MnCl}_4]^{2-}$ iv) $[\text{Ni}(\text{CN})_4]^{2-}$ v) $\text{Fe}(\text{CO})_5$ vi) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ vii) IF_7

VSEPR theory: Assumptions, need of theory, application of theory to explain geometry of irregular molecules such as

i) ClF_3 ii) Cl_2O iii) BrF_5 iii) TeCl_4 iv) XeO_3 v) XeOF_4

[Ref. 1,2,3]

REFERENCES:

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, , R. L. Keiter, Prentice Hall; 4th Edition (1997) P 205,222.
2. New guide to Modern Valence Theory-G.I. Brown, Longman, 3rd Edn. (1980).
3. Concise Inorganic Chemistry-J.D. Lee, Wiley-India, Fifth Edition(2009)- Chapter-4, p 72-81
4. Concept & model of Inorganic Chemistry-Douglas Mc Doniels, Wiley, 3rd Edⁿ (1994), p 54,66.

**F. Y. B.Sc. CHEMISTRY
(C.B.C.S.) (2016 COURSE)
SEMESTER II**

C-22

ORGANIC & INORGANIC CHEMISTRY-II

Total Lectures: 36

Total Credits: 03

SECTION – I (ORGANIC CHEMISTRY)

1. STEREOCHEMISTRY OF ORGANIC COMPOUNDS (8)

Concept of Isomerism: -

Types of isomerism, structural isomerism, chain, position, functional group and Tautomerism.

Representation of organic molecules: -

Projection formulae – Saw horse (Adrion), Newman, Fischer, Dotted – Wedge – Line formula.

Conformational isomerism: -

Conformational isomerism in alkanes, free rotation about Carbon – carbon single bond. Conformations of Ethane, propane and Butane. Relative stabilities of different conformations.

Optical isomerism: -

Tetrahedral Carbon atom, optical isomerism, polarimeter, specific rotation, Enantiomerism Diastereomerism, Chirality, Prediction of optical activity, plane of symmetry, centre of symmetry. Relative and Absolute Configuration – sequence rules, R and S system of nomenclature.

Geometrical isomerism: -

Geometrical isomerism restricted to carbon – carbon double ($C = C$) bond and open chain compounds only. Conditions for geometrical isomerism, cis – trans and E / Z nomenclatures, Physical and chemical properties of geometrical isomerism.

[Ref. 1, Pages 125,126,135 to 146, 279 to 282, 1162 to 1164]

2. Polynuclear Aromatic Compounds (4)

Fused ring aromatic compounds, Nomenclature of naphthalene derivative, Haworth synthesis of Naphthalene, Reactions of naphthalene - oxidation reduction, nitration, halogenation, sulphonation and Friedel Craft acylation. Haworth Synthesis of Anthracene, Reactions of anthracene-oxidation, reduction, nitration, halogenations and sulphonation.

[Ref. 1:Pages: - 1167-169, 1170-174, Ref.3: pages: - 710-713]

3. Cycloalkanes and cycloalkenes (6)

Cycloalkanes: -

Introduction.

Method of formation - a) By addition of carbene to alkene

b) Action of metallic sodium on dihaloalkane

c) Diels - Alder reaction d) By reduction of aromatic compounds.

Chemical properties- a) Photohalogenation b) Catalytic halogenations

c) Catalytic hydrogenation d) Effect of heat e) Reaction with hydrogen halide

Cycloalkenes :

Introduction.

Method of formation- From cyclic compounds:

Chemical Properties - a) Hydrogenation b) Addition of Halogens and halogen acids c) Allylic halogenations

[Ref.1 , Pages:- 272 – 279; Ref.5 Pages:- 585-589]

4. HETEROCYCLIC COMPOUNDS (6)

Introduction, Huckel's rule for aromatic heterocyclic compounds, synthesis, Resonance, molecular orbital structure and reactions of Furan, Pyrrole & Thiophene.

[Ref.3 , Pages:- 836 – 850]

REFERENCES:

1. Organic Chemistry (Sixth Edition) by Robert Morrison and Robert Boyd. Prentice Hall of India Pvt. Ltd. New Delhi (1989).
2. Guide book to mechanism in organic chemistry (Sixth Edition) by Peter Sykes, Orient Longman (1981).
3. Textbook of Organic Chemistry (Fifth Edition) by Raj K. Bansal - New Age International (P) Ltd. Publishers, Mumbai (2007)
4. Principles of modern Heterocyclic Chemistry By L.A. Paquette.
5. Text – book of Organic Chemistry by Arun Bhal , B.S.Bhal (18th Edition), S.Chand & company,Ltd. New Delhi (2006)
6. Stereochemistry of Organic Compounds by D. Nasipuri, (Second Edition), Wiley Eastern Ltd., New Delhi.(1999)
7. Stereochemistry of Carbon Compounds by Eliel, (Fourth Edition), New Age International (P) Ltd. Publishers New Delhi (1997)

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SECTION – II (INORGANIC CHEMISTRY)

1. CHEMISTRY OF p-BLOCK ELEMENTS (12)

Position of elements in periodic table, electronic configuration of elements trends in properties like atomic size, ionization potential, electronegativity, electron affinity, reactivity, oxidation states, anomalous behaviour of first member of each group.

Structure and properties of: Borate, Halides of aluminium, Allotropes of carbon, Classification of silicates, Oxyacids of phosphorous and sulphur, Inter-halogen compounds.

[Ref. 1,2,3]

REFERENCES:

1. Concise Inorganic Chemistry-J.D. Lee, Wiley-India 5th Edition(2011)
-P 359-638pages.
2. Concept & model of Inorganic Chemistry-Douglas Mc Doniels, Wiley,
3rd Edⁿ (1994), p 789
3. Basic Inorganic Chemistry, F.A. Cotton, G. Wilkinson, P.L. Gaus
Wiley-India, 3rd Ed(2008), p 319-483.

F. Y. B.Sc. CHEMISTRY
(C.B.C.S.) (2016 COURSE)
C-23 : PRACTICAL COURSE - II
Total Credits: 02

PHYSICAL CHEMISTRY EXPERIMENTS (Any 2)

1. Determination of equivalent weight of a given metal by Eudiometer.
2. To study the hydrolysis of methyl acetate in presence of HCl.
3. To study the reaction between $K_2S_2O_8$ and KI (equal concentration).
4. To determine DH and DS for the following chemical reactions
 - i) $Zn(s) + CuSO_4(aq) \longrightarrow Cu(s) + ZnSO_4(aq)$
 - ii) $3Mg(s) + 2FeCl_3(aq) \longrightarrow 2Fe(s) + 3MgCl_2(aq)$
5. Determination of specific and molar refractivities of benzene, toluene and xylene.

REFERENCES:

3. Systematic Experimental Physical Chemistry by Rajbhoj and Chondhekar, Anjali Publication. 1st Edition, 1990.
4. Experiments in Chemistry by D.V. Jahagirdar, Himalaya Publishing House. 1st Edition, 1994.

INORGANIC CHEMISTRY EXPERIMENTS

A) Gravimetric Analysis: (Any Two)

- 1) To determine the Loss/gm and percentage purity of given mixture of $NaHCO_3$ and Na_2CO_3 .
- 2) To determine the number of molecules of water of crystallization from given $BaCl_2$ sample by heating.
- 3) To determine the number of molecules of water of crystallization from given $MgSO_4$ sample by heating.

B) Volumetric Analysis: (Any Two)

- 1) To determine the total hardness of the given sample of water by using EDTA.
- 2) To prepare 0.1 N sodium oxalate solution and standardization of given 0.1N $KMnO_4$ solution.
- 3) To standardize given NaOH solution and hence to find out the strength of the given HCl solution.
- 4) Estimation of % purity of a given sample of sodium chloride.

REFERENCES:

- 1) Inorganic Qualitative Analysis.- by A.I. Vogel
- 2) Inorganic Quantitative Analysis. - by A.I. Vogel

ORGANIC CHEMISTRY EXPERIMENTS**A) Volumetric estimations: (Any Two)**

- (i) Aniline (ii) Phenol (iii) Acetone

B) Techniques: (Any Two)

Purification of an impure organic compound by crystallization/sublimation method and determination of melting point of purified sample.

- (a) Student will report M.P. of organic compound before and after crystallization/sublimation
- (b) Solvents like water, alcohol water + alcohol can be selected for crystallization.

REFERENCES:

- 1) Organic qualitative analysis by A.I. Vogel, (Fourth Edition), Longman group Ltd., England (1996)
- 2) Laboratory Manual of Organic Chemistry by R.K. Bansal, (Second Edition), Wiley Eastern Ltd., New Delhi (1990)

**BHARATI VIDYAPEETH
DEEMED UNIVERSITY, PUNE (INDIA)**

**Syllabus for S.Y.B.Sc (CBCS-2016) : Chemistry
(Choice based Credit System)**

(To be implemented from Academic Year 2017-2018)

Syllabus for S.Y.B.Sc (CBCS) : Chemistry
(To be implemented from Academic Year 2017-2018)

SEMESTER - III

C - 31 : PHYSICAL & ANALYTICAL CHEMISTRY-I

Total Lectures: 48

SECTION - I (PHYSICAL CHEMISTRY)

1. Electrochemistry (12 Lectures)

Introduction, Conduction of electricity, Types of conductors: electronic and electrolytic, Explanation of the Terms: Specific, equivalent and molecular conductance's, relation between specific and equivalent conductance, variation of conductance with dilution, equivalent conductance at infinite dilution, Measurement of Conductance by Wheatstone Bridge, Types of Conductivity cells, Cell constant and its determination, Migration of Ions, Hittorf's Rule (Migration), Transport number, Determination of transport number by moving boundary method, Factors influencing transport number: Concentration, Temperature, Complex formation, Abnormal transport number, Degree of hydration, Kohlrausch Law: i) Relation between ionic conductance, ionic mobility and transport number ii) Determination of equivalence conductance at infinite dilution for weak electrolytes iii) Determination of degree of dissociation iv) Determination of ionic product of water v) Determination of solubility and solubility product of sparingly soluble salts.

Conductometric Titrations: Theory, general procedure, different types of conductometric titrations and applications of conductometric titrations. Ref.7 Page no. 339-464.

2. Thermodynamics - I (06 Lectures)

Spontaneous and non-spontaneous process, Second law of thermodynamics and its different statements, Carnot's Theorem (Heat engine) , Carnot cycle and its efficiency.
Numerical. Ref.1 and 2.

3. Thermodynamics - II (06 Lectures)

Entropy: Introduction, Concept of entropy, Entropy as a state function, Definition mathematical expression, unit, physical significance of entropy, Entropy changes for reversible and irreversible processes in isolated system, Entropy changes for an ideal gas as a function of V and T and as a function of P and T, Entropy change in mixing of gases.

Entropy change in Physical transformations: (i) Fusion of a solid.(ii) Vaporization of a

liquid. (iii) Transition from one crystalline form to another.

Third law of thermodynamics, Absolute entropy and Evaluation of absolute entropy, Use of absolute entropies: Determination of entropy changes in chemical reactions.

Ref.1 and 2.

REFERENCE BOOKS:

1. Essentials of Physical Chemistry (2012), S Chand & Co. Ltd., ArunBahl, B. S. Bahl& G. D. Tuli.
2. Advanced Physical Chemistry (2011), S Chand & Co. Ltd., D. N. Bajpai.
3. Physical Chemistry, G.M.Barrow, International Student Edition, McGraw Hill.
4. Physical Chemistry, R.A.Alberty, Wiley Eastern Ltd.
5. University General Chemistry, C.N.Rao, Macmillan.
6. Physical Chemistry Through Problems, S.K.Dogra, Wiley Eastern Ltd.
7. Principles of Physical Chemistry, Samuel H. Maron, Carl F. Prutton, Fourth Edn.

SECTION – II (ANALYTICAL CHEMISTRY)

1) Importance of Analytical Chemistry and Sampling (3 Lectures)

The analytical process, types of analytical techniques and their comparison. Sampling, storage of samples, sampling of solids, liquids and gases.

Ref. 2 and 3 (Relevant Pages)

2) Errors in Quantitative Analysis. (5 Lectures)

Accuracy, precision, mean deviation, standard deviation, classification of errors, minimization of errors, significant figures and computations, reliability of results, Numericals.

Ref. 2 and 3 (Relevant Pages)

3) Theory of Qualitative Analysis (8Lectures)

Basic principle, common ion effect, solubility, solubility product, preparation of original solution, classification of basic radicals in groups, separation of basic radicals, removal of interfering anions (Phosphate and borate), detection of acidic radicals.

Ref. 2 and 4 (Relevant Pages)

4) Analysis of Organic Compounds (Qualitative & Quantitative)

(8 Lectures)

I. Qualitative

A. Types of organic compounds, Characteristic tests and classifications, reactions of different functional groups, analysis of binary mixtures.

Ref. 4 (Relevant Pages)

II Quantitative

B. Estimation of C, H, (O) by combustion tube, detection of nitrogen, sulfur, halogen and phosphorous by Lassigen's test.

C. Estimation of nitrogen by Dumas's Kjeldahl's flask method, estimation of halogen, sulphur and phosphate by Carious tube method.

D. Determination of empirical and molecular formula and numerical problems.

Ref. 2 and 3 (Relevant Pages)

REFERENCE BOOKS:

- 1) The Quantitative Inorganic Chemistry - by A.I. Vogel
- 2) Fundamentals of Analytical Chemistry - by S.M.Khopkar
- 3) Quantitative Analysis - by Day and Underwood
- 4) Analytical Chemistry - by G.D.Christian

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S.Y. B.Sc. (CBCS) (CHEMISTRY)

SEMESTER - IV

C - 41 : PHYSICAL & ANALYTICAL CHEMISTRY-II

Total Lectures: 48

SECTION - I (PHYSICAL CHEMISTRY)

1. Solutions (10 Lectures)

Ways of expressing concentration, Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids, azeotropes – HCl-H₂O and ethanol – water systems.

Partially miscible liquids – Phenol – water, trimethylamine-water, nicotine-water systems. Lower and upper consolute temperature effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Ref. 7

2. Chemical Kinetics (10 Lectures)

Introduction, Simultaneous reactions such as opposing reactions, Side reactions, Consecutive reactions and chain reactions. (Derivations of rate equations for these reactions are not expected.

Effect of temperature on the rate of reaction : (i) Temperature, coefficient, (ii) Arrhenius equation, (iii) Energy of activation.

Theories of reaction rate : (i) Collision theory, (ii) Transition state theory. Ref no. 1

3. Colloidal State (04 Lectures)

Definition of colloids, classification of colloids.

Solids in liquids (sols) : properties – kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schule law, gold number.

Liquids in liquids (emulsions): preparation and properties, inhibition, general applications of colloids. Ref. 1 and 7

REFERENCE BOOKS:

1. Essentials of Physical Chemistry (2012), S Chand & Co. Ltd., ArunBahl, B. S. Bahl & G. D. Tuli.
2. Advanced Physical Chemistry (2011), S Chand & Co. Ltd., D. N. Bajpai.
3. Physical Chemistry, G.M.Barrow, International Student Edition, McGraw Hill.
4. Physical Chemistry, R.A.Alberty, Wiley Eastern Ltd.
5. University General Chemistry, C.N.Rao, Macmillan.
6. Physical Chemistry Through Problems, S.K.Dogra, Wiley Eastern Ltd.
7. Principles of Physical Chemistry, Samuel H. Maron, Carl F. Prutton, Fourth Edn.

SECTION – II (ANALYTICAL CHEMISTRY)

1) Introduction to Volumetric Analysis

(6 Lectures)

Introduction: Methods of expressing concentrations, Methods of preparation of standard solutions, primary and secondary standard substances.

Apparatus used and their calibration (burettes, microburettes, volumetric pipettes, graduated pipettes, volumetric flask etc.), methods of calibration.

Ref. 2 and 4 (Relevant Pages)

2) Non Instrumental Volumetric Analysis

(18 Lectures)

Indicators : Theory of indicators, acid base indicators, mixed and universal indicators

Acid–Base titrations: Strong acid–Strong base, Weak acid–strong base, Weak acid–Weak base titration, Displacement titrations, polybasic acid titrations. **Redox titrations:** Principle of redox titration, detection of equivalence point using suitable indicators.

Complexometric titrations: Principle, EDTA titrations, choice of indicators

Iodometry and Iodimetry: Theory of iodometry and iodimetry, Preparation and standardization of sodium thiosulphate, Preparation and standardization of iodine solution, Determination of copper in copper sulphate, available chlorine in bleaching powder

Argentimetry: Theory of precipitation titration, Mohr’s method, Fazans method, Preparation and standardization of silver nitrate solution, Determination of chloride, bromide and iodide individually and in a mixture.

Ref. 1-4 (Relevant Pages)

REFERENCE BOOKS:

- 1) The Quantitative Inorganic Chemistry - by A.I. Vogel
- 2) Fundamentals of Analytical Chemistry - by S.M.Khopkar
- 3) Quantitative Analysis - by Day and Underwood
- 4) Analytical Chemistry - by G.D.Christian

Syllabus for S.Y.B.Sc (CBCS) : Chemistry
(To be implemented from Academic Year 2017-2018)

SEMESTER - III

C-32

ORGANIC & INORGANIC CHEMISTRY-III

Total Lectures: 48

SECTION – I (ORGANIC CHEMISTRY)

1. **Organic reaction Mechanism** [08]
 - a) Introduction, types of reagents–electrophile, nucleophile and free radical.
 - b) Types of organic reactions: Addition, Elimination (β -elimination and Hofmann elimination), substitution (aliphatic electrophilic and nucleophilic, aromatic electrophilic) and rearrangement.
 - c) Mechanism: (i) Aldol condensation (ii) Markovnikov and anti-Markovnikov addition reaction (iii) SN^1 and SN^2 reactions
Ref. 1 & 4
2. **Stereochemistry of Cycloalkanes** [06]
 - a) Baeyer's strain theory, Heat of combustion,
 - b) cycloalkanes, factors affecting the stability of conformation,
 - c) Conformation of cyclohexane - equatorial and axial bonds,
 - d) Monosubstituted cyclohexane stability with $-CH_3$ and $-C(CH_3)_3$ substitutes.
Ref. 3
3. **Ethers and Epoxides** [05]
 - a) Ether linkage, classification, Nomenclature, Physical properties.
 - b) Industrial source.
 - i) Williamson's synthesis.
 - ii) Diazomethane method.
 - iii) Alkoxy mercuriation demercuration.
 - iv) Reactions of ethers with cold HI, hot HI and dil H_2SO_4 .
 - v) Synthesis of epoxides, Acid base catalyzed ring opening of epoxides, Reactions with Grignard reagent
(Ref.1, Pages 699 - 708, 713 - 719)
4. **Heterocyclic Chemistry** [05]
 - a) Introduction.
 - b) Structure.
 - c) Nomenclature.

- d) Synthesis and reactions of:- (i) Pyridine (ii) Quinoline (iii) Isoquinoline.

(Ref. 5 :- Sections 7 & 8, Pages :- 223-232, 273-293).

Reference Books:

Ref. 1: Organic Chemistry-6h Ed. Morrison and Boyd Prentice Hall of India Pvt Ltd, New Delhi-2001.

Ref. 2: Outline of Biochemistry 5h Ed., Conn, Stumpf Bruening and Roy Doi John Wiley 1987.

Ref. 3: Stereochemistry of carbon compounds - E. L. Eliel

Ref. 4: Reactions, rearrangements and reagents – S N Sanyal

Ref. 5: Principles of modern Heterocyclic Chemistry By L.A. Paquette.

SECTION – II (INORGANIC CHEMISTRY)

1. **Chemistry of d-block elements** [08]
Position of d-block in periodic table, electronic configuration, trends in properties of these elements w.r.t.(a) size of atoms & ions (b) reactivity (c) catalytic activity (d) oxidation state (e) complex formation ability (f) colour (g) magnetic properties (h) nonstoichiometry (i) density, melting & boiling points.
Ref.1 Page no. 651-675 and
2 Page no. relevant pages.
2. **Bioinorganic chemistry** [06]
Role of metals in bioinorganic compounds, Biological role of some alkali metals and transition metals: compounds of Ca, Mg, Fe and Co, Bioinorganic chemistry of iron, Haemoglobin and myoglobin, Functions of oxygen transfer, oxyhaemoglobin and deoxyhaemoglobin, photosynthesis; photosystem-I and photosystem-II, Vitamin B-12, structure and applications.
Ref.3. page no. 851-921
4. page no. 645-655.
3. **General Principles of Metallurgy:** [06]
Introduction, occurrence of metals, ores and minerals, types of ores, operations involved in metallurgy, crushing, connotation, various methods of concentration such as hand picking, gravity separation, magnetic separation. Froth flotation, Calcinations, Roasting etc.

Reduction, various methods of reduction such as smelting, Aluminothermic process and electrolytic reduction, Refining of metals, various methods of refining such as poling, liquation, electrolytic and vapour phase refining (Van Arkel Process).

Ref. 5. page no. 262-271.

6. page no. 2.3-2.8, 2.13-2.17.

4. **Metallurgy of Aluminium (Electrometallurgy):** [04]

Occurrence, Physiochemical principles, Extraction of Aluminium, Purification of bauxite by Baeyer's process, Electrolysis of alumina, application of aluminum and its alloys.

Ref. 5 page no. 458-463.

6 page no. 2.209 to 2.211.

References:

1. Concise Inorganic Chemistry by J. D. Lee.
2. General Chemistry-Raymond Chang.
3. Inorganic Chemistry-James Huheey, Third Edⁿ
4. Inorganic Chemistry-Shriver and Atkins, Third Edⁿ.
5. Advanced Inorganic Chemistry, Satyaprakash, Tuli, Basu,
6. Text book of Inorganic Chemistry, P.L. Soni.

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S.Y. B.Sc. (CHEMISTRY)
SEMESTER - IV

C-42

ORGANIC & INORGANIC CHEMISTRY-IV
Total Lectures: 48
SECTION – I (ORGANIC CHEMISTRY)

1. **Organic Conversions** [08]
Based on the knowledge of functional group Chemistry the students should be able to suggest how to bring about the given Organic conversions. The conversion should include.
 - a) Converting one functional group in to the other.
 - b) Converting a given molecule in to another with more or less number of carbon atoms.
 - c) Suggesting synthetic routes to the given targets molecule.
 - d) Suggesting the product/s at reactants and conditions are given indicating major/minor products if any.

Ref. 1 & 4
2. **Green Chemistry** [06]
 - a) Introduction ,
 - b) 12 principles of green chemistry,
 - c) Green chemicals - Green reagents, green catalyst, green solvents.
 - d) Emerging green technologies-Microwave chemistry, Sonochemistry.
 - e) Green synthesis

Ref. 5 & 6
3. **Aromatic Nitrogen compounds** [06]
Aromatic nitrocompounds:
 - a) Preparation : Nitration using mixed acid, Preparation of mononitro and dinitro-compounds through nitration of benzene (mechanism), toluene.
 - b) Reactions : Reduction of nitro-compounds under different conditions.
 - c) Applications of nitro compounds : In the preparation of amines.
Aromatic amino compounds:
 - a) Preparation : Reduction of aromatic nitro compounds using catalytic hydrogenation, dissolving metal reduction using – Fe-HCl, Sn-HCl.
 - b) Reactions : Basicity of aromatic amines – effect of substituents on

basicity of aniline, salt formation, N-alkylation, halogenations,
diazotization of aromatic primary amines
Reactions of aryl diazonium salts-Sandmeyer reactions,
Replacement of diazo group by H – OH- CN
Azo-coupling reaction with phenols/naphthols, Reduction of diazonium
salt to aryl hydrazine. Formation of azo-benzenes.
Ref. 1, 7 & 8

4. Introduction of Bio-molecules: [04]

Carbohydrates:

- a) Definition, classification, reaction of monosaccharide (glucose)-
oxidation, reduction, osazone and ester formation, isomerization,
- b) Killiani-Fischer synthesis and Ruff degradation,
- c) Configuration of D/L configuration of (+) Glucose,
- d) Brief account of disaccharides: Sucrose and lactose.

Ref. 2

References:

- 1. Organic Chemistry - By Morrison - Boyd (6th Edition)
- 2. Organic Chemistry - By Finar Vol. II (5th Edition)
- 3. Advanced organic Chemistry - By B.S. Bahl & Arun Bahl.
- 4. Reactions, rearrangements and reagents – S N Sanyal
- 5. Advances in green chemistry: chemical synthesis using MW irradiation by
R.S.Varma
- 6. Green chemistry: Environment friendly alternatives by Rashmi Sanghi and
M.M.Srivastava
- 7. A guide to mechanism in Organic Chemistry, 6th Edition, Peter Sykes,
Pearson Education
- 8. Organic Chemistry, S.H. Pine, McGraw Hill Kogakusha Ltd.

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SECTION – II (INORGANIC CHEMISTRY)

1. **Inorganic high polymers:** [06]

Basic concepts & definitions, classification, comparison of organic and inorganic polymers, classification of inorganic polymers, polymer backbone, Polymers containing Boron, Silicon, Phosphorous, sulphur, fluorocarbons, Heteroatomic polymers, silicones, phosphonitrilic compounds PON polymers, Borazole and its derivatives.

Ref. 1 Relevant pages.

2. **Acids, Bases and Solvents** [06]

Definition of acids and bases, Arrhenius theory, Lowry-Bronsted theory, Lewis concept, Lux-Flood theory, strength of acids and bases, trends in the strength of hydracids and oxyacids, Properties of solvents, M.P-B.P range, dipole moment, dielectric constant, Lewis acid-base character and types of solvents.

Ref. 2. Page no. 163-173.

3. Page no. 143-170.

4. Page no. 299-322.

3. **Hydrogen Bonding and Van-der Waals Forces** [06]

Introduction, Definition of Hydrogen bonding, conditions for formation of Hydrogen bond, strength of Hydrogen bond, Types of Hydrogen bond, Effect of Hydrogen bonding on properties of compounds like M.P, B.P, Physical state, solubility, density, viscosity. Van-der Waals forces, Types of Van-der Waals forces, factors affecting strength of Van-der-Waals forces.

Ref. 1 Page no. 256-258

4. **Chemistry and our life** [06]

Introduction, Essential Nutrients for plants, e.g. carbon, oxygen, hydrogen, nitrogen etc., physiological role of essential elements e.g. phosphorus, potassium, manganese, sulphur, magnesium, calcium, iron, copper, boron etc., Sources of nutrients, Inorganic compounds as medicines e.g. Antacids like Sodium bicarbonate, Aluminium hydroxide gel, Aluminium phosphate, Magnesium hydroxide, platinum complex as antitumour agent.

Ref. 4. Page no. 124-167.

5. Page no. 71-77.

6. Page no. 1-107 and 506-520.

References:

1. Concise Inorganic Chemistry by J. D. Lee, Fifth Edⁿ.
2. Basic Inorganic Chemistry – F. A. Cotton
3. Inorganic Chemistry- Inorganic Chemistry-Shriver and Atkins, Third Edⁿ.
4. Modern Inorganic Chemistry-P.R. Shukla, Pages-299-322
5. Environmental Chemistry-A.K.Day, Seventh Edn, Pages
6. Bioinorganic Chemistry-I. Bertini, H. Gray, Viva Low-Priced Student Edn.

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Semester III (CBCS)
C-III : PRACTICAL COURSE - III

A. PHYSICAL CHEMISTRY EXPERIMENTS (Any 5)

- 1 To study the reaction between $K_2S_2O_8$ and KI. (Equal concentrations).
- 2 To determine the normality of the given strong acid by titrating it against strong alkali conductometrically.
- 3 To determine degree of dissociation and dissociation constant of acetic acid at various dilutions and to verify Ostwald's dilution law conductometrically.
- 4 To determine critical solution temperature of phenol water system
- 5 To determine molecular weight of given organic liquid by steam distillation
- 6 Determination of solubility of benzoic acid at different temperature and to determine ΔH of dissociation process.
- 7 To determine the rate constant of base catalyzed ester hydrolysis.

B. ORGANIC CHEMISTRY EXPERIMENTS

Organic qualitative analysis: (3 Mixtures)

a) Separation of binary mixtures (without ether) followed by Type determination, Recrystallization, M.P./B.P. of separated organic components from mixture.

Type determination, Recrystallization, M.P./B.P.

The following compounds should be selected:-

Acids:- Benzoic, salicylic, phthalic, cinnamic and oxalic acid.

Phenols:- a - Naphthol, b-Naphthol & Resorcinol

Bases:- Aniline, p-Toluidine, o-Nitroaniline, p-Nitroaniline, m-Nitroaniline, and N-N dimethyl aniline.

Neutrals:- Acetone, Ethylmethyl ketone, Ethyl acetate, Naphthalene, m-Dinitrobenzene, Nitrobenzene, Acetanilide, Thiourea

Volumetric analysis :

(Any one)

- (i) Estimation of Acetamide.
- (ii) Estimation of Carboxylic acid.

Organic preparations:

(Any one)

- (i) Acetanilide from aniline using anhydrous ZnCl_2 and Zn dust
- (ii) Acetanilide to p-bromoacetanilide
- (iii) Diazoaminobenzene from Aniline.

**Semester IV (CBCS)
Chemistry Practical-IV**

B. ANALYTICAL CHEMISTRY EXPERIMENTS

(Any 5)

- 1 To determine the strength of given H_2O_2 solution by using 0.05M KMnO_4 & hence to find out the volume strength of H_2O_2 .
- 2 To determine the amount of acetic acid from the given commercial sample of Vinegar by using standard NaOH solution.
- 3 To determine the amount of Vitamin C from the given tablet.
- 4 To determine the amount of Lactic acid and from the given sample of curd by using 0.05N NaOH solution.
- 5 Estimation of sodium carbonate content of washing soda.
- 6 To find out the saponification value of the given sample of an oil.

C. INORGANIC CHEMISTRY EXPERIMENTS

Inorganic Qualitative Analysis

(3 Mixtures)

Qualitative Analysis of Inorganic mixture containing two Basic and two Acidic radicals (including water soluble borate radicals)

INORGANIC PREPARATION**(Any One)**

- i) Preparations of Ferrous ammonium sulphate (Mohr's salt)
- ii) Synthesis of nitropenta-amino Cobalt (III) Chloride.

Laboratory techniques**(Any one)**

- (i) TLC:- Separation of pigments, dyes, nitroanilines.
- (ii) Isolation of Anthocyanin from flowers.

Note:-

- a) Double burette method should be used for all types of titrations.
- b) Stock solutions should be supplied in 100 ml volumetric flask (10 to 15 ml)
- c) Student must write general reactions for all tests that are performed during analysis.

REFERENCE BOOKS

- 1) Organic qualitative analysis - By A.I.Vogel.
- 2) Organic Chemistry by Finar Volume-II, 5th edition.
- 3) Analytical Chemistry by G.D. Christian 6th edition.
- 4) Vogel's Textbook of Quantitative chemical analysis 6th edition R.C. Denney, J.D. Barnes, M.J.K. Thomas

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T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)

SEMESTER - V

C - 51 : PHYSICAL CHEMISTRY-I

Course content: 04 Credits

48 Lectures

1. Surface Chemistry

(10 Lectures)

Adsorption isotherm.

(i) Langmuir adsorption isotherm with derivation and its limitations.

Types of physical adsorption isotherms.

BET equation (derivation not expected).

Determination of surface area of adsorbent using.

(i) B.E.T. equation.

(ii) Harkin and Jura method.

[Ref, 2: Pages 928-938, Ref 3: Pages 171-180]

2. Electromotive force.

(18 lectures)

Convention: Reduction potentials to be used) Introduction, Thermodynamics of electrode potentials, Nernst equation for electrode and cell potentials in terms of activities, Types of electrodes: Description in terms of construction, representation, half cell reaction and emf equation for i) Metal – metal ion electrode, ii) Amalgam electrode, iii) Metal – insoluble salt electrode, iv) Gas – electrode v) Oxidation –Reduction electrode, Reversible and Irreversible cells, i) Chemical cells without transference, ii) Concentration cells with and without transference, iii) Liquid – Liquid junction potential : Origin, elimination and determination, Equilibrium constant from cell emf, Determination of the thermodynamic parameters such as ΔG , ΔH and ΔS , Applications of emf measurements: i) Determination of pH of solution using Hydrogen electrode. ii) Solubility and solubility product of sparingly soluble salts (based on concentration cell).

Numerical problems.

[Ref, 1: Pages 471-486, 492-519]

3. Introduction to Absorption Spectrophotometry

(10 Lectures)

Principles of colorimetry, nature of radiation, interaction of radiation and matter, Laws of absorptivity, factors governing absorptivity, deviations and limitations of absorption laws. Additivity of absorbances, simultaneous determinations, photometric titrations.

[Ref, 4: Pages 2.107-2.147]

4. Elementary Quantum Mechanics.

(10 lectures)

Introduction, Black body radiation, Planck's radiation law, Photoelectric effect, Compton effect, De Broglie hypothesis, The Heisenberg's uncertainty principle, Schrodinger wave equation and its importance (no derivation), Physical interpretation of the wave function.

[Ref. 11. Quantum Chemistry second edition by Manas Chandra-Relevant Pages

Ref. 12. Physical Chemistry a molecular approach by Donald A. McQuarrie, John D. Simon-Relevant pages]

Reference Books:

1. Principles of Physical Chemistry by S.H.Marron and C.FPrutton. 4thedition.Oxford and IBH Publishing Co. Pvt Ltd.
2. Essentials of Physical Chemistry by B. S. Bahl, G. D. Tuli and ArunBhal Edition 2000 S Chand and Company Ltd.
3. Physical Chemistry by R.L. Madan and G. D. Tuli, 5th edition 2009, S. Chand & Co Ltd.
4. Instrumental methods of Chemical Analysis by Chatwal and Anand, Enlarge edition 2011, Himalaya Publications.
5. Elements of Physical Chemistry by S.Glasstone and D.Lewis. 2nd edition.McMillan Education.
6. Physical Chemistry by N. Kundu and S.K. Jain, S. Chand and Co. Ltd. 1987.
7. University General Chemistry, C.N.R. Rao, MacMillan.
8. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
9. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
10. Physical Chemistry Through problems, S.KDogra and S. Dogra, Walley Eastern Ltd.
11. Quantum Chemistry Second Edition by Manas Chandra
12. Physical Chemistry a Molecular Approach by Donald A. Mcquarrie, John D. Simon

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T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)

SEMESTER - VI

C - 61 : PHYSICAL CHEMISTRY-II

Course content: 04 Credits

48 Lectures

Course Contents: 48 Lectures

1. Physical Properties and Molecular Structure. (10 Lectures)

Optical activity, polarization – (Clausius – Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment – temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties – paramagnetism, diamagnetism and ferromagnetism.

2. Molecular Spectroscopy (16 Lectures)

Introduction: electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules, energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum

Infrared spectrum : energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of an harmonic motion and isotope on the spectrum, idea of vibrational frequencies of difference functional groups.

Raman Spectrum:

Concept of polarizability, pure rotational and pure vibrational Raman Spectra of diatomic molecules, selection rules.

[Ref, 1: Pages 691-710, Ref, 2: 398-424]

3. Solid State Chemistry (10 Lectures)

Introduction, space lattice, lattice planes, unit cells.

Laws of crystallography: (i) Law of constancy of interfacial angles(ii) Law of rational indices. (iii) Law of crystal symmetry.

Weiss indices and Miller indices.

Cubic lattice and types of cubic lattice, planes or faces of a simple cubic system, spacings of lattice planes.

Diffraction of X-rays, derivation of Bragg's equation.

Determination of crystal structure of NaCl and KCl on the basis of Bragg's equation.

[Ref, 1: Pages 67-85]

4. Nuclear Structure and Radioactivity (12 Lectures)

The atom, its nucleus and outer sphere, classification of nuclides, nuclear stability, binding energy, discovery of radioactivity, types of radioactivity, general characteristics of radioactive decay, decay kinetics.

Measurement of radioactivity, gaseous ion collection method, proportional counter, G.M.counter.

Radiochemical principles in the use of tracers, typical applications of radio isotopes as tracers : (a) Chemical investigation (b) Reaction mechanism (c) Structure determination (d) Age determination.

[Ref, 4: Pages 4-15, 117-119, 121-125, 371-378]

Reference Books:

1. Principles of Physical Chemistry by S.H.Marron and C.FPrutton. 4thedition.Oxford and IBH Publishing Co. Pvt Ltd.
2. Elements of Physical Chemistry by S.Glasstone and D.Lewis. 2ndedition.McMillan Education.
3. Physical Chemistry by N. Kundu and S.K. Jain, S. Chand and Co. Ltd. 1987.
4. Essentials of Nuclear Chemistry by Prof. H.J. Arnikar, Willey Eastern Ltd.
5. University General Chemistry, C.N.R. Rao, MacMillan.
6. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.
7. The Elements of Physical Chemistry, P.W. Atkins, Oxford.
8. Physical Chemistry Through problems, S.KDogra and S. Dogra, Walley Eastern Ltd.

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T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - V
PRACTICAL COURSE - V
(PHYSICAL CHEMISTRY)

GROUP-I

NON - INSTRUMENTAL EXPERIMENTS

A Chemical Kinetics

1. To study the effect of concentration of the reactants on the rate of hydrolysis of an ester.
2. To determine the first order velocity constant of decomposition of H_2O_2 by volume determination of oxygen.
3. To determine the energy of activation for the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI for unequal initial concentration.
4. To study the effect of addition of electrolyte (KCl) on the reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI . (Equal Concentration)
5. Determine the order of reaction of a given reaction.
(Any three experiments)

B Phenol-Water

1. To study the mutual solubility of phenol and water at various temperatures and hence determine the critical solution temperature.

C Transport Number

1. To determine the transport number of cation by moving boundary method.

GROUP-II

INSTRUMENTAL EXPERIMENTS

A Potentiometry

1. Titration of strong acid with strong alkali.
2. Determine the formal redox potential of ferrous/ferric system by potentiometry.
(Any one experiment)

B Colorimetry.

1. Determine the λ_{max} and concentration of the given solution of KMnO_4 in $2\text{N H}_2\text{SO}_4$.

C Conductometry

1. To determine the dissociation constant of a weak acid conductometrically.
2. To determine the strength of the given acid conductometrically using standard alkali solution.
3. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by conductometrically.
4. Titration of a mixture of weak and strong acid with strong alkali.
(Any two experiments)

D pH Metry.

1. Determination of degree of hydrolysis of aniline hydrochloride.

E Refractometry.

1. Determination of molar refraction of the given liquids A,B,C and D.

2. To verify law of refraction of mixtures(e.g., glycerol and water) using Abbe's refractometer.

(Any one experiment)

G Polarimetry.

1. To determine the specific rotation of a given optically active compound.

Reference Books:

1. Experiments in Chemistry Dr.D.V.Jahagirdar, Himalaya Publishing House.
2. Systematic Experimental Physical Chemistry by S.W.Rajbhoj and Dr.T.K.Chondhekar, Anjali Publication Aurangabad.
3. Experimental Physical Chemistry, Daniel.Alberts.7th Edition.
4. Findlay's Practical Physical ChemistryB.P.Levitt.9th Edition.
5. Experiments in PhysicalChemistry, R.C.Dasand .Behra. Tata McGrawHill.
6. Advanced Practical Physical Chemistry, J.B.Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol1-Physical,J.N.GurtuandR.Kapoor,S.Chand&Co.
8. Selected Experiments in Physical Chemistry N.G.Mukherjee. J.N.Ghose& Sons.
9. Experiments in Physical Chemistry, J.C.Ghosh, BhartiBahavan.

T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI

PRACTICAL COURSE - VIII
(PHYSICAL CHEMISTRY)

GROUP-I

NON - INSTRUMENTAL EXPERIMENTS

A Chemical Kinetics

1. To compare the relative strength of HCl and H₂SO₄ by measuring the rates of hydrolysis of an ester.
2. To investigate the kinetics of hydrolysis of acetate using a dilatometer.
3. Investigate the influence of ionic strength on the rate constant between potassium persulphate and potassium iodide.
4. To study the energy of activation of second order of reaction between K₂S₂O₈ and KI. (Equal concentration)
(Any two experiments)

B Viscosity

1. To determine the molecular weight of a high polymer using its solutions of different concentrations.

C Phenol-Water

1. To study the effect of addition of salt on critical solution temperature of phenol-salt system.

GROUP-II

INSTRUMENTAL EXPERIMENTS

A Potentiometry

1. Determination of P^H of unknown buffer solutions by potentiometric measurements.
2. Determination of dissociation constant of given monobasic acid by potentiometric titration.
(Any one experiments)

B Colorimetry.

1. Determine the λ_{max} and concentration of given CuSO₄- NH₃ complex.

C Conductometry

1. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically.
2. To study the effect of substituent on dissociation constant of weak acid w.r.t. acetic acid & monochloroacetic acid.

D. P^H Metry.

1. Determination of the dissociation constant of given weak acid by pH metric titration.

E Refractometry.

1. Determination of molar refraction of the given liquids A,B,C and D.
2. To verify law of refraction of mixtures (e.g., glycerol and water) using Abbe's refractometer.

G Polarimetry.

1. Study of kinetics of inversion of cane sugar using same strength of two acids.

Reference Books:

1. Experiments in Chemistry Dr.D.V.Jahagirdar, Himalaya Publishing House.
2. Systematic Experimental Physical Chemistry by S.W.Rajbhoj and Dr.T.K.Chondhekar, Anjali Publication Aurangabad.
3. Experimental Physical Chemistry, Daniel.Alberts.7th Edition.
4. Findlay's Practical Physical Chemistry B.P.Levitt.9th Edition.
5. Experiments in Physical Chemistry, R.C.Das and .Behra. Tata McGrawHill.
6. Advanced Practical Physical Chemistry, J.B.Yadav, Goel Publishing House.
7. Advanced Experimental Chemistry, Vol1-Physical, J.N.Gurtu and R.Kapoor, S.Chand & Co.
8. Selected Experiments in Physical Chemistry N.G.Mukherjee. J.N.Ghose & Sons.
9. Experiments in Physical Chemistry, J.C.Ghosh, Bharti Bahavan.

T.Y.B.Sc (CHEMISTRY) CBCS-2016
SEMESTER - V
C - 52 : INORGANIC CHEMISTRY –I

Credits-4

48 Lectures

1. Coordination Chemistry

(8 Lectures)

- a. Introduction to coordination chemistry
- b. Double salts and Coordination compounds
- c. Basic terms involved in coordination chemistry- Coordinate bond, central metal atom or ion, complex compound, complex ion etc , charge on complex ion, calculation of oxidation number of metal, coordination number, Ligands: Classification of ligands, definitions, Chelates and chelating agents.
- d. IUPAC nomenclature of coordination compounds
- e. Applications of metal complexes in different fields

Ref. 2: pages 194-195, 230-232

Ref.12: pages 620-685

2. Werner's Theory of Co-ordinations compounds

(06 Lectures)

Postulates of Werner's coordination theory, Werner's formulation of Coordination compounds, Physical and chemical test to support his formulation of ionizable and non-ionizable complexes, Stereoisomerism in complexes with C.N.4 and C.N. 6 to identify the correct geometrical arrangement of the complexes.

Ref.2: pages 234-238

3. Isomerism in Coordination Complexes (Coordination No 8 and 6)

(6 Lectures)

- a. Structural isomerism (Ionisation, hydrate, linkage, Ligand, Co-ordination Position. Polymerisation isomers)
- b. Geometrical isomerism and optical isomerism.

Ref-14: pages 205-230

4. Sidgwick model:

Introduction to Sidgwick's model, Scheme of arrow indication for M-L bond suggested by Sidgwick, Concept of Effective Atomic Number rule (EAN), Calculations of EAN value for complexes and stability of complexes, Advantages and Drawbacks of Sidgwick's theory.

Ref 9: pages 411-415, Ref.14: pages 229-2315.

5. Pauling's Valence Bond Theory:

(06 Lectures)

- a. Introduction
- b. Assumptions
- c. Concept of hybridization
- d. Bonding in Tetrahedral, Square Planar and Octahedral complexes with examples.
- e. Inner and outer orbital complexes.
- f. Electro neutrality Principle.
- g. Multiple bonding
- h. Limitations

Ref 3: pages 77-78, Ref.14: pages-231-241

6. Crystal Field Theory: (CFT):

(12 Lectures)

- a. Introduction
- b. Assumptions
- c. Degeneracy of 'd' orbitals
- d. Application of CFT to octahedral, tetrahedral & Square planer complexes
- e. CFSE, Calculation of CFSE in Weak field and Strong field complexes.
- f. Evidences of CFSE
- g. Factors Affecting $10 Dq$
- h. CFT and magnetic properties
- i. Spectrochemical series
- j. Nephelauxetic effect
- k. Jahn Teller Distortion, Merits and Limitation of CFT.

Ref 9: pages 421-434

7 (A) Corrosion:

(10 Lectures)

Definition, Electrochemical theory of corrosion, Factors affecting the corrosion, Position of elements in the electrochemical series, Purity of metal, Effect of moisture, Effect of oxygen, Physical state of metal, Methods for protection of the metals like, alloy formations, coating of the metals such as electroplating, hot dipping, metal spraying, cladding, Cathodic protection and use of inhibitors.

(B) Passivity :

Definitions, theories of passivity, electrochemical passivity and its applications.

Ref-13: pages 211-234.

Reference Books:

1. Introduction to Electrochemistry by Glasstone - 2nd edition.
2. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
3. Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS - 2nd edition.
4. Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.
5. Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3rd edition.
6. Chemistry by Raymond Chang - 5th edition
7. New Guide to Modern Valence Theory by G.I. Brown - 3rd edition
8. Co-ordination Compounds by Baselo and Pearson.
9. Theoretical Inorganic Chemistry by Day and Selbin.
10. Inorganic Chemistry by A. G. Sharpe - 3rd Edition.
11. Coordination Chemistry by A. K. De.
12. General and Inorganic Chemistry, Part-II by R. Sarkar, New central book agency
13. Applied inorganic Chemistry, T.W. Swaddle pp211-234 corrosion
14. Modern inorganic chemistry, P.R. Shukla, Ed 1st, 2002, Himalaya publishing House.

T.Y.B.Sc (CHEMISTRY) CBCS-2016
SEMESTER - VI
C - 62 : INORGANIC CHEMISTRY –II

Credits-4

48 Lectures

1. Molecular Orbital Theory: (15 Lectures)

L. C. A. O. method (Approach), Combination of s-s, s-p, p-p, p-d and d-d orbitals, Nonbonding atomic orbitals, combination of orbitals, Rules for linear combination of atomic orbitals, Qualitative M.O. energy level diagrams for homonuclear diatomic molecules of first row and second row elements, M.O. energy diagrams for three centre - two electron (3c - 2e) bond, M.O. energy diagrams for heteronuclear diatomic molecules like NO, CO and HCl, M. O. energy level diagrams for CO₂, Comparison of V. B. and M. O. bond approach.

Ref. 2: Pages 89-112, 106-117

Ref. 4: Pages 55-72

2. Molecular Orbital Theory (MOT) of Coordination complexes (06 Lectures)

Introduction, M.O. treatment of Bonding in Octahedral complexes without pi bonding, Metal orbitals and Symmetry symbols, M.O. energy level diagram of complexes without pi bonding, Octahedral complexes with pi bonding, Ligand field theory, charge transfer spectra, Merits and Limitations of M.O.T. comparison of VBT, CFT & M.O.T.

Ref. 2: Pages 194 -236

Ref. 8: Relevant Pages

Ref. 9: Relevant Pages

3. Metals and Semiconductors (10 Lectures)

Introduction, metallic properties, Nature and theories of bonding in metals, Band theory of metals with respect to Na, Electronic energy bands, n(E) and N(E) curves,. Electronic conductivity of metals(monovalent, bivalent, trivalent), semiconductors and their types, effect of temperature and impurity on semiconductivity n-type and p-type semiconductors, semiconductivity in ZnO and NiO, Applications of semiconductors.

Ref. 7: Pages 209-221

Ref. 6: Related Pages

Ref. 13: Pages 73-85

4. Homogeneous Catalysis (06 Lectures)

Introduction definition, types of homogeneous catalysts, properties of homogeneous catalysts, Catalytic Reactions such as:

a. Wilkinson's Catalysis

b. Zeigler Natta Catalysis

c. Monsanto acetic acid synthesis

Ref. 3: 588-591

Ref. 6: Related Pages

Ref. 12: Pages 650-652 and 656-661

5. Chemistry of f block elements

(08 Lectures)

A) The Lanthanides:

Introduction, Position of Lanthanides in the periodic table, Electronic configuration, oxidation states, Lanthanide contraction & its effect, Occurrence & separation of Lanthanides by ion exchange method & solvent extraction method, Applications of Lanthanides, Misch metal.

B) The Actinides:

Introduction, Position of Actinides in periodic table, Electronic configuration, oxidation states, General methods of preparation of transuranic elements. Nuclear fuels, Gas mantle.

Ref. 2: Pages 859-863, 865-866, 874 – 875, 879-886, 891-893, 898-900

Ref.13: Pages, 632-642, 645-662

6 Chemical Toxicology:

(03 Lectures)

Introduction, Toxic chemicals in environment, Impact of toxic chemicals on enzymes, Biochemical effects of arsenic, cadmium, lead and mercury, Biological methylation

Ref.14: pages 158-167

Reference Books:

1. Introduction to Electrochemistry by Glasstone - 2nd edition.
 2. Concise Inorganic Chemistry by J.D. Lee - 5th edition.
 3. Inorganic Chemistry, - D.F. Shriver & P.W. Atkins- C.H. Longford ELBS - 2nd edition.
 4. Basic Inorganic Chemistry, - F.A. Cotton and G. Wilkinson, Wiley Eastern Ltd 1992.
 5. Concept and Model of Inorganic Chemistry by Douglas – Mc Daniels - 3rd edition.
 6. Chemistry by Raymond Chang - 5th edition
 7. New Guide to Modern Valence Theory by G.I. Brown - 3rd edition
 8. Co-ordination Compounds by Baselo and Pearson
 9. Theoretical Inorganic Chemistry by Day and Selbin
 10. Inorganic Chemistry by A. G. Sharpe - 3rd Edition
 11. Principles of Bioinorganic Chemistry by S. J. Lippard and J. M. Berg, Panima Publishing Corporation, 1st Edn.
 12. Inorganic Chemistry by J.E. Huheey, 4th Edn, Pearson Education.
 13. Modern aspects of Inorganic Chemistry by H.J. Emeleus, A.G. Sharpe, 4th Edn, 6th Indian reprint.
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T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - V

PRACTICAL COURSE - VI
(INORGANIC CHEMISTRY)

A) Inorganic Qualitative Analysis(Six mixtures)

- a) Water soluble mixture – any one
- b) Water insoluble mixture-any one
- c) Mixtures containing Borate-any two
- d) Mixtures containing Phosphate-any two

B) Inorganic preparations (Any Three)

- 1. Preparation of Potassium trioxalatoaluminate(III) trihydrate
- 2. Preparation of Reinecke's salt.
- 3. Preparation of Tris(Thiourea)Copper (I) Chloride $[\text{Cu}(\text{Thiourea})_3]\text{Cl}$.
- 4. Preparation of Manganese (III) acetylacetonate $[\text{Mn}(\text{acac})_3]$.
- 5. Preparation of Potassium Trioxalatoferrate (III), $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$.

Reference Books:

- 1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
- 2. Quantitative Chemical Analysis S. Sahay (S. Chand & Co.).
- 3. Quantitative Analysis R.A. Day, Underwood (Prentice Hall).
- 4. General Chemistry Experiment – Anil J Elias (University press).
- 5. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
- 6. Vogel's Textbook of Quantitative Chemical Analysis.
- 7. "Experimental Methods in Inorganic Chemistry." Tanaka, J. and Suib, S.L., Prentice Hall

T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI

PRACTICAL COURSE - IX
(INORGANIC CHEMISTRY)

A) Gravimetric Estimations (Any Three)

1. Estimation of Ni as Ni – DMG
2. Estimation of Pb as PbCr₂O₄
3. Estimation of Al as Aluminum oxide
4. Estimation of Ba as BaSO₄ using homogeneous precipitation method.
5. Estimation of Fe as Fe₂O₃

B) Volumetric Estimations (Any Three)

1. Estimation of Mg from talcum powder
2. Analysis of Brass-Estimation of copper by Iodometry
3. Estimation of % purity of given sample of Sodium Chloride
4. Estimation of Mn by Volhard's method
5. Estimation of Copper in the given CuSO₄ crystals using standard 0.1N AgNO₃ solution.

C) Colourimetric Estimations (Any One)

1. Iron by thiocyanate method.
2. Cobalt by using R-nitroso salt method.

D) Column Chromatography (Any Two mixtures)

To separate cations of a given binary mixtures by Column chromatography.

Reference Books:

8. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
9. Quantitative Chemical Analysis S. Sahay (S. Chand & Co.).
10. Quantitative Analysis R.A. Day, Underwood (Prentice Hall).
11. General Chemistry Experiment – Anil J Elias (University press).
12. Practical Chemistry K.K. Sharma, D. S. Sharma (Vikas Publication).
13. Vogel's Textbook of Quantitative Chemical Analysis.
14. "Experimental Methods in Inorganic Chemistry." Tanaka, J. and Suib, S.L., Prentice Hall

T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)

SEMESTER - V

C - 53 : ORGANIC CHEMISTRY-I

Course content: 04 Credits

48 Lectures

1. Nucleophilic substitution at Saturated carbon.

(10 Lectures)

- (a) Nucleophilic aliphatic substitution.
- (b) Nucleophiles and leaving groups.
- (c) Rate of reactions.
- (d) Kinetics of first order and second order reactions.
- (e) Duality of mechanism.
- (f) SN^1 reaction : - Kinetics, mechanism and stereo chemistry.
- (g) SN^2 reaction: - Kinetics, mechanism and stereo chemistry.
- (h) Comparison between SN^1 & SN^2 reactions.

Ref.1: Sections: - 5.7 to 5.21, 5.23

Pages - 172 to 203 and 208 to 210

2. Elimination Reactions

(08 Lectures)

- (a) 1, 2 elimination reactions.
- (b) Kinetics (duality of mechanism)
- (c) E_2 mechanism with evidence.
- (d) Orientation and Reactivity.
- (e) E_1 mechanism with evidence
- (f) Orientation in E_1 reaction.
- (g) Elimination Vs substitution.

Ref.1 – Sections: - 8.13 to 8.25

Pages - 290 to 310

3. Aromatic Electrophilic substitution.

(10 Lectures)

- (a) Introduction.
- (b) Effect of substituent group (orientation)
- (c) Determination of orientation and relative reactivity.
- (d) Classification of substituent groups.
- (e) Orientation in disubstituted benzene.
- (f) Mechanism of nitration, sulphonation, halogenation, Friedel Craft alkylation, Friedel Craft acylation.

Ref. 1- Sections: 15.1 to 15.19, 16.8, 16.9 & 18.5 Pages: -517 to 544, 666 to 667

Ref.4 Sections: - 6.10.2 : Pages: - 169 to 173

4. Electrophilic addition to Carbon – Carbon double bond.

(10 Lectures)

- a) Introduction.
 - b) Reactions at Carbon – Carbon double bonds: -
 - (i) Addition of halogens.
 - (ii) Addition of halogen acids.
 - (iii) Addition of water.
 - (iv) Addition of KMnO_4 .
 - (v) Addition of OsO_4 .
 - (vi) Addition of H_2SO_4 .
 - (vii) Addition of per acid.
 - (viii) Ozonolysis.
- Ref. 1 Section: - 9.1 – 9.2, 9.5 to 9.14, 9.17 to 9.21, 9.25, 9.26
Pages: - 317 to 323, 327 to 343, 346 to 355, 357 to 360.

5. Stereochemistry of cyclic Compounds.

(10 Lectures)

Introduction, Disubstituted cyclohexane – 1,1 disubstituted cyclohexane, 1,2 disubstituted cyclohexane, 1,3 disubstituted cyclohexane and 1,4 disubstituted cyclohexane.
Geometrical and optical isomers & their relative stabilities.

Reference books:

- 1) Organic Chemistry by Morrison and Boyd - 6th Ed. 1996.
- 2) Organic Chemistry by John McMurry – 5th Ed. Assian books 1999.
- 3) Organic Chemistry by Graham Solomans and Craig Fryhle - 7th Ed. 2002.
- 4) A guide book to reaction mechanism by peter sykes - 6th Ed.
- 5) Organic chemistry by I.L.Finar vol.II – 6th Ed. 1975.
- 6) Absorption spectroscopy of organic molecules by V.M.Parikh (1974).
- 7) Designing organic synthesis by stuart warren (1983).
- 8) Organic Chemistry by pine 5th ed. 1987.

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)

SEMESTER - VI

C - 63 : ORGANIC CHEMISTRY-II

Course content: 04 Credits

48 Lectures

- 1. Addition of Carbanions to Carbonyl (C = O) group. (10 Lectures)**
 - (a) Carbanion formation and stabilisation.
 - (b) Carbanion reactions: -
 - (i) Aldol Condensation.
 - (ii) Henry reaction.
 - (iii) Perkin's reaction.
 - (iv) Claisen – ester Condensation.
 - (v) Dieckmann Condensation
 - (vi) Wittig reaction.

Ref.4 Sections: - 8.4.1, 8.4.4, 8.4.5, 8.4.6, 8.4.8, 8.4.11, 10.1 & 10.2 Pages: 219-231, 233, 234, 271–275
- 2. Introduction to Spectroscopy. (03 Lectures)**
 - (a) Meaning of spectroscopy, Nature of electromagnetic radiation, wavelength, amplitude, wave number and their relationship, frequency, different regions of electromagnetic spectrum.
 - (b) Interaction of radiation with matter, excitation of molecules with different energy levels such as rotational, vibrational and electronic level.
 - (c) Types of spectroscopy and advantages of spectroscopic methods.

Ref.6: - Sections: - 1.2, 1.3, 1.6, 1.7, 1.8, & 1.10
Pages: - 1 to 3, 7 to 11
- 3. Ultraviolet (UV) Spectroscopy. (08 Lectures)**
 - (a) Introduction: - Nature of UV spectrum, Beer's law, absorption of UV, radiations by organic molecules leading to different excitations.
 - (b) Terms used in UV spectroscopy: - Chromophore, Auxochrome, Bathochromic Shift, Hypsochromic Shift, Hyperchromic and Hypochromic shifts.
 - (c) Effect of Conjugation on a position of UV band.
 - (d) Calculation of λ_{max} by Woodward and Fisher rule for dienes and enone systems.
 - (e) Applications of UV Spectroscopy: -
 - (i) Determination of structure.
 - (ii) Determination of stereo chemistry (Cis & trans).

Ref. 6: - Section:- 2.1, 2.3, 2.7 to 2.15 ; Pages: - 13 to 15, 18 to 38
- 4. Infrared (IR) spectroscopy (10 Lectures)**
 - (a) Introduction: - Principles of IR, spectroscopy, fundamental modes of vibrations, types of vibrations.
 - (b) Conditions for absorption of IR radiations, vibration of diatomic molecules.
 - (c) Parts of I.R. Spectrum.
 - (d) Characteristics of IR absorption of following functional groups such as alkanes, alkenes,

alkynes, alcohols, halides, carbonyl compounds, amines, amides, aromatic compounds etc.

- (e) Effect of following factors on IR absorption: - Inductive effects, resonance effects & hydrogen bonding.
- (f) Applications of I.R. Spectroscopy: -
 - (i) Determination of structure.
 - (ii) Study of chemical reactions.
 - (iii) Hydrogen bonding.

Ref.6: Sections – 3.1, 3.4, 3.7., 3.8.

Pages: 46-51, 53, 54, 72 to 81, 86; Ref. 8 Pages : 1095 to 1103

5. Nuclear Magnetic Resonance (NMR) Spectroscopy. (12 Lectures)

- (a) Introduction: - Principles of PMR spectroscopy, magnetic & non magnetic nuclei, precessional motion of nuclei without mathematical details, nuclear resonance, chemical shift, molecular structure, shielding & deshielding.
- (b) Measurement of chemical shift.
- (c) TMS as reference & its advantages.
- (d) Spin – spin splitting and coupling constants.
- (e) Areas of signals.
- (f) Applications of PMR spectroscopy.

Ref. 6 Sections: 4.1 to 4.4 & 4.9

Pages: 95 to 98, 106 to 108

Ref. 8 Pages: 1065 to 1083

6. Spectral problems based on UV, IR & NMR (05 Lectures)

Spectral problems based on UV, I.R., NMR data and relevant problems from Ref. 1 & 8

Note:

- (i) Spectral data such as λ_{max} value, IR frequency, chemical shift and coupling constant should be provided to the students.
- (ii) Actual UV, IR, NMR spectra of some molecules should be shown to the students.

Reference books:

- 1) Organic Chemistry by Morrison and Boyd - 6th Ed. 1996.
- 2) Organic Chemistry by John McMurry – 5th Ed. Assian books 1999.
- 3) Organic Chemistry by Graham Solomans and Craig Fryhle - 7th Ed. 2002.
- 4) A guide book to reaction mechanism by peter sykes - 6th Ed.
- 5) Organic chemistry by I.L.Finar vol.II – 6th Ed. 1975.
- 6) Absorption spectroscopy of organic molecules by V.M.Parikh (1974).
- 7) Designing organic synthesis by stuart warron (1983).
- 8) Organic Chemistry by pine 5th ed. 1987.

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T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - V

PRACTICAL COURSE - VII
(ORGANIC CHEMISTRY)

1. Organic Estimations (Any three)

- (i) Estimation of Iodine value.
- (ii) Estimation of Glucose.
- (iii) Estimation of Ethyl benzoate.
- (iv) Determination of Molecular weight of Mono and Dibasic acids by Volumetric Methods
- (v) Determination of acid value of the given oil.

2. Preparation of derivatives (Any Two)

- (i) 2, 4 DNP derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.
- (ii) Semicarbazone derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.
- (iii) Oxime derivatives of $-\text{CHO} / \text{C} = \text{O}$ group.

3. Single stage preparations (Any Three)

- (i) Hydroquinone to Quinone.
- (ii) Acetanilide to p-Nitroacetanilide.
- (iii) p – Nitroaniline to p - Iodonitrobenzene.
- (iv) Sulphanilic acid to Methyl orange.
- (v) m – Dinitrobenzene to m – Nitroaniline.

Note:

- (i) Starting Compound should not be given more than 1 gm.
- (ii) The purity of preparation and derivative products should be checked by TLC.
- (iii) The crystalline sample should be submitted and M.P.must be reported to the examiner

Reference Books:

- 1) Practical Qualitative Analysis by A.I. Vogel.
- 2) Advanced Practical Organic Chemistry by O.P.Agarwal.
- 3) Laboratory Manual in Organic Chemistry by R.K.Bansal, Wiley Eastern.
- 4) Experimental Organic Chemistry I & II by P.R.Singh, D.S.Gupta and K.S.Bajpal (Tata McGraw Hill)

T.Y.B.Sc. (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI

PRACTICAL COURSE - X
(ORGANIC CHEMISTRY)

1. Organic Qualitative Analysis of Binary Mixtures (Minimum 8 mixtures)

(i) Solid – Solid (4) (ii) Solid – liquid (2) (iii) Liquid – liquid (2)

At least one mixture from each of the following types

(Acid-Base, Acid – Phenol, Acid – Neutral, Base – Neutral, Neutral - Neutral)

Note:

Students should report – nature, type, separation of mixture, physical constants of purified compounds, detection of elements, functional group tests (Name and structure of compound is not expected)

Reference Books:

- 1) Practical Qualitative Analysis by A.I. Vogel.
- 2) Advanced Practical Organic Chemistry by O.P. Agarwal.
- 3) Laboratory Manual in Organic Chemistry by R.K. Bansal, Wiley Eastern.
- 4) Experimental Organic Chemistry I & II by P.R. Singh, D.S. Gupta and K.S. Bajpal (Tata McGraw Hill)

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)

SEMESTER - V

C - 54 : ANALYTICAL CHEMISTRY-I

**Total
Credits-04**

lectures-48

1. Gravimetric Analysis: (12 Lectures)

Introduction, Common ion effect and solubility product principles, solubility of precipitates, effect of acids, temperature and solvents upon solubility of precipitates. Super saturation and precipitate formation. co-precipitation and post-precipitation, precipitation from homogeneous solution, optimum conditions for precipitation, filtration of precipitates, washing of precipitates, Drying and Ignition of precipitates, Numerical problems.

Ref. 1.Pg. 22-28, 30-33, 95, 107-114, 169-171, 403-404, 407-415

Ref. 3.Pg. 527-532

2. Thermal methods of analysis: (10 Lectures)

Principle of thermal analysis, classification of thermal techniques, Principle, instrumentation and applications of TGA and DTA, factors affecting the thermal analysis, numerical problem.

Ref. 1.Pg. 515-527,531-537

Ref. 6 Pg. 732-737

3. Nephelometry and Turbidimetry: (10 Lectures)

Introduction, Principles and instrumentation of Nephelometric and Turbidimetric analysis, Difference between Nephelometric and Turbidimetric measurements, Choice between Nephelometry and Turbidimetry, Factors affecting Nephelometric and Turbidimetric measurements, Quantitative Applications, Numerical Problems

Ref.1. Pg.781-785

Ref.3. Pg.380-390

4. Polarimetry: (08 Lectures)

Introduction, polarization of radiation, essential terms, Nicol prism, Optical activity, Types of optically active substances, Instrumentation-Polarimeter-construction, working of polarimeter and applications of Polarimetry. numerical problems.

Ref.6. 691-734

5. Atomic Absorption Spectroscopy: (08 Lectures)

Introduction and theory of atomic absorption spectroscopy, Instrumentation of single beam atomic absorption Spectrophotometer, Measurement of absorbance of atomic species by AAS, Spectral and Chemical Interferences, Qualitative and Quantitative Applications of AAS.

Ref. 3.Pg. 321-342

Reference Books:

- Ref. 1 Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
- Ref. 2 Principles of Physical Chemistry 4th edition – Prutton and Marron
- Ref. 3 Instrumental Methods of Chemical Analysis- Chatwal and Anand
- Ref. 4 Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
- Ref. 5 Vogel's textbook of Quantitative Inorganic Analysis-4th edition Besset Denney, Jaffrey, Mendham
- Ref. 6 Instrumental Methods of Chemical Analysis- 6th edition Willard, Merritt, Dean and Settle
- Ref. 7 Analytical Chemistry by Skoog
- Ref. 8 Introduction to Instrumental Analysis- R.D. Braun

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI
C - 64 : ANALYTICAL CHEMISTRY-II

Total	lectures-48
04 Credits	
1. Solvent Extraction	(08Lectures)
Introduction, Principle of solvent extraction, Distribution coefficient, distribution ratio, Relation between Distribution coefficient and distribution ratio, factors affecting solvent extraction, percentage extracted, solvent extraction method, separation factor, batch extraction, counter current extraction, application of solvent extraction, numerical problems. References: 3,4,7 relevant pages	
2. Chromatography	(10Lectures)
Introduction and classification of chromatographic methods, Principle of chromatographic analysis with match box model, Theoretical plates and column efficiency, Theory, Principle, technique and applications of- Column Chromatography, Thin layer Chromatography, Paper Chromatography, Numerical Problems Ref. 6,7,8 Relevant pages	
3. Gas Chromatography	(10Lectures)
Introduction, Theory, Principle, GSC and GLC, Separation mechanism involved in GSC and GLC, Instrumentation of Gas chromatography, Working of gas chromatography, Gas chromatogram and qualitative-quantitative analysis, Applications of gas chromatography Ref. 1.Pg. 167-174 Ref. 4.Pg. 454-464 Ref. 5 Pg. 624-640	
4. High Performance Liquid Chromatography	(10Lectures)
Introduction, Need of liquid chromatography, Separation mechanism involved in adsorption and partition HPLC, Instrumentation and working of HPLC, Applications of HPLC, Introduction to super critical fluid chromatography Ref. 6.Pg. 529-545	
5. Flame Emission Spectroscopy :	(10Lectures)
Introduction, Principle, Theory, Instrumentation, Flame Photometers – single beam & double beam instruments, Evaluation methods, Applications in Qualitative & Quantitative analysis. Ref. 3, Relevant pages	

Reference Books:

- Ref. 1 Textbook of Quantitative Chemical Analysis- 3rd Edition, A. I. Vogel
Ref. 2 Principles of Physical Chemistry 4th edition – Prutton and Marron

- Ref. 3 Instrumental Methods of Chemical Analysis- Chatwal and Anand
- Ref. 4 Basic Concept of Analytical Chemistry-2nd edition S.M. Khopkar
- Ref. 5 Vogel's textbook of Quantitative Inorganic Analysis-4th edition Besset Denney, Jaffrey, Mendham
- Ref. 6 Instrumental Methods of Chemical Analysis- 6th edition Willard, Merritt, Dean and Settle
- Ref. 7 Analytical Chemistry by Skoog
- Ref. 8 Introduction to Instrumental Analysis- R.D. Braun

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - V
C - 55 : INDUSTRIAL CHEMISTRY-I

CREDITS 4

48 Lectures

1. Modern Approach to Chemical Industry (08Lectures)

Introduction, basic requirements of chemical industries, chemical production, raw materials, unit process and unit operations, Quality control, quality assurance, process control, research and development, pollution control, human resource, safety measures, classification of chemical reactions, batch and continuous process, Conversion, selectivity and yield, copy right act, patent act, trade marks.

Ref. No. 1

2. Manufacture of Basic Chemicals (08Lectures)

- a) Ammonia: Physicochemical principles involved, Manufacture of ammonia by modified Haber-Bosch process, its uses.
- b) Sulphuric acid: Physicochemical principles involved, Manufacture of sulphuric acid by contact process, its uses.
- c) Nitric acid: Physicochemical principles involved, Manufacture of nitric acid by Ostwald's process, its uses.

Ref.No.1: P.No. 571 to 588, 618 to 664

3. Sugar Industry. (10 Lectures)

Introduction, manufacture of cane sugar, Details of various steps, Extraction of juice, purification of juice, Defection, Sulphitation & Carbonation, concentration, Crystallization, separation of crystals, Dying, Refining, Recovery of sugar from molasses, Bagasse, Manufacture of sucrose from Beet root, Testing of sugar, sugar Industry in India.

Ref. 1 – page 664, 674

4. Food and Starch Industry (08Lectures)

Food Industry:

- (a) Definition and scope, nutritive aspects of food constituents, , food deterioration factors and their control; (b) Preservation and processing: Heat and cold preservation and processing, cold storage, food dehydration and concentration, various foods, their processing and preservation methods, fruits, beverages, cereals, grains, legumes and oil seeds; (c) Food additives: Enhancers, sugar substitutes, sweeteners, food colors,

Ref.6

Starch industries:

Chemistry of starch, manufacturing of industrial starch and its applications, characteristics of some food starches, non-starch polysaccharides-cellulose-occurrence.

Ref. 5

5. Cement and Glass industry

(08Lecture)

Cement industry:

Introduction, Importance, composition of portland cement, raw materials, proportioning of raw materials, setting and Hardening of cement, reinforced concrete.

Ref.1: P.No. 313-333 Ref. 2: P.No173-176, Ref. 4: P.No.188-192

Glass industry

Introduction, importance, physical and chemical properties of glass, chemical reaction, annealing of glass Special glasses: colored, safety, hard, borosilicate, optical, photosensitive, conducting, glass laminates.

Ref.1: P. No.160-171;Ref. 2: P. No. 247-265; Ref.3: P. No. 197-212

6. Some small scale Industries

(06 Lectures)

Safety matches, Agarbattis, Naphthalene balls, wax candles, shoe polish, Gum paste, plaster of Paris, chalk crayons, fountain pen ink.

Ref. 1 - page. sect. IV 1 – 8

Reference Books:

- 1) Industrial Chemistry – B.K.Sharma.
- 2) Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
- 3) Riegel's hand book of Industrial chemistry, 9th Edition, Jems A. Kent
- 4) Industrial chemistry –R.K. Das, 2nd Edition, 1976.
- 5) Chemistry and industry of starch, New York, N.Y., Academic Press, incby Kerr, Ralph Waldo Emerson
- 6) The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
- 7) Industrial Chemistry. Arora & Singh

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI
C - 65 : INDUSTRIAL CHEMISTRY-II

Course content: 48 Lectures

CREDITS 4

1. Polymer chemistry

(10 Lectures)

Classification of Polymers: Organic and Inorganic polymers

(a) Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamic and transport properties of polymer

b) *Commercial polymers and their importance*: (a) Nylon, polyesters (terylene and dacron), rubber, vulcanization of rubber, synthetic rubber, Bun 2-N rubber, copolymers of butadiene, PVC, acrylic, teflon, polyethylene and acrylonitrile; (b) Silicone polymers: silicone oils, rubber, grease and resin;

(c) Resins: Phenol-formaldehyde resins, urea-formaldehyde resins, epoxy resins, melamine-formaldehyde resins.

Ref. 2,3

2. Chemistry of pharmaceutical industries

(10 Lectures)

a. *General aspects of drug action*: Introduction, classification, nomenclature, structure-activity relationship, action of drugs, factors affecting drug action, metabolism of drugs, chemical structures, methods of production and pharmacological activity.

b. Meaning of the terms: Prescriptions, doses, analgesic, antipyretic, diuretic, anesthetics, antibiotics, anti-inflammatory, anti-viral, tranquilizer, antiulcer, antialergic and bronchodilators, cardiovascular, cold preparations, anti-hypertensive, cough preparation, anti-neoplastic, sedative and hypnotics, steroidal, contraceptive, histamine and antihistamine.

c. Synthesis and uses: Paracetamol, Aspirin, Sulphanilamide.

Ref.1: P. No.762-775; Ref.4: P. No.803-804, 818-822 ; Ref.5: P. No.987-1011

3. Fertilizer Industry

(10 Lectures)

Definition, Importance of fertilizers, N.P & K ratio, Numerical problems on percentage of elements and percentage of purity, various nitrogenous fertilizers, manufacture of urea with flow sheets, various phosphate fertilizers, manufacture of triple super phosphate with flow sheet, mixed fertilizers, manufacture with flow-sheet diagram.

Ref.1 pages 590 – 612

4. Pollution prevention and waste management

(08 Lectures)

Introduction, importance of waste management, concept of atom economy, Terms involved in waste minimization: source reduction, recycling, product changes, source control, use and reuse, reclamation, assessment procedures, types of wastes, treatment and disposal of industrial waste. Treatment of wastes or effluents with organic impurities. Treatment of wastes or effluents with inorganic impurities. The nature, effect and treatment of some important chemical wastes-(Pulp and paper industries, soap and detergent industries and food processing industries).

Ref. 1: P.No. 8-92; Ref.6: P.No. 15-30;

Ref. www.wikipedia.org/atom_economy

5. Soaps & Detergents

(10 Lectures)

Soaps: - Introduction, Raw materials, manufacture of soap, varieties of soaps, cleansing action of soaps.

Detergents: - Introduction, classification, Anionic detergents, cationic detergents, Non-ionic detergents, Amphoteric detergents, Builders & Additives.

Ref. 1 and 6

Reference Book:

- 1) Industrial Chemistry – B.K.Sharma.
- 2) Chemistry and industry of starch, New York, N.Y., Academic Press, incby Kerr, Ralph Waldo Emerson
- 3) The Complete Manual Of Small-Scale Food Processing, by Peter Fellows, Practical Action Pub
- 4) Shreeve's chemical process industries 5th Edition, G.T. Oustin, McGraw Hill
- 5) Riegel's hand book of Industrial chemistry, 9th Edition, James A. Kent
- 6) Emergency Medicine: Chapter 146 Insecticides, Herbicides & Rodenticides, by James Adams
- 7) Industrial Chemistry. Arora & Singh.

* * *

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - V
C-59A ENVIRONMENTAL CHEMISTRY-I

Credits:04

Total Lectures: 48

1. Evolution and Structure of Atmosphere (10 Lectures)

Composition of the atmosphere; Atmospheric structure; Evolution of the atmosphere; Earth's radiation balance; Particles, ions and radicals in the atmosphere; Chemical and photochemical reactions in the atmosphere; Green house effect; Ozone hole; The earth's mechanism and global climate; El Nino Phenomenon

Reference 1 : Pages 13-51.

2. Air Pollution and Air Pollution disasters (10 Lectures)

Air pollutants (carbon monoxide, Nitrogen oxides, Hydrocarbons and Photochemical smog, sulphur dioxide, Acid rain, Particulates, Radioactivity), Effects of atmospheric pollution, TCDD accident, Bhopal disaster, Chernobyl disaster); Air quality standards; Sampling; Monitoring (CO, SO_x, NO_x, H₂S, SPM, HC).

Reference 1: Pages 107-167.

3. Hydrosphere (10 Lectures)

Water resources; The hydrologic cycle; Physical chemistry of sea water; composition; Sea water equilibrium, pH, pE, Complexation in natural water and waste water; Nitrogen transformation by bacteria.

Reference 1: Pages 52-65.

4. Water Pollution and monitoring (10 Lectures)

Aquatic environment; water pollutants (Organic pollutants- pesticides, detergents, marine pollution); Inorganic pollutants; Acid mine drainage; Sediments; Thermal pollution; Eutrophication; Trace elements in water; Chemical speciation and environmental chemistry of Cu, Pb, Hg and As; water quality parameters and standards; Sampling; Preservation; Monitoring techniques and methodology of D.O., NH₃, NO₃, and NO₂, F, CN, PO₄, Cl, Total hardness, As, Cd, Cu, Pb, Hg, COD, BOD, TOC, E.Coli (Principle and necessary equations and procedures are expected).

Reference 1: Pages 172-279

5. Origin of Life (8 Lectures)

The atmosphere and hydrosphere of primitive earth; synthesis of building block molecules; formation of biopolymers; the second stage of atmospheric evolution; The third stage of atmospheric evolution.

Reference 2: Pages 40-61.

Reference Books:

1. Environmental Chemistry, A. K. De, Fourth Edition, New age International (P) Ltd., Publishers, New Delhi, 2000.
2. Environmental Chemistry, John W. Moore and Elizabeth A. Moore, Academic Press, New York, 1976.
3. Environmental Chemistry, S. E. Manahan, Willard Grant Press, Boston, Third Edition, 1983.
4. Chemistry and Man's Environmental, E. D. Fuller, Houghton Mifflin Co., Boston, Third edition, 1974.
5. Environmental Pollution, A. M. Dix, John Wiley, New York, 1980.

T.Y.B.Sc (CHEMISTRY) (CBCS-2016 Course)
SEMESTER - VI
C-69A ENVIRONMENTAL CHEMISTRY-II

Total Lectures: 48

Credits:04

1. Our earth-Lithosphere (8 Lectures)

Composition of Lithosphere/ Soil; Water and air in Soil; Inorganic and organic components in soil; Acid-base and ion exchange reactions in soil; Micro-and Macronutrients; Nitrogen pathways and NPK in soil; Wastes and pollutants in soil; Waste classification and disposal.

Reference 1; Pages 69-79.

2. Energy and Environment (10 Lectures)

Mineral resources; Metals and non-metals; Wood-a major renewable resource; Fuel and energy resources (Coal, Petroleum and natural gas, nuclear fission and fusion, Solar energy, Hydrogen, Gasohol); World energy resources-consumption and conservation; Environmental management.

Reference 1; Pages 328-346.

3. Food and the Sustenance of Life (10 Lectures)

Food Quality; The Green revolution; Pest control; Persistence of pesticides; Toxicity of pesticides; Mode of action of pesticides; Integrated pest management; Energy and agriculture; Carcinogenicity awareness.

Reference 2; Pages 440-469.

4. Solid Waste Management (10 Lectures)

Population X Affluence X Technology; Municipal wastes; Sanitary landfills; Incinerators; Incineration of plastics; Pyrolysis: Biodegradation; Reclamation; Recycling; Reuse; Paper and cellulose fiber; Garbage; Grass and organic matter; Textiles, Plastics and rubber; Glass and ceramics; metals; The entropy ethics and solid waste; Beverage container industry; Automobile industry.

Reference 2; Pages 317-345.

5. Industries and Pollution (10 Lectures)

Sources of industrial water pollution; Heavy metals; Mercury; Minamata diseases, Bioamplification; The mechanism of mercury poisoning; Detection and abatement of mercury pollution; Chlor-alkali production; Paper mills and other industries like sugar industry. Concept of ISO 14000; Environmental clearance;

Reference 1; Pages 298-304, 316-317.

Reference Books:

1. Environmental Chemistry, A. K. De, Fourth Edition, New age International (P) Ltd., Publishers, New Delhi, 2000.
2. Environmental Chemistry, John W. Moore and Elizabeth A. Moore, Academic Press, New York, 1976.
3. Environmental Chemistry, S. E. Manahan, Willard Grant Press, Boston, Third Edition, 1983.
4. Chemistry and Main's Environment, E. D. Fuller, Houghton Mifin Co., Boston, Third Edition, 1974.
5. Environmental Pollution, A. M. Dix, John Wiley, New York, 1980.

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

**YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,
PUNE 411 038**

Accredited with 'A+' Grade (2017) by NAAC
'A' Grade University Status by MHRD, Govt. of India
Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF COMPUTER SCIENCE (B.Sc.(CS)) PROGRAME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

TO BE IMPLEMENTED FROM ACADEMIC YEAR 2016-17

BHARATI VIDYAPEETH UNIVERSITY,
Bachelor of Computer Science B.Sc.(Computer Science)
(Choice Based Credit System)
Under: Faculty of Science
(To be implemented from 2016)

The B.Sc.(Computer Science) Degree Course is of three years duration divided into six semesters. The structure of the course and syllabus of the first year will come into effect from the academic year 2016-2017. The second and third year syllabus will be implemented from 2017-2018 and 2018-2019 respectively.

Objectives : B.Sc(Computer Science) Course:

- To develop problem solving abilities using a computer
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To imbibe quality software development practices.
- To create awareness about process and product standards
- To train students in professional skills related to Software Industry.
- To prepare necessary knowledge base for research and development in Computer Science
- To help students build-up a successful career in Computer Science.

Learning Outcomes from the B.Sc (Computer Science)

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills and other attributes. The programme provides sufficient breadth for the students to support a wide range of future careers and sufficient exposure to theoretical and fundamental issues to support lifelong learning in the discipline. The theme of the programme is one of designing and developing programmed solutions to problems, recognizing the complexity of interaction between people and systems. Practice is used as a way of exploring theory through its application.

RULES & REGULATIONS FOR B.Sc (COMPUTER SCIENCE) COURSE

1. ELIGIBILITY FOR ADMISSION TO B.Sc(COMPUTER SCIENCE) COURSE :

- i. A candidate who has passed the Higher Secondary School Certificate Examination of the Maharashtra State Board or Higher Secondary Examination of its equivalent of any other statutory Board or University and has passed in English and in two Science subjects (i) Physics (ii) Mathematics shall be eligible for admission to the First year B.Sc (Computer Science) Degree course.
- ii. Candidate who has passed H.S.C. examination (10+2) with English and any one of the following vocational subjects is also eligible for admission to the F.Y.B.Sc. (Computer Science) course.

Subject code	Subject
97	Information Technology
D9	Computer Science
C2	Electronics
J1/J2/J3	Electronics Technology
K1/K2/K3	Auto Engg. Technician
A1	Electrical Maintainance

iii. Also student who has completed Diploma course in Engineering (Polytechnic) Computer Science, Electronics and Information Technology or its equivalent examination recognized by MBTE, Mumbai or its equivalent of any other statutory Board or University.

Admission process:

- Admissions will be given as per the selection procedure/policies adopted by the college, in accordance with conditions laid down by Bharati Vidyapeeth University, Pune.
- Reservation and relaxation will be as per the Government rules and Bharati Vidyapeeth University, Pune.

2.INTAKE CAPACITY:

Intake capacity of the students for this course at the entry level will be 80 per year.

3. Course Structure of B.Sc.(Computer Science) Degree Programme and scheme of credits

Course Structure and Scheme of Credits :

Course	Semester	Credits	Total of Semester	Grant Total of the year
F.Y.B.Sc(Computer Science)	I	Theory (Core) - 24	32	62
		Practical – 06		
		Foundation - 02		
	II	Theory (Core) - 24	30	
		Practical – 06		
S.Y.B.Sc(Computer Science)	III	Theory (Core) - 24	36	70
		Practical – 06		
		Elective – 04		
		Foundation -02		
	IV	Theory (Core) – 24	34	
		Practical-06		
		Elective-04		
T.Y.B.Sc(Computer Science)	V	Theory (Core) -20	34	64
		Practical-06		
		Elective-04		
		Foundation-02		
		Mini Project -02		
	VI	Theory (Core) -20	32	
		Practical-06		
		Elective-04		
		Mini Project -02		
Grand Total of the Course (All Semesters)			198 (192+6)	198

F.Y.B.Sc(Computer Science): Semester I (From the Academic Year 2016-17)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -11	Introduction to RDBMS	03	03	03	40	60	100
	CS -12	Programming in C - I	03	03	03	40	60	100
	CS -13	Mathematical Foundation of Computer Science	03	03	03	40	60	100
	CS -14	Algebra -I	03	03	03	40	60	100
	CS -15	Principles of Analog Electronics - I	03	03	03	40	60	100
	CS-16	Principles of Digital Electronics -I	03	03	03	40	60	100
	CSI- LI	Lab Course on Oracle-I	04	02	03	40	60	100
	CSI- LII	Lab Course on C-I	04	02	03	40	60	100
	CSI- LIII	Lab Course on Electronics-I	04	02	03	40	60	100
Elective Courses	Any Two from the following:							
	CS -17	Computer Oriented Statistical Techniques -I	03	03	03	40	60	100
	CS-18	Compulsory English -I	03	03	03	40	60	100
	CS-19	Elementary Algorithmics	03	03	03	40	60	100
Foundation Course	This paper is compulsory for all the students:							
	UGF 12	Youth Development	02	02	02	20	30	50

F.Y.B.Sc(Computer Science): Semester II (From the Academic Year 2016-17)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -21	RDBMS using oracle	03	03	03	40	60	100
	CS -22	Programming in C - II.	03	03	03	40	60	100
	CS -23	Graph Theory	03	03	03	40	60	100
	CS -24	Algebra-II	03	03	03	40	60	100
	CS -25	Principles of Analog Electronics - II	03	03	03	40	60	100
	CS -26	Principles of Digital Electronics -II	03	03	03	40	60	100
	CSII- LI	Lab Course on Oracle-II	04	02	03	40	60	100
	CSII- LII	Lab Course on C-II	04	02	03	40	60	100
	CSII- LIII	Lab Course on Electronics-II	04	02	03	40	60	100
Elective Courses	Any Two from the following:							
	CS -27	Computer Oriented Statistical Techniques -II	03	03	03	40	60	100
	CS-28	Compulsory English -II	03	03	03	40	60	100
	CS-29	Operating Environment	03	03	03	40	60	100

S.Y.B.Sc(Computer Science): Semester III(From the Academic Year 2017-18)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -31	Object Oriented Programming with C++	04	04	03	40	60	100
	CS -32	Introduction to .Net using C#	04	04	03	40	60	100
	CS -33	Linear Algebra	04	04	03	40	60	100
	CS -34	Computer Oriented Numerical Methods	04	04	03	40	60	100
	CS -35	Digital systems and Microprocessors	04	04	03	40	60	100
	CS -36	Principles of Communication	04	04	03	40	60	100
	CSIII- LI	Lab Course on C++ and Data Structures -I	04	02	03	40	60	100
	CSIII- LII	Lab Course on .NET -I	04	02	03	40	60	100
	CSIII- LIII	Lab Course on Electronics -III	04	02	03	40	60	100
Elective Courses	Any One from the following:							
	CS -37	Cloud Computing -I	04	04	03	40	60	100
	CS -38	Data Warehousing and data mining-I	04	04	03	40	60	100
Foundation Course	This paper is compulsory for all the students:							
	UGF 32	Cyber Law	02	02	02	20	30	50

S.Y.B.Sc(Computer Science): Semester IV (From the Academic Year 2017-18)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -41	Data Structures using C++	04	04	03	40	60	100
	CS -42	ASP.Net	04	04	03	40	60	100
	CS -43	Computational Geometry	04	04	03	40	60	100
	CS -44	Optimization Techniques	04	04	03	40	60	100
	CS -45	8051 Microcontroller	04	04	03	40	60	100
	CS -46	Analog Systems	04	04	03	40	60	100
	CSIV-LI	Lab Course on C++ and Data Structures -II	04	02	03	40	60	100
	CSIV-LII	Lab Course on .NET -II	04	02	03	40	60	100
	CSIV-LIII	Lab Course on Electronics -IV	04	02	03	40	60	100
Elective Courses	Any One from the following:							
	CS -47	Cloud Computing -II	04	04	03	40	60	100
	CS -48	Data Warehousing and data mining-II	04	04	03	40	60	100

Environment Studies

As per the order of Honourable Supreme Court of India, this course is compulsory for every undergraduate student. The college is implementing this module course in Environment Studies in the second year of all degree courses. There will be 50 lectures for this course. The examination will be conducted at the end of Semester IV and will carry 50 marks. These marks will be converted into the grades accordingly. These grades will be mentioned in the degree marksheet. If any student fails in this course, the result of his/her degree course will be withheld by the university.

T.Y.B.Sc(Computer Science): Semester V (From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -51	Operating System	04	04	03	40	60	100
	CS -52	Web Supporting Technologies	04	04	03	40	60	100
	CS -53	Theoretical Computer Science	04	04	03	40	60	100
	CS -54	Core JAVA	04	04	03	40	60	100
	CS -55	Software Engineering	04	04	03	40	60	100
	CSV-LI	Lab Course on System programming and Linux - I	04	02	03	40	60	100
	CSV-LII	Lab Course on Web Supporting Technologies -I	04	02	03	40	60	100
	CSV-LIII	Lab Course on JAVA -I	04	02	03	40	60	100
	CSV-LIV	Mini Project -I	04	02	03	40	60	100
Elective Courses	Any One from the following:							
	CS -56	Data Communication and Networking -I	04	04	03	40	60	100
	CS -57	Management Information System -I	04	04	03	40	60	100
	CS -58	Research in Computer Science -I	04	04	03	40	60	100
Foundation Course	This paper is compulsory for all the students:							
	UGF 51	Soft Skills	02	02	02	20	30	50

T.Y.B.Sc(Computer Science): Semester VI (From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment	University Examination	Total
Core Courses	CS -61	Linux Programming	04	04	03	40	60	100
	CS -62	Open Source Technologies	04	04	03	40	60	100
	CS -63	Compiler Construction	04	04	03	40	60	100
	CS -64	Advance JAVA	04	04	03	40	60	100
	CS -65	Unified Modeling Language	04	04	03	40	60	100
	CSVI-LI	Lab Course on System programming and Linux - II	04	02	03	40	60	100
	CSVI-LII	Lab Course on Web Supporting Technologies -II	04	02	03	40	60	100
	CSVI-LIII	Lab Course on JAVA -II	04	02	03	40	60	100
	CSVI-LIV	Mini Project -II	04	02	03	40	60	100
Elective Courses	Any One from the following:							
	CS -56	Data Communication and Networking-II	04	04	03	40	60	100
	CS -57	Management Information System-II	04	04	03	40	60	100
	CS -58	Research in Computer Science -II	04	04	03	40	60	100

4. SCHEME OF TEACHING:

Class	Subjects/courses to be offered by student	No. of contact hours / week	Work Load / Week			
			Theory	Tutorial	Total	Practical
F.Y.B.Sc(Computer Science)	12	38	2	1	03	04
S.Y.B.Sc(Comput	11	42	3	1	04	04

er Science)						
T.Y.B.Sc(Computer Science)	11	42	3	1	04	04

5. MEDIUM OF INSTRUCTION:

The medium of instruction and examination shall be English.

6. CHANGE OF COURSE

As all the heads of the course are compulsory change of course is not allowed.

7. SCHEME OF EXAMINATION:

The Assessment of Regular students of Bachelor of Science (B.Sc.) course in the academic session 2016-17 and thereafter shall be based on

- (a) University Examinations (UE),
- (b) Internal Assessment (IA),
- (c) Choice Based Credit System (CBCS), and
- (d) Semester Grade Point Average (SGPA) and Cumulative Grade Point Average system (CGPA)

For each core and elective paper of 100 marks, there will be Internal Assessment of 40 marks and the University Examination of 60 marks/3 hours duration at the end of each semester. The 04 credit will be given to a student who secures at least 40% of marks allotted to each paper. A candidate who does not pass the examination in any subject or subjects in one semester will be permitted to reappear in such failed subject or subjects along with the papers of following semesters.

The Internal Assessment (IA) for each paper will be of 40 marks. The Internal Assessment may be in the forms as follows:

a) Attendance	10
Marks	
b) Home Assignment/Tutorial/Test/Presentation	15
Marks	
c) Mid Semester Examination	15
Marks	

Each practical examination for laboratory course is of 100 marks and three hour duration. The mini project included in the in Semesters V and VI will be evaluated for 100 marks for the allotted credits by a panel consisting of one internal and one external examiner. For both laboratory course and mini project, there will be internal assessment of 40 marks and the university examination of 60 marks.

A candidate shall be permitted to proceed further from the first semester upto Fourth Semester Irrespective of his/her failure in any of the semester Examinations subject to the condition that the candidates should register for all the arrear subjects of earlier semesters along with current (Subsequent)semester subject. However he/she should have cleared all the papers at F.Y.B.Sc(Comp.sci)I and II when He/She gets admission to T.Y.B.Sc.(Comp.Sci) Sem V.

8. GRACING:

The gracing shall be done as per existing rules of the University.

9. VERIFICATION AND REVALUATION:

There is provision for verification and revaluation of the result. A student can apply for the verification and revaluation of the result within the two weeks from the declaration of the results with the prescribed fee. The verification and revaluation shall be done as per the existing rules of the University.

10. STANDARD OF PASSING:

For all courses, both UE and IA constitute separate heads of passing. In order to pass in such courses and to earn the assigned credits, the learner must obtain a minimum grade point of 5.0 (40% marks) at UE and also a minimum grade point of 5.0 (40% marks) at IA.

If a student fails in IA, the learner passes in the course provided he/she obtains a minimum of 25% in IA and GPA for the course is at least 6.0 (50% in aggregate). The GPA for a course will be calculated only if the learner passes at the UE.

A student who fails at UE in a course has to reappear only at UE as a backlog candidate and clear the head of passing. Similarly, a student who fails in a course at IA has to reappear only at IA as a backlog candidate and clear the head of passing.

The 10-point scale Grades and Grade Points according to the following table.

Range of Marks (Out of 100)	Grade	Grade Point
$80 \leq \text{Marks} \leq 100$	O	10
$70 \leq \text{Marks} < 80$	A+	9
$60 \leq \text{Marks} < 70$	A	8
$55 \leq \text{Marks} < 60$	B+	7
$50 \leq \text{Marks} < 55$	B	6
$40 \leq \text{Marks} < 50$	C	5
Marks < 40	D	0

The performances at UE and IA will be combined to obtain the Grade Point Average (GPA) for the course. The weights for performance at UE and IA shall respectively be 60% and 40%.

GPA is calculated by adding the UE marks out of 60 and IA marks out of 40. The total marks out of 100 are converted to grade point, which will be the GPA

Formula to calculate Grade Points (GP)

Suppose that 'Max' is the maximum marks assigned for an examination or evaluation based on which GP will be computed. In order to determine the GP, Set $x = \text{Max} / 10$ (since we have adapted 10-point system). Then GP is calculated by the formulas shown as below.

Range of Marks at the evaluation	Formula for the Grade Point
$8x \leq \text{Marks} \leq 10x$	10
$5.5x \leq \text{Marks} < 8x$	Truncate (Marks/x) + 2
$4x \leq \text{Marks} < 5.5x$	Truncate (Marks/x) + 1

Two kinds of performance indicators, namely, the Semester Grade Point Average (SGPA) and the Cumulative Grade Point Average (CGPA) shall be computed at the end of each term. The SGPA measures the cumulative performance of a learner in all the courses in a particular semester, while the CGPA measures the cumulative performance in all courses since his/her enrolment. The CGPA of learner when he/she completes the programme is the final result of the learner.

The SGPA is calculated by the formula $SGPA = \frac{\sum C_k \times GP_k}{\sum C_k}$, where C_k is the credit-value assigned to a course and GP_k is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study during the semester, including those in which he/she might have failed or those for which he/she remained absent. **The SGPA shall be calculated up to two decimal place accuracy.**

The CGPA is calculated by the formula $CGPA = \frac{\sum C_k \times GP_k}{\sum C_k}$, where C_k is the credit-value assigned to a course and GP_k is the GPA obtained by the learner in the course. In the above, the sum is taken over all the courses that the learner has undertaken for the study from the time of his/her enrolment and also the during the semester for which CGPA is calculated, including those in which he/she might have failed or those for which he/she remained absent. **The CGPA shall be calculated up to two decimal place accuracy.**

The Formula to compute equivalent percentage marks for specified CGPA:

% Marks (CGPA) =	$10 \times CGPA - 10$	if $5.00 \leq CGPA \leq 6.00$
	$5 \times CGPA + 20$	if $6.00 \leq CGPA \leq 8.00$
	$10 \times CGPA - 20$	if $8.00 \leq CGPA \leq 9.00$
	$20 \times CGPA - 110$	if $9.00 \leq CGPA \leq 9.50$
	$40 \times CGPA - 300$	if $9.50 \leq CGPA \leq 10.00$

Award of Honours :

A student who has completed the minimum credits specified for the programme shall be declared to have passed in the programme. The final result will be in terms of letter grade only and is based on the CGPA of all courses studied and passed. The criteria for the award of honours are given below.

Range of CGPA	Final Grade	Performance Descriptor	Equivalent Range of Marks (%)
9.50 ≤CGPA≤ 10.00	O	Outstanding	80 ≤ Marks ≤ 100
9.00 ≤CGPA≤ 9.49	A+	Excellent	70 ≤ Marks < 80
8.00 ≤CGPA≤ 8.99	A	Very Good	60 ≤ Marks < 70
7.00 ≤CGPA≤ 7.99	B+	Good	55 ≤ Marks < 60
6.00 ≤CGPA≤ 6.99	B	Average	50 ≤ Marks < 55
5.00 ≤CGPA≤ 5.99	C	Satisfactory	40 ≤ Marks < 50
CGPA Below 5.00	F	Fail	Marks Below 40

* * * * *

F.Y.B.Sc. (COMPUTER SCIENCE)

SEMESTER –I

CS- 11 : INTRODUCTION TO RDBMS

Course content

36 Lectures

Objectives:

1. To introduce the fundamental concepts of RDBMS
2. To understand principles of databases
3. To learn database management operations
4. To learn client server architecture

Chapter 1 File Organization

[5]

- 1.1 Introduction
- 1.2 Physical / logical files
- 1.3 Types of file organization
- 1.4 Choosing a file organization

Chapter 2 Introduction to RDBMS

[5]

- 2.1 Structure of Relational Databases (table, row, relation, Tuple)
- 2.2 keys in a relational database

Chapter 3 Database Architecture

[6]

- 3.1 Data models (relational, hierarchical, network)
- 3.2 Data abstraction
- 3.3 Data independence
- 3.4 Classification of DBMS

Chapter 4 Conceptual Design (E-R model)

[8]

- 4.1 Overview of DB design
- 4.2 ER data model (entities , attributes, entity sets, relations, relationship sets)
- 4.3 constraints (Key constraints, Mapping constraints, Strong & Weak entities, aggregation / generalization)
- 4.4 Conceptual design using ER modeling (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER)
- 4.5 Case studies

Chapter 5 structure Query Language

[12]

- 5.1 Introduction DDL (create, drop, alter), DML Statements(Insert, Update, Delete)
- 5.2 Forms of Basic SQL Query
- 5.3 union, intersection, nested queries
- 5.4 Aggregate Operator (group by, having), Aggregate functions

References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,
2. Database Management Systems ,Raghu Ramakrishnan,ISBN:9780071254342,

Mcgraw-hill higher Education

3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke , McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
4. Database Systems, Shamkant B. Navathe, Ramez Elmasri

F.Y.B.Sc. (COMPUTER SCIENCE)

SEMESTER –I

CS-12 : PROGRAMMING IN C - I

Course content

36 Lectures

Objectives:

1. To develop problem solving abilities using structured programming language features using C.
2. To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
3. To imbibe quality software development practices.
4. To create awareness about process and product standards.

1. Introduction

[6]

Introduction to problem solving, Program development process, algorithms, Flowchart , Introduction to programming languages (High level,low level , machine)compiler, interpreter, assembler, linker, loader.

2. Introduction to C language

[8]

Structured programming concept, benefits of structured programming, History of C language, Importance of C, Basic Structure of C program, scope, features, objectives and application areas, writing and executing a C program, benefits of structured programming.

3. C fundamentals

[8]

C character set, C tokens, keywords, identifiers, variables, constants, operators(arithmetic, relational, logical ,special and other), expressions, data types, statements, Managing I/O operations.

4. Control structures

[7]

Introduction, Basic control structures (sequence, selection/decision making Statement, Iterative statements, jump statements. etc.)

5. Functions

[7]

Introduction, Standard functions, need for user defined functions , advantages of functions, how to write function, calling a function, Passing parameters, methods of passing arguments, recursion, storage Classes and its scope rules.

References

- Programming in C by S . Kohan
- Born to code in C by H. Schildt
- The art of C by H. Schildt
- C programming by Kerningham & Richie by 2 nd edition
- Let us C by Yashwant Kanetkar
- C programming by E. Balaguruswami

F.Y.B.Sc.(COMPUTER SCIENCE) MATHEMATICS

SEMESTER -I

CS-13 MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE.

Course content

36

Lectures

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in logic, lattices and Boolean algebra, recurrence relation and counting principles.

At the end of this course student are expected to be able to.

- (i) know tautology, predicates and quantifiers.
- (ii) draw Hasse diagrams, example of lattices and its types.
- (iii) use counting principles, applications of Pigeonhole principle, permutation and combination.
- (iv) solve recurrence relation for finding total solution with the help of homogeneous solution and particular solution.

Unit 1: Logic

[9]

1.1 Revision : Propositional Logic, Propositional Equivalences.

1.2 Predicates and Quantifiers : Predicate, n -Place Predicate or n -ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.

1.3 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods), Rules of Inference for Propositional Logic, Building Arguments.

Unit 2 : Lattices and Boolean Algebra

[9]

2.1 Poset, Hasse diagram.

2.2 Lattice, Complemented lattice, Bounded lattice and Distributive lattice.

2.3 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n , **Boolean identities, Definition of Boolean Algebra.**

2.4 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles

[10]

3.1 Cardinality of a Set : finite set, countable and uncountable sets.

3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion-Exclusion Principle.

3.3 The Pigeonhole Principle: Statement, The Generalized Pigeonhole Principle, Its

Applications.

3.4 Generalized Permutations and Combinations : Permutation and Combination with Repetitions, Permutations with Indistinguishable Objects, Distributing objects into boxes : Distinguishable objects and distinguishable boxes, Indistinguishable objects and distinguishable boxes, Distinguishable objects and Indistinguishable boxes, Indistinguishable objects and Indistinguishable boxes

Unit 4 : Recurrence Relations

[8]

4.1 Recurrence Relations : Introduction, Formation.

4.2 Linear Recurrence Relations with constant coefficients.

4.3 Homogeneous Solutions.

4.4 Particular Solutions.

4.5 Total Solutions.

Reference Books:

- 1) Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill)
- 2) C. L. Liu ,Elements of Discrete Mathematics, (Tata McGraw Hill)
- 3) S.R. Patil, R.S.Bhamare, M.D.Bhagat, D.M.Pandhare, S.M Waingade, N.M Phatangare; Discrete Mathematics; Nirali Prakashan, 1998

F.Y.B.Sc.(COMPUTER SCIENCE) MATHEMATICS

SEMESTER-I

CS-14 ALGEBRA-I

Course content

36 Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts relations and functions, binary operations and groups, divisibility in intergers.

At the end of this course student are expected to be able to.

- (1) study the sets, relations, and equivalence class, find transitive closure with the help of Warshall's algorithm, types of function.
- (2) study the groups and various examples and types of groups.
- (3) solve the examples on mathematical induction, to solve the examples with the help of Fermat's theorem.

Unit 1: Relations and functions

[9]

- (1.1) Ordered pairs, Cartesian product of Sets.
- (1.2) Relations, types of relations, equivalence relations. Partial orderings.
- (1.3) Equivalence Class, properties and partition of a set.
- (1.4) Transitive closure and Warshall's Algorithm.
- (1.5) Digraphs of relations, matrix representation and composition of relations.
- (1.6) Definition of function as relation, types of functions (one-one, onto and bijective)

Unit 2: Divisibility in Integers

[13]

- (3.1) Well ordering principle
- (3.2) First and second Principle of Mathematical Induction, Examples
- (3.3) Division Algorithm (without proof)
- (3.4) Divisibility and its properties, prime numbers.
- (3.5) Definition G.C.D and L.C.M., Expressing G.C.D. of two integers as a linear combination of the two integers.
- (3.6) Euclidean Algorithm (Without proof).

(3.7) Relatively prime integers, Euclid's Lemma and its generalization.

(3.8) Congruence relations and its properties, Residue Classes: Definition, Examples: $(\mathbb{Z}_n, +, \times)$, $\mathbb{Z}_n$ is a field iff n is prime, addition and multiplication modulo n and composition tables

(3.9) Euler's and Fermat's Theorems. (Without proof). Examples

Unit 3: Coding Theory, Automata Theory and Languages, Group Codes [7]

(3.1) Coding of binary information and error detection

(3.2) Decoding and error correction

(3.3) Linear codes, parity check

(3.4) Generator matrix, examples of coset leader

Unit 4: Complex Numbers [7]

(4.1) Revision: Addition, Subtraction, Multiplication, Conjugate, Division

(4.2) Modulus and Argument of Complex number, Geometric Representation

(4.3) Polar form and its properties

(4.4) DeMoivre's theorem and its applications

(4.5) Solution of equations by using DeMoivre's theorem

Text Books:

- 1) S.R. Patil, R.S.Bhamare, M.D.Bhagat, D.M.Pandhare, S.M Waingade, N.M Phatangare; Discrete Mathematics; Nirali Prakashan, 1998
- 2) Prof .Mrs. M.D.Bhopatkar, Prof. C.S.Nimkar, Prof .Mrs. S.Joglekar; Algebra; Vision Publications, 1998.
- 3) S.R. Patil, R.S.Bhamare, M.D.Bhagat, D.M.Pandhare; Algebra; Nirali Prakashan, 1998.

**F.Y.B.Sc(COMPUTER SCIENCE)(ELECTRONICS)
SEMESTER I**

CS-15 : Principles of Analog Electronics - I

Objectives:

1. To get familiar with basic circuit elements and passive components
2. To understand DC circuit theorems and their use in circuit analysis
3. To study characteristic features of semiconductor devices
4. To study elementary electronic circuits and applications
5. To understand basics of BJT, FET

Course content

36Lectures

1. Introduction to components (6)

Resistors

Capacitors

Inductors and Transformers

Charging and discharging of capacitors

Growth and decay of current in L-R circuits

Growth and decay of voltage in C-R circuits

Simple numerical on the above

2. Network theorems (only statement and problems applied to DC (08)

Revision of Ohm's law & Kirchoff's laws

Thevenin's theorem

Norton's theorem

Maximum power transfer theorem

Superposition theorem

(numerical problems with
maximum two meshes)

3. Bipolar Junction Transistor (09)

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, I-V Characteristics, parameters, specifications

BJT as an amplifier .Transistor amplifier configurations - CB, CC and CE,

Transistor biasing, Q-point

DC load line for a CE amplifier

Transistor as a switch

Simple numerical problems on biasing and DC load line.

4. Amplifier (7)

Concept and definition of an amplifier

Classification based on frequency, coupling and operating point
Single stage RC coupled CE amplifier.
Frequency response and bandwidth of RC coupled amplifier .

5. JFET and MOSFET

(06)

Working Principle of JFET and MOSFET

I/V Characteristics

Parameters

Application of JFET as a switch and as an amplifier.

Numerical problems.

comparison of JFET, MOSFET and BJT

Working principle of UJT and SCR

Application of UJT as relaxation Oscillator.

REFERENCE BOOKS

1. Integrated circuits by Milliman.
2. Electronic Devices and circuits: A. Motorshed, Prentice Hall of India.
3. Basic Electronics:Bernard Grob, McGraw Hill Publication, 8th Revised Edition,
4. 2010
5. Electronic Principles:Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012
6. Principals of Electronics: V.K. Mehta, S.Chand and Co.
7. A text book of electrical technology: B.L.Theraja, S.Chand and Co.

F.Y.B.Sc. (COMPUTER SCIENCE) (ELECTRONICS)

SEMESTER I

CS- 16 : Principles of Digital Electronics -I

Objectives:

1. To get familiar with concepts of digital electronics
2. To learn number systems and their representation
3. To understand basic logic gates, Boolean algebra and K-maps
4. To study arithmetic circuits, combinational circuits and sequential circuits

Course Content	36 Lectures
1.Number Systems And conversions Binary, Octal , Decimal, Hexadecimal number systems. Inter conversions of number systems. BCD, Excess-3 code, Gray codes and Hamming codes. Error detection and correcting codes Excess three code , One's and Two's compliment method Examples	(07)
2.Logic gates And their Applications Revision of different logic gates. Boolean algebra and a few identities De-morgan's 1 st and 2 nd theorem. Interconversion of gates. Rules of binary addition and subtraction, subtraction using 1's and 2's complements, Half adder, full adder, Half subtractor, Full subtractor, Four bit parallel adder, Universal adder / subtractor, Digital comparator Introduction to logic families TTL NAND gate, input output parameters, tristate logic Fan-in fan-out, propagation delay, noise margin	(08)
3.Boolean Algebra and Karnaugh maps Boolean algebra rules and Boolean laws: Commutative, Associative, Distributive, AND, OR and Inversion laws, De Morgan's theorem, Universal gates. Min terms, Max terms , Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form., Simplifications of Logic equations using Boolean algebra rules . Introduction to Karnaugh's map.	(09)

Formation of Pair, Quad and Octet.

Significance of Karnaugh Map.

Simplification of 2,3 and 4 variables using K-Map

4. Multiplexers - Demultiplexers and Encoder –Decoder

(12)

Introduction to multiplexers and Demultiplexers

2:1, Mux 4:1 Mux, 8:1 Mux

Multiplexer Tree.

1:2 Demux, 1:4 Demux, 1:8 Demux

Introduction to Encoders and decoders.

Decimal to BCD encoder

BCD to 7 Segment Decoder.

Study of IC 74147 and IC 74138.

REFERENCE BOOKS:

1. Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education

F.Y.B.Sc. (COMPUTER SCIENCE)
CSI –L I : LAB COURSE ON ORACLE-I

Objectives

1. To introduce the fundamental concepts of RDBMS
2. To learn SQL environment
3. To familiar with basic operations of SQL

Practical Examination

- A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.
B) Semester examination: 60 Marks in One session of 3 Hrs .
60 marks Distribution: Practical work 50 marks and 10 marks for oral

List of Topics

1. Create simple tables.
2. Create tables using various data constraints.
3. Create tables using existing tables.
4. Different forms of select statements
5. Queries using insert, delete statements.
6. Queries using Alter and Update statements.
7. Simple queries using functions & Set Operators.
8. Simple queries using mathematical functions and Date functions

NOTE: At least 8 assignments must be performed.

Note: An Industrial visit should be arranged and report should be submitted at the end of academic year.

F.Y.B.Sc. (COMPUTER SCIENCE)

CSI –L II : LAB COURSE ON C-I

Objectives

1. To introduce the fundamental concepts of C
2. To learn C Programming Language
3. To learn basic structures in C programming Language

Practical Examination

- A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.
B) Semester examination: 60 Marks in One session of 3 Hrs .
60 marks Distribution: Practical work 50 marks and 10 marks for oral

List of Topics

1. Introduction to c programming environment.
2. Basic programs using c programming language including use of arithmetic operators, areas etc.
3. Program based on if statements, if---else and nested if else statements
4. Programs based on condition checking and Looping (e.g. inverting Number, checking whether number is prime, finding GCD and LCM etc.)
5. .Program based on switch case ,return and goto statements.
6. Program using Function
7. Program using recursion

NOTE : At least 8 assignments must be performed.

F.Y.B.Sc. (COMPUTER SCIENCE)

CSI – LIII : LAB COURSE FOR ELECTRONICS -I

Objectives:

1. To use basic concepts for building various applications in electronics.
2. To understand design procedures of different electronic circuits as per requirement.
3. To build experimental setup and test the circuits.
4. To develop skills of analyzing test results of given experiments.
 - One activity equivalent to 2 experiments by the student.
- a. Electronics project
- b. Documentation type experiments
- c. Presentation/Seminar on Electronics /advanced topic/research topics.
 - One activity equivalent to 2 experiments to be arranged by the teacher – Arrange atleast two practical demonstrations / Workshops /Industrial visit which will enhance quality and skills of the student.
 - Examination will be conducted on 8 experiments as well as on activities

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

List of Topics

1. Identification of circuit components.
2. Use of CRO signal generators , power supplies and multimeters.
3. CRO for frequency ,phase and amplitude measurements.
4. Verification of KCL,KVL, Thevenin's and Norton's theorems.
5. Verification of maximum power transfer theorem.
6. Study of phase shift oscillator,Wein bridge oscillator.
7. Crystal Oscillator.
8. Study of potential divider biasing of BJT and its use in DC motor driving
9. Diode as half wave ,full wave and bridge rectifier.
- 10.OP-AMP applications as adder –subtractor.
- 11.OP-AMP applications integrator-differentiator
- 12.Study of output and transfer characteristics JFET/MOSFET
- 13.5. Study of I-V characteristics of UJT and Demonstration of UJT based relaxation oscillator .

NOTE : At least 8 Practicals must be performed.

F.Y.B.Sc. (Computer Science)

Semester- I

CS - 17 : Computer Oriented Statistical Techniques –I

(CBCS 2016 Course)

Total Lectures:- 36

Objectives: The main objective of this course is to acquaint students with some basic concepts in Statistics and introduced some elementary statistical methods of analysis of data. At the end of this course students are expected to be able,

- (i) to compute various measures of central tendency, dispersion, skewness and kurtosis.
- (ii) to analyze data pertaining to attributes and to interpret the results.
- (iii) to compute the correlation coefficient for bivariate data and interpret it.
- (iv) to fit linear regression line to the bivariate data

Unit 1. Scope of Statistics and Data Condensation and Graphical Methods (08L)

- 1.1 Definitions : Webster's and Secrist's definition of Statistics
- 1.2 Importance of statistics
- 1.3 Scope of statistics : Industry, Government, Computer science, social science, etc
- 1.4 Raw data, attributes and variables, discrete and continuous variables
- 1.5 General principles of classification of raw data
- 1.6 Construction of frequency distribution and cumulative frequency distribution, relative frequency distribution.
- 1.7 Graphical representation of frequency distribution : histogram, frequency polygon, frequency curve, ogive curve
- 1.8 Diagrammatic representation : simple bar, subdivided bar, pie diagram, use of MS-excel/ spreadsheet for demonstrating these diagrams
- 1.9 Numerical problems

Unit 2. Measures of Central Tendency and Dispersion

(11L)

- 2.1 Concept of central tendency
- 2.2 Criteria for good measures of central tendency
- 2.3 Arithmetic mean : definition for ungrouped and grouped data, combined mean, merits and demerits
- 2.4 Median: definition, formula for computation for ungrouped and grouped data, graphical methods, merits and demerits
- 2.5 Mode: definition, formula for computation for ungrouped and grouped data, merits and demerits
- 2.6 Use of appropriate average
- 2.7 Quartiles: definition, formulae for grouped data
- 2.8 Concept of dispersion and measures of dispersion
- 2.9 Absolute and relative measure of dispersion
- 2.10 Range: definition for ungrouped data, merits and demerits
- 2.11 Variance: definition for ungrouped and grouped data, combined Variance for two groups, merits and demerits
- 2.12 Standard deviation: definition for ungrouped and grouped data, Coefficient of variation
- 2.13 Numerical problems

Unit 3. Moments and Measures of Skewness and Kurtosis

(08L)

- 3.1 Raw and central moments: definition, for ungrouped and grouped Data (only up to first 4 moments)
- 3.2 Relation between central and raw moments
- 3.3 Idea of symmetric frequency distribution, skewness of a frequency distribution, positive and negative skewness, empirical relation between mean, median and mode
- 3.4 Pearson's and Bowley's coefficients of skewness
- 3.5 Idea of kurtosis for a frequency distribution
- 3.6 Measures of skewness and kurtosis based on moments
- 3.7 Numerical problems

Unit 3. Correlation and Regression (for ungrouped data)

(09L)

- 4.1 Bivariate data : scatter diagram
- 4.2 Concept of correlation, positive correlation, negative correlation
- 4.3 Karl Pearson's coefficient of correlation (r)
- 4.4 Limits of r , $-1 \leq r \leq 1$, and interpretation of r
- 4.5 Concept of regression, cause and effect relation
- 4.6 Properties of regression coefficient : $b_{xy} b_{yx} = r^2$, $b_{xy} b_{yx} \leq 1$,
 $b_{xy} = r\sigma_x/\sigma_y$, and $b_{yx} = r\sigma_y/\sigma_x$
- 4.7 Numerical problems

Books Recommended

- 1) Hogg R. V. and Craig, R. G.
Introduction to Mathematical Statistics.
- 2) Hoel. P. G.
Introduction to Mathematical Statistics.
- 3) Feller. W
Introduction to probability Theory and its Applications. Vol –I
- 4) Mood A. M., Grabill, F. A. Boes D. C.
Introduction to Theory of Statistics.
- 5) Meyer P. L.
Introduction to Probability and Statistical Applications.
- 6) Goon, Gupta and Das Gupta
Fundamentals of Statistics Vol I & II
- 7) S. P. Gupta
Statistical methods.

F.Y.B.Sc. (Computer Science)

Semester- I

CS18: Compulsory English - I (To be implemented from June 2016)

Course Content

36 Lectures

A. Objectives:

- a) To encourage and enable the students to read the various types of texts on their own and discuss them among peers.
- b) To develop competence among the students for self-learning.
- c) To develop their communicative skills and their proficiency in English language.
- d) To make students aware of the different communicative skills.
- e) To prepare them to function effectively in their future professions.

**Prescribed Text: *Views & Visions: An English Coursebook for Undergraduates* by
Orient BlackSwan**

Prose:

1. Towards Universal Brotherhood	<i>Rashtrasant Tukdoji Maharaj</i>
2. Buddha, 'The Enlightened One'	<i>Max Eastman</i>
3. How Wealth Accumulates and Men Decay	<i>George Bernard Shaw</i>
4. The Romance of a Busy Broker	<i>O. Henry</i>
5. Kalpana Chawla	<i>Anonymous</i>

Poetry:

1. Where the Mind is Without Fear	<i>Rabindranath Tagor</i>
2. A Psalm of Life	<i>H.W. Longfellow</i>
3. Mirror	<i>Sylvia Plath</i>
4. Lord Ullin's Daughter	<i>Thomas Cambell</i>
5. Curious Mishaps	<i>Vikram Seth</i>

Grammar, Usage and Composition:

1. Articles	2. Prepositions	3. Tense
4. Kinds of Sentences	5. Transformation of Sentences	

(Note: All the units as covered in the prescribed text)

F.Y.B.Sc. (COMPUTER SCIENCE)

SEMESTER –I

CS- 19 : ELEMENTARY ALGORITHMICS

Course content

36 Lectures

Objectives:

- Analyze the performance of algorithms.
- To develop Analytical / Logical Thinking and Problem Solving capabilities
- Apply important algorithmic design paradigms and methods of analysis.

1. Concepts of Problem, Procedure and Algorithm, Algorithm Representation through Pseudo-Code and Flow-Charts Tracing of Algorithms. Concept of a program and structure of procedure oriented languages. [6]
2. Problem Analysis and Design of Algorithms for problems such as (1) Swapping(2) Counting (3) Finding the Sum, Product, maximum, minimum of a list of numbers, and (4) Simple variations of the above problems realization that there may be alternative algorithm and that one algorithm may be better (in some sense)than the other. [7]
3. Problem Analysis and Design of Algorithms for problems such as (1) Evaluation of a polynomial (2) Sum of first n factorials (3) Finding the n^{th} term of a Fibonacci sequence, (4) Finding the largest and second largest of a list, (5) Evaluating finite series and variations of these problems, (6) Determining n^{th} root of a number [7]
4. Introduction to recursive algorithms and their tracing. Applications to (1) Computation of a factorial, sum, maximum, Fibonacci terms . (2) Base conversion (3) Reversing a String and checking for palindrome property. (4) To compute GCD . [5]
5. Concept of array and problems that involve array manipulation (1) Removing the duplicates (2) Partitioning of an array, (3) Listing of prime numbers (4) Finding the prime factor of a number (5) Printing a Histogram. [5]
- 6 . The problem of search and merge, Linear, Binary search algorithms. The problem of Sorting, Selection, Insertion, Bubble, Quick, and Merge Sort algorithms. [6]

Reference Books :

1. How to solve it by a computer by Dromey R.G.
2. Data Structures, Algorithms and applications in C++ (Ch I I) by Sartaj Sahni

F.Y.B.Sc. (COMPUTER SCIENCE)

SEMESTER-II

CS-21 : RDBMS USING ORACLE

Course content

36 Lectures

Objectives:

1. To teach database management operations
2. To teach data security and its importance
3. To teach client server architecture
4. To Understand Concepts of Data Normalization

Chapter 1 : Transaction Concepts

[12]

Describe a transaction, properties of transaction, state of the transaction., Executing transactions concurrently associated problem in concurrent execution, Schedules, types of schedules, concept of serializability, precedence graph for Serializability, Ensuring Serializability by locks, different lock modes, 2PL and its variations, Basic timestamp method for concurrency, Thomas Write Rule, Locks with multiple granularity, dynamic database concurrency (Phantom Problem), Timestamps versus locking, Deadlock handling methods, Detection and Recovery (Wait for graph).Prevention algorithms (Wound-wait, Wait-die)

Chapter 2 : Relational algebra

[5]

Preliminaries, Relational algebra (selection, projection, set operations, renaming joins, division

Chapter 3 : Relational Database Design

[5]

Dependencies : Functional, transitive , multi –valued , Normalization : First ,Second ,Third normal form, Desirable properties of decomposition(lossless -join , dependency preservation)

Chapter 4: PL/SQL

[7]

Introduction, Syntax, Datatypes, Variables, Control Structure(Conditional & Iterative),block structure

Chapter 5 : Stored Procedure & Triggers

[7]

Creating Procedure(Declarative Part, Executable Part), Syntax Applications ,Using Procedures, Advantages, functions, Use of database triggers ,Types of triggers, Working of Triggers

References

1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S. Sudarshan, ISBN:9780071289597,Tata McGraw-Hill Education
2. Database Management Systems ,Raghu Ramakrishnan,ISBN:9780071254342,

Mcgraw-hill higher Education.

3. Database Management Systems,Raghu Ramakrishnan and Johannes Gehrke, McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
4. Database Systems, Shamkant B. Navathe, Ramez Elmasri,ISBN:9780132144988, PEARSON HIGHER EDUCATION
5. Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones,Neil Matthew, ISBN:9781590594780, Apress
6. PostgreSQL, Korry Douglas, ISBN:9780672327568, Sams
7. Practical PostgreSQL (B/CD),John Worsley, Joshua Drake, ISBN:9788173663925 Shroff/O'reilly
8. Practical Postgresql , By Joshua D. Drake, John C Worsley (**O'Reilly publications**)
9. "An introduction to Database systems", Bipin C Desai, Galgotia Publications
- 10.Commercial Application Development Using ORACLE DEVELOPER 2000,BPB PUBLICATIONS By IVAN BAYROSS

F.Y.B.SC. (COMPUTER SCIENCE)

SEMESTER II

CS-22 : PROGRAMMING IN C-II

Course content

36 Lectures

Objectives:

1. To train students in professional skills related to Software Industry.
2. To prepare necessary knowledge base for research and development in Computer Science.
3. To help students build-up a successful career in Computer Science using foundation of C language.

1. Arrays [12]

Declaration, entering data into an array, reading data from an array, one dimensional arrays, two dimensional arrays, multi dimensional arrays, arrays and functions, character strings, declaring and initializing string variables, standard library functions, arrays of strings.

2. Structures and Unions [8]

Declaration of structures, initialization of structures, nested structures, Arrays of structures, Declaration of union, initialization of union, differentiate between structures and union.

3. Pointers [8]

Introduction to pointers, pointer declaration ,uses of pointers, applications of pointers, pointer arithmetic, pointer to pointer, pointer to constant object, pointers and arrays, pointers to functions ,pointers to structures.

4 File handling [8]

Introduction, streams, types of files, operations on file standard input-output functions, formatted input-output functions.

References

- Programming in C by S . Kohan
- Born to code in C by H Schildt
- The art of C by H Schildt
- C programming by Kerningham & Richie – 2 nd edition
- Let us C by Yashwant Kanetkar
- C programming by E- Balaguruswami

F.Y.B.Sc.(COMPUTER SCIENCE) MATHEMATICS

SEMESTER-II

CS-23 GRAPH THEORY

Course content Lectures

36

Objectives:

The main objective of this course is to introduce students to some basic concepts in Graphs, operations on graphs, Connected Graphs, Eulerian and Hamiltonian graphs, Trees, Directed Graphs. At the end of this course student are expected to be able to.

- (1) find adjacency and incidence matrix of graphs.
- (2) studied various types operations on graph.
- (3) find shortest path of graph using Dijkstra's Algorithm.
- (4) introduce the Chinese Postman Problem and Travelling Salesman Problem.
- (5) find shortest spanning tree using Kruskal's algorithm.

Unit 1 : Graphs

[03]

(1.1) Definition, Elementary terminologies and results, Graphs as Models.

(1.2) Special types of graphs.

(1.3) Isomorphism.

(1.4) Adjacency and Incidence Matrix of a Graph.

Unit 2 : Operations on Graphs

[09]

(2.1) Subgraphs, induced subgraphs, Vertex deletion, Edge deletion, edge contraction.

(2.2) Complement of a graph and self-complementary graphs.

(2.3) Union, Intersection and Product of graphs.

(2.4) Fusion of vertices.

Unit 3 : Connected Graphs.

[09]

(3.1) Walk, Trail, Path, Cycle : Definitions and elementary properties.

(3.2) Connected Graphs : definition and properties.

(3.3) Distance between two vertices, eccentricity, center, radius and diameter of a graph.

(3.4) Isthmus, Cut vertex : Definition and properties.

(3.5) Cutset, edge-connectivity, vertex connectivity.

(3.6) Weighted Graph and Dijkstra's Algorithm.

Unit 4 : Eulerian and Hamiltonian Graphs

[08]

(4.1) Seven Bridge Problem, Eulerian Graph : Definition and Examples, Necessary and Sufficient condition.

(4.2) Fleury's Algorithm.

(4.3) Hamiltonian Graphs : Definition and Examples, Necessary Condition.

(4.4) Introduction of Chinese Postman Problem and Travelling Salesman Problem.

Unit 5 : Trees

[07]

(5.1) Definition, Properties of trees.

(5.2) Center of a tree.

(5.3) Binary Tree : Definition and properties.

(5.4) Tree Traversal : Ordered rooted Tree, Preorder traversal, inorder traversal and postorder traversal, Prefix Notation.

(5.5) Spanning Tree : Definition, Properties, Shortest Spanning Tree, Kruskal's Algorithm.

Reference Books:

- 1) Kenneth Rosen, Discrete Mathematics and It's Applications (Tata McGraw Hill)
- 2) C. L. Liu ,Elements of Discrete Mathematics, (Tata McGraw Hill)
- 3) John Clark and Derek Holton, A First Look at Graph Theory (Allied Publishers)
- 4) Narsingh Deo, Graph Theory with Applications to Computer Science and Engineering, (Prentice Hall).
- 5) S.R. Patil, R.S.Bhamare, M.D.Bhagat, D.M.Pandhare, S.M Waingade, N.M Phatangare; Discrete Mathematics; Nirali Prakasha.

F.Y.B.Sc.(COMPUTER SCIENCE) MATHEMATICS

SEMESTER-II

CS-24 ALGEBRA-II

Course content

36

Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts in Groups, normal subgroups, homomorphism and isomorphism, Connected Graphs, Eulerian and Hamiltonian Rings and field.

At the end of this course student are expected to be able to.

- 1) examples of group , subgroup, various properties.
- 2) operations on a group.
- 3) study the ring and integral domain.

Unit 1: Groups

[17]

- (1.1) Binary Operations, Semigroups, Monoids, Groups: Definitions and Examples, Simple, Properties
- (1.2) Abelian Group, Finite Group, Infinite Group
- (1.3) Order of an element of a Group
- (1.4) Subgroups: Definition, Necessary and Sufficient Conditions, Examples on finding subgroups of finite groups, Union and Intersection of Subgroups
- (1.5) Cyclic Subgroups: Definition, Simple Properties.
- (1.6) Coset : Definition & Simple Properties.
- (1.7) Lagrange's theorem (with proof) & its Corollaries .
- (1.8) Permutation Groups :Definition of S_n and detail discussion of the group S_3 , Cycles and Transpositions, Even and Odd Permutations, Order of Permutation, Properties :
 - a) $|S_n| = n!$ b) A_n is subgroup of S_n .

Unit 2: Normal Subgroups, Homomorphism & Isomorphism

[15]

- (2.1) Normal Subgroups: Definition, properties with examples
 - a) If G is abelian group then every subgroup of G is normal.
 - b) H is normal subgroup of G iff $xhx^{-1} = H$,
 - c) H is normal subgroup of G iff every left coset of H in G is also a right coset of H in G . (all with proof).
 - d) H is normal subgroup of G iff product of two right coset of H in G is also a right coset of H in G .
 - e) If H is subgroup of index 2 in G then H is normal subgroup of G .
 - f) If H is the only subgroup in G of a fixed finite order then H is normal subgroup of G . (all without proof.).
- (2.2) Quotient Groups: Definition and Examples
- (2.3) Homomorphism and Isomorphism: Definitions, Examples, Simple properties.

Unit 3: Rings & Fields

[4]

- (3.1) Rings , Integral Domains: Definitions ,Some results (without proof), Examples.

(3.2) Fields , Skew Field: Definitions ,Some results (without proof),Examples.

References:

- 1) J.B. Fraleigh, A. First Course in Abstract Algebra, Third Ed., Narosa, New Delhi, 1990.
- 2) S.R. Patil, R.S. Bhamare, M.D. Bhagat, D.M. Pandhare;
Algebra; Nirali Prakashan, 1998
- 3) S.R. Patil, R.S. Bhamare, M.D. Bhagat, D.M. Pandhare;
Algebra; Nirali Prakashan, 2003.
- 4) P.B. Bhattacharya, S.K. Jain, S.R. Nagpaul : Basic abstract algebra (second edition).

F.Y.B.Sc. (Computer Science) (ELECTRONICS)

SEMESTER II

CS-25 :Principles of Analog Electronics – II

1. To get familiar with differential amplifiers
2. To understand basics of operational amplifiers
3. To study features of oscillators
4. To study elementary concepts of power supply

Course content

36 Lectures

1.Differential amplifier

(04)

Black box concept

Different modes of operation

Parameters of differential amplifier

Differential Amplifier with constant current source

Concept of feedback

Types of feedback

2.Operational Amplifier

(12)

Introduction to OP-AMP

Block diagram

Concept of virtual ground

OP-AMP IC 741

OPAMP applications - Inverting and non inverting amplifier, adder, subtractor, comparator, integrator and differentiator

Numerical problems.

3.Oscillators

(12)

Introduction to Oscillators.

Concept of positive feedback

Barkhausen criteria

Classification of oscillators

Weinbridge oscillator, Phase Shift oscillator

Hartley, Colpitt oscillator

Crystal oscillator

Numerical problems.

4.Power Supply

(08)

Review of rectifiers,

Types of regulations.

Block diagram, working and specifications of regulated power supply

Switching mode power supply (**SMPS**)

Uninterrupted power supply (**UPS**)

REFERENCE BOOKS

1. Integrated circuits by Milliman.
2. Electronic Devices and circuits: A. Motorshed, Prentice Hall of India.
3. Basic Electronics:Bernard Grob, McGraw Hill Publication, 8th Revised Edition,2010
4. Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition. 2012
5. Principals of Electronics: V.K. Mehta, S.Chand and Co.
6. A text book of electrical technology: B.L.Theraja, S.Chand and Co.

F.Y.B.Sc. (Computer Science) (ELECTRONICS)

SEMESTER II

CS – 26 : Principles of Digital Electronics -II

Objectives:

1. To get familiar with concepts of digital electronics
2. To learn the concept of flip -flops
3. To understand the working of counters
4. To study Shift registers
5. To get introduced to semiconductor memory.

Course content

36 Lectures

1.Flip-flops

(10)

Introduction to flip flop

RS flip-flop, Clock R-S flip-flop

JK flip-flop, Master-slave JK flip flop

D and T flip-flop.

Race around condition

Triggering in flip-flops,

Preset Clear, Delay (Definitions only)

Examples of commonly used flip-flops and their applications.

2.Counters

(12)

Introductions to counters.

Asynchronous counters, Synchronous counter,

Modulus of counter

Ring counter , Up-down counter,

study of IC 7490 (Internal block diagram)

Frequency division in IC 7490(MOD 2,MOD 4, MOD 6 ,MOD 8, MOD 10)

3.Study of shift registers

Serial and parallel data shifting. SISO (right and left shift), SIPO ,PIPO And PISO. Study of IC 7495 .

4.Clock generating circuits

(09)

Multivibrators

Introduction to IC555,

Working of IC 555 as a clock generator(Astable, monostable, bistable multivibrator),

Working of IC 741 as a clock generator (No derivations expected for the above, only formula and problems)

Duty cycle

Problems.

5.Semiconductor Memory

(05)

Introduction to memory devices.

RAM,ROM,PROM,EPROM

REFERENCE BOOKS:

1. Digital Electronics: Jain R.P., Tata McGraw Hill
2. Digital Principles and Applications:Malvino Leach, Tata McGraw-Hill.
3. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education

F.Y.B.Sc. (Computer Science)
SEMESTER II
CSII –L I : LAB COURSE ON ORACLE-II

. Objectives

1. To introduce the concepts of PL/SQL Block Structures
2. To understand PL/SQL control Structures
3. To familiar with handling errors, Procedures and triggers.

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

List of Topics

1. Assignment on nested queries.
2. Introduction to PL/SQL blocks structure .
3. Simple PL/SQL blocks
4. Assignments based on PL/SQL Conditional statements
5. Assignments based on PL/SQL Looping statements
6. Usage of procedures.
7. Assignments based on exception Handling
8. Usage of triggers.

NOTE: At least 8 assignments must be performed.

Note: An Industrial visit should be arranged and report should be submitted at the end of academic year.

CSII –L II : LAB COURSE ON C-II

Objectives

1. To introduce the arrays concept
2. How to handle data of different Structure
3. Introduction to file structure .

Practical Examination

- A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.
- B)Semester examination: 60 Marks in One session of 3 Hrs .
60 marks Distribution: Practical work 50 marks and 10 marks for oral

List of Topics

1. Programs using one dimensional and two dimensional array
2. Programs based on character array. (counting of character words, lines and white spaces etc.)
3. Programs on pointer
4. Programs on Structure and Unions.
5. Programs on structure within structure
6. Programs on File handling.

NOTE : At least 8 assignments must be performed.

CSII – LIII : LAB COURSE FOR ELECTRONICS -II

Objectives:

1. To use basic concepts for building various applications in electronics.
2. To understand design procedures of different electronic circuits as per requirement.
3. To build experimental setup and test the circuits.
4. To develop skills of analyzing test results of given experiments.
 - One activity equivalent to 2 experiments by the student.
- a. Electronics project
- b. Documentation type experiments
- c. Presentation/Seminar on Electronics /advanced topic/research topics.
 - One activity equivalent to 2 experiments to be arranged by the teacher –
Arrange atleast two practical demonstrations / Workshops /Industrial visit which will enhance quality and skills of the student.
 - Examination will be conducted on 8 experiments as well as on activities

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

List of Topics:

1. Study of 7490 as a counter.
2. Transistor as a switch.
3. FET characteristics.
4. SCR characteristics.
5. Study of logic gates.
6. Study of flip-flops
7. Verification of Demorgan's theorem and conversion of one gate to other.
8. Study of half and full adder and subtractor.
9. Study of shift register IC 7495.
10. Study of up down counter
11. Build and Test Diode matrix ROM
12. Study of Four bit Universal Adder/Subtractor

NOTE : At least 8 Practicals must be performed

F.Y.B.Sc. (Computer Science)

Semester II

CS – 27 : Computer Oriented Statistical Techniques -II

(CBCS 2016 Course)

Total Lectures:- 36

Objectives

The main objective of this course is to introduce to the students the basic concepts of probability, axiomatic theory of probability, concept of random variable, probability distribution (univariate) discrete random variables, expectation and moments of probability distribution. By the end of the course students are expected to be able

- (i) to find the probabilities of events.
- (ii) to obtain a probability distribution of random variable (one dimensional) in the given situation, and
- (iii) to apply standard discrete probability distribution to different situations
- (iv) to apply continuous probability distribution to different situations.
- (v) to apply small and large sample tests to different situations.

Unit 1. Probability (10)

- 1.1 Idea of deterministic and non-deterministic models
- 1.2 Sample space (Finite and countably finite)
- 1.3 Events : types of events, operations on events
- 1.4 Probability : classical definition, relative frequency approach, probability models
- 1.5 Axioms of probability
- 1.6 Probability of events
- 1.7 Theorems on probability :
 - 1) $0 \leq P(A) \leq 1$
 - 2) $P(A) + P(A') = 1$
 - 3) $P(A) \leq P(B)$ when $A \subset B$
 - 4) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- 1.8 Concept and definitions of conditional probability $P(A \cap B) = P(A) P(B | A)$
- 1.9 Concept and definitions of independence of two events
- 1.10 Numerical problems

Unit 2. Discrete Random Variables and some Standard Discrete Probability Distributions (10)

- 2.1 Definition of random variable and discrete random variable.
- 2.2 Definition of probability distribution and distribution, Probability mass function.
- 2.3 Definition of expectation and variance, theorems on expectation.
- 2.4 Binomial distribution : definition, mean, Variance, additive property, illustrations of real life situations.
- 2.5 Poisson distribution : definition, mean, variance, additive property, approximation to binomial, illustrations of real life situations.
- 2.6 Numerical problems

Unit 3. Continuous random variables and some Standard Continuous Probability Distribution (08)

- 3.1 Definition through p.d.f.
- 3.2 Distribution function : definition, statements of properties
- 3.3 Definitions of mean and variance
- 3.4 Exponential distribution : p.d.f. with mean, nature of probability curve, mean, variance, lack of memory property.
- 3.5 Normal distribution : definition of p.d.f., identification of parameters, Probability curve, standard normal distribution.
- 3.6 Numerical problems

Unit 4. Test of Hypothesis and Some Large and Small sample Tests (08)

- 4.1 Definitions : random sample, parameter, statistic, standard error of statistic.
- 4.2 Concept of null and alternative hypothesis, critical region, level of significance, types of error, Concept of test of hypothesis, one sided and two sided tests.
- 4.3 $H_0 : \mu = \mu_0$ Vs $H_1 : \mu \neq \mu_0$
- 4.4 $H_0 : P = P_0$ Vs $H_1 : P \neq P_0$
- 4.5 Chi-square test for goodness of fit and 2 X2 contingency table
- 4.6 t-test for testing $H_0 : \mu = \mu_0$ Vs $H_1 : \mu \neq \mu_0$
- 4.7 Numerical problems

Books Recommended

- 1) Hogg R. V. and Craig, R. G.
Introduction to Mathematical Statistics.
- 2) Hoel. P. G.
Introduction to Mathematical Statistics.
- 3) Feller. W
Introduction to probability Theory and it's Applications. Vol –I
- 4) Mood A. M., Grabill, F. A. Boes D. C.
Introduction to Theory of Statistics.
- 5) Meyar P. L.
Introduction to Probability and Statistical Applications.
- 6) Goon, Gupta and Das Gupta
Fundamentals of Statistics Vol I & II
- 7) S. P. Gupta
Statistical methods.
- 8) Waikar and Lev.
Elementary Statistical Methods.
- 9) BIS Publication
Statistical Quality Control (Hand Book)
- 10) ATAG (Automotive Industries Action Group) :SPC/MMS manuals.
- 11) Samprit Chatterjee and Bertram Price.
Regression analysis by Example (1991).
John Wiley and sons. Inc.
- 12) Guilford, J. P. and Fruchter B: Fundamental Statistics in Psychology and Education
(1980), Mc Graw Hill.
- 13) Mathur, Rajiv. Learning Excel-97 for windows step by step Galgotia

F. Y. B. Sc. (Computer Science)

Semester II

CS-28 : Compulsory English - II

A. Objectives:

- a) To encourage and enable the students to read the various types of texts on their own and discuss them among peers.
- b) To develop competence among the students for self-learning.
- c) To develop their communicative skills and their proficiency in English language.
- d) To make students aware of the different communicative skills.
- e) To prepare them to function effectively in their future professions.

Prescribed Text: *Views & Visions: An English Coursebook for Undergraduates* by

Orient BlackSwan

Prose:

1. The Task of Education	<i>Vinoba Bhave</i>
2. A Letter by Hazlitt to His Son	<i>William Hazlitt</i>
3. The Bet	<i>Anton Chekov</i>
4. Curious Mishaps	<i>Vikram Seth</i>
5. Refund	<i>Fritz Karinthy</i>

Poetry:

1. Polonius to Laertes	<i>William Shakespear</i>
2. No Men are Foreign	<i>James Kirkup</i>
3. Stopping by Woods on a Snow Evening	<i>Robert Frost</i>
4. The Golden Pitcher	<i>Acharya Vidyasagar Maharaj</i>

Grammar, Usage and Composition:

1. Degrees of Comparison
2. One-word Substitution
3. Synonyms and Antonyms
4. Paragraph Writing
5. Reading Comprehension
6. Summarising

(Note: All the units as covered in the prescribed text.)

F.Y.B.Sc. (Computer Science)

SEMESTER-II

CS-29 : OPERATING ENVIRONMENT

Course content

36 Lectures

Objectives:

- 1) To aware the computer fundamentals
- 2) To know the structure and working of compute
- 3) Obtain understanding of the concepts of information technology

1. Computer definition, uses, block diagram, functions of ALU, input/output, scanner, plotter, keyboard, mouse, MICR, bar decoder, OCR, joystick, monitor, printer, memory unit and CPU. [7]
2. Software-types, compilers, interpreter, assembler, linker, loader, high level and low-level languages. Files-types and operations, indexed, sequential and hashed organization. Sorting, merging, indexing and updating functions, concept of a file allocation table. [8]
3. Operating System-types-timesharing, batch processing, multiprogramming , real- time; functions of operating systems – Introduction to file management, detailed study of DOS and Windows. [7]
4. Networking - Data communication concepts, classification, communication media, LAN, Wan, Man, Internet, Intranet, Extranet , and their efficient use. [7]
5. Study of office 2000(MS-Word, MS-Power Point, MS-Excel) [7]

Reference Books :

1. A First course in computers by Ravi Saxena
2. Computer Fundamentals :Milind Oak
3. Computer Fundamentals : P.K.Sinha

SEMESTER –III

CS -31 : Object Oriented Programming with C++

COURSE CONTENT

4CREDITS(48 L)

Learning Outcomes:

Perform object oriented programming to develop solutions to problems demonstrating usage of control structures, modularity, I/O. and other standard language constructs.

Demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

Demonstrate ability to implement one or more patterns involving realization of an abstract interface and utilization of polymorphism in the solution of problems which can take advantage of dynamic dispatching.

Prerequisites: Knowledge of C Programming Language

1. Principles of Object oriented Programming [04]

Object oriented concepts
Features, advantages and Applications of OOPS

2. Introduction to C++ Programming Language [08]

Tokens, Expressions ,Control structures
Data types, new operators and keywords, using namespace concept
Simple C++ Program
Introduction to Reference variables
Usage of 'this' pointer
Classes and Objects
Access specifiers
Defining Data members and Member functions
Array of objects

3. Functions in C++ [12]

Call by reference, Return by reference
Function overloading and default arguments
Inline function
Static class members
Friend Concept – Function, Class

4. Constructors and destructor [05]

Constructor
Types of constructors
Memory allocation (new and delete)
Destructor

5. Operator overloading **[08]**

- Overloading function
- Overloading Unary and Binary operators
- Overloading using friend function
- Type casting and Type conversion

6. Inheritance **[06]**

- Types of inheritance with examples
- Constructors and destructor in derived classes
- Virtual base classes, Virtual functions and Pure virtual function
- Abstract base classes

7. Managing Input and Output using C++ **[05]**

- Managing console I/O
- C++ stream classes
- Formatted and unformatted console I/O
- Usage of manipulators

References:-

- 1) Object Oriented programming with C++ 4th Edition by e .Balaguruswamy,Tata Mc-Graw Hill Publication.
- 2) The C++ Programming Language by Bjarne Stroustrup, Addison Wesley, 2000
- 3) Object oriented programming in C++, Robert Lafore, Galgotia Publication.

S.Y.B.Sc. Computer Science

SEMESTER –III

CS-32 :Introduction To .Net Using C#

COURSE CONTENT

4CREDITS(48 L)

Learning Outcomes:

1. Giving the students the insides of the .net environment in c#.
2. It covers the concepts of web servers and web application, server design methodology with an object oriented concepts, client side programming, server side programming
3. It also covers usage of recent platform used in developing web applications such as .Net environment like C# and Asp.net

1) Introduction to .Net Technology: (08 L)

.Net Framework, common Language Runtime, Common Language Specification, Intermediate Language Code, Just-In-Time Compiler, Assemblies, Manifest, Metadata ,Global assembly Cache

2) Introduction TO C# (08 L)

Introducing C#, Overview of C# ,Literals, Variables, Data Types, Operators, Expressions, Branching, Looping, Methods, Arrays, Strings, Structures, Enumerations.

3) Exception Handling (08 L)

Using Structured Exception(try-catch-finally

4) Windows Forms using C# : (10 L)

Text Box, Buttons, Labels, Checks Boxes, radio Buttons, List Boxes, Combo Boxes, Picture Boxes, Scrollbars, Timer, Menus, Built-in Dialogs, Image List, Toolbars, Status Bar and Progress bars, Event and Delegates, Tracing, Debugging

5) Object Oriented Programming: (08 L)

Class and Objects Properties, methods and events, Constructor and Destructor, Method overloading, Inheritance, Access modifiers(Public, Private, Protected, Friend), Overriding and shadowing, Interfaces, Polymorphism, Private and Shared Classes

6) File Handling: (06 L)

File stream class, Stream Writer, Stream Reader, Binary Reader, Binary Writer Classes ,File and Directory Classes

TEXT BOOKS:

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2004. (Unit I, II)
2. J. Liberty, "Programming C#", 2nd ed., O'Reilly, 2002. (Unit III, IV, V)

REFERENCES:

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill, 2004.

2. Robinson et al, "Professional C#", 2nd ed., Wrox Press, 2002.
3. Andrew Troelsen, "C# and the .NET Platform", A! Press, 2003.
4. Thamarai Selvi, R. Murugesan, "A Textbook on C#", Pearson Education, 2003.
5. Programming Microsoft ASP.NET Dino Esposito

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER – III

CS- 33 : Linear Algebra

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in Linear equations and matrices, General vector spaces, Eigen Values and Eigen functions and linear transformation.

At the end of this course student are expected to be able to.

- (i) Know linear system, matrix transformation, solution of linear systems of equations, and LU decomposition.
- (ii) Know the real vector spaces, subspaces, linear independence, basis and dimensions.
- (iii) Find linear dependence, linear span, basis and dimension of vector spaces.
- (iv) Solve kernel and range of linear transformation..

[1] Linear Equations and Matrices [12]

- (1.1) Linear systems
- (1.2) Matrices
- (1.3) Dot Product and Matrix Multiplication
- (1.4) Matrix Transformations
- (1.5) Solutions of Linear Systems of Equations
- (1.6) LU- Factorization.

[2] General Vector Spaces [12]

- (2.1) Real vector spaces.
- (2.2) Subspaces.
- (2.3) Linear independence.
- (2.4) Basis and dimensions.
- (2.5) Row space, column space and null space.
- (2.6) Rank and Nullity.

[3] Eigen values and Eigen vectors [12]

- (3.1) Eigen values and Eigen vectors.
- (3.2) Diagonalization.
- (3.3) Quadratic forms.
- (3.4) Using scilab : (i)Find Eigen values and Eigen vectors.
(ii) Diagonalization

[4] Linear Transformations [12]

- (4.1) General linear transformations.
- (4.2) Kernel and range. (Rank nullity theorem without proof.)

- (4.3) Inverse linear transformation.
- (4.4) Matrix of general linear transformation.

TEXT BOOKS:

- (1) S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Nirali Prakashan
- (2) S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Vision Publication
- (3) F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Nirali Prakashan
- (4) F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Vision Publication
- (5) Elementary Linear Algebra (Applications Version) by Howard Anton, Chris Rorres. (Seventh Edition) John Wiley & Sons, Inc.
Sections: 5.1 to 5.6, 7.1, 7.2, 9.5, 9.6, 8.1 to 8.4
- (6) Discrete Mathematical Structures (sixth edition), Kolman, Busby and Ross. PHI.
Sections: 9.5, 11.1 to 11.3

REFERENCE BOOKS:

- (1) M. Artin, Algebra, Prentice Hall of India , New Delhi, (1994).
- (2) K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India New Delhi, (1998).
- (3) S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New York, (1986).
- (4) A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata mcgraw Hill, New Delhi (1994).
- (5) G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER-III

CS- 34 : COMPUTER ORIENTED NUMERICAL METHODS

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in PERT and CPM, solution of non linear equation, polynomial interpolation, numerical differentiation and integration solution of ODE and simultaneous linear equation.

At the end of this course student are expected to be able to.

- (i) Know forward and backward pass computation slack, critical path of PERT and CPM terms.
- (ii) Solve non linear equation by using bisection, secant , regula- falsi, Newton- Raphson methods .
- (iii) Create a polynomial by using Newton's backward and forward formulae, Lagrange's interpolation formulae, Hermite interpolation.
- (iv) Solve integration by using Bisection, Secant, Regula-Falsi and Newton-Raphson methods
- (v) Solve differential equation examples on Euler's method, Runge-Kutta second and fourth Order formula.

[1] PERT and CPM Computations

[10]

- (1.1) Phases of project scheduling
- (1.2) Network logic , numbering the events (Fukerson's rule.)
- (1.3) Measure of activity
- (1.4) PERT: forward and backwad pass computations slack , critical path.
- (1.5) CPM terms, critical path, float.
- (1.6) Using scilab
 - i. Use of ' deff ' command for one and two variables functions.
 - ii. Draw 2-D and 3-D graph for some standard functions.
E.g. x^2 , $\sin (x)$, $\exp(x)$, x^3+y^3 etc .

[2] Solutions of Non – linear Equations

[10]

- (2.1) Location of Roots
- (2.2) Bisection, Secant, Regula-Falsi and Newton-Raphson methods, Comparison Of these methods
- (2.3) Acceleration of convergence Aitken's Process
- (2.4) Regula-Falsi method and Newton-Raphson method using Scilab.

[3] Polynomial Interpolation & Approximation

[10]

- (3.1) Finite differences: Forward, Backward and Central
- (3.2) Detection of errors using different tables

- (3.3) Newton's backward and forward formulae for interpolation
- (3.4) Lagrange's interpolation formulae for unequal intervals
- (3.5) Least square approximation by Polynomials up to third degree
- (3.6) Hermite Interpolation.
- (3.7) Newton Forward, Newton Backward and Lagrange's Interpolation by using Scilab

[4] Numerical Differentiation and Integration

[10]

- (4.1) Numerical differentiation using interpolating polynomials
- (4.2) Trapezoidal rule, Simpson's (1/3)rd rule and Simpson's (3/8)th rule
- (4.3) Extrapolation to the limit : Ramberg Interpolation
- (4.4) Numerical integration by Simpson's (1/3)rd, numerical integration by Simpson's (3/8)th rule, rule by using Scilab

[5] Solution of Ordinary Differential Equations & solution of Simultaneous Linear Equations

[08]

- (5.1) Numerical Integration By Taylor Series
- (5.2) Euler's method
- (5.3) Runge-Kutta method: 2nd and 4th orders
- (5.4) Predictor corrector method
- (5.5) Gaussian Elimination, Pivoting Strategy, Conditional Equations
- (5.6) Modification of Gaussian Elimination to Compute Inverse of Matrix
- (5.7) Comparison of direct and iterative methods
- (5.8) Examples on Euler's method, Runge-Kutta second and fourth order formula by using Scilab.

Text Books :

Prof S.R.Patil; Prof S.G.Gujrathi; Prof D.M. Pandhare;
Numerical Methods And Operation Research; Nirali Prakashan, 1998.

Reference Books:

1. S.S. Sastry; Introductory methods of Numerical Analysis ; Prentice-Hall of India (3rd edition) 2000
2. J.H. Mathews; Numerical methods for Mathematics, Science and Engineering (2nd edition); Prentice-Hall of India , 1994.
3. R.J. Dromey; How To Solve It By Computer; Prentice-Hall Of India; 1982
4. Anthony Ralston, Philip Rabinowitz; A First Course in Numerical Analysis; (2nd edition) International Student edition; mcgraw-Hill Book Company; TOKYO; 1978
5. Computer Oriented Numerical Methods-Rajaraman.
6. Introduction To Numerical Analysis-C.E. Froberg.
7. Introduction To Applied Numerical Analysis-C.E. Froberg.
8. Numerical Methods that works-Forman S. Action.
9. Numerical Methods in Fortran-J.M. McCormik.
10. Numerical Methods For SC & Engg - R.G. Stanton (Prentice Hall)

S.Y.B.Sc. Computer Science(Electronics)

SEMESTER – III

CS-35 : Digital systems and Microprocessors

COURSE CONTENT

4CREDITS(48 L)

Learning outcomes

- To study the concept of data convertors and its applications.
- To use memory concepts for digital circuit design.
- To study and understand basics of microprocessors
- To understand fundamentals of multicore technology

1. Data Converters

(12 L)

Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters of DAC. Analog to Digital Converter (ADC): Types of ADC- Flash, Successive approximation, dual slope. Parameters of ADC. Applications of DAC and ADC .

2. Memory organization

(12 L)

Memory Architecture, Memory Hierarchy, Introduction to USB storage device, Memory parameters like Access time, speed, capacity, cost , Associative Memory, Cache memory, cache mapping techniques, virtual memory, virtual memory mapping: paging and segmentation.

3. Computer Organization

(12L)

Concept of Address Bus, Data Bus, Control Bus. Register based CPU organization, stack organization, I/O organization: need of interface, block diagram of general I/O interface. Working concepts like polling, interrupt initiated data transfer.

Concept of DMA , DMA transfer, DMA Controller Serial communication: Synchronous, asynchronous and their data transmission formats, RS–232, General block diagram of PPI and UART

4. Microprocessor

(12L)

Introduction, General register organization, Stack Organization, Instruction formats, Addressing modes .Generations of microprocessors, general operation of microprocessors. Concept of RISC and CISC, Von-Neumann & Harvard Architecture, Concept of pipeline. Architecture of basic microprocessors 8086 and basic version of Pentium .Concept of multicore processors.

Reference books

1. Microprocessor and interfacing by Douglas Hall, Tata Mcgraw-Hill Edition
2. Computer organization and Architecture by William Stallings
3. The Intel Microprocessor by Barry B.Brey.
4. Computer architecture and organization by Rifiqzaman and Chandra.
5. Computer Organization J.P. Hays TMH
6. The Pentium Microprocessor by James Antonakos(PEA)
7. The Intel Microprocessor by Barry.B.Brey
8. Digital design : M. Morris Mano, Prentice-Hall of India

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER – III

CS-36 : Principles of Communication

Learning outcomes

- To understand basics of communication systems.
- To understand modulation, demodulation and multiplexing of signals.
- To understand digital communication techniques
- To introduce concepts in advanced wireless communication

COURSE CONTENT

4CREDITS(48 L)

1. Introduction to Electronics Communication (08L)

Importance of Communication, Elements of communication systems, Electromagnetic spectrum, type of communication, Concepts of communication system: channel bandwidth, Nyquist theorem, S/N ratio, channel capacity, error handling, Shannon theorem, concept of companding, Data rate, baud rate, serial communication and protocol.

2. Modulation and Demodulation. (16L)

Introduction to concepts of modulation and demodulation. Modulation techniques: Analog modulation: Amplitude, Phase and Frequency modulation, Circuit diagram and working of transistorized amplitude modulator and diode demodulator. Equation of amplitude modulated wave, modulation index and frequency spectrum.

Digital modulation, PAM, PCM, delta modulation, MODEM – concept of ASK, FSK, QPSK, MSK, GMSK.

3. Multiplexing and Multiple Access Techniques. (12L)

Multiplexing, Space division multiplexing, Time division multiplexing, Frequency Division Multiplexing, Code division multiplexing, Introduction to multiple access, FDMA, TDMA, CDMA

4. Introduction to wireless and Mobile Communication. (12L)

Introduction to wireless communication system and its concept. Introduction to antennas, working principle and parameters of antenna. Introduction to mobile communication, Cellular concept, Working of GSM: Hand over, Introduction to GPRS, Wi-Fi and blue tooth Applications. Introduction to RFID, Zigbee.

Recommended Books:

1. Digital and Data Communication, 4th edition by Micheal A. Miller.
2. Communication Electronics by Frenezel Louis E.
3. Wireless Communication, 2nd edition. Rappaport.
4. Mobile Communication. Schiller Jochen.
5. Wireless Communications and Networks. William Stallings

S.Y.B.Sc. Computer Science

CS –III-LI : Lab Course on C++ and Data Structures-I

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B) Annual examination: Maximum marks: 60 Marks and duration is 3 Hrs .

40 marks: Practical work 30 marks and 10 marks for oral

PROGRAM LIST IN C++

1. Write a program in C++ to implement class concept for creating and displaying employee data.
2. Write programs in C++ to implement function overloading and operator overloading(unary, binary , relational).
3. Write a program in C++ to implement Write a program in C++ to implement virtual function.
4. Write a program in C++ to implement constructor and destructor to calculate net salary of n employees.
5. Write a program in C++ to implement the concept of inline functions.
6. Write a program in C++ to use scope resolution operator for member definition.
7. Write a program in C++ to implement how a function can act as a friend with one or more classes.
8. Write programs in C++ to implement simple, hybrid, multiple , multilevel inheritance ..

S.Y.B.Sc. Computer Science

CS-III-LII : Lab course on .NET – I

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B) Annual examination: Maximum marks: 60 Marks and duration is 3 Hrs .

40 marks: Practical work 30 marks and 10 marks for oral

1. Create basic calculator utility in c#.
2. Write c# program using timer & progress bar controls
3. Write a program in c# using list box control , check box control, radio buttons.
4. Write program in c# for implementing single and multiple inheritance.
5. Write program in c# for implementing interface, polymorphism
6. Write c# program for exception handling. (Try-Catch)
7. Write program using File handling in c#
8. Write program using control structures.

SEMESTER-III

CSIII- LIII: Lab Course on Electronics -III

2 Credits

Learning outcomes

- To use basic concepts for building various applications in electronics.
- To understand design procedures of different electronic circuits as per requirement.
- To build experimental setup and test the circuits.
- To develop skills of analyzing test results of given experiments.

➤ Examination will be conducted on 8 experiments .

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

(Note : Any 8 experiments should be performed)

1. Study of SMPS.
2. Study of 8038 function generators.
3. .DC motor drive and speed control.
4. I-V characteristics temperature sensor AD 590.
5. Analog multiplexers.
6. Analog to Digital converter using discrete components/IC LM 234/74148 or IC 7109/Flash ADC
7. Digital to Analog converter using discrete components.
8. Comparison of Monostable using IC-741 and IC-74121.
9. Simple assembly language program : addition,subtraction
- 10.Simple assembly language program: multiplication, division
- 11.Simple assembly language program to find smallest and largest number.
- 12.LM-35 based temperature sensing system/Optocoupler /opto-isolator base system.
- 13.Low Pass Filter and High Pass Filter using IC-741 Op Amp.
- 14.Build and test Hamming Code generator and detector circuit Thumbwheel to seven segment display

S.Y.B.Sc. Computer Science(Electronics) CBCS

S.Y.B.Sc. Computer Science

SEMESTER – IV

CS-47 : CLOUD COMPUTING -II

COURSE CONTENT 4CREDITS(48 L)

Learning Outcomes:

1. To study cloud computing concepts;
 2. Enhancing cloud computing environment.
 3. To study various platforms
 4. To study the applications that uses cloud computing
-
1. **Virtualization** :Introduction, Characteristics of Virtualized environments, Taxonomy of Virtualization techniques, Pros and Cons of Virtualization. (8L)
 2. **Storage in Cloud** -Storage system architecture, Big data, Virtualize data centre(VDC) architecture,VDC Environment, storage, networking. (8L)
 3. **Security in Cloud Computing** : Introduction, Global Risk and Compliance aspects in cloud environments and key security terminologies, Technologies for Data security, Data security risk. (10L)
 4. **Applications:** business applications, management applications, social applications, entertainment applications (8L)
 5. **Cloud computing platforms:** cloud platforms and challenges. (5L)
 6. **Advance concepts in cloud computing:**
Basics and Vision, Applications and Requirements, Smart Devices and Services, Human Computer Interaction. (9L)

Books:

Cloud Computing: A Practical Approach for Learning and Implementation - Srinivasan

S.Y.B.Sc. Computer Science**SEMESTER – IV****CS-48 : DATA WAREHOUSING AND DATA MINING- II****COURSE CONTENT****4CREDITS(48 L)****Learning Outcomes**

- 1) Study and understand various algorithms used for data mining
- 2) Be able to analyze the data using existing data mining tools
- 3) Be able to apply operations like association , classification and clustering for a given dataset

1. Data preprocessing (6 L)
Need, Objectives and techniques ,Data cleaning ,integration ,transformation, reduction, discretization
2. Data mining concepts (4 L)
Data mining architecture , evolution of database technology , Types of data that can be mined ,functionalities, classification, major issues
3. Association rule mining (6 L)
Basic concepts, market basket analysis, road map, classification of association rule
4. Classification and prediction (10 L)
Classification concept ,prediction, issues regarding classification and prediction,comparing classification methods,decision trees ,attribute selection measures
5. Cluster Analysis (6 L)
Introduction ,need ,clustering methods,types of data in cluster analysis ,partitioning methods
6. Cases (2 L)
Case studies

Text Book :-

Data mining concepts and techniques - Jiawei Han and Micheline Kamber

S.Y.B.Sc. Computer Science
Semester IV
CS - 41 : Data Structures using C++

COURSE CONTENT

4CREDITS(48 L)

Learning Outcomes

- To teach fundamental data structures, which allow one to store collections of data with fast updates and queries.
- To efficiently implement the different data structures .
- To efficiently implement solutions for specific complex problems.

Prerequisites: Students are expected to be proficient in a high level object oriented programming language like C++

1. INTRODUCTION TO DATA STRUCTURES

[06]

Abstract Data type, data object, data structures , algorithm analysis, space and time complexity

2. SORTING AND SEARCHING TECHNIQUES

[06]

Bubble, Selection, Insertion, Shell sorts and Sequential, Binary, Indexed Sequential Searches, Binary Search Tree Sort, Heap sort, Radix sort

3. STACK AND QUEUE

[08]

Stacks: LIFO structure, create, POP, PUSH, multiple stacks, ,hashing ,applications

Queues: FIFO structure , Priority Queues, Circular Queues, operations on Queues

4. LINKED LISTS

[08]

Concept, Node structure ,Types of linked list, Linked List Data Structure and operations like Create List, Insert Node (empty list, beginning, Middle, end), Delete node(First, general case), Search list, Retrieve Node, add node, Remove node, Print List , Circularly-Linked List , Doubly Linked List(Insertion, Deletion)

5. TREES

[10]

Tree terminologies, binary tree concept, types of binary trees, operations performed on it , binary Search tree ,Expression trees, AVL trees ,threaded binary tree, Tree traversals, applications.

6. GRAPHS

[10]

Definition, types of graph , terminologies , representation in memory, graph data structures,Operations on graph, Breadth first search, Depth first search , Shortest path problem, spanning tree concept ,topological sort.

References:-

1. Data Structures and Algorithm Analysis in C++, Michael T. Goodrich, Wiley student edition, 2007.
2. Data Structures Using C++, Sahni ,The McGraw-Hill, 2006.
3. Schaum's Outlines Data structure, Seymour Lipschutz, Tata McGraw Hill 2nd Edition
4. Data Structures and Algorithm Analysis in C, Mark Allen Weiss, 2nd Edition, Pearson Education , 1997
5. Data Structures Using C and C++ by Tanenbaum and Moshe, 1998

S.Y.B.Sc. Computer Science

SEMESTER-IV

COURSE CONTENT**4CREDITS(48 L)**

Learning Outcomes

- 1) Introduction to ASP.NET (08L)**
Asp.net Component Model, ASP.NET Development Stack, Difference between C# and ASP.NET
- 2) Introduction to ADO.NET (10L)**
.Net Data Access Infrastructure, Connected Architecture using ADO.Net, Data reader, Connection objects, command Objects.
- 3) Disconnected architecture using ADO.Net (08L)**
Data adapters, and Datasets, Data binding with controls, Navigating data source ,Data from wizard
- 4) Crystal Report (06L)**
Connection to Database, Building Reports, Modifying Report, Header,Footer, Details, Group Header, Group Footer, Summary ,Working with Multiple tables
- 5) Web application: (08L)**
Introduction to Web form, page directive, Page redirection
- 6) Web services: (04L)**
Concept of web services, Create a small web services
- 7) Deployment: (04L)**
Deploying applications using wizard

TEXTBOOKS:

1. E. Balagurusamy, "Programming in C#", Tata McGraw-Hill, 2004. (Unit I, II)
2. J. Liberty, "Programming C#", 2nd ed., O'Reilly, 2002. (Unit III, IV, V)

REFERENCES:

1. Herbert Schildt, "The Complete Reference: C#", Tata McGraw-Hill, 2004.
2. Robinson et al, "Professional C#", 2nd ed., Wrox Press, 2002.
3. Andrew Troelsen, "C# and the .NET Platform", A! Press, 2003.
4. Thamarai Selvi, R. Murugesan, "A Textbook on C#", Pearson Education, 2003.
5. Programming Microsoft ASP.NET Dino Esposito

S.Y.B.Sc. Computer Science(Electronics) CBCS**SEMESTER-IV****CS- 45 : 8051 MICROCONTROLLER**

Learning outcomes

- To study the basics of 8051 microcontroller
- To study the Programming and interfacing techniques of 8051
- To apply knowledge of 8051 to design different application circuits
- To introduce the basic concepts of advanced Microcontrollers

COURSE CONTENT

4CREDITS(48 L)

1. Introduction to 8051 microprocessor

[08L]

Introduction to microcontrollers, difference between a microcontroller and microprocessor. Architecture of 8051:Block Diagram of 8051 and Study of Internal Blocks, Pin configuration of 8051,Reset and Clock,Registers, Flags and Internal Memory, SFRS, I/O Ports. Input/Output, Ports, internal memory, External memory.

2. 8051 Instruction Set

[12L]

Study of 8051 Instruction Set and Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives .Data transfer, Arithmetic, Logical, JUMP, Loops & CALL instructions, Bit manipulation Instructions.

3. Facilities In 8051

[18L]

Programming 8051 timers, counter programming timer interrupts, Timer and Counter: Timer and Counters, Timer modes, Programming for time delay in Mode 1 and Mode 2 using assembly and C. Introduction to interrupt ,Interrupt types and their vector addresses. Interrupt enable register and interrupt priority register(IE,IP), Synchronous and asynchronous serial communication , Programming serial port without interrupt, Use of timer to select baud rate for serial communication.

4. Interfacing:

[10L]

Interfacing ADC, DAC, LCD, stepper motor.

Recommended Books:

1. "The 8051 Microcontroller and Embedded systems using Assembly and C", by Rolin D.MckinlaySecond Edition. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. by Mckinlay.
2. "The 8051 Microcontroller Architecture, Programming & Application", K.Uma Rao and AndhePallavi, Pearson publications.
3. Programming and customizing the 8051 microcontroller by Myke Predko.
4. ARM System Developers guide: Sloss, Andrew n. Symes.
5. Design with PIC microcontrollers: Peatman, Pearson publications.

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER-IV

CS-46 : Analog Systems

COURSE CONTENT

4CREDITS(48 L)

Learning outcomes

- To understand basics of analog electronics
- To study different types of sensors
- To understand different types of signal conditioning circuits
- TO APPLY KNOWLEDGE OF ANALOG SYSTEMS IN DIFFERENT APPLICATIONS

- 1. Measurements, Instrumentation And Calibration [2L]**
Measurements, Units, Standards Instrument, instrumentation, Calibration
- 2. Transducers And Sensor [10L]**
Definition of sensors and transducers. Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility. Temperature sensors (LM-35 and AD590), pH sensor, piezoelectric humidity sensor, optical sensor (LDR), displacement sensor (LVDT), Passive Infrared sensor (PIR), tilt sensor, touch sensor, ultrasonic sensor
- 3. Signal Conditioning [18L]**
Principles of signal conditioning, Signal conditioning of passive sensors using bridge circuit: Wheatstone's bridge, Level Shifter, Amplifier, Three OP-amp instrumentation amplifier, Filters; active and passive filters. Working principle of Single order Op-Amp based Low Pass Filter, High Pass Filter, Band Pass Filter, Notch Filter, Band reject filter; Working of Voltage to frequency Converter using OpAmp.
- 4. Case Study [14L]**
Temperature monitoring system using LM35, Water Level Indicator system using float switch, Electrocardiography (ECG).
- 5. Introduction to Quantum dots, its applications. [4L]**

Books Recommended

1. Electronic Instrumentation: H. S. Kalsi: TMH: 2nd Ed.
2. Modern Electronic Instrumentation and Measurement Techniques: Albert D.
3. Helfrick, William D. Cooper: PHI publications
4. Electronic measurements : K.A. Bakshi, A. V. Bakshi and U. A. Bakshi, Technical publications. A Course in Electrical and Electronic measurements and Instrumentation: A.K. Sawhney:
5. Dhanpat Rai & Sons Educational & technical publishers
6. Transducers & Instrumentation - Murthy PHI (Unit 1)
7. Instrumentation Measurements & Analysis- Nakra & Chaudhry TMH
8. Instrumentation Devices & Systems - Rangan, Sarma, Mani TMH
9. Sensors & Transducers : Dr. A. D. Shaligram: CTC publications
10. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad: PHI: 4th Ed.

S.Y.B.Sc. Computer Science

SEMESTER-IV

CS –IV-LI : Lab Course On C++ and Data Structures-II

Practical Examination

- A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.
B) Annual examination: Maximum marks: 60 Marks and duration is 3 Hrs .
40 marks: Practical work 30 marks and 10 marks for oral

PROGRAM LIST IN DATA STRUCTURES

1. Write a program in C++ to implement sorting algorithms like simple exchange sort, insertion sort and selection sort
2. Write a program in C++ to implement searching techniques like linear search and binary search.
3. Write a program in C++ to implement simple linear Stack with its basic operations like push(),POP()
4. Write a program in C++ to implement simple linear Queue and its operations.
5. Write a menu driven program that implements singly linked list for the following operations:
Create, Display, add a new node, delete a node
6. Write a menu driven program that implements doubly linked list for the following operations:
Create, Display, insert and delete
7. Write a program in C++ to implement insertion and deletion in B tree.
8. Write a menu driven program in C++ to
 - a. Create a binary search tree
 - b. Traverse the tree in Inorder, Preorder and Post Order
9. Write a program in C++ to implement binary search tree.
10. Write a program in C++ to implement simple linear Queue and its operations using linked list.
11. Write a program in C++ to implement stack and its operations using linked list.

S.Y.B.Sc. Computer Science**SEMESTER – IV****CS-IV-LII : Lab Course On .NET-II****Practical Examination**

- A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.
B) Annual examination: Maximum marks: 60 Marks and duration is 3 Hrs .
40 marks: Practical work 30 marks and 10 marks for oral

1. Write program to create ado.net connectivity using connected architecture. (using Connection, Data reader , command object) & display data in List box.

2. Write program to create ado.net connectivity using disconnected architecture.(using Connection ,Data Adapter ,Data dataset object) & display data in textboxes & navigate data. (first ,prev, next, last)
Write ASP.NET program using ado.net for multiple table connection through wizard (textbox, list box)
3. Create crystal report .
4. Write ASP.NET program for exception handling. (Try-Catch)
5. Create WebApplication using Validation Controls
6. Create small WebServices
7. Create application using deployment.
8. Write program using ado.net to connect data grid .

SEMESTER-IV

CSIV- LIII : Lab Course on Electronics -IV

2Credits

Learning outcomes

- To use basic concepts for building various applications in electronics.
- To understand design procedures of different electronic circuits as per requirement.
- To build experimental setup and test the circuits.
- To develop skills of analyzing test results of given experiments.

➤ Examination will be conducted on 8 experiments.

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

(Note : Any 8 experiments should be performed)

1. Absolute decoding and linear select decoding.

2. Temperature to frequency / voltage converter
3. Reed relay control using digital logic
4. Build and test Amplitude Modulator and Demodulator.
5. Build and test Frequency Shift Keying.
6. Build and test TDM.
7. Study of pulse amplitude modulation.
8. Demonstration of working of Wi-fi card.
9. Demonstration Experiment on RFID application.
10. Build and test LDR based light control system.
11. Study of Linear Variable Differential Transformer.
12. Build and test Instrumentation Amplifier.
13. Study of radiation pattern of antenna.
14. 8051 Microcontroller programs: Arithmetic, logical & code conversion problems using assembly/C programming
15. Interfacing the thumbwheel & seven segment display.
16. Traffic light controller using microcontroller.
17. Interfacing LCD to Microcontroller.
18. To study waveform generator (square, triangular and saw tooth using DAC) with microcontroller
19. Study of radiation pattern of antenna.

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER-IV

CS- 43 : COMPUTATIONAL GEOMETRY

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in Two dimensional transformations, Three dimensional transformations, plane curves, space curves.

At the end of this course student are expected to be able to.

- (i) Know representation of points, lines, transformation and matrices, various type of transformation.
- (ii) Solve multiple transformation and projection of 3 dimensional .
- (iii) Find equidistance points on ellipse, circle, parabola, hyperbola.
- (iv) Know the introduction and properties of Beizer curve, and B-spline curve.

[1] Two Dimensional Transformations

[12]

- (1.1) Introduction
- (1.2) Representation of points
- (1.3) Transformation and matrices
- (1.4) Transformation of points
- (1.5) Transformation of straight line
- (1.6) Midpoint transformation
- (1.7) Transformation of parallel lines
- (1.8) Transformation of intersecting lines
- (1.9) Transformations: rotation, reflection, scaling, shearing
- (1.10) Concatenated transformations
- (1.11) Transformation of a unit square
- (1.12) Solid body transformations
- (1.13) Translations and homogeneous coordinates
- (1.14) Rotation about an arbitrary point
- (1.15) Reflection through an arbitrary line
- (1.16) Overall scaling , point at infinity
- (1.17) Projection – a geometric interpretation of homogeneous coordinates

[2] Three Dimentional Transformations

[12]

- (2.1) Introduction
- (2.2) Three Dimentional-Scaling, Shearing , Reflection, Translation, Rotation
- (2.3) Multiple Transformation
- (2.4) Rotation About - an axis parallel to a coordinate axis, an arbitrary axis in space
- (2.5) Reflection through an arbitrary plane.
- (2.6) Affine and Perspective Geometry.
- (2.7) Orthographic Projections.
- (2.8) Axonometric Projections.
- (2.9) Oblique Projections
- (2.10) Single Point Perspective Transformations.
- (2.11) Vanishing Points

[3] Plane Curves

[12]

- (3.1) Introduction
- (3.2) Curve representation
- (3.3) Non-parametric curves.
- (3.4) Parametric curves.
- (3.5) Parametric representation of circle.
- (3.6) Parametric representation of ellipse.
- (3.7) Parametric representation of parabola.
- (3.8) Parametric representation of hyperbola

[4] Space Curves

[12]

- (4.1) Beizer Curves –Introduction , Definition, Properties (without proof), Curve Fitting (Upto $n=3$), Equation of Curves in Matrix form (upto $n=3$)
- (4.2) B-Spline Curve-Introduction ,Definition, Properties (without proof)

TEXT BOOKS:

1. S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Nirali Prakashan
2. S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Vision Publication
3. S.Y.B.Sc. (Computer Science) Sem.-II, Paper-I, Computational Geometry, Nirali Prakashan
4. S.Y.B.Sc. (Computer Science) Sem.-II, Paper-I, Computational Geometry, Vision Publication
5. F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Nirali Prakashan
6. F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Vision Publication
7. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intl Edition.

REFERENCE BOOKS:

- (1) G.S. Pandey And R.R.Sharma; Vector and Geometry ; Wishwa Prakashan
- (2) P. Balsubrahmanyam, K.G. Balsubrahmanyam, G.R.Venkataraman;
Coordinate Geometry of two and three Dimensions; Tata mcgraw-HILL, New Delhi
- (3) David F. Rogers, J Alan Adams; Mathematical Elements for Computer Graphics (Second Edition); mcgraw-HILL International Editions.1990
- (4) William M. Newman, Robert F. Sproul; Principles of Interactive computer Graphics (Second Edition); International Student Edition, Mcgraw-Hill Book company, Tokyo. 1979.

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER – IV

CS – 44 : OPTIMIZATION TECHNIQUES

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in linear programming, transportation problem, assignment problem and game theory.

At the end of this course student are expected to be able to.

- (v) Know formulation, graphical method and simplex method, duality of L.P.P.
- (vi) To find the initial basic feasible solution and optimal solution by using North-West corner method, Least cost method, VAM method, MODI method of a transportation problem.
- (vii) To find initial optimal solution by using Hungarian method, with their types.
- (viii) Solve the game by using graphical method, dominance method.

[1] Linear Programming :-

[12]

- (1.1) Advantages, Limitations, Definitions, Terminology, Formulation of L.P.P.
- (1.2) Solution by Graphical Method & Simplex Method, special Cases
- (1.3) Duality – concept, Interrelation between a Primal and Dual, Advantages, Interpretation of dual
- (1.4) Solution of L. P. P. by simplex method (verification by TORA)

[2] Transportation Problems :-

[12]

- (2.1) Introduction, General structure of transportation problem
- (2.2) Unbalanced transportation problem
- (2.3) North-West Corner Method, Least Cost Method, Vogel's Approximation Method
- (2.4) MODI Method
- (2.5) Degeneracy in transportation problem
- (2.6) Maximization in transportation problem
- (2.7) Prohibited transportation problem
- (2.8) Numerical problems

(2.9) Transportation problem (verification by TORA)

[3] Assignment Problems :-

[12]

(3.1) Statement and mathematical representation of assignment problem

(3.2) Unbalanced assignment problem

(3.3) Hungarian method of solving A.P. (Minimization Case)

(3.4) Maximization assignment problem

(3.5) Multiple assignment problem

(3.6) Prohibited assignment problem

(3.7) Numerical problems

(3.8) Assignment problem (verification by TORA)

[4] Theory of games

[12]

(4.1) Two persons zero sum game, pure and mixed strategies, statement of The mini-max theorem

(4.2) Graphical method for solving 2xm principles and dominance and Nx2 games and solving some simple games

(4.3) Connection between the game problem and L. P. P., Simple games

Text Books :

Prof S.R.Patil; Prof S.G.Gujrathi; Prof D.M. Pandhare;
Numerical Methods And Operation Research; Nirali Prakashan,1998.

Reference Books:

1.

1. R.J. Dromey; How To Solve It By Computer; Prentice-Hall Of India; 1982
2. V.K.Kapoor; Operations Research; Sultan Chand & Sons Educational Publishers, New Delhi; 1985.
3. S.D.Sharma; Operations Research;Kedar Nath Ram Nath & Co. Publishers, Meerut, 1972.
- 4 L.C. Jhambh; Quantitative Techniques Vol I & II; Everest Publishing House, Pune-1998.
5. N.D. Vohra; Quantitative Techniques in Management (Second Edition); Tata mcgraw-Hill Publishing Company Limited New Delhi; 1990.
6. Kanti Swarup, P.K.Gupta, Man Mohan; Operations Research; Sultan Chand & Sons Educational Publishers, New Delhi, 1977.
7. P.K.Gupta, D.S.Hira; Operations Research ; S.Chand & Company Ltd, New Delhi. 1979.
8. N.Paul Loomba; Linear Programming TMH Edition; Tata mcgraw-Hill Publishing Company Limited, New Delhi, 1971.

Course Structure of S.Y. B.Sc.(Computer Science) Degree Programme CBCS

Subject : Electronics

Revised Syllabus

To be implemented from the academic year 2017-18

S.Y.B.Sc(Computer Science): Semester III(From the Academic Year 2017-18)

Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
					Continuous Internal Assessment	University Examination	Total
CS -35	Digital systems and Microprocessors	04	04	03	40	60	100
CS -36	Principles of Communication	04	04	03	40	60	100
CSIII-LIII	Lab Course on Electronics -III	04	02	03	40	60	100

S.Y.B.Sc(Computer Science): Semester IV (From the Academic Year 2017-18)

Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
					Continuous Internal Assessment	University Examination	Total
CS -45	8051 Microcontroller	04	04	03	40	60	100
CS -46	Analog Systems	04	04	03	40	60	100
CSIV-LIII	Lab Course on Electronics –IV	04	02	03	40	60	100

S.Y.B.Sc. Computer Science(Electronics)

SEMESTER – III

CS-35 : Digital systems and Microprocessors

COURSE CONTENT **4CREDITS(48 L)**

Learning outcomes

- To study the concept of data convertors and its applications.
- To use memory concepts for digital circuit design.
- To study and understand basics of microprocessors
- To understand fundamentals of multicore technology

1. Data Converters (12 L)

Digital to Analog Converter (DAC): Resistive divider, R-2R ladder, Parameters of DAC. Analog to Digital Converter (ADC): Types of ADC- Flash, Successive approximation, dual slope. Parameters of ADC. Applications of DAC and ADC .

2. Memory organization (12 L)

Memory Architecture, Memory Hierarchy, Introduction to USB storage device, Memory parameters like Access time, speed, capacity, cost , Associative Memory, Cache memory, cache mapping techniques, virtual memory, virtual memory mapping: paging and segmentation.

3. Computer Organization (12L)

Concept of Address Bus, Data Bus, Control Bus. Register based CPU organization, stack organization, I/O organization: need of interface, block diagram of general I/O interface. Working concepts like polling, interrupt initiated data transfer.

Concept of DMA , DMA transfer, DMA Controller Serial communication: Synchronous, asynchronous and their data transmission formats, RS–232, General block diagram of PPI and UART

4. Microprocessor (12L)

Introduction, General register organization, Stack Organization, Instruction formats, Addressing modes .Generations of microprocessors, general operation of microprocessors. Concept of RISC and CISC, Von-Neumann & Harvard Architecture, Concept of pipeline. Architecture of basic microprocessors 8086 and basic version of Pentium .Concept of multicore processors.

Reference books

9. Microprocessor and interfacing by Douglas Hall, Tata Mcgraw-Hill Edition
10. Computer organization and Architecture by William Stallings
11. The Intel Microprocessor by Barry B.Brey.
12. Computer architecture and organization by Rifiqzaman and Chandra.
13. Computer Organization J.P. Hays TMH

14. The Pentium Microprocessor by James Antonakos(PEA)
15. The Intel Microprocessor by Barry.B.Brey
16. Digital design : M. Morris Mano, Prentice-Hall of India

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER – III

CS-36 : Principles of Communication

Learning outcomes

- To understand basics of communication systems.
- To understand modulation, demodulation and multiplexing of signals.
- To understand digital communication techniques
- To introduce concepts in advanced wireless communication

COURSE CONTENT

4CREDITS(48 L)

1. Introduction to Electronics Communication (08L)

Importance of Communication, Elements of communication systems, Electromagnetic spectrum, type of communication, Concepts of communication system: channel bandwidth, Nyquist theorem, S/N ratio, channel capacity, error handling, Shannon theorem, concept of companding, Data rate, baud rate, serial communication and protocol.

2. Modulation and Demodulation. (16L)

Introduction to concepts of modulation and demodulation. Modulation techniques: Analog modulation: Amplitude, Phase and Frequency modulation, Circuit diagram and working of transistorized amplitude modulator and diode demodulator. Equation of amplitude modulated wave, modulation index and frequency spectrum.

Digital modulation, PAM, PCM, delta modulation, MODEM – concept of ASK, FSK, QPSK, MSK, GMSK.

3. Multiplexing and Multiple Access Techniques. (12L)

Multiplexing, Space division multiplexing, Time division multiplexing, Frequency Division Multiplexing, Code division multiplexing, Introduction to multiple access, FDMA, TDMA, CDMA

4. Introduction to wireless and Mobile Communication. (12L)

Introduction to wireless communication system and its concept. Introduction to antennas, working principle and parameters of antenna. Introduction to mobile communication, Cellular concept, Working of GSM: Hand over, Introduction to GPRS, Wi-Fi and blue tooth Applications. Introduction to RFID, Zigbee.

Recommended Books:

6. Digital and Data Communication, 4th edition by Micheal A. Miller.
7. Communication Electronics by Frenezel Louis E.
8. Wireless Communication, 2nd edition. Rappaport.
9. Mobile Communication. Schiller Jochen.
10. Wireless Communications and Networks. William Stallings

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER-III

CSIII- LIII: Lab Course on Electronics -III

2 Credits

Learning outcomes

- To use basic concepts for building various applications in electronics.
- To understand design procedures of different electronic circuits as per requirement.
- To build experimental setup and test the circuits.
- To develop skills of analyzing test results of given experiments.

- Examination will be conducted on 8 experiments .

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

(Note : Any 8 experiments should be performed)

15. Study of SMPS.
16. Study of 8038 function generators.
17. DC motor drive and speed control.
18. I-V characteristics temperature sensor AD 590.
19. Analog multiplexers.
20. Analog to Digital converter using discrete components/IC LM 234/74148 or IC 7109/Flash ADC
21. Digital to Analog converter using discrete components.
22. Comparison of Monostable using IC-741 and IC-74121.
23. Simple assembly language program : addition, subtraction
24. Simple assembly language program: multiplication, division
- 25.** Simple assembly language program to find smallest and largest number.
26. LM-35 based temperature sensing system/Optocoupler /opto-isolator base system.
27. Low Pass Filter and High Pass Filter using IC-741 Op Amp.
28. Build and test Hamming Code generator and detector circuit Thumbwheel to seven segment display

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER-IV

CS- 45 : 8051 MICROCONTROLLER

Learning outcomes

- To study the basics of 8051 microcontroller
- To study the Programming and interfacing techniques of 8051
- To apply knowledge of 8051 to design different application circuits
- To introduce the basic concepts of advanced Microcontrollers

COURSE CONTENT **4CREDITS(48 L)**

1. Introduction to 8051 microprocessor [08L]

Introduction to microcontrollers, difference between a microcontroller and microprocessor. Architecture of 8051:Block Diagram of 8051 and Study of Internal Blocks, Pin configuration of 8051,Reset and Clock,Registers, Flags and Internal Memory, SFRS, I/O Ports. Input/Output, Ports, internal memory, External memory.

2. 8051 Instruction Set [12L]

Study of 8051 Instruction Set and Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives .Data transfer, Arithmetic, Logical, JUMP, Loops & CALL instructions, Bit manipulation Instructions.

3. Facilities In 8051

[18L]

Programming 8051 timers, counter programming timer interrupts, Timer and Counter: Timer and Counters, Timer modes, Programming for time delay in Mode 1 and Mode 2 using assembly and C. Introduction to interrupt, Interrupt types and their vector addresses. Interrupt enable register and interrupt priority register(IE,IP), Synchronous and asynchronous serial communication, Programming serial port without interrupt, Use of timer to select baud rate for serial communication.

4. Interfacing:

[10L]

Interfacing ADC, DAC, LCD, stepper motor.

Recommended Books:

6. "The 8051 Microcontroller and Embedded systems using Assembly and C", by Rolin D.Mckinlay Second Edition. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. by Mckinlay.
7. "The 8051 Microcontroller Architecture, Programming & Application", K.Uma Rao and AndhePallavi, Pearson publications.
8. Programming and customizing the 8051 microcontroller by Myke Predko.
9. ARM System Developers guide: Sloss, Andrew n. Symes.
10. Design with PIC microcontrollers: Peatman, Pearson publications.

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER-IV

CS-46 : Analog Systems

COURSE CONTENT

4CREDITS(48 L)

Learning outcomes

- To understand basics of analog electronics
- To study different types of sensors
- To understand different types of signal conditioning circuits
- To Apply Knowledge Of Analog Systems In Different Applications

1. **Measurments, Instrumentation And Calibration** [2L]
Measurements, Units, Standards Instrument, instrumentation, Calibration
2. **Trancducers And Sensor** [10L]
Definition of sensors and transducers. Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility. Temperature sensors (LM-35 and AD590), pH sensor, piezoelectric humidity sensor, optical sensor (LDR), displacement sensor (LVDT), Passive Infrared sensor (PIR), tilt sensor, touch sensor, ultrasonic sensor
3. **Signal Conditioning** [18L]
Principles of signal conditioning, Signal conditioning of passive sensors using bridge circuit:Wheatstone 's bridge, Level Shifter, Amplifier, Three OP-amp instrumentation amplifier, Filters;active and passive filters. Working principle of Single order Op-Ampbased Low Pass Filter, High Pass Filter, Band Pass Filter, Notch Filter, Band reject filter;Working of Voltage to frequency Converter using OpAmp.
4. **Case Study** [14L]
Temperature monitoring system using LM35, Water Level Indicator system using float switch, Electrocardiography (ECG).
5. Introduction to Quantum dots, its applications. [4L]

Books Recommended

11. Electronic Instrumentation: H. S. Kalsi: TMH: 2nd Ed.
12. Modern Electronic Instrumentation and Measurement Techniques: Albert D.
13. Helfrick, William D. Cooper: PHI publications
14. Electronic measurements : K.A. Bakshi, A. V. Bakshi and U. A. Bakshi, Technical publications. A Course in Electrical and Electronic measurements and Instrumentation: A.K. Sawhney:
15. Dhanpat Rai & Sons Educational & technical publishers
16. Transducers & Instrumentation - Murthy PHI (Unit 1)
17. Instrumentation Measurements & Analysis- Nakra & Chaudhry TMH
18. Instrumentation Devices & Systems - Rangan, Sarma, Mani TMH
19. Sensors & Transducers : Dr. A. D. Shaligram: CTC publications
20. Op-Amps and Linear Integrated Circuits: Ramakant Gaikwad: PHI: 4th Ed.

S.Y.B.Sc. Computer Science(Electronics) CBCS

SEMESTER-IV

CSIV- LIII : Lab Course on Electronics -IV

2Credits

Learning outcomes

- To use basic concepts for building various applications in electronics.
- To understand design procedures of different electronic circuits as per requirement.
- To build experimental setup and test the circuits.
- To develop skills of analyzing test results of given experiments.

- Examination will be conducted on 8 experiments.

Practical Examination

A) Internal Marks 40 : Completion of journal , attendance and involvement in activities.

B)Semester examination: 60 Marks in One session of 3 Hrs .

60 marks Distribution: Practical work 50 marks and 10 marks for oral

Distribution of 50 marks

Circuit diagram / flowchart and algorithm	15
Connection / program	10
Demonstration and working explanation	10
Observation table	10
Result analysis / conclusion	05

(Note : Any 8 experiments should be performed)

20. Absolute decoding and linear select decoding.
21. Temperature to frequency / voltage converter
22. Reed relay control using digital logic
23. Build and test Amplitude Modulator and Demodulator.
24. Build and test Frequency Shift Keying.
25. Build and test TDM.
26. Study of pulse amplitude modulation.
27. Demonstration of working of Wi-fi card.
28. Demonstration Experiment on RFID application.
29. Build and test LDR based light control system.
30. Study of Linear Variable Differential Transformer.
31. Build and test Instrumentation Amplifier.
32. Study of radiation pattern of antenna.
33. 8051 Microcontroller programs: Arithmetic, logical & code conversion problems using assembly/C programming
34. Interfacing the thumbwheel & seven segment display.
35. Traffic light controller using microcontroller.
36. Interfacing LCD to Microcontroller.
37. To study waveform generator (square, triangular and saw tooth using DAC) with microcontroller
38. Study of radiation pattern of antenna.

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER – III

CS- 33 : Linear Algebra

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in Linear equations and matrices, General vector spaces, Eigen Values and Eigen functions and linear transformation.

At the end of this course student are expected to be able to.

- (v) Know linear system, matrix transformation, solution of linear systems of equations, and LU decomposition.
- (vi) Know the real vector spaces, subspaces, linear independence, basis and dimensions.
- (vii) Find linear dependence, linear span, basis and dimension of vector spaces.
- (viii) Solve kernel and range of linear transformation..

[1] Linear Equations and Matrices [12]

- (1.1) Linear systems
- (1.2) Matrices
- (1.3) Dot Product and Matrix Multiplication
- (1.4) Matrix Transformations
- (1.5) Solutions of Linear Systems of Equations
- (1.6) LU- Factorization.

[2] General Vector Spaces [12]

- (2.1) Real vector spaces.
- (2.2) Subspaces.
- (2.3) Linear independence.
- (2.4) Basis and dimensions.
- (2.5) Row space, column space and null space.
- (2.6) Rank and Nullity.

[3] Eigen values and Eigen vectors [12]

- (3.1) Eigen values and Eigen vectors.
- (3.2) Diagonalization.
- (3.3) Quadratic forms.
- (3.4) Using scilab : (i)Find Eigen values and Eigen vectors.
(ii) Diagonalization

[4] Linear Transformations [12]

- (4.1) General linear transformations.
- (4.2) Kernel and range. (Rank nullity theorem without proof.)
- (4.3) Inverse linear transformation.
- (4.4) Matrix of general linear transformation.

TEXT BOOKS:

- (7) S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Nirali Prakashan
- (8) S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Vision Publication
- (9) F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Nirali Prakashan
- (10) F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Vision Publication
- (11) Elementary Linear Algebra (Applications Version) by Howard Anton, Chris Rorres. (Seventh Edition) John Wiley & Sons, Inc.
Sections: 5.1 to 5.6, 7.1, 7.2, 9.5, 9.6, 8.1 to 8.4
- (12) Discrete Mathematical Structures (sixth edition), Kolman, Busby and Ross. PHI.
Sections: 9.5, 11.1 to 11.3

REFERENCE BOOKS:

- (1) M. Artin, Algebra, Prentice Hall of India , New Delhi, (1994).
- (2) K. Hoffmann and R. Kunze Linear Algebra, Second Ed. Prentice Hall of India New Delhi, (1998).
- (3) S. Lang, Introduction to Linear Algebra, Second Ed. Springer-Verlag, New York, (1986).
- (4) A. Ramchandra Rao and P. Bhimasankaran, Linear Algebra, Tata mcgraw Hill, New Delhi (1994).
- (5) G. Strang, Linear Algebra and its Applications. Third Ed. Harcourt Brace Jovanovich, Orlando, (1988).

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)**SEMESTER-III****CS- 34 : COMPUTER ORIENTED NUMERICAL METHODS****COURSE CONTENT****4CREDITS(48 L)**

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in PERT and CPM, solution of non linear equation, polynomial interpolation, numerical differentiation and integration solution of ODE and simultaneous linear equation.

At the end of this course student are expected to be able to.

- (vi) Know forward and backward pass computation slack, critical path of PERT and CPM terms.
- (vii) Solve non linear equation by using bisection, secant , regula- falsi, Newton- Raphson methods .
- (viii) Create a polynomial by using Newton's backward and forward formulae, Lagrange's interpolation formulae, Hermite interpolation.
- (ix) Solve integration by using Bisection, Secant, Regula-Falsi and Newton-Raphson methods
- (x) Solve differential equation examples on Euler's method, Runge-Kutta second and fourth Order formula.

[1] PERT and CPM Computations

[10]

- (1.1) Phases of project scheduling
- (1.2) Network logic , numbering the events (Fukerson's rule.)
- (1.3) Measure of activity
- (1.4) PERT: forward and backwad pass computations slack , critical path.
- (1.5) CPM terms, critical path, float.
- (1.6) Using scilab
 - i. Use of ' deff ' command for one and two variables functions.
 - ii. Draw 2-D and 3-D graph for some standard functions.
E.g. x^2 , $\sin (x)$, $\exp(x)$, x^3+y^3 etc .

[2] Solutions of Non – linear Equations

[10]

- (2.1) Location of Roots
- (2.2) Bisection, Secant, Regula-Falsi and Newton-Raphson methods, Comparison Of these methods
- (2.3) Acceleration of convergence Aitken's Process
- (2.4) Regula-Falsi method and Newton-Raphson method using Scilab.

[3] Polynomial Interpolation & Approximation

[10]

- (3.1) Finite differences: Forward, Backward and Central
- (3.2) Detection of errors using different tables
- (3.3) Newton's backward and forward formulae for interpolation
- (3.4) Lagrange's interpolation formulae for unequal intervals
- (3.5) Least square approximation by Polynomials up to third degree
- (3.6) Hermite Interpolation.
- (3.7) Newton Forward, Newton Backward and Lagrange's Interpolation by using Scilab

[4] Numerical Differentiation and Integration

[10]

- (4.1) Numerical differentiation using interpolating polynomials
- (4.2) Trapezoidal rule, Simpson's $(1/3)^{\text{rd}}$ rule and Simpson's $(3/8)^{\text{th}}$ rule
- (4.3) Extrapolation to the limit : Ramberg Interpolation
- (4.4) Numerical integration by Simpson's $(1/3)^{\text{rd}}$, numerical integration by Simpson's $(3/8)^{\text{th}}$ rule, rule by using Scilab

[5] Solution of Ordinary Differential Equations & solution of Simultaneous Linear Equations [08]

- (5.1) Numerical Integration By Taylor Series
- (5.2) Euler's method
- (5.3) Runge-Kutta method: 2nd and 4th orders
- (5.4) Predictor corrector method
- (5.5) Gaussian Elimination, Pivoting Strategy, Conditional Equations
- (5.6) Modification of Gaussian Elimination to Compute Inverse of Matrix
- (5.7) Comparison of direct and iterative methods
- (5.8) Examples on Euler's method, Runge-Kutta second and fourth order formula by using Scilab.

Text Books :

Prof S.R.Patil; Prof S.G.Gujrathi; Prof D.M. Pandhare;
Numerical Methods And Operation Research; Nirali Prakashan, 1998.

Reference Books:

1. S.S.Sastry; Introductory methods of Numerical Analysis ; Prentice-Hall of India (3rd edition) 2000
2. J.H.Mathews; Numerical methods for Mathematics, Science and Engineering (2nd edition); Prentice-Hall of India , 1994.
3. R.J. Dromey; How To Solve It By Computer; Prentice-Hall Of India; 1982
4. Anthony Ralston, Philip Rabinowitz; A First Course in Numerical Analysis; (2nd edition) International Student edition; mcgraw-Hill Book Company; TOKYO; 1978
5. Computer Oriented Numerical Methods-Rajaraman.
6. Introduction To Numerical Analysis-C.E. Froberg.
7. Introduction To Applied Numerical Analysis-C.E.Froberg.
8. Numerical Methods that works-Forman S. Action.
9. Numerical Methods in Fortran-J.M.Mcormik.
10. Numerical Methods For SC & Engg - R.G.Stanton (Prentice Hall)

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER-IV

CS- 43 : COMPUTATIONAL GEOMETRY

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in Two dimensional transformations, Three dimensional transformations, plane curves, space curves.

At the end of this course student are expected to be able to.

- (v) Know representation of points, lines, transformation and matrices, various type of transformation.
- (vi) Solve multiple transformation and projection of 3 dimensional .
- (vii) Find equidistance points on ellipse, circle, parabola, hyperbola.
- (viii) Know the introduction and properties of Beizer curve, and B-spline curve.

[1] Two Dimensional Transformations

(1.1) Introduction

[12]

- (1.2) Representation of points
- (1.3) Transformation and matrices
- (1.4) Transformation of points
- (1.5) Transformation of straight line
- (1.6) Midpoint transformation
- (1.7) Transformation of parallel lines
- (1.8) Transformation of intersecting lines
- (1.9) Transformations: rotation, reflection, scaling, shearing
- (1.10) Concatenated transformations
- (1.11) Transformation of a unit square
- (1.12) Solid body transformations
- (1.13) Translations and homogeneous coordinates
- (1.14) Rotation about an arbitrary point
- (1.15) Reflection through an arbitrary line
- (1.16) Overall scaling , point at infinity
- (1.17) Projection – a geometric interpretation of homogeneous coordinates

[2] Three Dimentional Transformations

[12]

- (2.1) Introduction
- (2.2) Three Dimentional-Scaling, Shearing , Reflection, Translation, Rotation
- (2.3) Multiple Transformation
- (2.4) Rotation About - an axis parallel to a coordinate axis, an arbitrary axis in space
- (2.5) Reflection through an arbitrary plane.
- (2.6) Affine and Perspective Geometry.
- (2.7) Orthographic Projections.
- (2.8) Axonometric Projections.
- (2.9) Oblique Projections
- (2.10) Single Point Perspective Transformations.
- (2.11) Vanishing Points

[3] Plane Curves

[12]

- (3.1) Introduction
- (3.2) Curve representation
- (3.3) Non-parametric curves.
- (3.4) Parametric curves.
- (3.5) Parametric representation of circle.
- (3.6) Parametric representation of ellipse.
- (3.7) Parametric representation of parabola.
- (3.8) Parametric representation of hyperbola

[4] Space Curves

[12]

- (4.1) Beizer Curves –Introduction , Definition, Properties (without proof), Curve Fitting (Upto $n=3$), Equation of Curves in Matrix form (upto $n=3$)

(4.2) B-Spline Curve-Introduction ,Definition, Properties (without proof)

TEXT BOOKS:

8. S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Nirali Prakashan
9. S.Y.B.Sc. (Computer Science) Sem.-I, Paper-I Linear Algebra, Vision Publication
10. S.Y.B.Sc. (Computer Science) Sem.-II, Paper-I, Computational Geometry, Nirali Prakashan
11. S.Y.B.Sc. (Computer Science) Sem.-II, Paper-I, Computational Geometry, Vision Publication
12. F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Nirali Prakashan
13. F.Y.B.Sc.. (Computer Science) Geometry and Calculus, Vision Publication
14. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intl Edition.

REFERENCE BOOKS:

- (1) G.S. Pandey And R.R.Sharma; Vector and Geometry ; Wishwa Prakashan
- (2) P. Balsubrahmanyam, K.G. Balsubrahmanyam, G.R.Venkataraman;
Coordinate Geometry of two and three Dimensions; Tata mcgraw-HILL, New Delhi
- (3) David F. Rogers, J Alan Adams; Mathematical Elements for Computer Graphics (Second Edition); mcgraw-HILL International Editions.1990
- (4) William M. Newman, Robert F. Sproul; Principles of Interactive computer Graphics (Second Edition); International Student Edition, Mcgraw-Hill Book company, Tokyo. 1979.

S.Y.B.Sc. COMPUTER SCIENCE (MATHEMATICS)

SEMESTER – IV

CS – 44 : OPTIMIZATION TECHNIQUES

COURSE CONTENT

4CREDITS(48 L)

OBJECTIVES:

The main objective of this course is to introduce students to some basic concepts in linear programming, transportation problem, assignment problem and game theory.

At the end of this course student are expected to be able to.

- (ix) Know formulation, graphical method and simplex method, duality of L.P.P.
- (x) To find the initial basic feasible solution and optimal solution by using North-West corner method, Least cost method, VAM method, MODI method of a transportation problem.
- (xi) To find initial optimal solution by using Hungarian method, with their types.
- (xii) Solve the game by using graphical method, dominance method.

[1] Linear Programming :-

[12]

- (1.1) Advantages, Limitations, Definitions, Terminology, Formulation of L.P.P.
- (1.2) Solution by Graphical Method & Simplex Method, special Cases
- (1.3) Duality – concept, Interrelation between a Primal and Dual, Advantages, Interpretation of dual
- (1.4) Solution of L. P. P. by simplex method (verification by TORA)

[2] Transportation Problems :-

[12]

- (2.1) Introduction, General structure of transportation problem
- (2.2) Unbalanced transportation problem
- (2.3) North-West Corner Method, Least Cost Method, Vogel's Approximation Method
- (2.4) MODI Method
- (2.5) Degeneracy in transportation problem
- (2.6) Maximization in transportation problem
- (2.7) Prohibited transportation problem
- (2.8) Numerical problems
- (2.9) Transportation problem (verification by TORA)

[3] Assignment Problems :-

[12]

- (3.1) Statement and mathematical representation of assignment problem
- (3.2) Unbalanced assignment problem
- (3.3) Hungarian method of solving A.P. (Minimization Case)
- (3.4) Maximization assignment problem
- (3.5) Multiple assignment problem
- (3.6) Prohibited assignment problem
- (3.7) Numerical problems
- (3.8) Assignment problem (verification by TORA)

[4] Theory of games

[12]

- (4.1) Two persons zero sum game, pure and mixed strategies, statement of The mini-max theorem
- (4.2) Graphical method for solving 2xm principles and dominance and Nx2 games and solving some simple games

(4.3) Connection between the game problem and L. P. P., Simple games

Text Books :

Prof S.R.Patil; Prof S.G.Gujrathi; Prof D.M. Pandhare;
Numerical Methods And Operation Research; Nirali Prakashan,1998.

Reference Books:

1.

- 1. R.J. Dromey; How To Solve It By Computer; Prentice-Hall Of India; 1982
- 2. V.K.Kapoor; Operations Research; Sultan Chand & Sons Educational Publishers, New Delhi; 1985.
- 3. S.D.Sharma; Operations Research;Kedar Nath Ram Nath & Co. Publishers, Meerut, 1972.
- 5 L.C. Jhambh; Quantitative Techniques Vol I & II; Everest Publishing House, Pune-1998.
- 5. N.D. Vohra; Quantitative Techniques in Management (Second Edition); Tata mcgraw-Hill Publishing Company Limited New Delhi; 1990.
- 6. Kanti Swarup, P.K.Gupta, Man Mohan; Operations Research; Sultan Chand & Sons Educational Publishers, New Delhi, 1977.
- 9. P.K.Gupta, D.S.Hira; Operations Research ; S.Chand & Company Ltd, New Delhi. 1979.
- 10. N.Paul Loomba; Linear Programming TMH Edition; Tata mcgraw-Hill Publishing Company Limited, New Delhi, 1971.

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,

PUNE – 411 038

Accredited with 'A+' Grade (2017) by NAAC

‘A’ Grade University Status by MHRD, Govt. of India

Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF SCIENCE (B.Sc. MATHEMATICS) PROGRAMME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

To Be Implemented From Academic Year 2016-17

Annexure - II
BHARATI VIDYAPEETH UNIVERSITY, PUNE
Syllabus for F.Y. B. Sc. (Sem.– I)
UNDER CHOICE BASED CREDITE SYSTEM
Subject: MATHEMATICS
(with effect from Academic Year 2016 - 2017)

M-11: Algebra
(CBCS 2016 Course)

Total Lectures: 36

Total Credit = 03

Objectives:

The main objective of this course is to introduce students to some basic concepts in matrices, rank of a matrix, system of Linear equations, Integers and complex numbers.

At the end of this course students are expected to be able to

- i) Find the rank of matrix by conversion of matrix into echelon form.
- ii) Solve the system of Linear equations.
- iii) Division algorithm and obtain g.c.d. by division algorithm.
- iv) Solution of the equations by De Moivre's theorem and n^{th} root of unity.

Unit 01: Matrices and System of Linear Equations. 16

- 1.1 Revision, adjoint of a square matrix and inverse of square matrix by adjoint method.
- 1.2 Echelon and reduced echelon form of a matrix, Reduction of a matrix to its echelon form.
Rank of a matrix by using echelon form.
Rank of a matrix by reducing the matrix into normal form.
- 1.3 System of homogeneous Linear equations in matrix form and its general solution.
- 1.4 System of non-homogeneous Linear equations in matrix form. Consistency of system of non-homogeneous linear equations and the solution of the system. Gauss Elimination method.
- 1.5 Eigen Values, characteristic equation of matrix of order up to 3×3 .
- 1.6 Statement of Cayley Hamilton theorem and its use to find the inverse of a matrix.

Unit 02: Integers.

12

- 2.1 Well ordering principle for $\mathbb{N}$. Principle of mathematical induction.
- 2.2 Divisibility in $\mathbb{Z}$: Definition and elementary properties. Division algorithm, Euclidean algorithm (without proof).
- 2.3 G.C.D. and L.C.M. of integers. Relatively prime integers, Euclid's lemma; Basic properties of G.C.D., G.C.D. of any two integers a and b if they exist are unique and can be expressed in the form $ax + by$ where $x, y \in \mathbb{Z}$
- 2.4 Equivalence relations, Equivalence classes, Properties of equivalence Classes. Definition of partition, every partition gives an equivalence relation. Definition of congruence; congruence as equivalence relation in $\mathbb{Z}$.

Unit 03: Complex Numbers.

08

- 3.1 Complex numbers, Algebra of complex numbers, conjugate complex number, properties of conjugate complex numbers. Sum and product of complex number and its conjugate is real.
- 3.2 Modulus amplitude form of a complex number properties of modulus and amplitude.
- 3.3 De Moivre's theorem.
- 3.4 n^{th} roots of unity.
- 3.5 Solution of the equations by using De Moivre's theorem.

References:

- 1 K. B.Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi – 2000
- 2 P.B. Bhattacharya, S. K. Jain, S. R. Nagpal, First course in Linear Algebra, Wiley Eastern, New Delhi, 1983
- 3 Shanti Narayan: A text Book of Matrices.
- 4 S. K. Jain, A Gunawardena and P.B. Bhattacharya: Basic Linear Algebra with MATLAB, Key College publishing (Springer - Verlag), 2001.
- 5 Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar,: Algebra & Geometry; Nirali Prakashan

F.Y. B. Sc. (Mathematics)

Semester – I

M-12: Calculus

(CBCS 2016 Course)

Total Lectures: 36

Total Credit = 03

Objectives:

The main objective of this course is to introduce students to some basic concepts in limit and continuity, mean value theorems and its geometrical interpretation and sequences and series.

At the end of this course students are expected to be able to

- i) Discuss the continuity of the functions at a point and interval.
- ii) Verify mean value theorems.
- iii) Obtain Taylor's and Maclaurin's expansions of functions.
- iv) Discuss the convergence of sequences and series.

Unit 1: Limit and Continuity:

08

- 1.1 ϵ - δ definition of the limit of a function.
 - 1.2 Basic properties and some theorems of limits.
 - 1.3 Continuity of a function at a point. Types of discontinuity.
 - 1.4 Continuous function on an interval.
 - 1.5 Properties of continuous function on closed and bounded intervals
- (a) Boundedness (b) Attains its bounds (c) Intermediate value theorem

Unit 2: Differentiability:

14

- 2.1 The derivative of a function. Property between continuity and differentiability.
- 2.2 Mean value theorem: (a) Rolle's mean value theorem (b) Lagrange's mean value theorem (c) Cauchy's mean value theorem
- 2.3 Geometrical interpretations of mean value theorems.
- 2.4 Indeterminate forms L' Hospital's rule.
- 2.5 Higher order derivatives, n^{th} derivatives of some standard functions, Leibnitz's theorem.

Unit 3: Sequences and Series:**14**

- 3.1 Convergent and divergent sequences, Algebra of convergent sequences.
- 3.2 Bounded sequence, monotonic sequences and convergence of sequences.
- 3.3 Convergence of $\{a_n\}$ where $a_n = \left(1 + \frac{1}{n}\right)^n$
- 3.4 Taylor's and Maclaurin's theorem with Lagrange's form of remainder (without proof)
- 3.5 Convergence of $\sum_{n=1}^{\infty} \frac{1}{n^p}$
- 3.6 Convergence of simple series by using comparison test and Ratio test.

References:

- 1. P. K. Jain and S. K. Kaushik, An Introduction to Real Analysis, S. Chand and Co., New Delhi.
- 2. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Alahabad
- 3. T. M. Apostol, calculus Vol. I and Vol. II, Wiley International Edition.
- 4. Shanti Narayan: Differential Calculus.
- 5. R. G. Bartle, Dr. R. G. Sherbert; Introduction to Real Analysis, John Wiley and sons.
- 6. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Calculus and Differential Equations; Nirali Prakashan

Mathematics Practical –I (M 13)
(CBCS 2016 Course)

Total Credit = 02

Objectives:

The main objectives of the Mathematics Practical is solve more problems and applications of different topics from the syllabus; so that student should able to recall basic facts about Mathematics and should be able to display knowledge of conventions. A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences. Student can obtain their Skills and Knowledge to translate information in mathematical form.

Mathematics Practical Course-I (M-13):

**(Practicals based on the applications and Problems of articles in
M-11 and M-12)**

List of Practicals (First Term)

1. Rank of matrix
2. Solution of system of Linear equations
3. Limit and Continuity
4. Integers
5. Equivalence relation, equivalence classes and partition, congruence relation.
6. Differentiation.
7. Complex numbers (De Movre's theorem and n^{th} roots of unity)
8. Leibnitz's theorem
9. Convergence of Sequences and series
10. Eigen values and inverse of a matrix by Cayley Hamilton theorem

F.Y. B. SC. (Mathematics)
Semester – II
M-21: Analytical Geometry
(CBCS 2016 Course)

Total Lectures :36

Total Credit = 03

Objectives:

The main objective of this course is to introduce students to some basic concepts in Analytical Geometry of two dimensions and three dimensions.

At the end of this course students are expected to be able to:

- i) Translation and rotation of equations of general equation of second degree in x and y .
- ii) Equations of sphere, tangent plane and normal to sphere.
- iii) Equations of cone and cylinder.

Unit 01: Analytical Geometry of Two Dimensions:

10

- 1.1 Translation of axes.
- 1.2 Rotation of axes.
- 1.3 Conic section: General equation of second degree in x and y . Centre of conic, nature of conic. Reduction to standard form. Length of the axes.

Unit 02: Planes in co-ordinate Geometry of 3 – Dimensions:

06

- 2.1 First degree equation in x, y, z represents a plane. Transformation to the normal form. Equation of plane in intercept form. Equation of plane passing through three given points.
- 2.2 System of planes.
- 2.3 Length of the perpendicular from a point to a plane.
- 2.4 Joint equation of two planes. Angle between planes.

Unit 03: Lines in co-ordinate Geometry of 3-Dimension:

06

- 3.1 Equations of a line, Equations of line in terms of direction cosines and the point on it, equations of lines through two points. Equations of line in symmetrical form. Angle between line and Plane.
- 3.2 The shortest distance between two skew lines, the length and equations of the line of shortest distance.

Unit 04: Sphere:**08**

- 4.1 Definition and equation of the sphere in various forms
- 4.2 Plane section of a sphere, intersection of two spheres.
- 4.3 Equation of a circle, sphere through a given circle, intersection of a sphere and a line.
- 4.4 Equation of a tangent plane and normal to sphere

Unit 05: Cones and Cylinders:**06**

- 5.1 Definition of cone. Equation of cone with vertex at the origin and $(\alpha \beta \gamma)$
- 5.2 Quadratic cone and some properties of quadratic cone
- 5.3 The right circular cone and equation of right circular cone.
- 5.4 Definition of cylinder, Right circular cylinder and equation of a right circular cylinder.

References:

- 1. S. L. Loney, The Elements of Co-ordinate Geometry, Macmillan and Company, London.
- 2. Gorakh Prasad and H.C.Gupta. Textbook on Co-ordinate Geometry, Pothishala Pvt., Ltd., Allahabad.
- 3. R. J. T. Bill, Elementary Treatise on Co-ordinate Geometry of Three dimensions, Macmillan India, Ltd., 1994
- 4. P. K. Jain and Khalil Ahmed, A textbook of Analytical Geometry of two dimensions, Wiley Eastern Ltd. 1994.
- 5. Shanti Narayan: Analytical Solid geometry, S-Chand & Co.
- 6. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Algebra & Geometry; Nirali Prakashan

F.Y. B. SC. (Mathematics)

Semester – II

M-22: Integral Calculus and Differential Equations

(CBCS 2016 Course)

Total Lectures 36

Total Credit = 03

Objectives:

The main objective of this course is to introduce students to some basic concepts in Integration and differential equations.

Students are able to

- i) Solve the integrals by partial fractions and reduction methods.
- ii) Obtain lengths of the curves, volumes and surfaces of solids obtained by revolving the curves.
- iii) Solve the differential equations of first order and first degree and their applications.

Unit 1: Integration:

13

1.1 Integration by method of substitution and integration by parts.

1.2 Integration by partial fractions:

- b) Denominator contains non-repeated linear factors.
- c) Denominator contains repeated linear factors
- d) Denominator contains one linear and one irreducible quadratic form.

1.3 Integration of the following form

$$(i) \int \frac{dx}{a+b\cos x} \quad (ii) \int \frac{dx}{a+b\sin x} \quad (iii) \int \frac{dx}{a+b\cos x+c\sin x}$$

$$1.4 \int \frac{x^2 \pm 1}{x^4 + 1} dx$$

$$1.5 \quad (i) \int (Ax+B)\sqrt{ax^2+bx+c} \quad (ii) \int \frac{Ax+B}{\sqrt{ax^2+bx+c}} dx$$

1.6 Reduction formulae

$$(i) \int \sin^n x dx \quad (ii) \int \cos^n x dx \quad (iii) \int_0^{\pi/2} \sin^n x dx$$

$$(iv) \int_0^{\pi/2} \cos^n x dx \quad (v) \int \sec^n x dx \quad (vi) \int \operatorname{cosec}^n x dx$$

$$(vii) \int \tan^n x dx \quad (viii) \int \cot^n x dx \quad (ix) \int_{(\sigma)}^{\pi/2} \sin^n x \cos^m x$$

Unit 2: Applications of Integration:**05**

- 2.1 Quadrature, Rectification – Lengths of plane curves
- 2.2 Volumes and Surfaces of solids obtained by revolving the curves about the co-ordinate axes.

Unit 3: Differential Equations of first order and first Degree:**14**

- 3.1 Differential equations, order and degree of differential equations, formation of differential equations.
- 3.2 General and particular solutions of differential equations.
- 3.3 Methods of finding solution of differential equations of first order and first degree
 - a) Variables separable form
 - b) Homogeneous differential equations.
 - c) Differential equations reducible to homogeneous form.
 - d) Exact differential equations.
 - e) Differential equations reducible to exact differential equations, Integrating factors and rules (without proof) for obtaining integrating factors.
 - f) Linear differential equations. Bernoulli's differential equations.

Unit 4: Applications of Differential Equations:**04**

- 4.1 Orthogonal trajectories of one parameter family of curves in Cartesian co-ordinates

References:

- 1. Robert G Bartle and Donald R Sherbert; Introduction to Real Analysis, John Wiley & Sons.
- 2. Shantinayakan: Integral Calculus, S. Chand & Co.
- 3. R. Courant and F. John, Introduction to Calculus and Analysis, Springer-Verlag, New York 1999.
- 4. Rainville and Bedient: Elementary Differential Equations, Macmillin Publication.
- 5. Gorakh Prasad; Integral Calculus, Pothishala Pvt. Ltd. Alahabad
- 6. D. A. Murray, Introductory course in Differential Equations; Orient Longman (India 1967)
- 7. G. F. Simmons: Differential Equations, Tata McGraw Hill (1972)
- 8. Patil, Bhamere, Bhagat, Waingade, Phatangre, Masalkar: Calculus and Differential Equations; Nirali Prakashan

Mathematics Practical-II (23)
(CBCS 2016 Course)

Total Credit = 02

Objectives:

The main objectives of the Mathematics Practical is solve more problems and applications of different topics from the syllabus; so that student should able to recall basic facts about Mathematics and should be able to display knowledge of conventions. A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences. Student can obtain their Skills and Knowledge to translate information in mathematical form.

Mathematics Practical Course-II (M-23):

**(Practicals based on the applications and Problems of articles in
M-21 and M-22)**

List of Practicals (Second Term)

1. Integration
2. Applications of Integration
3. Change of axes; translation and rotation
4. Conic Section
5. Planes in three dimensions
6. Lines in three dimensions
7. Solution of differential equations of first order and first degree
(Homogenous, Non-homogenous, Exact and linear)
8. Applications of differential equations
9. Cones and cylinders
10. Spheres.

Examination Pattern (For Each Semester) of Theory Paper of Mathematics

(A) Continuous assessment:	40 Marks
1. Attendance of the Students :	10 Marks
2. Home Assignment :	10 Marks
3. Mid – Semester :	20 Marks
(B) University Examination :	60 Marks
Nature of question paper :	
N.B.	
1. Total time 3 Hours	
2. All questions are compulsory	
3. Figures to the right indicate full marks	
Q.1 (A) MCQ (No Internal option and one mark each)	6 Marks
(B) Short answers (No Internal option and 1or 2 marks each)	6 Marks
Q.2 Attempt any two of the following	12 Marks
a)	
b)	
c)	
Q.3 Attempt any two of the following	12 Marks
a)	
b)	
c)	
Q.4 Attempt any two of the following	12 Marks
a)	
b)	
c)	
Q.5 Attempt any two of the following	12 Marks
a)	
b)	
c)	

Total =(A)+(B)= **100 marks**

Examination Pattern for Practical course in Mathematics

Modalities for Conducting the Practical and the Practical Examination:

- 1) There will be one 4 hours practical session for each batch of 20 students per week.
- 2) A question bank consisting of 60 questions in all for each semester, distributed in two sections: 25 questions each of Paper I and Paper II will be the course work for this paper. Question Bank will be prepared by the individual subject teacher based on pattern of questions provided by University. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
- 3) University will conduct the Practical Examination each semester twice a year. The practical examination will consist of written examination of 50 marks and oral examination of 10 marks.
- 4) The University exam will be of the duration of 3 hours.
- 5) Each student will maintain a journal to be provided by the college.
- 6) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.
- 7) Trips/ Study tours may be arranged at places having important mathematical institutes or historical places.
- 8) Special Instruction: Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

(A) Continuous assessment and division of these marks are as below **40 marks**

- i. Regular attendance in the practical : 10 marks
- ii. Certified journal :10 marks
- iii. Internal tests : 20 Marks

(B) The pattern of question paper for University examination. **60 marks**

Q.1 a) Attempt any 01 out of 02 questions each of 13 marks. (Based on Paper I) **(13 arks)**

b) Attempt any 02 out of 03 questions each of 06 marks. (Based on Paper I) **(12 Marks)**

Q.2 a) Attempt any 01 out of 02 questions each of 13 marks. (Based on Paper II) **(13 Marks)**

b) Attempt any 02 out of 03 questions each of 06 marks. (Based on Paper II) **(12 Marks)**

Q.3 Viva **(10 marks)**

Total : (A)+ (B) 100 marks

CBCS
Annexure - II
BHARATI VIDYAPEETH UNIVERSITY, PUNE
Syllabus for S.Y. B. Sc.
Subject: MATHEMATICS AND STATISTICS
(with effect from June 2017)

Introduction:

Bharati Vidyapeeth University has decided to change the Syllabi of various faculties from June 2016. Taking into consideration the changes in the syllabi of H.S.C. Board examination for XI and XII Science and Commerce classes and new approaches in different areas of Mathematics and Statistics and related subjects. Board of Studies in Mathematics and Statistics with concern of teachers of Mathematics and Statistics from different Colleges of Bharati Vidyapeeth University and affiliated Colleges of University of Pune has prepared the syllabus of S.Y.B.Sc. Mathematics and Statistics. To develop the syllabus the U.G.C. Model curriculum is followed. Syllabus of SY.B.Sc. is to be implemented from June 2017.

Aims:

- i) Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical and Statistical ideas and tools and know how to use them by modeling, solving and interpreting.
- ii) Reflecting the broad nature of the subject and developing mathematical and Statistical tools for continuing further study in various fields of science.
- iii) Enhancing students' Overall development and to equip them with mathematical and Statistical modeling abilities, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
- iv) Enabling students to develop a positive attitude towards mathematics and Statistics are as an interesting and valuable subject of study.

CBCS
S.Y.B.Sc. (MATHEMATICS)
SEMESTER-III
M – 31 : (Calculus of Several Variables)

Course content :

60 Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts in calculus of several variables, limits, continuity, partial derivatives and mean value theorems in two variables, double and triple integrals.

At the end of this course students are expected to be able to-

- (i) Examine and evaluate the limits of functions of two and three variables.
- (ii) Discuss and examine the continuity of functions at given points.
- (iii) Expansions of functions about the point by Taylor's theorem.
- (iv) Evaluate double and triple integrals.

Unit 01 - FUNCTIONS OF SEVERAL VARIABLES:

(18)

- 1. Functions of two and three variables
- 2. Notions of limits and continuity for functions of two and three variables.
- 3. Simultaneous limit, limit along a path, repeated limits.
- 4. If $f(x,y)$ approaches to l as (x, y) approaches (a, b) then $f(x,y)$ approaches the limit l along any path (Proof).
- 5. Counter examples on continuity.
- 6. Partial derivatives and higher order partial derivatives
- 7. Chain rules.
- 8. Differential and differentiability. Necessary and sufficient
Conditions for differentiability (with proof), Counter examples..
- 9. Euler's theorem for homogeneous functions and its corollary.
- 10. Converse of Euler's theorem (with proof).
- 11. Jacobians.

Unit-02 - MEAN VALUE THEOREMS.

(12)

- 1. Lagrange's mean value theorem for functions of two variables (with proof).
- 2. Taylor's theorem for functions of two variables (with proof).
- 3. Statement of Maclaurin's theorem (without proof).
- 4. Expansions of functions of two and three variables by using Taylor's Theorem, and Maclaurin's theorem.

Unit-03 - EXTREME VALUES**(12)**

1. Extreme values for functions of two variables.
2. Maxima, minima and saddle points of functions of two variables.
3. Necessary condition for extreme values (with proof).
4. Sufficient condition for the existence of extreme values. (without proof).
5. Lagrange's method of undetermined multipliers.

Unit - 04 - MULTIPLE INTEGRALS -**(18)**

1. Integrals over plane areas in xy plane.
2. Evaluation of double and triple integrals.
3. Area of a region by double integrals.
4. Volume by double and triple integrals.
5. Change of order of integration for two variables.
6. Change of variables in double integrals.
7. Change of variables in polar co-ordinates.
8. Illustrative examples of change of variables using Jacobians.

Reference Books :-

1. T. M. Apostol; Calculus, Wiley Student edition.
2. D. Somasundaram and B Choudhary : A first course in Mathematical Analysis; Narosa Publishing House, New Delhi 1997.
3. Gorakh Prasad : Differential Calculus; Pothishala Pvt. Ltd. Allahabad
4. Gorakh Prasad : Integral Calculus ; Pothishala Pvt. Ltd., Allahabad.
5. Shanti Narayan : A Course of Mathematical Analysis; S. Chand and Company, New Delhi.
6. J.N. Sharma - Mathematical Analysis - II (Chapter 4); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
7. J.N.Sharma - Differential Calculus (Chapter 3); Krishna Prakashan Mandir, 119 Shivaji Rd., Meerat
8. M.L.Khanna : Integral Calculus . (Chapter 5 & 7); Jai Prakash Nath

* * *

CBCS

M-32 – (Group Theory and Differential Equations)

Course content :

60 Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts in Group Theory and Differential equations.

At the end of this course students are expected to be able to.

- (i) Understand the concepts in Group and simple properties of group.
- (ii) Understand the concepts of subgroup and simple properties of subgroup.
- (iii) Understand the concept of differential equations of first order and higher degree.
- (iv) Concept of linear differential equations with constant coefficients.

Unit-01: GROUPS :

(15)

- 1) Binary operations, definition and examples.
- 2) Definition of a group with examples.
- 3) Types of groups.
- 4) Simple properties of group.
- 5) Integral powers of Elements in a Group.

Unit-02 : SUBGROUPS :

(15)

- 1) Introduction.
- 2) Subgroups.
- 3) Criteria for a subset to be subgroup.
 - a) H is subgroup of G iff for all $a, b \in G$ implies $ab^{-1} \in G$
 - b) H is subgroup of G iff
 - (i) for all $a, b \in G$ implies $ab \in G$
 - (ii) $a \in G$ implies $a^{-1} \in G$
 - c) Intersection of two subgroups of a group G is also a subgroup G .
- 5) Order of a element in a group.
- 6) Properties of order of an element in a group.
- 7) Cyclic subgroups.
- 8) Properties of cyclic subgroup

Unit-03 : DIFFERENTIAL EQUATIONS OF FIRST ORDER AND HIGHER

DEGREE

(15)

1. Equations solvable for p.
2. Equations solvable for y.
3. Equations solvable for x.
4. Clairaut's equation.
5. Lagrange's equation.

Unit-04 : LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS: (15)

1. Introduction.
2. Complementary function and Particular Integral.
3. Fundamental laws of operators, $f(D)y = 0$,
4. The operator $\frac{1}{f(D)}$
5. Evaluation of $\frac{1}{f(D)}e^{ax}$
6. Evaluation of $(D^2 + a^2)^{-1} \sin ax$ and $(D^2 + a^2)^{-1} \cos ax$.
7. Evaluation of $\frac{1}{f(D)} x^m$
8. Evaluation of $\frac{1}{f(D)} e^{ax} V$ and $\frac{1}{f(D)} (xV)$

where V is a function of x

REFERENCES :

- 1) N.S. Gopalkrishana ; University Algebra ; Wiley Eastern, 1986.
- 2) P.B. Bhattacharya, S.K.Jain and S.R.Nagpal Basic Abstract Algebra (2nd Edition), Cambridge University Press, Indian Edition 1997.
- 3) Shanti Narayan : A Text Book of Modern Abstract Algebra, S.Chand & co; New Delhi.
- 4) Vivek Sahai and Vikas Bist : Algebra ; Narosa Publishing house. 1997.
- 5) D.A. Murry; Introductory course in Differential Equations; Orient Longman (India 1967)
- 6) E.A. Cochington; A Introduction to ordinary Differential Equations; Prentice Hall of India, 1961.
- 7) Gupta P.P.; Malik G.S.; Mittal S.K.; Differential Equations; Pragati Prakashan Meerut.
- 8) Earl D. Rainville and Phillip E. Bedient : Elementary Differential Equations; Maxwell Mac. Millan International Edition.
- 9) David A Murray: Introductory Course in Differential Equations; Orient Logman.

* * *

CBCS

First Term (Semester-III)

Mathematics Practical Course-III (M-33) (Based on M-31 and M-32)

List of Practicals

M-31

- 1) Euler's theorem for homogeneous functions.
- 2) Expansions of functions of two and three variables by using Taylor's theorem and Maclaurin's theorem.
- 3) Lagrange's method of undetermined multipliers.
- 4) Necessary condition for extreme values.
- 5) Evaluation of double integrals by change of order of integration and change of variables in double integrals.

M-32

- 6) Problems in Groups.
- 7) Problems in Subgroups.
- 8) Differential equations of first order and higher degree.
- 9) Clairaut's equation and Lagrange's equation.
- 10) Linear differential equations with constant coefficients.

Practicals: Modalities for Conducting the Practical and the Practical Examination:

- 1) There will be one 3 hours practical session for each batch of 12 students per week.
 - 2) A question bank consisting of 60 questions in all for each semester, distributed in two sections: 25 questions each of Paper I and Paper II will be the course work for this paper. Question Bank will be prepared by the individual subject teacher based on pattern of questions provided by University. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
 - 3) University will conduct the Practical Examination each semester twice a year. The practical examination will consist of written examination of 32 marks and oral examination of 08 marks.
 - 4) The practical exam will be of the duration of 3 hours duration.
 - 5) The pattern of question paper for Paper-III.
- Q. 1 A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper I) (08 Marks)
B) Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper I) (08 Marks)

Q. 2 A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) (08 Marks)

Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) (08 Marks)

- 6) Each student will maintain a journal to be provided by the college.
- 7) The internal 10 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.
- 8) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.
- 9) Trips/ Study tours may be arranged at places having important mathematical institutes or historical places.
- 10) Special Instruction: Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

CBCS
M-41 : VECTOR CALCULUS

Course content :

60 Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts in vector calculus. At the end of this course students are expected to be able to :

- (i) Understand the concepts of vector functions of one and several variables, partial derivatives etc.
- (ii) Understand the concepts of Gradient of scalar point function, Divergence and curl of a vector point function.
- (iii) Surface integral, line integral, volume integral, Green's theorem, Gauss's divergence theories, Stoke's theorem.

Unit-01: VECTOR FUNCTIONS OF ONE VARIABLE : (12)

- 1) Vector valued functions.
- 2) Limits and continuity of vector valued functions.
- 3) Differentiability of vector valued functions.
- 4) Theorems on derivatives.
- 5) Curves in space.
- 6) Tangent vector and normal plane.

Unit-02: VECTOR FUNCTIONS OF SEVERAL VARIABLES (12)

- 1) Vector functions of several variables.
- 2) Limit and continuity of vector functions.
- 3) Partial derivatives for vector functions of two and three variables.
- 4) Total Differential.

Unit-03: DIFFERENTIAL OPERATORS. : (18)

- 1) Scalar field, vector field, level surfaces.
- 2) Gradient of scalar point function and its geometrical interpretation.
- 3) The directional derivative of a scalar point function.
- 4) Divergence of a vector point function.
- 5) Physical Interpretation of divergence.
- 6) Curl of a vector point function.

- 7) Physical interpretation of curl.
- 8) Properties of gradient, divergence and curl
- 9) Solenoidal and irrotational vector fields.

Unit-04: VECTOR INTEGRATION.

(18)

- 1) The vector integration.
- 2) Line integrals.
- 3) Conservative vector field and theorems based on conservative vector fields.
- 4) Surface integrals.
- 5) Volume integrals.
- 6) Green's theorem in the plane (with proof)
- 7) Gauss's divergence theorem (without proof)
- 8) Stoke's theorem (without proof)
- 9) Examples of integrals and theorems based on sphere cube, cylinder, square.

REFERENCE BOOKS.

1. Shanti Narayan, A Course of Mathematical Analysis.
2. M.R. Spiegel; Advanced Calculus, Schaum series.
3. David V. Wider, Advanced Calculus, second edition; Prentice Hall of India, New Delhi.
4. John M.H.Olmsted, Advanced Calculus, Euresia Publishing House, New Delhi.
5. T.M. Apostol; Calculus, Vol - 2 , 2nd Edition, John Wiley.
6. Shanti Narayan; A text Book of Vector Analysis.
7. W.Kaplan; Advanced Calculus; Addison - Wiley, Reading Mass 1952.
8. J.E. Marsdan and A.J. Tromba, Vector Calculus, fourth Ed; W.H. Freeman and Co. New York.
9. Monty J.Strauss, Gerald L. Bradley, Karl J Smith, Calculus (3rd Edition); Pearson Education

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CBCS

M-42 : COMPLEX VARIABLES

Course content :

60 Lectures

Objectives:

The main objective of this course is to introduce students to some basic concepts of complex variables. At the end of this course students are expected to be able to:

- (i) Understand the concepts of functions of complex variables, Cauchy-Riemann equations.
- (ii) Understand the concepts of complex integrals, Cauchy theorem, Cauchy's integral formulae etc.
- (iii) Concepts of Calculus of residues.

Unit-01: FUNCTIONS OF COMPLEX VARIABLES :

(20)

- 1. Definition and examples, Limit, theorems on limits, Continuity, theorems on continuity.
- 2. Derivative : Differentiable functions, Algebra of differentiable functions.
- 3. Chain rule (without proof).
- 4. Analytic functions.
- 5. Cauchy - Riemann equations. Necessary condition (with proof). sufficient condition (without proof)
- 6. Harmonic functions : Real and imaginary parts of an analytic functions are harmonic (proof)
- 7. To find an analytic function if either real or imaginary parts are given.
- 8. Milne - Thomson Method for construction of analytic function.

Unit-02: COMPLEX INTEGRALS :

(20)

- 1. Contour integration. Simple arc. Line integral.
- 2. Statement of Cauchy Goursat theorem and examples for verification.
- 3. Simply and multiply connected regions, Antiderivatives and independence of path definition and examples.
- 4. Statements of Cauchy's integral formulae (without proof).
- 5. Taylor series and Laurent's Series (statements only).
- 6. Zeros of an analytic functions

Unit-03: CALCULUS OF RESIDUES :**(20)**

1. Definition and examples of residues of a function.
 2. Poles of a function. Simple and double pole.
 3. Residue of a pole.
 4. Residue of $f(z)$ at $z=a$ is $\lim_{z \rightarrow a} (z-a) f(z)$ (proof).
 5. Cauchy's residue theorem (With proof)
 6. Evaluation of contour integrals of the following form.
 - a) Examples using Cauchy's residue theorem.
 - b) $\int_0^{2\pi} f(\cos\phi, \sin\phi) d\phi$, integration round the unit circle.
 - c) Evaluation of definite integral of the type $\int_{-\infty}^{\infty} f(x) dx$, where $f(x) = \frac{P(x)}{Q(x)}$ and $P(x)$ and $Q(x)$ are polynomials in x .
 - d) Evaluation of $\int_0^{\infty} f(x) dx$, when $f(x)$ is even.
 - e) Evaluation of $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx dx$ and $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx dx$ where $P(x)$ and $Q(x)$ are polynomials.
- (Note - Examples involving simple poles only)

Reference Books

1. Shanti Narayan : Theory of Functions of Complex variables S. Chand & Co.
2. R.K.Gupta, J.N.Sharma : Complex Analysis; Krishna Prakashan Mandir, Meerat (U.P.)
3. M.L. Khanna : Complex Analysis.
4. R.V. Churchill ; Complex Variable and Applications; McGraw Hill (1984)
5. Agashe, Kulkarni, Chiruptkar : Complex Variables, Narendra Prakashan.

Practicals: Modalities for Conducting the Practical and the Practical Examination:

- 11) There will be one 3 hours practical session for each batch of 12 students per week.
- 12) A question bank consisting of 60 questions in all for each semester, distributed in two sections: 25 questions each of Paper I and Paper II will be the course work for this paper. Question Bank will be prepared by the individual subject teacher based on pattern of questions provided by University. The question bank of each year should be preserved by the subject teachers, which can be reviewed by the L.I.C. members visiting college.
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Q. 2 A) Attempt any 01 out of 02 questions each of 08 marks. (Based on Paper II) (08 Marks)
 Attempt any 02 out of 03 questions each of 04 marks. (Based on Paper II) (08 Marks)
- 16) Each student will maintain a journal to be provided by the college.
- 17) The internal 10 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practicals.
- 18) It is recommended that concept may be illustrated using computer software and graphing calculators wherever possible.
- 19) Trips/ Study tours may be arranged at places having important mathematical institutes or historical places.
- 20) Special Instruction: Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed.

CBCS

Second Term (Semester-IV)

Mathematics Practical Course-IV (M-43) (Based on M-41 and M-42)

M-41

- 1) Partial derivatives for vector functions of two and three variables.
- 2) Gradient of scalar point function, divergence of vector point function and curl of vector point function.
- 3) Obtaining scalar point function at given point whose gradient is given.
- 4) Volume Integrals.
- 5) Green's theorem, Gauss's divergence theorem and stoke's theorem.

M-42

- 6) Obtain an analytic function if either real or imaginary parts are given.
- 7) Cauchy's integral formulae.
- 8) Taylor's and Laurent's series.
- 9) Contour integration by Cauchy's residue theorem.
- 10) Evaluation of $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \sin mx \, dx$ and $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} \cos mx \, dx$.

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,

PUNE – 411 038

Accredited with 'A+' Grade (2017) by NAAC

‘A’ Grade University Status by MHRD, Govt. of India

Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF SCIENCE (B.Sc. MICROBIOLOGY) PROGRAME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

To Be Implemented From Academic Year 2016-17



BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I (Sem I & II)

MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE

CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I (Sem I & II)

MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

PREAMBLE-

Many of the biological processes occurring in living systems could be understood through the study of microorganisms as simple models. On the background of rapid advancement made in the field of microbiology, most of the concepts require theoretical revision. It has also become essential to consider the prior knowledge of the students at entry level which is based on the syllabus of 10+2 pattern or C.B.S.E. In view of these aspects, the syllabus is revised.

OBJECTIVES:

- 1) To keep the parity with existing 10+2 pattern for introducing the new subject at entry level.
- 2) To develop the learning interest of students by introducing applied aspects in very simplified manner.
- 3) To create awareness about the positive and negative potential of microorganisms and to make them competent to handle the microorganisms in responsible manner.
- 4) To develop the scientific temper among students.
- 5) To disseminate the knowledge in a way to gear up student's potential for solving unsolved questions in the field of Microbiology.
- 6) To introduce new trends in Bacterial taxonomy.

BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE

CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I (Sem I & II)

MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Details with course number and title of the paper

SEMESTER-WISE COURSE INFORMATION

F.Y.BSc Sem. I and II

Semester	Subject Type	Code	Title of the paper	Credit Value	Lec.	T	Lab.	Weightage for EoTE/IA	EoTM
F.Y.BSc Sem. I	Core Courses	MB-11	Introduction to Microbiology	3	2	1	-	0.6/0.4	Univ.
		MB -12	Structure of Prokaryotes and Eukaryotes	3	2	1	-	0.6/0.4	Univ.
		MB-13	Practical Course (based on MB 11,MB 12)	2			2		
	Foundation Course	UGF 11		2	2	-	-	0.6/0.4	Univ.
F.Y.BSc Sem. II	Core Courses	MB -21	Microbial Nutrition, Growth and Control	3	2	1	-	0.6/0.4	Univ.
		MB-22	The Diversity of Microbial World	3	2	1	-	0.6/0.4	Univ.
Semester I& II	Core Courses	MB -23	Practical Course (MB 21, MB 22)	2	-	-	02	0.6/0.4	Univ.
	TOTAL			18	10	4	04		

SEMESTER-WISE COURSE INFORMATION

S.Y.BSc Sem. III and IV

Semester	Subject Type	Code	Title of the paper	Credit Value	Lec .	T	Lab.	Weightage for EoTE/IA	EoTM
S.Y.BSc Sem. III	Core Courses	MB- 31	Microbial Metabolism	4	3	1	-	0.6/0.4	Univ.
		MB- 32	Bacterial Genetics	4	3	1	-	0.6/0.4	Univ.
		MB- 33	Practical Course (based on MB 31,MB 32)	2			2		
	Elective Options		English	4	3	1		0.6/0.4	Univ.
			Marathi	4	3	1		0.6/0.4	Univ.
	Foundation Course	UGF 31		2	2		0.6/0.4		Univ.
S.Y.BSc Sem. IV	Core Courses	MB- 41	Principles of Disease, Epidemiology and Immunology	4	3	1	-	0.6/0.4	Univ.
		MB -42	Applied Microbiology	4	3	1	-	0.6/0.4	Univ.
Semester III & IV	Core Courses	MB -43	Practical Course (based on MB 41, MB 42)	2	-	-	2	0.6/0.4	Univ.
	Elective Options		English	4	3	1		0.6/0.4	Univ.
			Marathi	4	3	1		0.6/0.4	Univ.
	TOTAL			30	22	04	04		

SEMESTER-WISE COURSE INFORMATION

T.Y.BScSem. V and VI

Semester	Subject Type	Code	Title of the paper	Credit Value	Lect	T	Lab.	Weightage for EoTE/IA	EoTM
T.Y.BSc Sem. V	Core Courses	MB -51	Medical Microbiology	4	3	1	-	0.6/0.4	Univ.
		MB- 52	Clinical Pathology	4	3	1	-	0.6/0.4	Univ.
		MB- 53	Virology	4	3	1	-	0.6/0.4	Univ.
		MB -54	Genetics of Prokaryotes	4	3	1	-	0.6/0.4	Univ.
		MB- 55	Enzyme Kinetics and Regulation	4	3	1		0.6/0.4	Univ.
		MB -56	Practical Course III (based on MB 51, MB 52)Medical Microbiology and Clinical Pathology.	2			2	0.6/0.4	Univ.
		MB- 57	Practical Course IV (based on MB 53, MB 54 Virology, Genetics of Prokaryotes.)	2			2		
		MB- 58	Practical Course V (based on MB 55, MB 59,) Enzyme Kinetics and Regulation and Food and DairyMicrobiology./ Applied microbiology /Advanced Techniques in Microbiology II)	2			2		
	Elective Options	MB- 59 A	Food and Dairy Microbiology	4	3	1		0.6/0.4	Univ.
		MB- 59 B	Applied microbiology I	4	3	1		0.6/0.4	Univ.
		MB- 59 C	Advanced Techniques in Microbiology I	4	3	1		0.6/0.4	Univ.
	Foundation Course	UGF 51		2	2			0.6/0.4	Univ.
	Total			32	20	06	06		

Semester	Subject Type	Code	Title of the paper	Credit Value	Lect	T	Lab.	Weightage for EoTE/IA	EoTM
T.Y.BSc Sem. VI	Core Courses	MB 61	Chemotherapy and Biomedical Instrumentation.	4	3	1		0.6/0.4	Univ.
		MB 62	Immunology	4	3	1		0.6/0.4	Univ.
		MB 63	Biotechnology	4	3	1		0.6/0.4	Univ.
		MB 64	Genetics of Eukaryotes and Gene Manipulation	4	3	1		0.6/0.4	Univ.
		MB 65	Microbial Metabolism and Biochemical Evolution.	4	3	1		0.6/0.4	Univ.
		MB 66	Practical Course III (based on, MB 61, MB 62) Chemotherapy and Biomedical Instrumentation and Immunology			2		0.6/0.4	Univ.
Semester I& II	Core Courses	MB 67	Practical Course IV (based on MB 63, MB 64 Biotechnology and Genetics of Eukaryotes and Gene Manipulation		-	2	04	0.6/0.4	Univ.
		MB 68	Practical Course V (based MB 65, MB 69) Microbial Metabolism and Biochemical Evolution.and Agricultural and Environmental Microbiology/ Applied microbiology II/ Advanced Techniques in Microbiology II			2	04	0.6/0.4	Univ.
	Elective Options	MB 69	Agricultural and Environmental Microbiology.	4	3	1		0.6/0.4	Univ.
		MB 69 B	Applied microbiology II	4	3	1		0.6/0.4	Univ.
		MB 69 C	Advanced Techniques in Microbiology II	4	3	1		0.6/0.4	Univ.
	Total			30	18	06	06		

BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE

CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester I

MB – 11 Introduction to Microbiology

Total credits 03

Total 36 Lectures

No. of lectures

(I) The Development of Microbiology and its Scope

(14)

- Microbes in our lives
- The scope and Relevance of Microbiology, Microbes and Human Welfare: Aerobiology, Recycling of Vital Elements .Sewage treatment: Using Microbes to Recycle water
Bioremediation: Using microbes to clean up Pollutants.
Insect/ pest control by microorganisms.
Modern Biotechnology and Genetic Engineering: Basic concepts
- A Brief History of Microbiology
The first observations – Antony van Leeuwenhoek
Theories of spontaneous generation.
The golden age of Microbiology – Louis Pasteur; Pasteur and disease, Robert Koch and pure culture Techniques
Development of Microbiology in 19th, 20th and 21st century: Ten important/Noble prize winning contributions from each century.
- Microbes and Human Diseases, Normal Micro biota
Infectious Diseases, The birth of Modern chemotherapy
Emerging Infectious Diseases.
- Modern Developments in Microbiology
- The future of Microbiology.

(II) Principles of Chemistry

(10)

- How atoms form Molecules: Chemical bonds.
- Types of bonds: Ionic Bonds, Covalent bonds, Hydrogen bonds., Molecular Weight & Moles
- Chemical Reactions
Energy in Chemical reactions
Types of chemical reactions: Synthesis, Decomposition, Exchange and Reversible reactions.
- Inorganic compounds – Water, Acids, Bases and Salts.
Acid-Base Balance
- Major organic compounds of living things – Structure & Function of Carbohydrates, Lipids, Proteins, Nucleic acids, Adenosine Triphosphate (ATP).

- Units of Measurement
- Lenses and the Bending of Light
- Light Microscopy: parts and their functions (Principle working and applications)
- Dark field and phase contrast microscopy functions (Principle working and applications)
- Fluorescence and Electron Microscopy, TEM & SEM (Principle working and applications)
- Preparation of Specimens for light microscopy
- Preparing smears for staining
 - Simple Staining - Monochrome, Negative
 - Differential staining – Gram’s staining and Acid Fast staining
 - Special Staining – Spore, Capsule, Cell wall, Flagella, Lipid granules, Metachromatic granules.

References:

1. Alcamo, Edward. I. (2007). Fundamentals of Microbiology, Eighth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Chapter No. 1,2,3.)
2. Dubey R.C., D.K. Maheshwari, Second Ed. (2010)
A Textbook of Microbiology, S. Chand And Company
3. Ingraham J.L and C.A. Ingraham (2000) Introduction to Microbiology .Second Edition Thompson Learning Inc. (Chapter No 2,3.)
4. Hofkin Bruce V.(2011) Living in a Microbial World. Garland Science. . (Chapter No 1,2,5,15,16)
5. Madigan , M.T. and J.M. Martinko (2006), Brock. Biology of Microorganisms 11th Edition, International Edition. Pearson , Prentice Hall. (Chapter No. 4.)
6. Manoharachary K. and B.R. Tilak (2012),
Principles of Microbiology, I. K. International Publishing House Pvt. Ltd
7. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010),
Microbiology, 39th Edition , Tata McGraw-Hill
8. Powar Daginwala Tenth Ed. (2010)
General Microbiology Vol.2, Himalaya Publishing House
9. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2008)
Microbiology, Eighth Edition McGraw Hill Higher Education. (Chapter No. ,2.)
10. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2007)
Microbiology: an Introduction, Ninth Edition, Pearson Education. (Chapter No. 3,5.)

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE

CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester I

MB – 12 Structure of Prokaryotes and Eukaryotes

Total credits 03

Total 36 Lectures

No. of Lectures

(I) Prokaryotic Cell Anatomy (10)

- Size, shape and arrangement of bacterial cells.
- Structure of typical bacterial cell.
- Structure and functions of cell wall.
- Composition and functions of 'Bacterial capsule'.
- Fluid Mosaic Model of bacterial cell membrane.
- Structure and functions of Flagellum
- Arrangement of Flagella
- Pilli

(II) Structure & functions of cell organelles (06)

- Ribosome
- Metachromatic granules
- Poly β hydroxybutyrate (PHB) granules.
- Carboxysomes
- Gas vacuoles
- Endospore

(III) General properties and significance of following groups of microorganisms. (10)

- Rickettsias
- Chlamydia
- Coxiella
- Mycoplasma
- Archaeobacteria
- Actinomycetes
- Algae
- Fungi
- Protozoa

(IV) The Viruses (10)

- Introduction and General characteristics,
- Morphological types of viral capsids

- Icosahedral, Helical, Complex
- Types of viral nucleic acids with representative examples.
- Virus cultivation using 'Embryonated Egg'
- Virus cultivation using 'Tissue Culture Technique'
- Merits and demerits of the following-
 - Primary cell cultures
 - Diploid cell cultures
 - Continuous cell cultures
- Structure of 'T₄ Bacteriophage'.
 - Viroids and Prions.

References :

1. Alcamo, Edward. I. (2001) . Fundamentals of Microbiology, Sixth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts.(Topic No-1 and 2).
2. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006) Microbiology, Sixth Edition McGraw Hill Higher Education.(Topic No 1 , 2 ,4)
3. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2004). Microbiology: an Introduction, Eight Edition, Pearson Education.(Topic No 1 and 2).
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5. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010), Microbiology, 39th Edition, Tata McGraw-Hill.(Topic No. 3,4).
6. Manoharachary K. and B.R. Tilak (2012), Principles of microbiology, I.K. International Publishing House Pvt. Ltd.(Topic No.3).

BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester II

MB - 21 Microbial Nutrition, Growth and Control

Total credits 03

Total 36 Lectures

No. of lectures

(I) Microbial Nutrition

(13)

- Requirements for Growth
- Physical and Chemical Requirement
- The common Nutrient Requirements
- Requirements for Carbon, Hydrogen and Oxygen
- Nutritional types of Microorganisms
- Requirements for Nitrogen, Phosphorous and Sulfur
- Uptake of Nutrients by the cell.
- Culture Media
 - Chemically defined media
 - Complex media
 - Anaerobic Growth media and methods
 - Special Culture techniques
 - Selective and Differential media
 - Enrichment Culture
- Obtaining Pure cultures .Methods of purification: Streak plate, spread plate and pours plate technique. Methods of obtaining pure cultures of motile organisms
- Preserving bacterial cultures .Methods of preservation: On Nutrient agar slants, agar overlay method, Cryopreservation, Freeze drying, Lyophilization.
- Concept of culture collection centre.

(II)

Microbial Growth

(10)

- The Growth of bacterial cultures
- Bacterial Division
- Generation time
- Phases of Growth – The Growth curve
- Measurement of Microbial Growth
 - a. Direct Measurement
 - b. Estimating bacterial numbers by indirect methods.
- Microbial Growth in Natural Environments
- The influence of Environmental factors on growth eg. Temperature, oxygen, pH, pressure, heavy metals, salts.

- The Terminology of Microbial control
- The rate of Microbial Death
- Actions of Microbial control Agents.
Alteration of Membrane permeability
Damage to proteins & Nucleic acids.
- The pattern of Microbial Death
- Physical methods of Microbial control
E.g. Heat, Filtration, low temperatures, High Pressure,
Desiccation, Osmotic Pressure, Radiation, Sonic waves
- Chemical methods of Microbial control : Principles of Effective
disinfection - Evaluation of a disinfectant types of disinfectants –
Phenols & Phenolics, Alcohol, Halogen compounds, Heavy
metals, Gaseous agents , Formaldehyde, Glutaraldehyde,
Ethylene oxide, Hydrogen peroxide, Soaps, Detergents , Dyes
Acids.
- Microbial Characteristics and Microbial control.
- Universal Precautions for Microbiology laboratory
- Safety in Microbiology laboratory

References:

1. Alcamo, Edward. I. (2007). Fundamentals of Microbiology, Eighth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Chapter No. 1,2,3.).
2. Dubey R.C., D.K. Maheshwari, Second Ed. (2010). A Textbook of Microbiology, S. Chand And Company.
3. Ingraham, J.L and C.A. Ingraham (2000) Introduction to Microbiology .Second Edition Thompson Learning Inc. (Chapter No 2,3).
4. Hofkin Bruce V .(2011) Living in a Microbial World. Garland Science. . (Chapter No 1,2,5,15,16).
5. Madigan , M.T. and J.M. Martinko (2006), Brock. Biology of Microorganisms 11th Edition, International Edition. Pearson , Prentice Hall. (Chapter No. 4.)
6. Manoharachary K. and B.R. Tilak (2012). Principles of Microbiology, I. K. International Publishing House Pvt. Ltd
7. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010), Microbiology, 39th Edition , Tata McGraw-Hill
8. Powar Daginwala Tenth Ed.(2010). General Microbiology Vol.2, Himalaya Publishing House.
9. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2008) Microbiology, Eighth Edition McGraw Hill Higher Education. (Chapter No. 2.)
10. Tortora, Gerard. J., Berdell, R. Funk and Case, Christine L. (2007) Microbiology: an Introduction, Ninth Edition, Pearson Education. (Chapter No. 3,5).

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester II

MB 22- The Diversity of Microbial World

Total credits 03

Total 36 Lectures

No of lectures

(I) Ecological Groups of Microorganisms

- **Soil Microorganisms** (10)
 - Microflora of soil
 - Interaction among soil microorganisms.
 - Mutualism
 - Commensalism
 - Antagonism
 - Microorganisms as fertilizers.
 - Microorganisms in plant protection
 - Bacillus thuringiensis*
 - Pseudomonas fluorescens*
- **Aquatic Microorganisms** (10)
 - Distribution of microorganisms in aquatic environment
 - Microorganisms in sewage
 - Oxidation lagoons
 - Bioluminescence of the marine bacteria and its significance in aquatic ecosystem.
 - Waterborne transmission of diseases.
 - Aquatic microbes for controlling 'oil spill'
- **Air Microorganisms** (05)
 - Distribution of air microflora
 - Significance of microorganisms in air.
 - Laboratory control of 'air contaminant'
 - Laminar air flow
 - Ultraviolet radiation

(II) Extremophiles:- Definition, examples and significance-- (8)

i) Based on Temperature

- Psychrophiles
- Mesophiles
- Thermophiles

ii) Based on pH

Acidophiles, Alkalophiles

iii) Halophiles (Based on salt conc.)

iv) Barophiles (Based on pressure)

(III) New horizons in Microbiology

(03)

- Viruses that kill superbug (ESKAPE Therapy)
- Microbes in 'Bioterrorism'

References :

1. Rubina Lawrence (Ed.), (2013) Antimicrobial Resistance, a cause of global concern, Narosa Publishing House. (Topic No. III).
2. Dubey R.C., D.K. Maheshwari, Second Ed. (2010). A Textbook of Microbiology, S. Chand And Company. (Topic No. I, II, III).
3. Powar Daginwala Tenth Ed. (2010). General Microbiology Vol. 2, Himalaya Publishing House (Topic No. I).
4. Alcamo, Edward. I. (2001). Fundamentals of Microbiology, Sixth Edition, Jones and Bartlett Publishers, Sudbury, Massachusetts. (Topic No. I and II).
5. Prescott, Lancing. M., John, P. Harley and Donald, A. Klein (2006). Microbiology, Sixth Edition McGraw Hill Higher Education. (Topic No. I, II).
6. Pelczar M.J., Chan E.C.S., Krieg N.R. (2010). Microbiology, 39th Edition, Tata McGraw-Hill. (Topic I).
7. Manoharachary K. and B.R. Tilak (2012). Principles of Microbiology, I. K. International Publishing House Pvt. Ltd. (Topic No. I, II)

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BHARATI VIDYAPEETH DEEMED UNIVERSITY,PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester I

Practical Course MB-13 (based on MB 11,MB 12)

Total number of Experiments: 17

- 1) Laboratory safety- General rules and regulations. (01)**
- 2) Study of laboratory equipments. (02)**
 - i) Incubator,
 - ii) Autoclave,
 - iii) Laminar Air Flow
 - iv) Oven
 - v) Colony counter
 - vi) Water bath,
 - vii)pH –Meter
- 3) Use care and study of Compound Microscope (03)**
 - i) Parts of microscope and their functions.
 - ii) Taking care of Microscope
 - iii) Using a Microscope.
- 4) Aseptic transfer techniques and demonstration of inoculation techniques (02)**
 - i) Broth inoculation
 - ii) Plate inoculation
 - iii) Slant inoculation
 - iv) Butt inoculation
- 5) Staining Techniques. (03)**
 - a) Basic Staining Techniques
 - i) Monochrome Staining
 - ii) Negative staining
 - iii) Gram staining
 - b) Special Staining Techniques (06)
 - i) Cell wall staining
 - ii) Endospore staining
 - iii) Capsule Staining
 - iv) Flagella Staining
 - v) Staining of ‘Metachromatic Granules’
 - vi) Staining of ‘Lipid Granules’

References

1. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London , Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory Manual in General Microbiology, Fifth Edition Wm.C Brown Publisher.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory Manual Sixth Edition, Pearson Education
4. Cruickshank R and J.P. Duguid(1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology , Churchill Livingstone Edinburgh, London and New York.
5. Pelzar M.J. and E.C.Schan(1972) laboratory Exercise in Microbiology Third Edition (Practical Manual Tata Macgraw Hill Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Books New Delhi.

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B.Sc Part I(Sem I & II) MICROBIOLOGY

To Be Introduced from Academic Year 2016 – 2017

Semester II

Practical Course MB-23 (based on MB21, MB 22)

Total number of Experiments : 17

- 1) Preparation and sterilization of common laboratory media. (03)**
i) Peptone Water, ii) Nutrient Broth, iii) Nutrient agar,
ii) MacConkeys Agar. V) Sabaroud's Agar
- 2) Motility by 'Hanging drop method' (02)**
Demonstration of swarming growth.
- 3) Pure Culture Techniques (03)**
i) Streak plate method,
ii) Spread plate method
iii) Pour plate method,
- 4) Isolation, Colony characteristics, Gram staining and Motility of (04)**
following microorganisms
i) *Escherichia coli*
ii) *Bacillus spp.*
iii) *Staphylococcus spp.*
iv) *Micrococcus spp.*
- 5) Demonstration of Algae, fungi and protozoa using permanent (03)**
slides / cultures / sample source
Amoebasp, Paramoeciumsp, Nostoc sp, Chlorella sp,
Aspergillus sp, Mucor sp, Penicillium sp
- 6) Effect of environmental factors on growth of Bacteria. (02)**
i) pH
ii) Temperature
iii) Heavy Metals
iv) salt

References

1. Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London , Toronto.
2. Benson H.J. (1990) Microbiological Applications A Laboratory Manual in General Microbiology, Fifth Edition Wm.C Brown Publisher.
3. Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory Manual Sixth Edition, Pearson Education.
4. Cruickshank R and J.P. Duguid(1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology , Churchill Livingstone Edinburgh, London and New York..
5. Pelzar M.J. and E.C.Schan(1972) laboratory Exercise in Microbiology Third Edition (Practical Manual Tata Macgraw Hill Edition New Delhi.
6. Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Books New Delhi.

University Examination Pattern
Theory Question Paper

Total Marks- 60

Time – 3 hrs.

Note : 1) All questions are compulsory and carry equal marks.
2) Figures to the right indicate full marks.

Que. 1. Short answer questions or Multiple Choice Questions. (12)

(No internal options for Question No. 1)

A. Multiple Choice Questions. 6 Marks

B. Short answer questions. 6 Marks

i) to vi) Answer in one sentence (e.g. Define or What is meant by)

Que. 2. Attempt ANY TWO of the following. (12)

a) b) c)

Que. 3. Attempt ANY TWO of the following. (12)

a) b) c)

Que. 4. Attempt ANY TWO of the following. (12)

(Write Short notes / Questions)

a) b) c)

Que. 5. Attempt ANY TWO short notes of the following. (12)

a) b) c)

Internal Examination Pattern(Theory)

Total Marks – 40

A. Attendance 10 Marks

B. Home Assignments 10 Marks

C. Mid- Semester Examination 20 Marks

University Examination Pattern
Practical Question Paper

Total Marks- 60

Time – 3 hrs+3hrs (2 days).

Practical examination will be of 6 hours duration per batch spreaded over two consecutive days (3 hours per day).

At the time of practical examination the students should submit the certified journal.

PATTERN:	Marks
Q.1 Major problem	(15)
Q.2 Minor problem	(10)
Q.3 Minor problem	(10)
Q.4 Spotting	(10)
Q.6 Journal	(05)
Q.7 Viva	(10)

Internal Examination Pattern (Practical)

Total Marks – 40

A. Attendance	10 Marks
B. Timely Journal Completion	10 Marks
C. Internal Exam (Spotting/Viva)	10 Marks
D. Study Tour Report/Visit	10 Marks



BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)

B. Sc. Part II MICROBIOLOGY
From Academic Year 2017 – 2018

Semester III
MB - 31 Microbial Metabolism

Total credits 04
Total 48 Lectures

Course Content

No. Of lectures

(I)	Enzymes	(15)
	i) Physicochemical properties of enzymes ii) Theories of enzyme catalysis a) Proximity effect b) Pauling concept of strain c) Acid-Base Catalysis d) Covalent Catalysis iii) Nomenclature of enzymes iv) Factors affecting enzyme activity – pH & Temperature v) Mechanism of enzyme action: a) Lock and Key hypothesis b) Induced fit hypothesis vi) Enzyme specificity – a) Absolute specificity b) Group specificity c) Optical specificity d) Geometrical specificity vii) Introduction to ‘Allosteric Enzymes’ viii) Biological role of Enzymes ix) Methods of investigation of active site a) Trapping of ‘Enzyme substrate complex’ b) Use of ‘substrate analogues’	
(II)	Bioenergetics	(12)
	i) Principles of Bioenergetics ii) Role of ATP in bacterial metabolism iii) Reducing power and its significance in bacterial metabolism iv) Generation of ATP through substrate level photophosphorylation v) Component's of Electron Transport chain (ETC) a) Flavoproteins (FMN & FAD) b) Quinones (Ubiquinone & Menaquinone) c) Iron sulphur proteins d) Cytochromes vi) Generation of ATP through ETC	

- (III) **Energy Cycles** (10)
- i)Energy Production by Anaerobic Processes
 EMP pathway
- ii)Energy Production by aerobic processes
 a) Tricarboxylic Acid cycle
 b) Anaplerotic reactions of ‘Tricarboxylic Acid cycle’.
- (IV) **Transport of Nutrients by Bacteria:** (04)
- i) Passive Diffusion
- ii) Facilitated Diffusion
- iii) Group Translocation
- iv) Active Transport
- (V) **Photosynthesis** (07)
- i) Bacterial Photosynthesis
- ii) Concept of ‘Purple Membrane’ in *Halobacterium* and its significance.
- iii) Plant /Algal/*Cynobacterial* Photosynthesis.

References:

- Michael Pelczar ECS Chan, Noel Krieg, Microbiology 11th print 1998, Tata Mcgraw Hill Publishing Company Limited, New Delhi. (Topic No. II and III)
- Prescott L.M., J.P. Harley and D.A. Klein Microbiology 5th Edition 2002, McGraw Hill Higher Education.(Topic No. II)
- Roger V. Stainier 1995, John L. Ingraham, Mark L. Wheelis, Page R. Painter, General Microbiology 5th Edition, Macmillan Press Ltd., Houndmills, Basingstoke Hampshire & London.(Topic No II and IV)
- Tortora G.J., B.R. Funke and C.L. Case Microbiology an Introduction , 8th Edition Pearson education
Voet D and J.G.Voet (2004) Biochemistry 3rd Edition Vol I John Wiley & Sons Inc.(Topic No. II)
- Trevor,Palmer,Understanding of Enzymes,2ⁿ Edition,John Wiley& sons limited(Topic No-I)
- Kulkarni,Deshpande,General Enzymology,First Edition,Himalay Publishing House(Topic No.I)

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)
B. Sc. Part II MICROBIOLOGY
Academic Year 2017 – 2018
Semester III
MB – 32 Bacterial Genetics

Total credits 04
Total 48 Lectures

Course Content	No. Of lectures
I. Structure of DNA, Gene and Chromosome	09
i) Characteristics of Genetic Material	
ii) The Molecular Basis of Heredity:-	
a) Different experiments which helped to understand the structure and function of DNA 1928-1956	
b) RNA as Genetic Material	
iii) The Structure of DNA	
a) The Primary and Secondary Structure of DNA	
b) Special Structures in DNA and RNA	
c) DNA Methylation, Bends in DNA	
iv) The organization of DNA in chromosomes:	
a) The Bacterial Chromosome	
b) The Eukaryotic Chromosome	
c) Viral Chromosomes	
II. DNA Replication	09
i) Semi conservative Replication	
ii) Meselson and Stahl's Experiment	
iii) Modes of Replication: θ , Rolling circle, D loop	
iv) Requirements of Replication: Enzymes, Proteins and mechanisms involved	
v) The Mechanism of Replication:	
a) Initiation, Unwinding, Primers, Elongation, Termination	
b) Bacterial DNA Replication- Components required for Replication	
c) The fidelity of DNA replication	
III. The Genetic Code	09
i) The one gene one enzyme hypothesis	
ii) The Genetic code:	
a) Milestones in deciphering the Genetic code	
b) Dictionary of the Genetic code	
iii) Features of the Genetic code:	
a) Genetic code is degenerate	
b) Genetic code is universal	
c) Genetic code is a triplet code	
d) Genetic code is non-overlapping	
e) Genetic code is comma less	

- iv) Initiation and Termination codons
- v) Wobble hypothesis, Isoaccepting tRNAs
- vi) The Central Dogma, Overlapping Genes
- vii) The process of Transcription and Translation

IV. Mutagenesis and Repair

21

- i) Mutagenesis: Definitions, Auxotrophic Mutants, Conditional Lethal mutants, Resistant Mutants. Experiments using mutants
- ii) Mutations are Spontaneous or induced?: Luria and Delbruck Experiment, the Newcomb Experiment, The Lederberg's Experiment
- iii) Mutation Rate: Calculation of mutation Rates
- iv) Types of Mutations:
 - a) Microlesions and Macrolesions: different types
 - b) Transitions and Transversions
 - c) Chemicals that mimic normal DNA bases-base analogs
 - d) Chemicals that react with DNA bases-base modifiers
 - e) Chemicals that bind DNA bases- Intercalators
 - f) Mutagens that physically damage the DNA; Ultraviolet light and ionizing radiations
- v) Reversion and suppression: Types with examples
- vi) Isolating mutants : Replica plating, Enrichment techniques
- vii) Complementation
- viii) Ames' Test: How have we exploited mutants?
- ix) Repair: a) Photo- reactivation b) The methyl – Directed mismatch Repair system
c) Nucleotide Excision repair d) Recombination repair
e) SOS inducible repair

References:

- Gardner E.J, Simmons M.J and D.P. Snustad (1991) Principles of Genetics. 8th edition, John Wiley and Sons. Inc.
- Lewin B (2000) Genes VII. Oxford University Press.
- Pierce B.A. (2005) Genetics a conceptual Approach 2nd Edition W.H. Freeman and Company New York. Chapter No. 10,12,15,17.
- Russel P.J. (2006) 1. Genetics a Molecular Approach. 2nd Edition Pearson Benjamin Cummings San Francisco, Boston New York. Chapter No. 1,2,3,4,5,6,7.
- Stanier R Y, J.N. Ingraham, M.L. Wheelis and P.R. Painter (1996) General Microbiology, 5th Edition, MacMillan Press.
- Snyder L and W. Champers (2003) Molecular Genetics of bacterial 2nd Edition ASM Press, Washington. Chapter No. 1, 2,3,11.
- Trun Nancy and Janine Trempey (2004) fundamental Bacterial Genetics Blackwell Publishing. Chapter No. 2, 3, 4.

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)
B. Sc Part II MICROBIOLOGY
Semester III Practical Course
MB- 33: (based on MB 31, MB 32)
From Academic Year 2017 – 2018
Total number of Experiments: 18

I.	Extracellular Enzymatic Activities of Micro-organisms	(04)
	i) Starch hydrolysis ii) Lipid hydrolysis iii) Caesin hydrolysis iv) Gelatin hydrolysis	
II.	Intracellular Enzymatic Activities of Microorganisms.	(06)
	i) Carbohydrate fermentation – Lactose, Sucrose, Dextrose, ii) Triple Sugar Iron Agar test. iii) Hydrogen sulfide test. iv) Urease test. v) Litmus milk test. vi) Nitrate Reduction test. vii) Catalase test.	
III.	Study of bacterial Growth	(02)
	i) Enumeration of cell numbers-direct counting/ turbidometry. ii) Determination of viable count.	
IV.	Study of Environmental Influences on Bacterial Growth	(02)
	i) Study of Effect of Energy Source and Role of buffers on growth ii) Study of oxygen requirements of bacteria.	
V.	Study of control of Microbial Growth by Antimicrobial Agents (Any Two)	(01)
	i) Study of Effect of Antiseptic and Disinfectant. ii) Determination of Phenol coefficient. ii) Study of lethal action of UV light and photoreaction in Bacteria.	
VI.	Study of Bacterial Genetics (Any Two)	(02)
	i) Isolation of Temperature variants/Antibiotic Resistant variants. ii) Isolation of Nutritional Mutants by Replica plating iii) Mutant isolation by Gradient Plate method.	

References:–

- Bradshaw L. Jack (1979) Laboratory Microbiology, 3rd Edition W.B. Saunders co Philadelphia, London, Toronto.
- Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
- Cappuccino J.G. and N. Sharma (2004) Microbiology A Laboratory manual Sixth Edition.
- Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
- Pelczar M.J. and E.C. Schwann (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata McGraw Hill) Edition New Delhi.
- Sharma K. (2005) Manual of Microbiology Tools & Techniques Anne Book New Delhi.

Total credits 04
Total 48 Lectures

No. of lectures
(16)

References :-

- Robert F. Boyd 1995, General Microbiology Times Mirror/Mosby College Publishing(Topic No.II)
- Michael J. Pelzar ‘ Microbiology’ 11th reprint Tata McGraw Hill Delhi(Topic No.I)
- Abul K. Abbas 2006 Cellular & Molecular Immunology 5th Edition S.awnders, Philadelphia(Topic No.III)
- David Male , Jonathan Brostorr, davidB.Roth Nan Roitt 2006, Immunology 7th Edition Elsevier UK/ USA(Topic No.III)
- R.Anantnarayan, C.K.JayaramPaniker (2009), ‘Text Book of Microbiology’ ,8th Edition, University Press India Pvt.Ltd. India. (Topic III)

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)
B. Sc. Part II MICROBIOLOGY
From Academic Year 2017 – 2018
Semester IV
MB – 42 Applied Microbiology

Total credits 04
Total 48 Lectures

Course Content

No. Of lectures

I)	Water Microbiology	24
	i) Water related illnesses associated with microorganisms a) Bacteria, Blue – green Algae, Parasites – Protozoa, Nematodes, b) Cestodes, Trematodes. Emerging pathogens, Viruses c) Opportunistic Bacterial pathogens ii) Indicator microorganisms: a) Concept of Indicator organisms b) Standard and Criteria for indicators c) Fecal coliforms d) Fecal <i>Streptococci</i>, <i>Clostridium perfringens</i>, <i>Bifidobacterium bifidus</i> e) Bacteriophages iii) Total coliforms: The most Probable numbers (MPN) Test, The Presence Absence (P-A) test iv) Domestic waste water treatment a) Domestic Wastewater: composition b) Modern Wastewater Treatment: Primary Treatment, Secondary c) Treatment, Tertiary Treatment: Activated sludge and Tricking Filter d) Removal of BOD and COD by sewage Treatment Processes e) Sludge Processing, Oxidation Ponds, Septic tanks v) Potable water treatment and distribution a) Water Treatment Processes-Physical and Chemical b) Thermal Destruction, Factors Affecting Disinfectants c) Disinfection by different agents: Halogens, Ozone, d) Metal ions, Ultraviolet Disinfection, Photodynamic Inactivation e) Gamma and High Energy inactivation	
II)	Industrial Microbiology	24
	i) Introduction and history: Fermentation – concept ii) Fermenter and its parts a) Vessels Used for fermentation, b) <i>In situ</i> Sterilization of Fermenter and its parts	

- iii) Organisms used in fermentations
 - a) Primary and Secondary screening,
 - b) Stock Culture and Inoculum preparation
- iv) Media used in fermentation
 - a) Different Raw materials used as a substrate
 - b) Screening, Pretreatment and Sterilization of media
- v) Control of contamination in fermentations
- vi) Buffers and antifoam agents
- vii) Different types of fermentations –
 - a) Dual and multiple b) Batch and continuous
- viii) Production of antibiotics: - Organisms, Medium Composition, Precursors, Process and Flow sheet, Recovery & purification.
 - a) Streptomycin
 - b) Penicillin and Semi synthetic Penicillins

Reference:

- Casida L.E. Jr. (1983) – Industrial Microbiology. Wiley eastern limited, New Delhi.
- Maier R.M., I.L.Pepper, C.P. Gerba (2000) Environmental Microbiology Academic Press. Chapter No. 19, 20,21,22,23.
- Patel A.H. (1985) – Industrial Microbiology Mac Milan India Ltd.
- Peppler H. H. (Ed) (1979) – Microbial Technology Vol I & UU Academic Press, New York.
- Peppler periman II (Ed) (2004) – Microbial Technology. Microbial Processes Vol I & II Academic Press: Published by Elsevier. Chapter 3 (Vol.II)
- Prescott S. C. & C. G. Dunn (1983) Industrial Microbiology 4th edition edited by Gerald Reed. AVI Tech Books USA. Chapter 13, (Vol. I)
- Stanbury P.F. & A Whitaker (1984) – Principles of Fermentation Technology. Pergamon, New York. Chapter No. 4,5,6,7,9.

BHARATI VIDYAPEETH DEEMED UNIVERSITY, PUNE
CHOICE BASED CREDIT SYSTEM (2016 course)
B. Sc Part II MICROBIOLOGY
Semester IV Practical Course
MB- 43: (based on MB 41, MB 42)
From Academic Year 2017 – 2018
Total number of Experiments: 16

I. Study of Medical Microbiology and Immunology. (03)

- i) Antibiotic sensitivity test.
- ii) Isolation of micro flora of skin OR
Isolation of oral micro flora.

II. Microbiology of Water. (13)

- i) Bacteriological examination of water (Qualitative test)
 - a) Presumptive
 - b) Confirmed
 - c) Completed test.
- ii) Standard Plate Count test (Quantitative)
- iii) Membrane Filter method.
- iv) Determination of Most Probable Number (MPN)
- v) Determination of DO.
- vi) Determination BOD.
- vii) IMViC tests:-
 - a) Indole production
 - b) Methyl Red Test.
 - c) Vogues Proskauer test.
 - d) Citrate Utilization test.

References:–

- Bradshaw L. Jack (1979) Laboratory Microbiology, 3rd Edition W.B. Saunders co Philadelphia, London, Toronto.

- Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
- Cappuccino J.G. and N. Sharma (2004) Microbiology A Laboratory manual Sixth Edition.
- Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
- Pelczar M.J. and E.C. Schwann (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata McGraw Hill) Edition New Delhi.
- Sharma K. (2005) Manual of Microbiology Tools & Techniques Anne Book New Delhi.

University Examination Pattern
Theory Question Paper

Total Marks- 60
Time – 3 hrs.

Note : 1) All questions are compulsory and carry equal marks.
2) Figures to the right indicate full marks.

Que. 1. Short answer questions or Multiple Choice Questions. (12)

(No internal options for Question No. 1)

A. Multiple Choice Questions.

B. Short answer questions.

i) to vi) Answer in one sentence (e.g. Define or What is meant by)

Que. 2. Attempt ANY THREE of the following. (12)

a) b) c) d)

Que. 3. Attempt ANY FOUR of the following. (12)

a) b) c) d) e)

Que. 4. Attempt ANY TWO of the following. (12)

(Write Short notes / Questions)

a) b) c)

Que. 5. Attempt ANY TWO short notes of the following. (12)

a) b) c)

Internal Examination Pattern (Theory)

Total Marks – 40

A. Attendance	10 Marks
B. Home Assignments and Presentation	15 Marks
C. Mid- Semester Examination	15 Marks

University Examination Pattern
Practical Question Paper

Total Marks- 60
Time – 3 hrs+ 3hrs (2 days).

Practical examination will be of 6 hours duration per batch spread over two consecutive days (3 hours per day).
At the time of practical examination the students should submit the certified journal.

PATTERN:	Marks
Q.1 Major problem	(15)
Q.2 Minor problem	(10)
Q.3 Minor problem	(10)
Q.4 Spotting	(10)
Q.6 Journal	(05)
Q.7 Viva	(10)

Internal Examination Pattern (Practical)

Total Marks – 40

A. Attendance	10 Marks
B. Timely Journal Completion	10 Marks
C. Internal Exam (Spotting/Viva)	10 Marks
D. Internal Exam (Minor problem)	10 Marks

T.Y. B .Sc.(Microbiology) – 2014 Course

Semester V

MB – 51: Medical Microbiology

Course Content	Total Lectures	60
I] Introduction to important Medical Terminologies.		03
II] Outline studies of the following human diseases w.r.t. etiology, symptoms, mode of transmission & treatment.		20
1. Chikungunya		
2. Dengue		
3. Japanese Encephalitis		
4. Herpes		
5. Common- cold		
6. Viral Diarrhoea		
7. Rabies		
8. Typhoid		
9. Cholera		
10. Gonorrhoea		
11. Plague		
12. Amoebiasis		
III] Outline studies of the following veterinary diseases w.r.t. etiology, symptoms, mode of transmission & treatment.		05
1. Mastitis		
2. Ranikhet		
3. Marek's Disease		
4. Brucellosis		
IV] Detailed study of following Human Diseases.		12
1. AIDS		
• Structure of HIV		
• ICTV Classification Of HIV		

- Difference between HIV 1 and HIV 2
- Mode of Transmission
- Significance of CCR5 AND CXR4 Receptors in the pathogenesis of AIDS
- Apoptosis of CD₄ Cells following HIV infection.
- ELISA, Western Blott, for Diagnosis of HIV infection.

2. Poliomyelitis

- Morphology
- Antigenic Properties
- Pathogenesis
- Prophylaxis

i) Injectable Polio Vaccine (IPV)

ii) Live Polio Vaccine (Oral Polio Vaccine)

3. Bacillary Dysentery

- Morphology
- Cultural Characteristics
- Biochemical Properties
- Toxic Activities of *Shigella dysenteriae* Type 1 in terms of Neurotoxicity, Enterotoxicity, Cytotoxicity
- Classification
- Pathogenicity
- Epidemiology

4. Malaria

- Etiology
- Life Cycle in Human Being including 'Pre Erythrocytic schizogony', Erythrocytic schizogony,
- Life Cycle in Mosquito
- Symptoms
- Laboratory Diagnosis

i) Examination of blood film and approximate quantitation method of parasites.

ii) Rapid and Simple Stick test

V] Molecular Techniques used for diagnosis of infectious

diseases :-

15

1. Polymerase Chain Reaction
2. R.F.L.P. [Restriction Fragment Length. Polymorphism]
3. RAPD [Randomly Amplified Polymorphic DNA Technique.]
4. 16S-rRNA Gene Sequencing
5. Fluorescence In Situ (FISH) in diagnostic Microbiology
 - Outline
 - Applications
 - Comparative study of 16S-r RNA gene sequencing and FISH

VI] Microbial Infection Imaging, a novel diagnostic approach

02

VII] Diagnosis of 'Transmissible Spongiform Encephalopathy Agents'

03

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1. Anunava Kali, 2015, Microbial Infection Imaging: A novel Diagnostic Approach, Indian Journal Of Nuclear Medicine , Apr-June,30(2),189-190 **(Topic VI)**
2. Cruickshank K.R.,2005, Medical Microbiology Vol I & II Livingstone, Longman.**(Topic II AND IV)**
1. Chakraborty P. 2009, Textbook Of Medical Parasitology, Central Publications, Kolkata, India. **(Topic I..pt.12, Topic IV..pt.4)**
3. David H.Persing et.al. 2004, Molecular Microbiology :,Diagnostic Principles and Practice , ASM Press Washington DC,USA. **(Topic V and VII)**
4. Dornald 2010, Dornalds Pocket Medical Dictionary, Oxford & IBH New Delhi. **(Topic I)**
5. N.I.V. handbook, 1993 PUNE NIV PUNE. **(Topic II)**
6. Panikar ^{9th} edition 2015 Textbook of Microbiology Orient Longman Bombay. **(Topic II AND IV)**
7. Rajan S.2012, Medical Microbiology,MJP Publishers,Chennai,India. **(Topic I)**

8. Sharma J.B.,2014, Medical Microbiology, A Clinical Perspective, Paras Medical Publishers, Hyderabad, India. **(Topic I and IV)**
9. Shastry G. A. 1998, Veterinary Pathology 6th edition , CSB publishers, New Delhi. **(Topic III)**

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T.Y. B .Sc. (Microbiology) – 2014 Course

Semester V

MB – 52 Clinical Pathology

Course Content	Total Lectures	60
I. Haematology :-		20
• Cytology of Eosinophiles, • Cytology of Basophiles, • Cytology of Neutrophiles, • Cytology of Macrophages • Cytology of NK Cells. • Plasma Electrolytes and their significance, • Significance of haemoglobin, • Anticoagulants used in laboratories, • Anticoagulants used as therapeutic agents, • Nomenclature of Procoagulants, • Formation Of Platelet plug, • Intrinsic Pathway for Blood Coagulation, • Extrinsic pathway for Blood Coagulation.		
II. Lipids & Clinical Pathology:-		08
• HDL & LDL cholesterol & their diagnostic significance, • Docosahexaenoic acid & it's clinical significance, • Lipid hypothesis of schizophrenia.		
III. Clinical relevance of Nervous system:-		06
• Composition of cerebrospinal fluid, • Formation of cerebrospinal fluid, • Functions of cerebrospinal fluid, • C.S.F. examination i. Total Proteins, ii. Glucose, iii. Chlorides		

IV. Renal system: -

10

- Structure of Nephron,
- Concept of Starling forces,
- Role of Glomerulus in the formation of Urine,
- Proximal tubule in the formation of Urine,
- Henle's loop in the formation of Urine,
 - Distal tubule in the formation of Urine,
- Renal function tests
 - i. Creatinine Clearance Test,
 - ii. Urea Clearance Test,
 - iii. Phenol Sulfonaphthalene Test.

V. Clinical Relevance of Hepatic system :-

10

- Bilirubin metabolism,
- Conjugate & Unconjugate bilirubin,
- Overproductive jaundice,
- Obstructive jaundice,
- Hepatocellular jaundice,
- Congenital jaundice,
- Liver function tests
 - i. SGOT,
 - ii. SGPT,
 - iii. Total Serum Bilirubin,
 - iv. Van Den Bergh Test,
 - v. Bromosulphalein Excretion Test

VI. Community Health services & Measures:-

06

- Blood – grouping
 - i. ABO
 - ii. Rh,
- Methods of Blood grouping,
- 'Blood Banking',

- Rh-incompatibility (HDN).

References

1. Berne, Levy 2014, Principles of Physiology, C.V. Mosby Company USA. **(Topics III and IV)**
2. David male, Jonathan Brostoff, David B Roth, Ivan Roitt, 2006 Immunology 7th edition **(Topic I)**
3. E. Roy Skinner (Ed.) 2002, brain lipids and Disorders in Biological Psychiatry, ELSEVIER. **(Topics II)**
4. Sengupta, "1992 Synopsis of clinical pathology & Microbiology" Hilton & company kolkotta. **(Topics III, IV and V)**
5. Sood Ramnik Fifth Edition 2003, Hematology for students & practioners. Jaypee Brothers, Medical publishers. **(Topics I and VI)**
6. Stites D.P. & A.I. Terr 1990 Basic & Clinical Immunology Prentice hall. **(Topics I)**
7. World Health Organization Blood Transfusion Services 2015, (Authorized reprint by B.I. Churchill Livingstone. **(Topic VI)**

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T. Y.B. Sc. (Microbiology) – 2014 Course

Semester – V

MB-53 - Food and Dairy Microbiology

Course Content		Total - 60 Lectures
		Lectures
I	Microbes in food.	10
	1. Evolution of Food Microbiology	
	2 Micro-organisms and food materials.	
	Principles that influence microbial growth, survival and death of microbes in food:-	
	• Intrinsic factors and substrate limitations: Nutrient content, pH & Antimicrobial barriers. • Environmental limitations: temperature & gaseous environment.	
II	Processing of food	10
	1. Asepsis	
	2. Heat Processing	
	Pasteurization, Appertization & Sterilization	
	3. High Pressure Processing	
	4. Irradiation – Traditional method, UV and Ionizing Radiation	
	5. Role of FDA	
III	Importance of Microbes in food	25
	1. Food Borne Infections and Intoxications.	
	2. Beneficial Activities of Microbes in food:-	

I. Microbial metabolism of food components.

II. Fermented foods:

- a. General methods of production
- b. Starter cultures, enzymes
- c. Traditional fermented foods
- d. Microbiology of process
- e. Fermented food – Idli
- f. Fermented milk and milk products – Curd, Yoghurt
- g. Concepts of genetically modified foods

3. Health benefits of beneficial microbes-probiotics (definition and significance) , Food Supplements – SCP.

4. Spoilage of Food

- General Principles underlying spoilage
- Important food spoilage bacteria
- Sequence of events in spoilage
- Factors governing spoilage of food.
 - i. Number and type of microbial load.
 - ii. Type of food
 - iii. Succession.
 - iv. Storage conditions – Temperature&, humidity.
- Spoilage of food commodities:-
 - i. Milk - Composition, types of microbial flora, Heat treatment spoilage.
 - ii. Meat – Structure and composition, primary processing, spoilage of fresh meat.
 - iii. Fish – Structure and composition, primary processing, spoilage of fresh fish.
 - iv. Plant Products – Fruits and vegetables.

- v. Canned foods.
- vi. Fermented foods.

IV Preservation and storage 15

- 1** Low temperature storage, Chilling, Freezing.
- 2** Chemical Preservatives.
 - i. Natural antimicrobials.
 - ii. Organic acids.
- 3** Hurdle Technology.
- 4** Aseptic packaging, modified atmosphere packaging, controlled atmosphere packaging.
- 5** Detection of microbes in food.
- 6** Indicator micro-organisms and microbiological criteria.

References :

- 1** Adam M.R. and Moss M.O. (2003) Food Microbiology, 2nd edition, Panima Publishing Corporation, New Delhi.
- 2** Banwart G.J. (1987) Basic food Microbiology CBS Publishes, New Delhi.
- 3** Day. S. (1980) Outlines of Dairy Technology, Oxford University Press, New Delhi.
- 4** Doyle M.P., Beuchet Z.R. & Montville T.J. (1997) Food Microbiology Fundamental and Frontiers, ASM Press, Washington D.C.
- 5** Frasier W.C. and Westhoff D.C. (1996) Food Microbiology 4th edition, Tata Mac Graw Hill, New Delhi.
- 6** James Jay (1986), Modern food Microbiology – 3rd edition, CBS publishes, New Delhi

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T.Y. B .Sc.(Microbiology)-2014 Course

SEMISTER V

MB – 54 Virology

Course Content		Total Lectures : 60
I	Introduction	06
	• Discovery and Definition of a Virus • Importance of Viral Nucleic acids • Properties of Viruses • Origin of Viruses • Classification of viruses	
II	Structure of Viruses	06
	1. Subunits of viruses	
	2. Structure of various viruses (one example each)	
	• Filamentous viruses • isometric viruses • Icosahedral viruses • picornaviruse • Bacteriophages • adenoviruses • enveloped viruses	
	3. Viral Nucleic acids	
	• DNA Viruses – Single and Double stranded • RNA viruses- Single and Double stranded	
	4. Subviral infectious Agents	
	• Satellite viruses • Viroids • Prions	
III.	Isolation, cultivation, purification and enumeration of viruses	10
	1. Isolation and cultivation of viruses	
	• Animal virus - tissue culture, chick embryo and live animals.	

- Plant virus – plant tissue culture and protoplast formation
- Bacteriophages – plaque method.

2. Purification of viruses

- Differential centrifugation.
- Density gradient centrifugation.
- Precipitation.

3. Enumeration of viruses

- Latex droplet method (Direct Microscopic count)
- Haemagglutination assay
- Plaque and pock method.
- LD 50 or ID50 assays (50% end point method.)

IV T even phages and T odd phages. comparison

02

V Gene regulation in bacteriophages

16

1. Life cycles of Bacteriophages: T Even phages (T₂ T₄ T₆) and λ

- One step growth curve
- Single burst Experiment
- Doermann's Experiment
- Features Of The T₄ Life Cycle
 - i. Taking over the cell
 - ii. Replication of T₄ DNA
 - iii. Production of T₄ phage particles
- T₄ Gene Organization
- Genetic Mapping Of Phage T₄
 - i. The genetic map of T₄ is circular
 - ii. Possible explanations for the T₄ circular map

2. Life cycles of Phage λ

- λ DNA And Its Gene Organization
- The Lytic Cycle Of λ
 - i. DNA Replication And Phage Production

ii. DNA replication and maturation : Coupled Processes

iii. Particle assembly

- Lysogenic establishment of λ
- Immediate Early, Delayed Early and the Late genes
- Essential and Nonessential genes
- Establishment and Maintenance of Lysogeny
- C_I, C_{II}, C_{III} and Cro proteins-Role as inducers and repressors
- A delicate balance: lysogeny versus lysis

3. Phage Mutants

4. Genetic Recombination In Phages

- Effect of the parental ratio on recombination frequencies
- Reciprocity in genetic recombination
- Recombination by breakage and rejoining of DNA molecule

VI Mapping of Genes in Bacteriophages.

10

- Bacteriophage DNA molecules in the same cell can recombine
- Bacteriophages form plaque on a lawn of bacteria
- Infection with two mutant bacteriophages yield recombinant progeny
- Genes are clustered by functions in many bacteriophages
- Recombination occurs within genes
- Fine structure Analysis of a Bacteriophage Gene – Benzer's spot test
- Recombination Analysis of T_4 r II mutants
- Deletion mapping
- Defining Genes by complementation Tests

VII Specialized Transduction

05

- Other Lysogenic phages
- Lysogenic phages and Bacterial pathogenesis

VIII Reproduction of Plant and Animal viruses

05

1. Animal Virus

- Adenovirus
- Influenza virus

2. Plant virus

- TMV (Tobacco Mosaic Virus)

References

1. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
2. Dimmock N.J. A. J. Easton and K.N. Leppard (2001) Introduction to Modern Virology Blackwell science.
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4. Lewin B. (2004) Genes VIII International Edition. Pearson. Prentice Hall.
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10. Tamarin R.H. (2003) Principles of Genetics, 2nd Edition. Tata McGraw Hill Edition.
11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell puldishing.
12. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford-

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T.Y. B .Sc.(Microbiology) – 2014 Course

SEMISTER V

MB – 55 Genetics of Prokaryotes

Course Content	Total Lectures 60
I Recombination in bacteria	30
1. Bacterial Transformation	(09)
• Discovery of Transformation • Steps in Transformation i. Competence development ii. Uptake of DNA during Natural Transformation. iii. Integration • Transformation in Gram positive and Gram negative bacteria • Molecular Mechanism of Transformation. • Mapping by Transformation • Uses Of Transformation • Transformation In Nature • Artificial Transformation (Transfection)	
2. Bacterial Conjugation	(12)
• F⁺ cells. Properties of F⁺ cells. Cross between F⁺ and F⁻ cells • Transfer of Plasmid DNA i. Stages in transfer process ii. Effective contact and pilli iii. Mobilization and transfer iv. Fertility inhibition v. <i>tra</i> genes of F vi. Host restriction in transfer • Formation of Hfr cells. Hfr Transfer: Cross between Hfr and F⁻ F⁻ Phenocopies (Lethal Zygotis) • Interrupted mating and Time-Of –Entry Mapping • Rate of chromosome transfer	

- Hfr mapping: Mapping of selected and “Unselected” markers
- Isolation of Hfr strain and F’ Plasmid
- Chromosome transfer mediated by F’ Plasmid (F-duction)
- Recombination In Recipient Cells. Necessity for a double exchange
- Anomalous plateau values. Efficiency of transfer from an Hfr
- Rec mutants. Other Properties Of rec Mutants
- Rec A Protein And Its Function
- Rec BCD Protein Complex (other Recombination Pathways in *E.coli*)
- Chromosome Transfer In Other Bacteria
- Conjugation in *Streptococcus faecalis* system

3. Bacterial Transduction

(09)

- Generalized Transduction
- Cotransduction And Linkage
- Mapping by Cotransduction
- Specialized Transduction
 - i. Formation of specialized transducing particles from a λ lysogen
 - ii. Specialized transduction of a nonlysogen
 - iii. Specialized transduction of a lysogen
 - iv. High frequency transducing lysates
- Specialized Transducing Phage as a cloning vehicle
- Transduction and phage conversion

II Regulation of Gene Expression in Bacteria.

16

1. Concept of Operon

2. Lactose Operon

- Structure of Lactose operon
- Regulation of *lac* system : Repression, Allolactose, role of cAMP
- Lac mutants
- Isolation of mutants in *lac* operon
- Differential Translation of the genes in *lac* m RNA
- Positive and negative regulation of the *lac* operon

3. Arabinose Operon

- Structure of Arabinose n operon
- Regulation of *Ara* system: Repression
- Regulation of *Ara* system at different concentration of arabinose
- Positive regulation of the *Ara* operon
- Double regulation by repressor

4. Typtophan Operon

- Regulation Of A Biosynthetic Pathway
- Structure of Tryptophan operon
- Regulation of *Trp* system at different conc of tryppyophan
- Autoregulation
- Repression Vs Attenuation
- Antitermination

III Transposable Elements

08

- Insertion sequences
- Structure of Transposable elements
- Transposon terminology
- Types of bacterial transposones
- Transposition
- Simple transposition
- Duplication of a target sequence at an insertion site
- Replicative transposition
- Mechanism of replicative transposition (J. Shapiro's Model)
- Excision of transposons
- Genetic phenomena mediated by transposons in bacteria
- Transposons and evolution

IV Genetics of *Streptomyces coelicolor*

06

- Life cycle of *Streptomyces coelicolor*.
- Three fertility types of *Streptomyces coelicolor*.
- Characters of different crosses

- Different plasmids of *Streptomyces coelicolor*.
- Preliminary detection of linkage
- 4 on 4 Test
- Sequencing of new markers
- Estimation of map distances
- Fine genetic analysis
- Non selective analysis

References

1. Norris , J.R. and D.W. Ribbons . (1972).Methods in Microbiology,Volume 7, Part Academic Press .
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5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and company, New York.
6. Russel. P.J. (2006) Genetics: A molecular Approach. 2nd Edition. Pearson Benjamin Cummings.
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11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell publishing.
12. Watson , J. D. (2007) Recombinant DNA: Genes and Genomes: A Short Course Publisher, W. H. Freeman, Edinburgh: Blackwell Scientific Publications.
13. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford- by Prentice Hall.

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T.Y. B .Sc.(Microbiology) – 2014 Course

SEMISTER V

MB – 56 Enzyme Kinetics and Regulation

Course Content	Total Lectures
I. Enzymes as biocatalysts: review	02
II. Structure and function of enzymes	08
1. Monomeric enzymes. • Characteristics of monomeric enzymes. • The serine proteases. • Function	
2. Oligomeric enzymes. • Characteristics of Oligomeric enzymes • Tryptophan synthetase • Lactose synthase • Function	
3. Multimeric enzymes • Characteristics of multimeric enzymes • Pyruvate dehydrogenase • Functions	
III. Regulatory enzymes and mechanism of regulation.	10
1. Allosteric enzymes • Structure • Co-operativity • WMC model, symmetry model and sequential model • Kinetic behavior of allosteric enzymes • K- enzymes and M-enzymes i. ATCase.	
2. Covalently modulated regulatory enzymes • Glycogen phosphorylase enzymes	

- Glutamine synthase
- .
- 3. Covalent activation of zymogens.
 - Stomach / duodenal enzymes.
- 4. Feedback inhibition
 - Concerted, Cumulative, Sequential regulation
- 5 .Isozymes
 - Concept , functioning and significance
 - Identification of isozyme forms
 - Lactate dehydrogenase

IV. Coenzymes.

06

- 1 .Involvement of coenzymes in enzymes catalysed reactions.
 - Riboflavin (vit. B₂) & the flavin nucleotides.
 - Thiamine (vit B₁) & Thiamine pyrophosphate.
 - Pantothenic acid and Coenzyme A.
 - Vitamin B₆ & Pyridoxine coenzymes

V. Isolation, purification and characterization of enzymes.

10

1. Methods of isolation.
2. Principles of enzyme purification.
3. Methods of purification based on.
 - Molecular size:
 - i. Dialysis
 - ii. Gel exclusion chromatography
 - iii. centrifugation
 - Solubility differences.
 - Electric charge.
 - i. Ion exchange chromatography
 - ii. Electrophoresis
 - iii. IEF
 - Specific binding property and selective adsorption.
 - i. Affinity chromatography

- Criteria for purity.
- Determining molecular weight of protein

VI. Enzyme assays. 08

Principles of enzyme assays.

1. Assay techniques with suitable examples.
 - Electrode method
 - Manometric
 - Spectrophotometric
 - Fluorescence spectroscopic
 - Radiochemical assay
 - Coupled kinetic assay

VII. Immobilization 04

1. Immobilization of enzymes various methods
2. Immobilization of whole cells
3. Applications of immobilized enzymes

VIII. Enzyme kinetics. 12

1. The concept and use of initial velocity
2. The Michaelis – Menten equation for initial velocity of single substrate enzyme catalyzed reaction.
3. Briggs' and Haldane modification of Michaelis – Menten equation.
4. Michaelis Menten plot and its significance.
5. Transformations of the Michaelis Menten equation for plotting kinetic data.
 - The Lineweaver & Burk plot.
6. Reversible enzyme inhibitions.
 - Competitive.
 - Uncompetitive.
 - Noncompetitive.

References :-

1. Conn, E.E. P.K., Stumpf, G. Bruening & R.H. Dol (1995) outlines of Biochemistry 5th Edition, John Wiley & sons.
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T.Y. B .Sc.(Microbiology) – 2014 Course

Semester VI

MB 61- Chemotherapy and Biomedical Instrumentation.

Course Content

Total Lectures : 60

I	Detailed study w.r.t. morphological, cultural, biochemical, antigenic properties, pathogenesis, epidemiology ,lab diagnosis of following microorganisms.	15
	1. <i>Escherichia coli.</i> 2. <i>Staphylococcus spp.</i> 3. <i>Streptococcus spp.</i> 4. <i>Treponema pallidum</i> 5. <i>Mycobacterium tuberculosis.</i>	
II	Introduction to chemotherapy.	20
	1. General Principles of Chemotherapy. 2. Mode of Action of following • Penicillin • Tetracyclin • Acyclovir • Rifampicin • Actinomycin D • Griseofulvin • Nystatin • Sulfonamides • Zidovudine (Azidothymidine) • Sulphated polysaccharides	
III	Mechanism of the drug resistance for the above drugs.	05
IV	Causes of Variable and Unpredictable Drug Response	05

V Single Nucleotide Polymorphisms (SNPs) in Human Genome Project with reference to its significance in Medical Microbiology. 03

VI Biomedical instrumentation & measurements:-

Principle and use of following biomedical instruments – 12

1. Blood cell counter,
 - Conductivity (Coulter) type.
 - Dark field type.
2. Electrocardiograph (ECG Transducer)
3. EEG Transducer
4. Sphygmomanometer.

References :-

1. David G.C.P. Richard & J.F. Peuther , 1989 , Medical Microbiology Churchill Livingstone Edinburgh. **(Topic I)**
2. David H. Persing et.al. Molecular Microbiology :,Diagnostic Principles and Practice 2004, ASM Press Washington DC,USA. **(Topics IV and V)**
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8. Rajan S.2012, Medical Microbiology,MJP Publishers,Chennai,India. **(Topic I)**
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T.Y. B .Sc.(Microbiology) – 2014 Course

Semester VI

MB -62 Immunology

Course Content

Total Lectures :- 60

I. Antigen :- 10

- Concept of Epitope,
- Types of Epitope,
- Carrier molecule,
- Factors affecting antigenicity.

II. Antibody :- 10

- Concept of paratope,
- Allotypes of immunoglobulin,
- Concept of idiotopes and idiotype,
- Early Hypothesis for antibody formation,
- Direct Template Theory for antibody formation,
- Indirect Template Theory for antibody formation,
- Burnet's Clonal Selection Theory for antibody formation,
- Cellular Mechanism of Antibody formation
 - i) Antigen Presentation
 - ii) Cytokine Signaling for Antibody formation
 - iii) Antibody Production

III. Cells of the immune system :- 06

- Cytology & functions of Microphages,
- Cytology & functions of
 - i. T-cells,
 - ii. B-cells,
 - iii. NK cells.

IV. Cytokines :- **05**

- Interleukin 1,
- Interleukin 10,
- Tumor Necrosis Factor (TNF),
- Interferons
 - i. α Interferons
 - ii. β Interferons
 - iii. γ . Interferon

V. Serology :- **15**

- Agglutination,
- Immunodiffusion
 - i. Oudin Tube Technique,
 - ii. SRID,
 - iii. Ouchterlony Technique
- Immunoelectrophoresis
 - i. Qualitative Immunoelectrophoresis,
 - ii. Cross Over Electrophoresis and forensic science,
 - iii. Laurell's rocket electrophoresis,
- Radioimmunoassay and its applications
- Immunofluorescence
 - i. Direct,
 - ii. Indirect,
 - iii. Substrate labelled florescent immunoassay
 - iv. Delayed enhanced lanthanide fluorescence immunoassay,
- ELISA
 - i. Direct,
 - ii. Indirect

VI. Hypersensitivity :- **08**

- Mechanism & Examples of
 - i. Type – I Hypersensitivity

- ii. Type – II Hypersensitivity,
- iii. Type – III Hypersensitivity,
- iv. Type – IV Hypersensitivity.

VII. Concept of Monoclonal antibodies, their production and Applications 05

References

1. Abul K. Abbas, 2006, **Cellular and Molecular Immunology** 5th Edition ,ELSEVIER Saunders Publications ,An imprint of Elsevier, Philadelphia., USA, (Topics IV, VI and VII)
2. David male, Jonathan Brostoff , David B Roth, Ivan Roitt, 2006, **Immunology**, 7th edition Mosby ELSEVIER,Canada. (Topics I, II and III)
3. Ian R Tizard 2004, **Immunology**, An introduction, 4th Edition, Saunders College Publishing. U.K. (Topics III, IV and VI)
4. Ivan M. Roitt,Peter J.Delves, 2001, **Roitt's Essential Immunonology**,10th Edition, 2001, Blackwell publishing Company, USA. (Topics III and VI)
5. Joshi K.R. & N.O. Osamo 2004, **Immunology**, 5th edition, Agro Botanical, Publishers, Jodhpur, India. (Topic V)
6. Keith Wilson & John Walker (Ed.) 2005, **Principles & Techniques of Biochemistry and Molecular Biology**, Cambridge University Press, New York, USA. (Topics V and VII)
7. Shetty Nandini 2006, **Immunology... Introductory Textbook**, New Age International Publishers New Delhi, India. (Topic II)
8. Stites D.P. & A.I. Terr 1990, **Basic & Clinical Immunology**, Prentice Hall, New York (Topics III)
9. Thomas J. Kindt et.al.2007, **Kuby Immunology**, Sixth Edition, W.H.Freeman and Company, New York,USA. (Topics IV and VI)

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T. Y.B. Sc. (Microbiology) – 2014 Course

Semester – VI

MB-63- Biotechnology

Course Content

Total – 60 Lectures

	Lectures
I Classical Fermentations	14
1 Alcohol (Ethyl alcohol)	
2 Wines	
3 Organic Acid – Citric acid,	
4 Microbial enzyme – Amylases	
5 Vitamin – vitamin B ₁₂	
6 Amino acid – Lysine	
7 Biomass production – yeast Biomass – Baker's and Distillers Yeast	
II Strain Improvement	08
(Techniques with suitable examples)	
1 Mutation approach	
• Use of auxotrophic, resistant and revertant mutants for the production of primary and secondary metabolites.	
2 Recombination techniques	
• Protoplast fusion technique.	
• Genetic manipulation technique.	
III Recovery and purification of fermentation products.	14
1. Foam separation.	
2. Precipitation.	
3. Filtration and Ultrafiltration.	
4. Centrifugation.	

	5. Solvent extraction.	
	6. Solvent recovery.	
	7. Adsorption and elution.	
	8. Drying.	
	9. Crystallization.	
IV	Detection and assay of fermentation products.	08
	1. Chromatographic assays.	
	2. Biological assays.	
V	Quality Control.	10
	1. Chemical Assay	
	2. Pyrogen testing	
	3. Sterility testing	
	4. Carcinogenicity testing-Ames Test	
	5. Toxicity testing	
	6. Allergy testing	
VI	Fermentation Economics	02
	1. Market potential.	
	2. Fermentation and Product recovery costs.	
	3. Patents and Secret Processes.	04
	• History of patent concept.	
	• Subject Matter and characterization of a patent.	
	• Inventor.	
	• Patents in India and other countries.	

References :

- 1 Casida L.E. Jr. (1983) – Industrial Microbiology, Wiley Eastern Limited, New Delhi.
- 2 Hunt, R and J Shelly (1995) – Computer and common sense, 4th edition, Prentice – Hall of India Private Ltd., New Delhi.
- 3 MousamiDebanth (2005) – Tools and Techniques in Biotechnology, Pointer Publishers, New Delhi.
- 4 Patel A.H. (1985) – Industrial Microbiology Mac Millan India Ltd., New Delhi.
- 5 Peppler H.H. (Ed) (1979) – Microbial Technology Vol. I and II, UU Academic Press, New York.
- 6 PepplerPeriman II (Ed) (2004) – Microbial Technology, Microbial Processes:Vol I and II Academic Press : Published by Elsevier.
- 7 Presscott S.C. and C.G. Dunn (1983) Industrial Microbiology, 4th edition,Edited by Genald Reed. AVI Tech Books USA.
- 8 Rajaraman V. (1996) – Fundamentals of Computers, 2nd edition, Prentice – Hall of India Private Ltd., New Delhi.
- 9 Stanbury P.F. and A Whiteker (1984) – Principles of Fermentation Technology, Pergamon, New York.
- 10 Subbarao, N.S. (1993) – Biofertilizers in Agriculture and Forestry, 3rd edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

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T.Y.B. Sc. (Microbiology) – 2014 Course
Semester – VI
MB-64- Agricultural and Environmental Microbiology

Course Content

Total – 60 Lectures

	Lectures
I Fertile soil and sustainable agriculture.	20
1. The basis of sustained fertility of soil.	
2. Wastage and degeneration of soil due to modern agriculture practices.	
3. Soil pollution and soil sickness.	
4. Conservation of soil.	
• Soil quality monitoring –	
i. Temperature, soil color, texture and structure – density and porosity, moisture, pH, salinity, organic matter and toxic material content.	
ii. Biomonitoring –	
a. A concept – basis of biomonitoring.	
b. Advantages and disadvantages of biomonitoring.	
• Bioremediation.	
i. Microbial approach in remediation of contaminated soils.	
ii. Micro-organisms in Bioremediation.	
iii. Biostimulation and augmentation	
• Sustainable Agriculture.	
i. Transforming intensive Agriculture into a sustainable system.	
ii. Microbial approach – Microbial inoculation.	
iii. Transformation of C, N& S compounds in nature.	

iv. Recycling of agriculture waste :-

Composting – Materials for composting, types of composting, composting process and Methods.

v. Biopesticides :-

a. Historical Background.

b. Bio-control agents – Bacteria, fungi and viruses

c. Applications.

- **Biogas**

i. Anaerobic treatment for Biogas Generation.

ii. Microbiology of process and interactions between microbial groups. Biochemistry of biogas generation

iii. Designs of digester and distribution of anaerobic microorganisms.

iv. KVIC Model: Structure of Biogas plant for urban domestic waste management.

v. Applications.

II Geomicrobiology 10

1 Scope of Geomicrobiology

2 *In-situ process :-*

Bioleaching and beneficiation process

3 Copper leaching.

III Water. 20

1. **Definition and types of pollution**

2. **Entry of pollutants in Biosphere:-**

3. **Effect of various pollutants on water or Biosphere.**

- Organic pollutant.
- Inorganic pollutant.
- Radioactive pollutant
- Petroleum and Oil pollutant

4. Factors affecting biodegradation:-

- Organic matter content.
- Oxygen and other environmental factors.
- Contaminant structure.

5. Marine pollution.

- Sources of marine pollution.
- Point sources.
- Non point sources.
- Types of marine pollution.
- Efforts to control and protect marine environment.
- Microbial approach in remediation of oil contaminated marine sites.

IV Microbes as plant pathogens

10

- 1 Historical background.
- 2 Host parasite relationship.
- 3 Diseases – Citrus canker & TMV:- Causative agent, Symptoms and physiology of disease, Mode of entry of pathogen and Control measures.

References :

- 1 Mukherjee N and T Ghosh (1995) Agricultural Microbiology – 1stedn. Kalyani publishers, New Delhi.
- 2 Maier R.M. Pepper I.L. Gerba C.P. (2004), Environmental Microbiology, Academic Press.
- 3 Ranade D.R. & Gadre R.V. (1988) Microbiology: Laboratory aspects of anaerobic digestion, Laboratory Manual, MACS, Pune.
- 4 Rutledge C.R. and Kristiansen science, Basic Biotechnology, 2ndEdn., Cambridge University Press.
- 5 Rao. C.S. (1991), Environmental pollution control engineering, Widely Eastern Limited, New Delhi

- 6** Rana SVS, (2006), Environmental Pollution, Health and Toxicology, Narosa publishing House, New Delhi.
- 7** Sharma B.K. and Kaur H. (1994) Water pollution. Goel Publishing House, Merrut.
- 8** Subbarao N.S. (1995) 3rd edition, Biofertilizers in Agriculture and Forestry, Oxford and IBH Publishers, New Delhi.
- 9** Thakur Indu (2006) Environmental Biotechnology., I.K. International Pvt. Ltd., New Delhi.
- 10** Rittmann B.E. and McCarty L. (2001) Environmental Biotechnology – Principles and Application, McGrawHill International Editions, Biological Sciences Series.
- 11** Subba Rao, N.S. (1999), Soil Microbiology 4th Edn Soil Microorganisms and Plant growth, Oxford and IBH publishers, New Delhi.

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T.Y. B .Sc.(Microbiology) – 2014 Course

Section VI

MB – 65 Genetics of Eukaryotes and Gene Manipulation

Course Content

Total Lectures :- 60

I Extra nuclear Inheritance. 30

1. In Eukaryotes. (Non mendelian inheritance.)

- Rules of Extra nuclear inheritance.
- Organization of Extra nuclear Genomes.
- Origin of Mitochondria and chloroplast.
- Mitochondrial Genome.
- Chloroplast Genome.
- Other Examples of Extra nuclear inheritance.
 - i. Chloroplasts in 4'o clock plant and corn.
 - ii. Streptomycin resistance in *Chlamydomonas*
 - iii. Respiratory deficiencies—Petites in yeast *Saccaromyces cerevisiae*
 - iv. Poky mutants in *Neurospora crassa*.
 - v. Human genetic diseases and mitochondrial DNA defects

2 Infectious heredity

- killer yeast.
- Killer Paramoecia

3 Maternal effect. Examples:

- Pigmentation in Flour moth,
- Inheritance of coiling in some snails
- Maternal effects in humans

II. Linkage and mapping in Eukaryotes (Haploid mapping) 10

1. Tetrad Analysis in *Neurospora crassa*.

- Life cycle of *Neurospora crassa*.
- Cross over events: single and double.

- i. Strands involved-
- ii. two strand double,
- iii. three strand double,
- iv. four strand double
- v. segregation pattern revealed by tetrad analysis.
- Arrangement of ascospores with respect to mating types
- Calculating Gene – centromere distance in organisms with linear Tetrads :
Based on PD's, NPD's, and T's
- Using Tetrad Analysis to map Two Linked Genes.

2 Mitotic Recombination in *Aspergillus nidulans*

- Parasexual cycle
- Discovery of mitotic Recombination.
- Heterokaryon formation
- Mechanism of mitotic crossing over.
- Mapping by Mitotic Recombination in *Aspergillus nidulans*.

III Recombinant DNA technology.

20

1. Introduction-Historical: Asilomer conference and NIH guidelines

2. Cutting DNA molecules

- Nucleases cut Nucleic Acids.
- Restriction and modification of DNA.
- Recognition of DNA by Restriction Endonucleases.
- Naming of Restriction enzymes
- Cutting of DNA by Restriction Enzymes
- Types of Restriction Enzymes

3. Joining DNA molecules

- Joining of DNA fragments by DNA ligases
- Joining of DNA fragments by addition of homopolymers
- Blunt end ligation-T4 ligase
- Linkers and Adaptors

4. Cloning vectors.

- Plasmid detail studies
 - General properties of plasmids
 - Detection of Plasmids
 - Purification of Plasmid DNA
 - *In Vitro* Plasmid Transfer
 - i. Chemical transformation
 - ii. Electrotransformation
 - Plasmid Replication
 - i. Use of host proteins in plasmid replication
 - ii. Control of copy number , Control of Copy Number by Antisense RNA
 - iii. Plasmid amplification
 - iv Plasmid families and Incompatibility
 - v *The par systems* – incompatibility – Maintaining plasmids belonging to the same incompatibility group.
 - vi. Replication inhibition by acridines
 - Partitioning Of Plasmids At Cell Division
 - Properties Of Particular Bacterial Plasmids
 - i. F Plasmids
 - ii. Drug resistance plasmids
 - iii. Colicinogenic plasmids
 - iv. *Agrobacterium* plasmid Ti
 - v. Broad host range plasmid
 - vi. Other plasmids
 - Advantages plasmids attribute to the host cells and some aggressive characters. .
-
- Multicopy plasmid vectors.
 - Inserting Genes into Vectors.
 - 4. Detecting Insertions in vectors.

- Moving genes between organisms : Shuttle vectors
- Bacteriophage Lambda vectors.
- Cosmid vectors
- Yeast Artificial chromosomes.
- Bacterial and P1 Artificial chromosomes.

5. Cloning Strategies

- Methods of construction of rDNA's by shot gun, mRNA, Blunt end ligation
- Cloning Genomic DNA
- cDNA cloning
- Genomic library and c DNA library
- Screening Strategies

6 Basic Techniques

- Agarose Gel Electrophoresis
- Blotting techniques
- Transformation in suitable host
- Polymerase Chain Reaction.

7 Sequencing and mutagenesis

- Basic DNA sequencing
- DNA sequencing techniques
- Analysing sequence data
- Changing genes-site directed mutagenesis.

8.Applications of Recombinant DNA Technology.

- Nucleic acid sequences as diagnostic tools
- New drugs and new therapies for genetic diseases
- Combating infectious diseases
- Protein Engineering
- Metabolic Engineering
- Biotechnology: Commercial Products.
- Synthetic and edible vaccines

- Genetic Engineering of plants and animals
 - i. Plants as bioreactors
 - ii. Animals as bioreactors
- Transgenic plants and animals.

References.

1. Norris , J.R. and D.W. Ribbons . (1972).Methods in Microbiology,Volume 7, Part Academic Press .
2. Clark D. P. (2005) Molecular Biology. Understanding the Genetic Revolution. Elsevier publishers.
3. David A. Jackson, Stephen P. Stitch, (1979). Recombinant DNA Debate
4. Hartl. D.L. E.W. Jones. (1999) Essential Genetics, 2nd Edition. Jones and Bartlett publishes. Sudbury Massachusetts.
5. Pierce B. A. (2005) Genetics a conceptual approach. 2nd Edition W.H. Freeman and company, New York.
6. Russel. P.J. (2006) Genetics: A molecular Approach. 2nd Edition. Pearson Benjamin Cummings.
7. Russet P.J. (1998) Genetics fifth. Edition. Addison Wesley Longman. Inc.
8. Snyder L and W. Champness (2003) Molecular Genetics of Bacteria Second Edition. ASM Press. Washing ton D.C.
9. Stanley R. Maloy, John E. Cronan, David Freifelder (1994) . Microbial Genetics Jones and Bartlett Publishers.
10. Tamarin R.H. (2003) Principles of Genetics, 2nd Edition. Tata McGraw Hill Edition.
11. Trun N and J Trempy (2004) Fundamental Bacterial Genetics. Blackwell publishing.
12. Watson , J. D. (2007) Recombinant DNA: Genes and Genomes: A Short Course Publisher, W. H. Freeman, Edinburgh: Blackwell Scientific Publications.
13. William Hayes, The Genetics of Bacteria and their Viruses (1968) 2nd Edition Oxford- by Prentice Hall.
14. Jackson A. , Stephen P. Stitch .(1979). Recombinant DNA Debate by David Prentice Hall.

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T.Y. B . Sc. (Microbiology) – 2014 Course

Semester VI

MB – 66 Microbial Metabolism and Biochemical Evolution.

Course Content	Total 60 Lectures
I. Introduction to metabolism	02
II. Bioenergetic considerations	08
• Laws of thermodynamics, free energy, standard free energy change, additive nature of standard free energy charge, enthalpy and entropy. • High energy compounds • Electron transport chain components and electron flow: i. Electron carrier Complex I ii. Electron carrier Complex II iii. Electron carrier Complex III iv. Electron carrier Complex IV • Bioluminescence, Role of luciferase and biochemistry of bioluminescence.	
III. Biological membranes & transport mechanisms.	10
An overview of Biological membranes structure	
• Functions of Membrane i. Transport mechanisms. a) Passive transport – Diffusion, Osmosis, facilitated transport. b) Active transport – Transport systems in bacteria. c) Group translocation – Group translocation of sugars into bacteria. d) Ionophores. ii. Signal transduction: concept	
IV. Degradative pathway and its relations to TCA	12
Overview of TCA cycle	
• Anaplerotic sequences. • Amphibolism • Degradation of fatty acids	

- i. Mechanism of acetyl CoA formation from fatty acids
 - ii. Transport of fatty acyl CoA derivative into mitochondria
 - iii. Beta oxidation
 - iv. Fate of acetyl CoA derived from fat breakdown
 - v. Peroxisomal oxidation of fatty acids
- Degradation of amino acids
 - i. Aspects of amino acid metabolism
 - ii. Deamination of amino acids
 - iii. Fate of keto acids formed after deamination
- Stickland reaction.

V. Biosynthesis and assimilation

- 18** Methods of studying Biosynthesis
- i. Use of biochemical mutants.
 - ii. Use of isotopic labeling.
 - Scheme of synthesis and control of Nucleotides.
 - i. Synthesis of purine nucleotide.
 - ii. Synthesis of pyrimidine nucleotides.
 - The synthesis of Amino acids & other nitrogenous cell constituents.
 - i. Synthesis of glutamic acid
 - ii. Synthesis of aspartic acid
 - iii. Synthesis of glycine
 - iv. Synthesis of serine & pyruvate
 - v. Synthesis of other molecules from amino acids
 - The synthesis of lipid constituents from acetate.
 - i. Role of Acetic acid as precursor of lipids
 - ii. Acyl carrier protein and β - keto acyl synthase
 - iii. The synthesis of fatty acids: source of acetyl groups and reducing equivalents
 - iv. FAS System
 - v. Synthesis of triacylglycerol
 - vi. Synthesis of glycerophospholipids

- vii. Synthesis of new membrane lipid bilayer.
- Synthesis of proteins.
 - i. Initiation
 - ii. Elongation
 - iii. Translocation
 - iv. Termination (p80 and c55)
 - v. Antibiotics inhibiting protein synthesis
- The synthesis of oligosaccharides and polysaccharides.
 - i. Synthesis of starch
 - ii. Synthesis of glycogen
 - iii. Regulation of glycogen synthesis
- The synthesis of peptidoglycan.
- The synthesis of isoprenoids
 - i. Isoprene formation
 - ii. Polyprenyl compounds
 - iii. Carotene formation

VI. Biochemistry of biological nitrogen fixation.

05

- Nitrogen fixing mechanisms
- Nitrogenase complex
- Nitrate respiration

VII. Biochemical Evolution.

05

The primordial cloud theory.

- Primitive atmosphere & primitive seas.
- Monomer formation.
- Periodic condensing agents.
- Periodic formation of polypeptides.
- The periodic origin of enzymatic activity.
- The prebiotic origin of nucleotides & Nucleic acids.
- Coacervate droplets.

- The gene hypothesis : Life without proteins
- Later stages in biochemical evolution

References :-

1. Conn, E.E. P.K., Stumpf, G. Bruening & R.H. Dol (1995) outlines of Biochemistry 5th Edition, John Wiley & sons.
2. David E. Metzler, Vol I & II second edition (2006) Biochemistry "The chemical Reactions of living cells" "Academic Press"
3. David Nelson & Michael M. Cox (2007) "Lehninger"- 4th edition. 'Principles of Biochemistry' Publisher – Sara Tenney W.H. Freeman & company.
4. Doelle, H.M. (1975) "Bacterial Metabolism" Academic Press. Inc. Ltd. London.
5. Foster, R.L. (1980) The Nature of enzymology Croon Helm Ltd. London.
6. Lehninger, A.L. (1975) – Biochemistry 2nd edition. Kalyani publisher, New Delhi.
7. Lehninger A.L. David L. Nelson & M. M. Cox. (1992) "Principles of Biochemistry" 2nd edition, Publisher – CBS publishers.
8. Mathews. K.K.E. Van Holde (1996) "Biochemistry" – II Edition. The Benjamin / Cummins Publishing company. Inc.
9. Palmer T. (1995) "Understanding enzymes" 4th Edition, Ellis Horwood Ltd. Publishers. John Wiley & sons. New York Chichester, Brisbane, Toronto.
10. Stanier, R.Y. J.N. Ingraham M.L. Wheelis & P. R. Painter (1995) – General Microbiology, 5th edition, Macmillan Press Ltd.
11. Stryer L. (1995) Biochemistry, 4th Edition, W.H. Freeman & company New York.
12. Subbarao, N.S. (1979) Recent advances in biological nitrogen fixation. Oxford IBH publishing Co. Private Ltd, New Delhi.
13. Wilson and J. Walker, Cambridge University "Principles and techniques at Practical Biochemistry."

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T.Y. B .Sc.(Microbiology) – 2014 Course
Practical Course
MB III Medical Microbiology and Immunology
Total number of Experiment: 30

1. Identification of Human Staphylococcal pathogens.	3
a. Coagulase Test.	
b. DNA ase Test.	
2. Isolation and Identification of Gram negative Intestinal pathogens- <i>E.coli, Salmonella.</i>	4
3. Isolation and Identification of Urinary Tract pathogens- <i>Proteus, Pseudomonas.</i>	4
4. Slide Agglutination Test : Serological typing.	3
a. Blood grouping ABO and Rh. II	
b. Tube Agglutination Test: The Widal Test	
c. Rapid Plasma Reagin Test (for diagnosis of Syphilis)	
5. Identification of an Antigen – Antibody complex by	2
a. Gel diffusion analysis (Immunodifusion or ouchterlony plate method)	
b. The Ring Test	
6. Enzyme Linked Immunosorbent Assay (Demonstration)	1
7. Total Blood cell count – WBC, RBC, platelet.	3
8. Differential blood count	1
9. Estimation of Total Hemoglobin	1
10. Determination of ESR and PCV	1
11. RBC indices and its significance	1
12. Determination of Koch postulates by using a pathogen either on plant or animal.	3
13. Determination of antibiotic peak levels attained in body fluids.	3

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T.Y. B .Sc.(Microbiology) – 2014 Course

Practical Course

MB IV Applied Industrial and Environmental Microbiology

Total number of Experiment : 30

A]	A Milk Microbiology	5
	1. Dye Reduction tests – Methylene Blue and Resazurin	
	2. Test for Mastitis.	
	3. TVC of milk.	
	5. Specific gravity of milk.	
	6. Direct microscopic count.	
	7. Estimation of fat content of milk.	
B]	Microbiology of Food.	6
	1. TVC of Food.	
	2. Preparation of fermentated products (curd, Idli batter) and Isolation of Lactic cultures.	
	3. Isolation of Anaerobes	
C]	Microbiology of soil.	7
	1. TVC : estimation of R:S ratio	
	2. Isolation of Rhizobia from root nodules.	
	3. Isolation of Azotobacter	
	4. Preparation of Biofertilizers.	
D]	Plant Pathology.	4
	1. Enrichment of Xanthomonas and its isolation.	
	2 Spot test to detect the presence of plant pathogenic bacteria	
	a) Detection of PHB granules – Nile blue staining Sudan Black Staining.	
	b) Detection of EPS	
E]	Study of Fungi	2
	1 . Culture of Baker's yeast – with different carbon and energy sources.	
	2. Slide culture technique	

- 1 . Production , estimation and tests of Citric acid.or wine
2. Microbiological Assays of
 - a)Vitamin- B₁₂
 - b)Antibiotic- Penicillin and or Streptomycin

References :-

- 1) Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
- 2) Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.
- 3) Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th Edition.
- 4) Cruickshank R and J.P. Duguid (1980) Medical Microbiology Volume II, 12th Edition. The Practice of Medical Microbiology, Churchill Livingstone Edinburgh, London and New York.
- 5) Dubey, R.C. and Maheshwari, D. K. (2002). Practical Microbiology . S Chand and Company Pvt Ltd.
- 6) Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
- 7) Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
- 8) Sawhney, S.K. and Singh, R. (1999). Introductory Practical Biochemistry. Narosa Publishing House.
- 9) Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

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T.Y. B .Sc. (Microbiology) – 2014 Course

Practical Course

MB V- Genetics & Biochemistry

Total number of Experiment: 30

1. UV survival curve.	2
2. Isolation of bacteriophage	2
3. Gel Electrophoresis – Isolation of DNA and Plasmids (demonstration)	2
4. Polyacrylamide Gel electrophoresis-Isolation of protein (demonstration)	1
5. Bacterial conjugation (demonstration)	1
6. Bacterial transformation (demonstration)	1
7. Polyploidy (demonstration)	1
8. Phosphatase test.	1
9. Amylase assay.	3
10. Effect of different parameters on amylase activity.	3
11. Estimation of serum Glucose.	1
12. Estimation of serum Urea.	1
13. Estimation of serum Cholesterol	1
14. Estimation of serum Protein	1
15. Estimation of serum Bilirubin and or SGOT/SGPT	3
16. Estimation of Riboflavin in human urine	1
17. Detection of iron in food stuff by α,α' dipyridyl method	2
18. Detection of niacin in food stuff.	1
19. Assessment of antibiotic like substances from culture filtrate	2

References :-

- 10) Benson H.J. (1990) Microbiological Applications A Laboratory manual in General Microbiology, 5th Edition Wm. C Brown Publisher.
- 11) Bradshaw L. Jack (1979) Laboratory Microbiology, Third Edition W.B. Saunders co Philadelphia, London, Toronto.

- 12) Cappuccino J.G. and N. Sherma (2004) Microbiology A Laboratory manual 6th Edition.
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- 15) Mukherjee K.L. Medical Laboratory Technology – A practical Manual for routine diagnostic tests – Volume I to Volume III. Tata MacGraw Hill Company.
- 16) Pelczar M.J. and E.C. Schan (1972) Laboratory. Exercise in Microbiology 3rd Edition (Practical Manual Tata MacGraw Hill) Edition New Delhi.
- 17) Sawhney, S.K. and Singh, R. (1999). Introductory Practical Biochemistry. Narosa Publishing House.
- 18) Sharma K. (2005) Manual of Microbiology Tools & Techniques Ane Book New Delhi.

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“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,

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BACHELOR OF SCIENCE (B.Sc. PHYSICS) PROGRAME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

To Be Implemented From Academic Year 2016-17

F.Y.B.Sc. (PHYSICS)
SEM.-I (CBCS-2016)
P - 11: MECHANICS & PROPERTIES OF MATTER

Total Credits: 36

1. NEWTON'S LAWS OF MOTION: (6)

Revision of Laws of motion, Various types of forces in nature (explanation) and concept of field, Equation of motion of a particle with different form of forces, Frame of reference (Inertial, Non-inertial), Pseudo Forces (e.g. Centrifugal Force), Kepler's laws (only statements)

2. MECHANICS OF PARTICLES (8)

Kinetic Energy of particle in translational and rotational motion, Work and Work-Energy Theorem, Calculation of Work done with Constant Force, Variable Force with Illustration, Conservative and Non-conservative Forces, Potential energy and conservation of Mechanical energy, Mass-energy equivalence,

3. ELASTICITY (8)

Revision of stress, strain and Hook's law, Poisson's ratio, its limiting values, Elastic constant for isotropic solid, Relation between Young modulus, Bulk Modulus and Modulus of elasticity (without derivation), Torsion of a cylinder (wire) and Torsional rigidity, To determine it by torsional oscillations, Bending of beam, Bending moment and shear force, bending equation, Cantilever: Beam supported at both the ends and loaded at the centre (double cantilever)

4. VISCOSITY (10)

Revision of Viscosity, Viscous fields and viscous force, Streamline flow and turbulent flow, streamline flow of liquid through capillary tube: Poiseuille's equation, Comparison of viscosities of liquids by Ostwald's viscometer. Effect of temperature on viscosity, Study of variation of viscosity with temperature, Bernoulli's Principle (Without Proof), Application of Bernoulli's equation i) Speed of Efflux, ii) Ventury meter, iii) Aspirator Pump, iv) Change of plane of motion of a spinning ball.

5. SURFACE TENSION (4)

Revision of Surface tension, angle contact, concept of surface tension as surface energy, surface tension by Jaeger's method, Ferguson method, Factors affecting surface tension, Applications of surface tension.

TEXT AND REFERENCE BOOKS

1. R. P. Feynman, R. B. Leighton M. Sands, " The Feynman Lectures on Physics" Vol. I (B. 1. publications, Bombay, Delhi, Calcutta, Madras).
2. Problems in Physics: P.K. Srivastava, Wiley Eastern Ltd
3. D. S. Mathur " General Properties of Matter" (Shamlal Charitable Trust, New Delhi)
4. D. Halliday and R. Resnik, " Physics Part I ".
5. A. B. Gupta, College Physics Volume 1, Book's and Allied (P) Ltd.
6. H.C. Varma, "Concept of Physics", (Bharati Bhavan Publisher)
7. Properties of Matter: D. S. Mathur, Shamlal Charitable Trust New Delhi
8. Mechanics: D.S Mathur, S Chand and Company New Delhi-5.

SEM.-I (CBCS-2016)
P-12: MODERN PHYSICS

Total Credits:36

1. ATOMS AND NUCLEI (6)

Bohr's hydrogen atomic Model (revision), Bohr's correspondence principle, discovery of neutron, Frank and Hertz experiment, Composition of nucleus, concept of mass defect and binding energy with curve, packing fraction

2. ELECTROMAGNETIC WAVES (8)

Prospective of electromagnetic waves with characteristics, electromagnetic spectrum, Planks hypothesis of photons, electromagnetic waves: Radio waves, Microwave, Infrared, Visible light, Ultraviolet, X-rays and Gamma rays with properties, Applications: microwave oven, RADAR, Pyroelectric thermometer, X-ray radiography and CT scan.

3. LASER (6)

Introduction to Lasers, properties of laser, principle with absorption, spontaneous emission and stimulated emission, optical pumping, population inversion, laser action and applications

4. PHYSICS OF MOLECULES (8)

Bonding mechanism: A Survey of Ionic bond, Covalent bonds, Van der Waals bonds, Metallic bonds and Hydrogen bond, Concept of electrostatic potential with potential energy, Variation of potential energy with inter-atomic distance

5. RENEWABLE ENERGY SOURCES (8)

Need and importance of energy sources, Different Renewable energy sources, Solar energy as a principle source, solar cell: Photovoltaic principle, construction and working of solar cell, I-V characteristics, Fill factor, efficiency of solar cell and applications.

Text and reference books

1. J. B. Rajan, "Atomic Physics"
2. A. Beiser, "Prospective of Modern Physics"
3. H. S. Mani and G. K. Mehata, " Introduction to Modern Physics"
4. F. K. Ritschmayer, " Modern Physics"
5. S. P. Sukhatme, " Solar Energy"
6. D. O. Hall and R. P. Overend, " Biomass-Renewable energy"
7. S.K.Kulkarni, Nanotechnology: Principles and Practices

F.Y.B.Sc. (PHYSICS)
SEM.-H (CBCS-2016)
P - 21 KINETIC THEORY AND THERMODYNAMICS

Total Credits:36

1 KINETIC THEORY OF GASES (9)

Review of kinetic model of an ideal gas, various equations of state, Behavior of real gases: Van-der-Waals model, Van-der-Waals equation of states, determination of Van der Waals constant, nature of Van-der-Waals forces, critical constants. Defect of Van der Waals equation, reduced equation of state, Boyle temperature.

2 THERMODYNAMICS (9)

Concept of thermodynamic state, adiabatic and isothermal thermodynamic changes, indicator diagram, adiabatic transformation and relations, work done during isothermal and adiabatic changes, first law of thermodynamics, Second law of Thermodynamics reversible and irreversible processes and illustrations.

3 HEAT ENGINES (9)

Conversion of Heat into Work and its converse, Carnot's theoretical heat engine, Camot's cycle and its efficiency, Practical heat engines; Diesel engine-construction, working, Diesel cycle and its efficiency, Otto engine -Construction, Working, Otto cycle and its efficiency, comparison of Diesel engine and Otto engine, Refrigerator.

4 ENTROPY (9)

Concept of entropy, definition of entropy, change in entropy in a reversible, irreversible and in natural processes, Determination of the change in entropy when substance heated and during change of state, temperature-entropy diagram, change of phase; First latent heat equation (Clausius-Clapeyron equation), Variation of melting point and boiling point.

TEXT AND REFERENCE BOOKS

1. M. W. Zemanasky, " Heat and Thermodynamics"
2. Saha and Shrivastava, " A Treatise on Heat".
3. Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.
4. A. B. Gupta, College Physics Volume 1, Book's and Allied (P) Ltd.
5. Heat and Thermodynamics: Brij lal, N. Subrahmanyam, S. Chand & Company Ltd, New Delhi
6. Heat and Thermodynamics: Mark. W. Zemansky, Richard H. Dittman, Seventh Edition Edition, McGraw-Hill International Editions
7. Thermodynamics and Statistical Physics: J.K. Shanna, K.K. Sarkar, Himalaya Publishing House
8. Thermal Physics (Heat & Thermodynamics): A.B. Gupta, H.P. Roy Books and Allied (P) Ltd, Calcutta.

F.Y.B.Se. (PHYSICS)
SEM.-H (CBCS-2016)
P-22: ELECTRICITY AND MAGNETISM

Total Credits: 36

1. Electrostatics **(9)**

Revision of Coulomb's law, Superposition principle, Electric field due to an electric dipole, line and disc, Revision of Gauss's law, Coulomb's law from Gauss's law, Gauss's law applications in Cylindrical, planar and spherical symmetry

2. Dielectrics **(9)**

Electric Dipole, Electric dipole and dipole moment, Electric potential and intensity at any point due to dipole, Torque on a dipole placed in an electric field, Polar and non-polar molecules, Electric polarization of dielectric material, Gauss' law in dielectric, Electric vectors and relation between them

3. Magneto statics **(9)**

1. Revision of Biot-Savart's law with examples, Amperes' law, e.g. Solenoid and Toroid, Gauss law for magnetism

4. Magnetic properties of materials **(9)**

1. Magnetic materials and Bohr magneton, Magnetization (M), magnetic intensity (H), magnetic induction (B), magnetic susceptibility and permeability, Relation between B, M and H, Hysteresis

TEXT AND REFERENCE BOOKS

1. Fundamentals of Physics: 8th Edition, Halliday Resnik and Walkar
2. Electromagnetics: B. B. Laud
3. Ritz and Milford, "Electricity and Magnetism"
4. A. S. Mahajan and A. A. Rangawala, "Electricity and Magnetism"
5. Brijal and Subramanyam, " Electricity and Electronics
6. B. L. Thareja, " Textbook of Electrical Technology"
7. S. S. Atwoods, "Electricity and Magnetism"
8. E. M. Pucell Ed, " Physics Course Vol. 1, "Electricity and Magnetism"
9. D. Haliday and R. Resnick, " Physics Volume 2"

SEM.-I (CBCS-2016)
P-1: Practical Course 4

Sem. I

1. Basic study of instruments (Vernier caliper, micrometer screw gauge, traveling microscope, spectrometer etc.) with least count, error analysis and range
2. Viscosity by flow through capillary tube (Poiseuille's method)
3. M. L of disc by Torsional oscillations and n - by torsion pendulum
4. MI of Flywheel
5. Poisson's by rubber and cord method
6. Surface tension of water by Jaeger's method
7. Verification of Kirchoff s law
8. Charging and discharging of condenser
9. Vector diagram of L-R circuit and power factor
10. Study of inductive reactance
11. Diode characteristics
12. Study of Analog/digital multi-meter
13. Comparison of capacitances (De-Sauty's method)

Sem.II

1. Y by Flat spiral spring and n by Flat spiral spring
2. Y-by bending (rectangular thin bar)
3. Specific heat of graphite by electrical method
4. Study of temperature coefficient of resistance
5. Velocity of sound in air by Kund's tube
6. Temperature coefficient of resistance
7. Study of thermocouple and determination of inversion temperature
8. Study of spectrometer (angle of prism, refractive index of glass material)
9. Calibration of spectrometer
10. LCR series resonance circuit and Q-factor
11. Frequency of A. C. using vibrating wire and magnet
12. Study of capacitive reactance
13. To determine fill factor of solar cell
14. Diode as a rectifier (Full wave and Bridge rectifier)
15. Thermal conductivity by Lee's method

Note: Eight (8) experiments should be performed from each section in a year

Text and reference books:

1. B. L. Worsnop and H. T. Flint, " Advanced Practical in Physics"
2. D. P. Khandewal, " Laboratory manual for Physics for Undergraduate students"
3. B. Saraf, Physics through experiments, vol. II

PATTERN OF THE QUESTION PAPER
BHARATI VIDYAPEETH UNIVERSITY, PUNE
F.Y.B.Sc. (PHYSICS)

(CBCS-2016)
SUBJECT CODE AND NAME

Max. Marks: - 60

Time: 3 hours

Q. 1 Attempt any Six (MCQ)

2 marks each.

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)

Q. 2 Attempt any two

12 marks.

- a)
- b)
- c)

Q. 3 Attempt any two

12 marks.

- a)
- b)
- c)

Q. 4 Attempt any Two

12 marks.

- a)
- b)
- c)

Q. 5 Attempt any Two

12 marks.

- a)
- b)
- c)



BHARATI VIDYAPEETH UNIVERSITY, PUNE

Faculty of Science

Revised Syllabus for

S.Y.B.Sc. Semester III & Semester IV

In Physics

(To be implemented from Academic Year 2015-2016 and onwards)

(2014 Course)

Bharati Vidyapeeth University, Pune
Proposed Course Structure for Bachelor of Science (S.Y.B.Sc.)
In Physics (Semester Pattern)
(To be implemented from Academic Year 2015-2016 and onwards)
(Equivalence of Courses in 2014 pattern with 2010 pattern)

Semester III

Paper	Title	Marks	Contact hrs/ week
PHY-31	Mathematical Methods For Physics	50	04
PHY-32	Optics	50	04

Semester IV

Paper	Title	Marks	Contact hrs/ week
PHY-41	Waves & Oscillations	50	04
PHY-42	Electronics	50	04

Practical Course (Annual)

PHY-II	Practical	100	04 per student

A) Pattern of Examination for S. Y. B. Sc.

- 1) There shall be university examination at the end of semester for 40 marks for each theory paper.
- 2) 10 marks for each paper are allotted to the comprehensive internal assessment of the student by the respective teacher, teaching the course.
- 3) University Practical examination be conducted at the end of the academic year 80 marks be assigned to practical's and 20 marks for internal examination, journal attendance (Journal 10 marks, Oral 10 marks).

B) For practical examination:

- 1) At least one examiner should be external
- 2) Certified journals be compulsory
- 3) There shall be two (internal and external) experts for all subjects.

C) Pattern of the Question paper:

For University examination theory paper shall be as follows. (40 marks, Time allotted: 2 hrs)

- 1). Q1, Q2 and Q3: (10 Marks for each questions) Three sub questions. Students have to attempt any two questions.
- 2). Q4:7 sub-question. Students have to attempt any five questions each for 2 marks. Sub questions be answerable within 2 to 4 lines and shall be based on complete syllabus.

D) Standard of Passing: 40 % marks

- E) **Equivalence** of previous syllabus (2010 course) along with propose syllabus: The papers are similar so no equivalence is required at B. Sc. level.

S. Y. B. Se. (Physics) Sem. - III
(2014 Course)
PH31: MATHEMATICAL METHODS FOR PHYSICS

1. Complex Algebra: (14 Lectures)

Complex Numbers, algebra of complex numbers, complex conjugate. Argand Diagram, Algebra of complex numbers by using Argand diagrams; Rectangular and polar form of complex numbers; Exponential form of complex numbers; Euler's relations De-Moivre's theorem (statement only), Trigonometric functions; exponential and hyperbolic functions, powers and roots of complex numbers; Applications of complex numbers to determine velocity and acceleration in Curved motion, Problems.

2. Partial Differentiation: (14 Lectures)

Definition of partial differentiation, total differential, exact differential, chain rule, implicit and explicit functions, Theorems of differentiation, change of variables from the Cartesian to Spherical polar co-ordinates, maxima and minima (Qualitative treatment), Problems

3. Vector Algebra (8 Lectures)

Introduction to scalars and vectors, dot product and cross product of two vectors and its physical significance, Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Problems.

4. Vector Analysis: (12 Lectures)

Introduction, differentiation of a vector with respect to scalar, scalar and vector fields, Vector differential operator and Laplacian operator, gradient of a scalar, physical significance of % a gradient of a scalar, physical significance of divergence of a vector field, curl of a vector field, its physical significances, del operator, some vector identities, Problems.

(I) $\nabla \times \nabla \phi = 0$, **(II)** $\nabla \cdot (\nabla \times V) = 0$, **(III)** $\nabla \cdot (\nabla \phi) = (\nabla \cdot \nabla) \phi$ **(IV)** $\nabla \cdot (\phi A) = \nabla \phi \cdot A + \phi (\nabla \cdot A)$

(V) $\nabla \times (\phi A) = \phi (\nabla \times A) + (\nabla \phi) \times A$, **(VI)** $\nabla \cdot (A \times B) = B \cdot (\nabla \times A) - A \cdot (\nabla \times B)$

5. Differential equations: (12 Lectures)

Frequently occurring partial differential equations in physics (Cartesian coordinates), Degree, order, linearity and homogeneity of differential equation, setting up of a differential equations for physical situations, computer programming toward physics, Problems.

Text and reference books:

1. A Course in Mathematics - Laud and Takawale.
2. Mathematical Methods in Physical Science - Mary Boas
3. Mathematical Physics - B.D. Gupta and Gupta
4. Vector Analysis - Spiegel (Schaum Series)
5. Mathematical Physics -B.S. Rajput (Pragati prakashan)
6. Advanced Engineering Mathematics - Krezick (8'h Edition)
7. Introduction to Classical Mechanics- R.G.Takwale and P. S. Puranic, Tata McGraw-Hill Publishing Company Ltd; New Delhi

S. Y. B. Sc. (Physics), Sem. IV
(2014 Course)
PH 41: Waves & Oscillations

1. Undamped free oscillations: (12 Lectures)

Revision of Undamped free oscillations, Definition of linear and angular S.H.M., Differential equation of S.H.M. and its solution (exponential form), Composition of two perpendicular linear S.H.Ms. for frequencies 1:1 and 1:2 (analytical method), Applications of S.H.M. to L.C. circuit, Lissajous's figures and its uses, Demonstration of Lissajous's figures (mechanical, electrical and optical), Problems.

2. Damped Oscillations (12 Lectures)

Introduction, Differential equation of damped harmonic oscillator and its solution, discussion of different cases, Logarithmic decrement, Energy equation of damped oscillations, Power dissipation, Quality factor, Application of Damped oscillations: LCR series circuit, Problems.

3. Forced oscillations: (14 Lectures)

Forced oscillations with one degree of freedom, Resonance and its examples, Equation of forced oscillations, Transient and steady state solution, log decrement, amplitude resonance and its condition, velocity resonance its condition, sharpness of resonance, energy absorption, power resonance curve, low and high frequency response, bandwidth and quality factor, forced oscillations in series LCR circuit, Problems.

4. Wave Motion (12 Lectures)

Differential equation of wave motion in continuous media, Equations for longitudinal waves in fluids and its solution (one dimension only), Equation for transverse waves and its solution (one dimension only), Energy of simple harmonic progressive wave, Energy density and energy transmission in waves, dispersion in waves, group velocity, phase velocity, Discussion of seismic waves, Problems.

5. Doppler Effect: (10 Lectures)

Concept of Doppler effect in sound, expression for apparent frequency in different cases, Asymmetric nature of Doppler effect in sound. Doppler Effect in light (Red shift and violet shift), Symmetric nature of Doppler Effect in light, Applications - Radar speed trap, Width of a spectral line, Violet shift, Problems.

Text and reference books:

1. Waves and Oscillations - by Stephenson.
2. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co. ltd.
3. Fundamentals of vibration and waves, S. P. Puri, Tata McGraw-Hill Publishing co. ltd.
4. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd. S.Y.B.Sc. (PHYSICS)
5. Waves and Oscillation, -Berkely Physics Course, Vol. III
6. Oscillation and Waves - by D. P. Khandelwal
7. College Physics Vol. 11 - by Narasappaya N.

S. Y. B. Sc. (Physics), Sem. III

PHY-32: Optics (2014 Course)

1. Geometrical Optics:

(12 Lectures)

Introduction, thin and thick Lenses, Sign convention, lens equation for thin lenses, Lens maker equation, Magnification of thin lens, Deviation by thin lens, Power of thin lens, Equivalent focal length of two thin lenses, Cardinal points, Optical instruments: Simple Microscope, Compound Microscope, Eyepieces - Ramsden and Huygen's Eyepieces, their merits and demerits, Problems.

2. Interference:

(14 Lectures)

Introduction - (Revision of Idea of coherence, Analytical treatment of interference, Intensity distribution in interference pattern, classification of interference), phase change on reflection (Stoke's treatment). Interference by parallel sided thin films, fringes of equal thickness (conditions for maxima and minima only), interference in thin wedge shaped films (normal incidence), Newton's rings. Theory and its application to determine wavelength of light, refractive index of liquid and flatness testing (Brief description)

3. Diffraction:

(12 Lectures)

Concept of diffractions, Fresnel and Fraunhofer diffractions - Fraunhofer diffraction at a single slit. Theory of plane transmission grating, intensity distribution in diffraction pattern, Fresnel diffraction - rectilinear propagation of light, simple theory of zone plate, Rayleigh's criteria of resolution, Resolving power, R.P of prism and transmission grating, crystal as a diffraction grating, Bragg's diffraction condition, Problems.

4. Polarization:

(10 Lectures)

Introduction to polarization, Methods to produce polarized light, Brewster's law, Law of Malus polarization by reflection, Double refraction in uniaxial crystals, Construction of polarizer, Quarter and Half Wave plates, Nicol prism, Problems

5. Lasers:

(12 Lectures)

Principle of LASER, Boltzman population distribution, stimulated absorption, spontaneous and stimulated emission. Population inversion, basic requirements of Laser action, Properties of Laser beam, Applications of Laser - alignment, ranging, medical field, Laser as a cutting tool, He-Ne Laser.

Text and reference books:

1. Geometrical and Physical Optics - Jenkins and White
2. Optics - Ajay Ghatak 2nd edition
3. Principles of optics, D.S. Mathur, Gopal Press, Kanpur
4. Optics - Brijlal and Subramanyam
5. Optics - Ghatak Loknathan.
6. A Text book of Optics, N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication
7. Lasers and Non-linear light - Dr. B.B. Laud
8. Laser Applications - Mont Ross (Academic Press).

**S. Y. B. Sc. (Physics), Sem. IV
(2014 Course)**

PHY42: Electronics

1. Network Theorems: (08 Lectures)

Kirchhoffs laws (revision), Voltage and Current divider circuits, Thevenin's theorem, Norton's theorem, Super-position theorem, Maximum power transfer theorem, Problems.

2. Power Supply Units: (08 Lectures)

Diode as a rectifier (half wave, full wave and bridge) for determination of ripple factor and efficiency, RC filter circuit, voltage multiplier, ERPS basic concept, typical ERPS circuit, SMPS power supply, three pin regulator (IC 7805 and IC 7905).

3. Bipolar Transistor: (12 Lectures)

Revision of bipolar junction transistor, types, symbols and basic action, Configurations (Common Base, Common Emitter & Common Collector), Characteristic of BJT, common emitter configuration input and output characteristics, common-base configuration, output characteristics, load line concept, emitter follower, biasing methods (self bias, Potential divider etc.), and stability factor. RC coupled CE amplifier. Definition of α and β and their interrelations, Transistor as a switch.

4. Uni-junction Transistor: (08 Lectures)

Symbol, types, construction, working principle, I-V characteristics, Specifications, Parameters of Uni-Junction Transistor (UJT), Use of UJT as a relaxation oscillator

5. Oscillators: (12 lectures)

Feedback principle, types of feedback, Basic theory of oscillator, Barkhausen's criteria, Negative feedback in amplifier, advantages of negative feedback, multivibrators - bistable, monostable and astable (using transistors only).

6. Digital Electronics: (12 Lectures)

Number systems: Binary, Binary coded decimal (BCD), Octal, Hexadecimal, Addition and subtraction of binary numbers and binary fractions using one's and two's complement, Basic logic gates (OR, AND, NOT), Derived gates: NOR, NAND, EXOR, EXNOR with symbols and truth tables, Boolean Algebra, De Morgan's theorems and its verification, RS flip-flop, IC 7400, IC 7402, Problems. Elementary concept on nano-electronics.

Text and reference books:

1. Electronic Devices and Circuits - Allen Mottershed (HPI) . Principles of Electronics - V.K. Mehta (S. Chand)
3. Basic Electronics - Grob.
4. Electronics Fundamentals and Applications: John D. Ryder
5. Electronic Devices and Circuits - Milliman and Halkins
6. Digital Principles and Applications, Malvino and Leech Tata Mc-Graw Hills Pub S.Y.B. Sc. (Physics)
7. Electronics Principles, Malvino, 7th Edition TaTa Mc-Graw Hills.
8. Op Amp and Linear integrated circuits, Ramakant Gaikwad, Prentice Hall of India Pub
9. Introduction for nano Technology by S.K. kulkarni

(Course 2014)
P - II : PRACTICAL COURSE - II

SECTION I
(GENERAL PHYSICS, OPTICS & ACOUSTICS).

1. 'g' by resonance pendulum - change in length of simple pendulum for two different amplitudes of compound pendulum.
2. Log decrement - Determination of in air and in water
3. Y by vibrations of wooden bar
4. Y and η of the given wire by Searle's method.
5. λ by cylindrical obstacle / straight edge
6. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
7. Study of musical scales using a signal generator and musical instruments
8. Newton's rings.
9. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
10. To determine the wavelengths of three colors in the spectrum using Diffraction Grating.
11. Dispersive power of glass prism
12. Total internal reflection (using a LASER beam and glass prism).
13. Optical activity of sugar solution (polarimeter)
14. Velocity of Sound by phase shift method.

SECTION - II
(ELECTRICITY AND ELECTRONICS)

1. Verification of circuit theorem - Norton, Thevenin's and Maximum power transfer theorems.
2. Zener stabilized power supply, load and line regulation and % ripple with and without zener.
3. Use of CRO - Measurement of frequency, A.C, D.C. voltages, Lissajous figures.
4. Single stage transistor amplifier
5. I-V characteristics of UJT
6. UJT as a Relaxation Oscillator
7. Study of Phase shift oscillator (using IC 741)
8. Study of R-S flip-flop
9. Study of rectifiers & calculation of ripple factor with & without filter
10. I-V characteristics of photo diode.
11. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor
12. Study of logic gates and Verification of De-Morgan's theorem
13. Transistor characteristics (CE configuration)

Note: 8 experiments should be performed from each section

Additional Activities (Any Two)

- 1) One educational tour with report equivalent to two experiment including computer aided

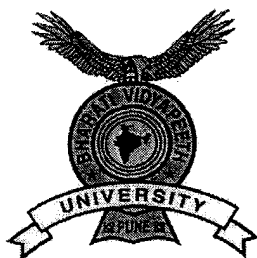
- 2) Demonstrations: any three demonstrations equivalent to two experiment
- 3) Mini project equivalent to two experiments

Note:

- i) Students have to perform at least one additional activity in addition to sixteen experiments mentioned above.
- ii) Total laboratory work with additional activities should -be equivalent to eighteen experiments.

Text and reference books:

- 1. Advanced Practical Physics - Worsnop and Flint
- 2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
- 3. Experimental Physics - Rajopadhye and Purohit
- 4. B.Sc. Practical Physics - C. N. Arora
- 5. Physics through Experiments Vol. I, Mechanical System - B. Saraf
- 6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
- 7. World Wide View of Physics - A. W. Joshi & others.



BHARATI VIDYAPEETH UNIVERSITY, PUNE

Faculty of Science

Revised Syllabus for

T.Y.B.Sc. Semester V & Semester VI

In Physics

(To be implemented from Academic Year 2016-2017 and onwards)

Bharati Vidyapeeth University
Proposed structure of T. Y. B. Sc. (Physics) revised syllabus
To be implemented from 2016-2017
Course- 2014 Structure

Semester V		Semester VI	
Subject Code	Title of the Course	Subject Code	Title of the Course
P-51	Mathematical Methods in Physics	P-61	Classical Electrodynamics
P-52	Quantum Mechanics	P-62	Atomic and Molecular Physics
P-53	Solid State Physics	P-63	Nuclear Physics
P-54	Advanced Electronics	P-64	Computational Physics
P-55	Classical Mechanics	P-65	Thermodynamics & Statistical Physics
P-56	Elective I (Select any one)	P-66	Elective 11 (Select any one)
A	Elements of Materials Science	A	Physics of Nano Materials
B	Lasers	B	Renewable Energy sources
C	Digital Electronics I	C	Digital Electronics 11
D	Microprocessors	D	Microcontroller
Laboratory course: P-III: Practical Course - III P-IV: Practical Course - IV P-V: Practical Course - V			

T.Y.B.Sc. (PHYSICS)
SEMESTER - V (Course-2014)
P-5 1: MATHEMATICAL METHODS FOR PHYSICS

Curvilinear coordinates: (16)

Introduction to Cartesian (x, y, z), spherical polar (r, θ, ϕ) and cylindrical (ρ, ϕ, z) coordinate systems and transformation equations, General curvilinear coordinates, coordinate surfaces, coordinate lines, length element, surface element and volume element in curvilinear coordinate system, Metric coefficients

Orthogonal curvilinear coordinate system; expressions for gradient, divergence, Laplacian and curl, special cases of the above for Cartesian, spherical polar and cylindrical coordinate systems

2. Equations and special functions: (14)

Introduction to partial differential equations, frequently occurring partial differential equations, (degree, order, linear/nonlinear, homogeneous/non-homogeneous), Method of separation of variables, singular points of differential equations, point of infinity, Fuchs's theorem (statement with proof) Frobenius's method of series solution. Series solution of Legendre, Hermite and Bessel differential equations

3. Special functions: (14)

Generating functions for Legendre $P_n(x)$, Hermite $H_n(x)$ Polynomials and Bessel functions of first kind in (x) and their properties

4. Special theory of relativity: (16)

Introduction, Newtonian relativity Galilean transformation equation, Michelson-Morley experiment, Postulates of special relativity, Lorentz transformations, Kinematic effects of Lorentz transformation, Length contraction, Proper time, Transformation of velocities, Variation of mass with velocity, Mass-energy relation. Four vectors.

Reference Books

- (1) Mathematical physics - Joshi, Wagh, Mandke and Agashe, G. Y. Prakashan, Pune.
- (2) Mathematics for physics - Bhat, Panat, Ogale, Rane (Suvichar Prakashan)
- (3) Mathematical methods for physicists, Arfken and Weber, Academic press New York.
- (4) Vector analysis - Spiegel (Schaum series)
- (5) Mathematical methods in the physical sciences - Marry L. Boas, John Wiley and sons publication
- (6) Applied mathematics for engineers and physicists - L. A. Pipes (Mc Graw Hill)
- (7) Introduction to special relativity, Robert Resnick, Wiley Eastern Ltd.

T.Y.B.Sc. (PHYSICS)
SEMESTER - V (Course-2014)
P-52: QUANTUM MECHANICS

1. Background of Quantum Mechanics: (14)

Historical Background, a) Review of Black body radiation, b) Review of photoelectric effects, Matter waves, De Broglie hypothesis. Davisson and Germer experiment, Wave particle duality, Wave function of a particle having definite momentum, Concept of wave packet, phase velocity, group velocity and relation between them, Dual nature of matter, phase velocity, Heisenberg's uncertainty principle, different forms of uncertainty principle (statements only), Heisenberg's gamma ray microscope, electron diffraction experiment.

2. Schrodinger's wave equation: (12)

Physical interpretation of wave function, formulation of time dependent and time independent Schrodinger's wave equation (one, two and three dimensional). Boundary conditions, energy eigen values and eigen functions, expectation values, Ehrenfest's theorem with proof, Equation of continuity (probability density, probability current density).

3. Applications of Schrodinger's equation: (10)

Step potential of finite depth, potential barrier, particle in one dimensional rigid box (infinite depth), one dimensional harmonic oscillator, three dimensional harmonic oscillators.

4. Operators: (12)

Hermitian operator, Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian), Commutator brackets- Simultaneous Eigen function, Commutator algebra, Commutator brackets using position, momentum and angular momentum operator, Raising and lowering angular momentum operator, Concept of parity, parity operator and its Eigen values.

5. Hydrogen atom: (12)

Schrodinger's wave equation for hydrogen atom, separation of radial and angular parts, solutions of radial part to obtain energy eigenvalues, Significance of quantum numbers n , l , m_l , m_s .

Text and reference books:

1. Introduction to quantum mechanics - by P. T. Mathew.
2. Quantum mechanics - by J. Powell and B. Craseman.
3. Introduction to quantum mechanics - by R. H. Dicke and J. P. Wittke.
4. Introduction to quantum mechanics - by Ogale, Panat, Bhide etc.
5. Perspective of modern physics - by Beiser.
6. Quantum Mechanics - By Ghatak and Lokanathan Published by Mc. Millan

SEMESTER - V (Course-2014)
P-53: SOLID STATE PHYSICS

1. The crystalline state: (16)

Translational vectors and lattices, symmetry operations, two and three dimensional lattice types, Miller indices, interplaner distances, simple crystal SC, BCC and FCC structural, packing fraction, concept of reciprocal lattice and its properties. Problems

2. Diffraction of x-rays by crystals: (16)

Introduction, Crystal as a grating for x-rays, Bragg's law of diffraction in reciprocal lattice, Bragg's diffraction conditions in direct and reciprocal lattice, Ewald's construction, Experimental method of X ray diffraction:- cubic crystals by powder method. Problems

3. Lattice vibrations and thermal properties: (14)

Introduction, Lattice heat capacity, classical theory of heat capacity, Einstein's model, limitations of Einstein model, vibrational modes of continuous medium, Debye model and its limitations, Problems

4. Free Electron and Band Theory of Metals (14)

Free Electron model, Energy levels and Density of orbital in 1D and 3D, Bloch theorem (statement only), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Origin of energy gap, Energy bands in Solids, Effective mass of electron (with derivation), Distinction between metal, semiconductor and insulator, Problems

Text and reference books:

1. Solid State Physics-S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999).
2. Solid State Physics - Kakani and Hemrajani, S. Chand Publication.
3. Solid State Physics By Saxena, Gupta and Saxena, PragatiPrakation.
4. Introduction to Solid State Physics- Charles Kittel, John Wiley and Sons, 7th Edition.
5. Solid State Physics-A.J.Dekker, Macmillan India Ltd, (1998).
6. Solid State Physics- R.K. Puri, V.K. Babbar, S. Chand Publication.
7. Problems in Solid State Physics-S.O. Pillai, New Age International (P) Ltd.
8. Solid State Physics-Palanyswamy.
9. Solid State Physics- David, Snoke, Pearson Publication.

T.Y.B.Sc. (PHYSICS)
SEMESTER - V (Course-2014)
P-54: ADVANCED ELECTRONICS

1. Electronic devices: (8)

Introduction, classification, principle, working and IV characteristics of FET, MOSFET(D-MOSFET and E-MOSFET).Problems on FET. SCR and UJT principle, working and applications of each

2. Power supplies: (8)

Principle of electronically regulated power supply, Series and shunt regulated power supply, electronically regulated power supply using IC 723 (both low voltage and high voltage)

3. Amplifiers: (6)

Idea of A.C. and D.C. load lines, graphical analysis of transformer coupled amplifier and impedance coupled amplifier.

4. A. Power amplifiers: (8)

Class A, Class B, Class C and Class AB amplifiers, calculation of efficiency in case of class A amplifier with resistive load and transformer coupled **amplifier**

B. Push-pull amplifiers: (6)

Class A and Class B push pull amplifiers, idea of cross over distortion, and calculation of efficiency in class B push-pull amplifiers.

C. Differential amplifier: (4)

Circuit, operations, common mode, differential mode, CMRR, need for constant current source (No mathematical derivations)

D. Operational amplifiers: (10)

IC 741, inverting and non-inverting configurations, concept of virtual ground parameters, offset, operational amplifier as adder, subtractor, comparator, integrator and differentiator. Problems based on above theory.

5. I C Versions: (2)

Block diagram of IC 555 and its applications as astable multivibrator

6. Oscillators: (8)

Theory of oscillator, RC and LC oscillators - Phase shift, Wein bridge,Colpitt and Hartly oscillator. Problems based on theory.

Text and reference books:

1. Solid state electronics devices- by B. G. Streetman
2. Integrated electronics - by Millmun-Halkais. . Basic electronics - by Grob
4. Digital electronics: principles and applications- by Malvino-Leach. .
5. Electronic ftndamentals and applications - John D. Ryder.
6. Electronic Devices and Circuits - Allen Mottershed

T.Y.B.Sc. (PHYSICS)
SEMESTER - V (Course-2014)
P-55: CLASSICAL MECHANICS

1. Newton's laws and constant fields: (16)

Conservation laws and mechanics of particles, equation of motion of a particle, applications of Newton's laws to the motion of charged particles under constant electric, magnetic fields and electromagnetic field, Mechanics of system of particles, concept of center of mass, Conservation of angular momentum of the particle, energy of the system., Problems

2. Motion in a central force field: (14)

Concept of the central force, Equivalent one body problem, motion of a particle in a central force field, general features of motion like constancy of angular momentum, motion in an inverse square law of force, qualitative discussion of the orbits, equation of orbit, Kepler's laws of planetary motion with proof, problems

3. Lagrangian and Hamiltonian formulation: (16)

General Idea about Lagrangian and Hamiltonian formulation, Constraints, generalized coordinates, D'Alembert's principle, Lagrange's equation from D'Alembert's principle, symmetric and conservation laws, cyclic coordinates, Hamiltonian and Hamilton's equation of motion, simple applications of Hamilton's and Lagrange's equations of motions such as simple pendulum, compound pendulum, projectile motion. Linear harmonic oscillator, Atwood's machine

4. Moving coordinate system: (14)

Coordinate systems with relative translation motions, Galilean relativity and invariance of Newton's laws under Galilean transformations, rotating coordinate system, derivation of $(d/dt)f = (d/dt)r + \omega \times r$ - is expected, Coriolis's force, effect of motion on the Earth, freely falling body in a rotating frame, effect of Coriolis's force, problems

Text and reference books:

1. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd.
2. Classical Mechanics, N. C. Rana, P. S. Joag, Tata McGraw Hill Publishing company Ltd.
3. Principles of mechanics, J. L. Synge, B. A. Griffith, Tata McGraw Hill Publishing company Ltd.
4. Classical Mechanics, Herbert Goldstein, Narosa Publishing House
5. Classical Mechanics by J.C. Upadhyaya, Himalaya publishing Houses. **004.6-** Problem solution of classical mechanics by P.V.Panat

SEMESTER - V (Course-2014)

P-56- Elective I (Student should select any of the following subject)

P-56: Elective I (A) Elements of Materials Science

1. Defects in Solids (10)

Introduction of materials science, Material Properties - Mechanical, Electrical and thermal, Impurities in solids, Solid solutions in metals, Rules of solid solubility, Imperfection in crystals, Defects in solids point, line, surface and volume, Atomic diffusions definition, mechanism, Fick's laws.

2. Single Phase Metals (10)

Single phase compound, Deformation, Elastic Deformation and Plastic Deformation, Mechanism of plastic Deformation by slip, Critical resolved shear stress (CRSS), Plastic deformation in poly crystalline materials

3. Molecular Phases (10)

Introduction, Polymers, Polymerization, Molecular weight of polymers, linear polymers addition and condensation, Cross linked polymer vulcanization of rubber

4. Ceramic Materials (10)

Ceramic Phases, Classification of ceramic materials, Ceramic crystals (AX), Mechanical behavior of ceramics, Electromagnetic behavior of ceramics - a) Electric properties dielectrics, semiconductors, piezoelectric b) Magnetic Properties Magnetic Ceramics, hard and soft ferrites

5. Phase Diagrams (12)

Basic terms System, Surrounding, Component, Coordinates, Phase, Equilibrium, Phase Diagram definition, importance and objective, Lever rule, Gibb's phase rule, Phase diagram of a) Sugar water b) NaCl water, Types of phase diagrams with construction a) Type I Lens type Cu-Ni phase diagram, b) Type II Only introduction c) Type III Eutectic type Pb-Sn phase diagram, Isothermal cuts

6. Introduction to smart materials (08)

Definition of smart materials, types and structure of smart materials, Properties of smart Materials, Applications of smart materials

Text and reference books:

1. Elements of materials science and Engineering L.H. Van Vlach (4th Edition)
2. Materials science and Engineering - V. Raghavan

List of experiments

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of FeCl₃
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material

T.Y.B.Sc. (PHYSICS)
SEMESTER - VI (Course-2014)
P-61: ELECTRODYNAMICS

1. Electrostatics: (24)

Electrostatic field in vacuum, principles of superposition, electrostatic potential, potential produced by continuous charge distribution Gauss Law the average potential over a spherical surface in a charge free region, fields produced by some simple charge distribution such as (1) spherical surface (2) infinite sheet of charge on conducting plate and (3) electric dipole. Poisson's and Laplace's equations, boundary conditions on potentials and field, solution of boundary value problem in Cartesian and spherical coordinate system. Method of images: a point charge near a

charged sphere and insulated

conducting grounded infinite plane, a point charge near a grounded conducting sphere

Concept of displacement vector, polarization vector, electric field vector at exterior and interior points of dielectric medium, concepts of true and induced charge density, electric susceptibility and dielectric constant

Boundary conditions at the interface of two dielectric media, Boundary value problems in dielectrics. Calculations of electrostatic field involving dielectric e.g. parallel plate capacitor and sphere.

2. Magnetostatics: 1 (20)

Lorentz force on a point charge moving in magnetic field, Biot-Savart law, magnetic induction B due to a current in long straight wire and a circular loop, magnetic induction between two long current carrying wires and Helmholtz's coil. Axial magnetic field of a solenoid. Magnetic force between two current carrying loops, Ampere circuital theorem, long cylindrical current carrying wire and coaxial cable

Magnetic vector potential A , magnetic energy in terms of B , J , A , V and magnetization vector M , calculation of magnetic field at a point inside and outside the sphere placed in magnetic field.

Electrodynamics: (16)

Faraday's laws of induction in integral and differential form, modified ampere's circuital law, Maxwell's equations in differential and integral form

Wave equations in free space, solution of wave equation for plane wave in free space. Poynting vector in free space, electromagnetic energy, Reflection and refraction of plane wave from nonconducting boundaries (normal incidence only)

Text and reference books:

here

Foundation of electromagnetic theory - by Reitz and Milford. Introduction to electrodynamics - by D. J. Griffiths. Electrodynamics - by Gupta, Singh and Kumar. Electrodynamics - by B. B. Laud. Electrodynamics - by Chopra, Agrawal.

6. Feynman lectures series No. 11 - by B. J. Publication. Classical Electrodynamics - by J. D. Jackson.

T.Y.B.Sc. (PHYSICS)

SEMESTER - VI (Course-2014)

P- 62: NUCLEAR PHYSICS

1. Understanding of Nucleus (12)

Composition, charge, size, density of nucleus, Nuclear Angular momentum, Nuclear

magnetic dipole moment, Electric quadrupole moment, parity and symmetry, Mass defect and

Binding energy, packing fraction, classification of nuclei, stability of nuclei (N Vs Z Curve) and

problems.

2. Radioactivity: (14)

Radioactivity disintegration, concept of natural and artificial radioactivity, Properties of α , β , γ rays, laws of radioactive decay, half life, mean life, specific activity and its units, successive disintegration and equilibrium and radioisotopes), applications of radioactivity (mechanical, biological etc.) Problems Ref I ch (8), Ref 2 - ch (15) Problems Ref 4 ch (2, 7, 2, 9)

Nuclear reactions: (12)

Theories of nuclear reactions based on nuclear models, conservation laws, Q-value equation,

exoergic and endoergic reactions, threshold energy in endoergic reactions,

Nuclear energy: (10)

Nuclear fission, nuclear fusion, energy available from fission, controlled chain reactions, nuclear

reactors (heterogeneous, swimming pool, breeder reactors)

Particle Accelerator and Detectors (12)

Introduction to particle Accelerators, Linear (electron/proton Linac) Cyclic (Cyclotron), Classification of Nuclear Detector, Gas filled Detectors (G. M. counter), Solid state detectors (NaI(Tl) scintillation counter)

Problems Ref I ch(7,12)

Reference books

1. Introduction to Nuclear Physics H.A. Enge (Addison Wesley co.) 2 The Atomic Nucleus R.D. Evans (Tata McGraw Hill co.) 3 Concepts of Nuclear Physics - B.L. Cohen (Tata

McGraw Hill co.) 4 Schaum's Outline Series Modern Physics R. Gaur (McGraw Hill co.)
5 Introduction to Nuclear Physics, S. B. Patel

6 Atomic and Nuclear Physics Shatendra Sharma (Pearson Education, 1st Edition) 7 Nuclear
Physics Kaplan (Narosa Publishing House)

Introduction to Nuclear Physics Y. R. Waghmare (Oxford IBH.)

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T.Y.B.Sc. (PHYSICS)

SEMESTER - VI (Course-2014)

P-63: ATOMIC & MOLECULAR PHYSICS

1. Atomic structure: (12)

Rutherford model of atom, Electron orbits, Bohr atom, Energy levels and spectra (I to 4

revision), Vector atom model (Concepts of space and quantization and electron spin), Atomic
excitation

and atomic spectra, Problems Ref I ch4

2. One and two valence electron systems (10)

Pauli Exclusion principle and electron configuration, quantum states, Spectral notations of

quantum states, Spin-Orbit Interaction (Single valence electron atom), Energy levels of Na
atom,

selection rules, spectra of sodium atom, sodium Doublet.

3. Two valence electron systems (10)

Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ coupling

schemes, Singlet Triplet separation for interaction energy of LS coupling. Lande's Interval
rule, spectra

of Helium atom, Problems Ref 1 ch7 Ref. 2 ch8 and ch 12

4. X ray spectroscopy (08)

Nature of X-rays, Discrete and continuous X-ray spectra, Duane and Hunt's Rule, X-ray
emission

spectra, Mosley's law and its applications, Auger effect, Problems Ref 2 ch16

5. Molecular spectroscopy (10)

Rotational energy levels, Vibration energy levels, Rotational and Vibrational spectra,
Electronic

spectra of molecules Problems Ref I ch8

6. Raman spectroscopy (10)

Classical theory of Raman Effect, Molecular polarizability, Quantum theory of Raman Effect
Experimental set up for Raman Effect, Applications of Raman spectroscopy Ref 3 ch4

Reference Books

1. Concepts of Modern Physics 4th edition Arthur Baisier (McGraw Hill International edition)
2. Introduction to Atomic spectra White.H.E (McGraw Hill International edition)
3. Fundamentals of Molecular spectroscopy, C.N.Banwell and E.M McCash (McGraw Hill International edition)
4. Modern Physics, J.B.Rajam

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T.Y.B.Sc. (PHYSICS)

SEMESTER - VI (Course-2014)

P-64: COMPUTATIONAL PHYSICS

1. Introduction: (10)

- introduction to computer, block diagram of computer, introduction to algorithm and flow chart

Programming languages (1) lower level languages (machine and assembly language), (2)

higher level languages (need and utility against lower level languages, various higher level

languages and their applications), History of 'C' language, introduction to C programming language

C fundamentals: (10)

Structure of 'C' program, C character set, identifiers and keywords, data types, constants and variables, array declaration, expressions statements, symbolic operators, Types of operators, library functions.

3. Data input and output: (6)

Single character input/output functions - print(), scanf(), getchar(), single character function, putchar(), get(n), gets(), puts()

Control statements: (6)

The WHILE statement, DO-WHILE statement, FOR statement, nested loop, IF-ELSE statement, BREAK statement, CONTINUE statement, SWITCH statement, GOTO statement, 'C' programming based on control statements

. Array and pointers: (12)

Defining an array, declaring an array, 1D and 2D, processing an array, passing an array to function, multidimensional array, string (character array), fundamentals of pointers, pointer declaration, passing a pointer to a function

. Functions and program structure: (6)

Definition of function, accessing a function, passing an argument to a function, functions prototypes, recursion, storage classes

. Computer graphics: (4)

Introduction to graphics, some simple graphic commands

8. Computational Physics: (6)

To find the roots of an algebraic equation, Bisection method, Newton's formula for differentiation, Simpson's rule for integration, errors in computation, Iterative methods: Discussion of algorithms and flow charts, Writing 'C' programs.

Reference books

The C programming language - by B. W. Kernighan and D. M. Ritchie.

Programming with C - by Schatz's outline series.

Introduction to methods of numerical analysis - by S. S. Shastry.

Let us C - by Y. Kanetkar.

Computer orientation numerical methods:- V. Rajaraman

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T.Y.B.Sc. (PHYSICS)

SEMESTER - VI (Course-2014)

P-65: THERMODYNAMICS & STATISTICAL PHYSICS

1. Kinetic Theory of Gases

Maxwell's thermodynamic relations:

(10)

Introduction, Fundamental assumptions of Kinetic theory of gases, kinetic interpretation of temperature, Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion, Problems

(12)

Basic ideas of thermodynamic functions- internal energy, enthalpy, helmholtz free energy function, Gibb's potential energy function, Maxwell's relations, applications of Maxwell's relations- first, second and third Tds equations, Energy equations, difference in heat capacity for ideal gas and real gas, ratio of heat capacities, variation of C_p with volume and variation of C_v with pressure, Problems

Joule-Thomson effect: (12)

Joule-Thomson effect and its applications- Production of low temperature, Porous plug experiment, observations and theory for J-T expansion (cooling effect) for ideal gas, expression of inversion temperature real gas, Liquefaction of gases- principle of regenerative cooling, air liquifier, liquification. of Helium, strides toward the absolute Zero-adiabatic demagnetization, experimental set up and thermodynamics of the process, Problems

4. Elementary Concepts of Statistics: (10)

Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem, Calculation of mean values, Probability distribution for large-scale N , Gaussian probability distributions,

5. Statistical Distribution of System of Particles:

Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions

6. Statistical Ensembles:

Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of canonical ensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble

Reference books

(08)

Heat and thermodynamics - by Zemansky.

Heat and thermodynamics - by Brijlal and Subramaniyam

A text book of heat and thermodynamics - by Shah and Shrivastava.

Fundamental of statistical physics and thermal physics - by Reif

Statistical physics - by Landau.

Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.

7. Statistical and Thermal physics, By Lokanathan, R.S. Gambhir,

8. Perspectives of modern physics, - By A. Beiser

9. A primer of Statistical Mechanics, - By R.B. Singh

10. Statistical Mechanics, - By Gupta, Kumar

T.Y.B.Sc. (PHYSICS)

SEMESTER - V (Course-2014)

Cft% P-66: Elective 11 (Student should select any of the following subject)

P-66: Elective 11 (A) Physics of Nanomaterials

C!*Ab* 1.]Introduction to nanomaterials: (12)

Introduction to nano-sized materials and structures, Brief history of nanomaterials and challenges

in nanotechnology, Significance of nano-size and properties, classification of nanostructured materials

2. Methods of synthesis of nanomaterials: (14)

Bottom-up and Top-down approaches, Physical methods: High energy ball milling, Physical

vapour deposition, Ionized cluster beam deposition, sputter deposition, Ultrasonic spray pyrolysis etc.

IL Chemical methods: colloidal method, co-precipitation and sol-gel method Hybrid method:

C"% Electrochemical and chemical vapour deposition.

3. Characterization techniques: (13)

0% UV- visible spectroscopy, X-ray diffraction, Scanning electron microscopy, Transmission

4. Properties of nanomaterials: (07)

Mechanical, Electrical, Thermal, Optical, solubility, melting point and Magnetic properties

5. Special nanomaterials: (08)

Carbon nanotubes, quantum dots, Nanocrystalline ZnO and TiO₂

6. Applications: (06)

Nanoelectronics, Medical, Biological, Automobiles, Space, Defense, Sports, Cosmetics, Cloth industry etc

Reference Books:

1. Nanotechnology: Principles and Practices: Sulbha Kulkarni, Capital Publishing Co. New Delhi.

2. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Owens, Wiley Publications.

3. Origin and development of nanotechnology: P.K.Sharma, Vista International publish house.

Cq% 4. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao, Imperials College Press, London.

List of experiments:

1. Synthesis of metallic nanoparticles by wet chemical method.

2. Study of optical absorption of nanoparticles.

Determination of nanoparticles size from X-ray diffraction spectra.

4. Synthesis of silver nanoparticles from silver nitrate by reduction using surfactant.

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T.Y.B.Sc. (PHYSICS)
P-111 PRACTICAL COURSE - III (Course-2014)
SECTION - I

Part A GENERAL PHYSICS:

I Surface tension by Quink's method

2. Surface tension by Fergusson method.

3. γ by Newton's rings.

4. Determination of coefficient of viscosity of a liquid by rotating cylinder method.

5. To study coupled oscillations and hence to determine the coefficient of coupling

Moment of Inertia by Bifilar suspension

Cot 7. Young's modulus by Newton's rings Young's modulus by Koenig method

8. Hall Effect

9. Kater's pendulum

B. STATISTICAL PHYSICS AND THERMODYNAMICS:

1. Joyle's steam calorimeter.

Part B 2. Verification of Stefan's law of radiation.

3. Thermal conductivity of a metal by Forbes's method.

4. Thermal conductivity of rubber by rubber tubing method.

5. Thermal conductivity of glass.

6. Determination of pressure coefficient of air by constant volume thermometer.

7. To study the characteristics of thermostat.

8. Platinum resistance thermometer

SECTION - II

C. ACOUSTICS and LASER:

I . Determination of velocity of sound in liquid by ultrasonic interferometer.

2. Determination of unknown frequency of tuning fork/AC
3. Characteristics of microphone/loudspeaker
Frequency response of loudspeaker (twitter, woofer, mid-range)
5. Determination of wavelength of He-Ne laser by using grating.
Study of double refraction phenomenon of prism.
7. Determination of wavelength of He-Ne laser by cylindrical obstacle.
8. Study of the characteristics of a laser beam.

OPTICS:

1. R.I. of glass and liquid by total internal reflection.
2. Determination of unknown wavelength of a given source using Lloyd's single mirror.
3. To determine the resolving power of grating.
4. To estimate the temperature of sodium flame.
5. Determination of cardinal points of given lens by Searle's Goniometer.
6. Determination of various focal lengths of zone plate and wavelength of light used.
7. Determination of refractive index of liquid using hollow prism.
8. Study of interference by Quinck's method

Note : 10 experiments should be performed from each section

Additional Activities (Any One)

- 1) One educational tour with report equivalent to two experiment including computer aided

Any three demonstrations equivalent to two experiment or Mini project equivalent to two experiments

T.Y.B.Sc. (PHYSICS)
P-IV PRACTICAL COURSE - IV (Course-2014)
SECTION - I

A. ELECTRICITY AND ELECTROMAGNETISM:

1. To find unknown inductance by Maxwell's Induction Bridge or Anderson bridge.
2. To determine the core losses in transformer by C.R.O.
3. Hysteresis by ballistic galvanometer (Determination of B and H).
4. To study self and mutual inductance.
5. Electromagnetic pendulum.
6. Core losses in transformers
7. Inductance by Maxwell's bridge

SB. ELECTRONICS: 1. Building of E. R. P. S. by using transistor. Designing, Building and testing of E. R. P. S. by using IC 723. Astable multivibrator using IC 555. 4. Characteristics of FET. Characteristics of SCR. 6. Applications of Opamp as adder and differentiator.

MODERN PHYSICS AND SOLID STATE PHYSICS

To determine a plateau voltage of G. M. tube
Verification of Einstein's photo-electric relation using photocell (Determination of h)
To determine e/m by Thomson's method.
To study the emission spectra of H, atom and determination of Rydberg's constant.
To determine Zeeman shift (λ) by using constant deviation spectrometer.
Study of XRD spectra of any matter
Inverse square law (γ -rays)
Determination of Planck's constant

SECTION - II

Any Three experiment from the optional subject (Minimum)

E. C-PROGRAMMING (Any Five) ,

Factorial of a number by simple and recursive method.
To find out the first 100 prime numbers
Matrix multiplication
Graphics (line, circle, arc, ellipse, bar, draw poly)
Position time data using kinematic equations
Temperature conversion ,
Finding pressure using Vander Waals' equation of state

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C18. To find maximum/minimum number in a set of given numbers.

9. Sorting an array in ascending/descending order and to find the sum of digits. 1

10. To find roots of differential equation.,

11. Decimal to binary conversion.

"12. To display the string in reverse order.,

F. COMPUTER INTERFACED PHYSICS EXPERIMENTS/INSTRUMENTATION (Any Three)

1. Charging and discharging of capacitor and RC time constant

Measurement of g using simple pendulum

Velocity of sound

4. Radiation detection

IV Characteristics of diode

Temperature controller using AD590

Study of IC 7490 as mod 2, mod 5, mod 7 and mod 10 counter

C"N5

0's 10 experiments should be performed from each section and one educational tour should be arranged and report should be submitted in a year

Additional Activities (Any One)

One educational tour with report equivalent to two experiment including computer aided

Demonstrations: any three demonstrations equivalent to two experiment

3) Mini project equivalent to two experiments

Use of plagiarism software to find plagiarism in research work.

T.Y.B.Se. (PHYSICS)

P-V: PRACTICAL COURSE - V (Course-2014)

(PROJECT WORK)

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S.Y.B.Sc. (CBCS – 2016 Course)

SEM. - III

P – 31 : MATHEMATICAL METHODS FOR PHYSICS

Total Credits : 04

Total Lectures : 60

1. Partial Differentiation:

Introduction, Idea, Definition and notation of partial differentiation, rules for obtaining partial derivative, total differential, exact differential, chain rule, Theorems of differentiation, change variables from the Cartesian to Spherical polar co-ordinates, problems based on change of variables, maxima and minima (Qualitative treatment), Problems, Frequently occurring differential equations (Cartesian coordinates), Degree, order, linearity and homogeneity of differential equation.

2. Complex Algebra:

Complex Numbers, algebra of complex numbers, complex conjugate. Argand Diagram, Algebra of complex numbers by using Argand diagrams; Rectangular and polar form of complex numbers; Exponential form of complex numbers; Euler's relations De-Moivre's theorem (statement only), Trigonometric functions; exponential and hyperbolic functions, powers and roots of complex numbers; Applications of complex numbers to determine velocity and acceleration in Curved motion, Problems.

3. Vector Algebra

Introduction to scalars and vectors, dot product and cross product of two vectors and its physical significance, Scalar triple product and its geometrical interpretation, Vector triple product and its proof, Problems.

4. Vector Analysis:

Introduction, differentiation of a vector with respect to scalar, scalar and vector fields, Vector differential operator and Laplacian operator, gradient of a scalar, physical significance of a gradient of a scalar, physical significance of divergence of a vector field, curl of a vector field, its physical significances, del operator, some vector identities, Problems.

$$\begin{aligned} \text{(a) } \nabla \times \nabla \phi &= \mathbf{0}, & \text{(b) } \nabla \cdot (\nabla \times \mathbf{V}) &= \mathbf{0}, & \text{(c) } \nabla \cdot (\nabla \phi) &= (\nabla \cdot \nabla) \phi, \\ \text{(d) } \nabla \cdot (\phi \mathbf{A}) &= \nabla \phi \cdot \mathbf{A} + \phi \cdot (\nabla \cdot \mathbf{A}), & \text{(e) } \nabla \times (\nabla \mathbf{A}) &= \phi (\nabla \times \mathbf{A}) + (\nabla \phi) \times \mathbf{A}, \\ \text{(f) } \nabla \cdot (\mathbf{A} \times \mathbf{B}) &= \mathbf{B} \cdot (\nabla \times \mathbf{A}) - \mathbf{A} \cdot (\nabla \times \mathbf{B}) \end{aligned}$$

Reference books:

1. A Course in Mathematics - Laud and Takawale
2. Mathematical Methods in Physical Science - Mary Boas.
3. Mathematical Physics - B.D. Gupta and Gupta
4. Vector Analysis - Spiegel (Schaum Series)
5. Mathematical Physics - B.S. Rajput (Pragati prakashan)
6. Advanced Engineering Mathematics - Krezick (8th Edition)
7. Introduction to Classical Mechanics - R.G.Takwale and P. S. Puranic, Tata McGraw-Hill Publishing Company Ltd; New Delhi

S.Y.B.Sc. (CBCS – 2016 Course)

SEM. - III

P – 32 : OPTICS

Total Credits : 04

Total Lectures : 60

1. Geometrical Optics:

Introduction, thin and thick Lenses, Sign convention, lens equation for thin lenses, Lens maker equation, Magnification of thin lens, Deviation by thin lens, Power of thin lens, Equivalent focal length of two thin lenses, Cardinal points, Optical instruments: Simple Microscope, Compound Microscope, Eyepieces - Ramsden and Huygen's Eyepieces, their merits and demerits, Problems.

2. Interference:

Introduction - (Revision of Idea of coherence, Analytical treatment of interference - Intensity distribution in interference pattern, classification of interference), phase change on reflection (Stoke's treatment). Interference by parallel sided thin films, fringes of equal thickness (conditions for maxima and minima only), interference in thin wedge shaped films (normal incidence), Newton's rings. Theory and its application to determine wavelength of light, refractive index of liquid and flatness testing (Brief description)

3. Diffraction:

Concept of diffractions, Fresnel and Fraunhofer diffractions - Fraunhofer diffraction at a single slit. Theory of plane transmission grating, intensity distribution in diffraction pattern, Fresnel diffraction - rectilinear propagation of light, simple theory of zone plate, Rayleigh's criteria of resolution, Resolving power, R.P of prism and transmission grating, crystal as a diffraction grating, Bragg's diffraction condition, Problems.

4. Polarization:

Introduction to polarization, Methods to produce polarized light, Brewster's law, polarization by refractionpile of plates, Law of Malus polarization by reflection, detection of polarized light, polarized by selective absorption, Double refraction in uniaxial crystals, Construction of polarizer, Quarter and Half Wave plates, Nicol prism, Problems

Reference Books

1. Geometrical and Physical Optics - Jenkins and White
2. Optics - Ajay Ghatak 2nd edition
3. Principles of optics - D.S. Mathur, Gopal Press, Kanpur
4. Optics - Brijlal and Subramanyarn
5. Optics - Ghatak Loknathan.
6. A Text book of Optics - N.Subhramanyam, Brijlal, M. N. Avadhanulu, S. Chand publication
7. Lasers and Non-linear light - Dr. B.B. Laud
8. Laser Applications - Mont Ross (Academic Press).

SEM. - III

P – 33 : PRACTICAL COURSE - III

Total Credits : 04

Total Lectures : 60

1) Waves and Oscillations

1. 'g' by resonance pendulum - change in length of simple pendulum for two different amplitudes of compound pendulum.
2. Log decrement - Determination of in air and in water
3. Study of coupled oscillators comprising two simple pendulum (Mechanical) and determination of coupling coefficient.
4. Study of musical scales using a signal generator and musical instruments.
5. Study of musical scales using a signal generator and musical instruments.
6. Determination of frequency of AC mains using sonometer.
7. Measurement of coefficient of absorption of sound for different materials (cork, thermocol, mica, paper etc.)
8. Velocity of Sound by phase shift method.
9. Study of acoustic resonance by using bottle as a resonator.

2) Optics

1. Newton's Ring: Determination of wavelength of monochromatic light source (?.)
2. Dispersive power of glass prism
3. Measurement of beam divergence of a LASER beam
4. Measurement of beam size of a LASER beam.
5. Diffraction at the edge of a razor blade.
6. Optical activity of sugar solution (polarimeter)
7. Wavelengths of any three colors in the Hg spectrum using Diffraction Grating.
8. Biprism

Note: At least 8 experiments should be performed from the course

REFERENCE BOOKS:

1. Advanced Practical Physics - Worsnop and Flint
2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
3. Experimental Physics - Rajopadhye and Purohit
4. B.Sc. Practical Physics - C. N. Arora
5. Physics through Experiments Vol. 1, Mechanical System - B. Saraf
6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
7. World Wide View of Physics - A. W. Joshi & others.

S.Y.B.Sc. (CBCS – 2016 Course)

SEM. - IV

P – 41 : WAVES AND OSCILLATIONS

Total Credits : 04

Total Lectures : 60

1. Composition of two S. H. M.'s

Composition of two S.H.M.s of equal frequencies along same line of vibration (analytical method only), Composition of two S. H. M.s of equal frequencies acting at right angles (analytical method with different cases), Composition of two S. H. M.'s right angles to each other (time period in the ratio 1 : 2), Lissajous figures - demonstration by mechanical, optical and electrical methods, Problems.

2. Damped Oscillations

Introduction, Differential equation of damped harmonic oscillator and its solution, discussion of different cases, Logarithmic decrement, Energy equation of damped oscillations, Power dissipation, Quality, factor, Application of Damped oscillations: LCR series circuit, Problems.

3. Forced oscillations:

Forced oscillations with one degree of freedom, Resonance and its examples, Equation of forced oscillations, Transient and steady state solution, log decrement, amplitude resonance and its condition, velocity resonance its condition, sharpness of resonance, energy absorption, power resonance curve, low and high frequency response, bandwidth and quality factor, forced oscillations in series LCR circuit, Problems.

4. Doppler Effect:

Concept of Doppler effect in sound, expression for apparent frequency in different cases, Asymmetric nature of Doppler effect in sound. Doppler Effect in light (Red shift and violet shift), Symmetric nature of Doppler Effect, problems

5. Sound:

Definition of sound intensity, loudness, pitch, quality and timbre, Acoustic intensity level measurement, Acoustic pressure and its measurement, Reverberation time and Reverberation of a hall, Sabine's formula (without derivation), Stroboscope, Problems,

Reference Books

1. Waves and Oscillations - by Stephonson.
2. The physics of waves and oscillations, N. K. Bajaj, Tata McGraw- Hill, Publishing co. ltd.
3. Fundamentals of vibration and waves - S. P. Puri, Tata McGraw-Hill Publishing co. ltd.
4. Waves and Oscillations, R.N. Chaudhari, New age international (p) ltd. S.Y.B. Sc.(PHYSICS)
5. Waves and Oscillation, Berkely Physics Course, Vol. III
6. Oscillation and Waves - by D. P. Khandelwal
7. College Physics Vol. II - by Narasappaya N.

S.Y.B.Sc. (CBCS – 2016 Course)

SEM. - IV

P – 42 : ELECTRONICS

Total Credits : 04

Total Lectures : 60

1. Network Theorems:

Kirchhoffs laws (revision), Voltage and Current divider circuits, Thevenin's theorem, Norton's theorem, Super-position theorem, Maximum power transfer theorem, Problems.

2. Power Supply Units:

Diode as a rectifier (half wave, full wave and bridge) for determination of ripple factor and efficiency, RC filter circuit,- Unregulated and regulated power supply SMPS,

3. Bipolar Transistor:

Revision of bipolar junction transistor, types, symbols and basic action, Configurations (Common Base, Common Emitter & Common Collector), Characteristic of BJT, common emitter configuration input and output characteristics, common-base configuration, output characteristics, load line concept, emitter follower, biasing methods (self bias, Potential divider etc.), and stability factor. RC coupled CE amplifier. Definition of α and β and their inter-relations, Transistor as a switch,

4. Uni-junction Transistor:

Symbol, types, construction, working principle, I-V characteristics, Specifications, Parameters of- Uni-Junction Transistor (UJT), Use of UJT as a relaxation oscillator

5. Oscillators:

Feedback principle, types of feedback, Basic theory of oscillator, Barkhausen's criteria, Negative feedback in amplifier, advantages of negative feedback, multivibrators - bistable, monostable and astable (using IC 555).

6. Digital Electronics:

Number systems: Binary, Binary coded decimal (BCD), Octal, Hexadecimal, Addition and subtraction of binary numbers and binary fractions using one's and two's complement, Basic logic gates (OR, AND, NOT), Derived gates: NOR, NAND, EXOR, EXNOR with symbols and truth tables, Boolean Algebra, De Morgan's theorems and its verification, RS flip-flop, IC 7400, IC7402, Problems. Elementary concept on nano-electronics

Reference Books

1. Electronic Devices and Circuits - Allen Mottershed (HPI)
2. Principles of Electronics - V.K. Mehta (S. Chand)
3. Basic Electronics - Grob.
4. Electronics Fundamentals and Applications - John D. Ryder
5. Electronic Devices and Circuits - Milliman and Halkins
6. Digital Principles and Applications - Malvino and Leech Tata Mc-Graw Hills Pub.
7. Electronics Principles, Malvino, 7th Edition TaTa Mc-Graw Hills.
8. Op Amp and Linear integrated circuits - Ramakant Gaikwad, Prentice Hall of India Pub
9. Introduction for nano Technology - S.K. kulkarni

SEM. - IV
P – 43 : PRACTICAL COURSE - IV

Total Credits : 04

Total Lectures : 60

1) (ELECTRICITY AND ELECTRONICS)

1. Verification of circuit theorem - Norton, Thevenin's and Maximum power transfer theorems.
2. Zener stabilized power supply, load and line regulation and % ripple with and without zener.
3. Use of CRO - Measurement of frequency, A.C, D.C. voltages, Lissgeous figures.
4. Single stage transistor amplifier (R-C coupled).
5. I-V characteristics of UJT
6. OPAMP as an adder/subtractor
7. Study of Phase shift oscillator (using IC 741)
8. Study of rectifiers & calculation of ripple factor with & without filter (Half wave and Full wave)
9. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor.
10. To measure displacement (linear and angular) using potentiometer/variable inductor/variable capacitor
11. Study of logic gates and Verification of De-Morgan's theorem
12. Transistor characteristics (CE configuration)
13. OPAMP as inverting and non inverting amplifier

Note: At least $8 + 2 = 10$ experiments should be performed from the course

Additional Activities

- 1) One educational tour with report equivalent to two experiments
- 2) Demonstrations: any three demonstrations equivalent to two experiments
- 3) Mini project equivalent to two experiments
- 4) Computer aided demonstrations (Using computer simulations or animations) (Any 2 demonstrations equivalent to 2 experiments)

Note:

- i) Students have to perform at least one additional activity in addition to eight experiments mentioned above.
- ii) Total laboratory work with additional activity should be equivalent to Ten experiments.

REFERENCE BOOKS:

1. Advanced Practical Physics - Worsnop and Flint
2. Advanced Practical Physics Vol I and 2, - Chauhan and Singh
3. Experimental Physics - Rajopadhye and Purohit
4. B.Sc. Practical Physics - C. N. Arora
5. Physics through Experiments Vol. 1, Mechanical System - B. Saraf
6. A Lab. Manual of Physics for undergraduate Students - D. P. Khandelwal
7. World Wide View of Physics - A. W. Joshi & others.



BHARATI VIDYAPEETH UNIVERSITY, PUNE

Syllabus (CBCS-2016)

for T.Y.B.Sc. Semester V & Semester VI

In Physics

(To be implemented from Academic Year 2018-2019 and onwards)

Title of the course: Bachelor of Science (CBCS-2016)
in Physics

(To be implemented from Academic year 2017-2018 and onwards)

Semester V (From the Academic Year 2018-19)

Subject Type	Course Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Physics						
	P-51	Mathematical Methods in Physics	04	04	03	40	60	100
	P-52	Quantum Mechanics	04	04	03	40	60	100
	P-53	Solid State Physics	04	04	03	40	60	100
	P-54	Advanced Electronics	04	04	03	40	60	100
	P-55	Classical Mechanics	04	04	03	40	60	100
	P-56	Practical Course – V	04	02	03	40	60	100
	P-57	Practical Course – VI	04	02	03	40	60	100
	P-58	Practical Course - VII	04	02	03	40	60	100
Elective Course		Any one of the following.						
	P-59A	Elements of Materials Science	04	04	03	40	60	100
	P-59B	Medical Electronics	04	04	03	40	60	100
	P-59C	Digital Electronics I	04	04	03	40	60	100
Foundation Course		This course is compulsory for all the students.						
	UGF-51	Soft skills	02	02	02	20	30	50

Semester VI (From the Academic Year 2018-19)

Subject Type	Code	Title of the paper	Hrs/ Week	Credits	Exam Hrs	Maximum Marks		
						Continuous Internal Assessment CIA	University Examination UEX	Total
Core Course		Physics						
	P-61	Classical Electrodynamics	04	04	03	40	60	100
	P-62	Atomic and Molecular Physics	04	04	03	40	60	100
	P-63	Nuclear Physics	04	04	03	40	60	100
	P-64	Computational Physics	04	04	03	40	60	100
	P-65	Thermodynamics & Statistical Physics	04	04	03	40	60	100
	P-66	Practical Course – VIII	04	02	03	40	60	100
	P-67	Practical Course – IX	04	02	03	40	60	100
	P-68	Practical Course - X	04	02	03	40	60	100
Elective Course	Any one of the following.							
	P-69A	Renewable Energy sources	04	04	03	40	60	100
	P-69B	Physics of Nano Materials	04	04	03	40	60	100
	P-69C	Digital Electronics II	04	04	03	40	60	100

SEMESTER V
T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P51: MATHEMATICAL MEHODS FOR PHYSICS

- 1. Curvilinear coordinates: (12)**
Introduction to Cartesian (x, y, z), spherical polar (r, θ , ϕ) and cylindrical (ρ , ϕ , z) coordinate systems and transformation equations, General curvilinear coordinates, coordinate surfaces, coordinate lines, length element, surface element and volume element in curvilinear coordinate system, Metric coefficients
Orthogonal curvilinear coordinate system; expressions for gradient, divergence, Laplacian and curl, special cases of the above for Cartesian, spherical polar and cylindrical coordinate systems
- 2. Equations and special functions: (10)**
Introduction to partial differential equations, frequently occurring partial differential equations, (degree, order, linear/nonlinear, homogeneous/non-homogeneous), Method of separation of variables, singular points of differential equations, point of infinity, Fuch's theorem (statement with proof) Frobeniu's method of series solution. Series solution of Legendre, Hermite and Bessel differential equations
- 3. Special functions: (12)**
Generating functions for Legendre P (x), Hermite $H_n(x)$ Polynomials and Bessel functions of first kind $J_n(x)$ and their properties
- 4. Special theory of relativity: (14)**
Introduction, Newtonian relativity Galilean transformation equation, Michelson-Morley experiment, Postulates of special relativity, Lorentz transformations, Kinematic effects of Lorentz transformation, Length contraction, Proper time, Transformation of velocities, Variation of mass with velocity, Mass-energy relation. Four vectors.

Reference Books

- (1) Mathematical physics - Joshi, Wagh, Mandke and Agashe, G. Y. Prakashan, Pune.
- (2) Mathematics for physics - Bhat, Panat, Ogale, Rane (Suvichar Prakashan)
- (3) Mathematical methods for physicists, Arfken and Weber, Acadmic press Newyork.
- (4) Vector analysis - Spiegel (Schaum series)
- (5) Mathematical methods in the physical sciences – Marry L. Boas, John Willy and sons publication
- (6) Applied mathematics for engineers and physicists - L. A. Pipes (Mc Graw Hill)
- (7) Introduction to special relativity, Robert Resnick, willyeastrn Ltd.

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T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-52: QUANTUM MECHANICS

- 1. Background of Quantum Mechanics: (12)**
Historical Background, a) Review of Black body radiation, b) Review of photoelectric effects., Matter waves, De Broglie hypothesis. Davisson and Germer experiment, Wave particle duality, Wave function of a particle having definite momentum, Concept of wave packet, phase velocity, group velocity and relation between them, Dual nature of matter, phase velocity, Heisenberg's uncertainty principle, different forms of uncertainty principle (statement only), Heisenberg's gamma ray microscope, electron diffraction experiment.
- 2. Schrodinger's wave equation: (10)**
Physical interpretation of wave function, formulation of time dependent and time independent Schrodinger's wave equation (one, two and three dimensional). Boundary conditions, energy eigen values and eigen functions, expectation values, Ehrenfest's theorem with proof Equation of continuity (probability density, probability current density).
- 3. Applications of Schrodinger's equation: (10)**
Step potential of finite depth, potential barrier, particle in one dimensional rigid box (infinite depth), one dimensional harmonic oscillator, three dimensional harmonic oscillators.
- 4. Operators: (10)**
Hermitian operator, Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian), Commutator brackets- Simultaneous Eigen function, Commutator algebra, Commutator brackets using position, momentum and angular momentum operator, Raising and lowering angular momentum operator, Concept of parity, parity operator and its Eigen values.
- 5. Hydrogen atom: (08)**
Schrodinger's wave equation for hydrogen atom, separation of radial and angular parts, solutions of radial part to obtain energy eigenvalues, Significance of quantum numbers n , l , m_l , m_s .

Reference books

1. Introduction to quantum mechanics - by P. T. Mathew.
2. Quantum mechanics - by J. Powel and B. Craseman.
3. Introduction to quantum mechanics - by R. H. Dicke and J. P. Wittke.
4. Introduction to quantum mechanics - by Ogale, Panat, Bhide etc.
5. Perspective of modern physics - by Beiser.
6. Quantum Mechanics. - By Ghatak and Lokanathan Published by Mc. Millan.

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-53: SOLID STATE PHYSICS

- 1. The crystalline state: (14)**
Translational vectors and lattices, symmetry operations, two and three dimensional lattice types, Miller indices, interplaner distances, simple crystal SC, BCC and FCC structural, packing fraction, concept of reciprocal lattice and its properties. Problems
- 2. Diffraction of x-rays by crystals: (12)**
Introduction, Crystal as a grating for x-rays, Bragg's law of diffraction in reciprocal lattice, Bragg's diffraction conditions in direct and reciprocal lattice, Ewald's construction, Experimental method of X-ray diffraction:- cubic crystals by powder method. **Problems**
- 3. Lattice vibrations and thermal properties: (10)**
Introduction, Lattice heat capacity, classical theory of heat capacity, Einstein's model, limitations of Einstein model, vibrational modes of continuous medium, Debye model and its limitations, Problems
- 4. Free Electron and Band Theory of Metals (12)**
Free Electron model, Energy levels and Density of orbital in 1D and 3D, Bloch theorem (statement only), Nearly free electron model, Fermi energy, Fermi level, Hall Effect, Origin of energy gap, Energy bands in Solids, Effective mass of electron (with derivation), Distinction between metal, semiconductor and insulator, Problems

Reference books

1. Solid State Physics-S.O.Pillai, 3rd Edition, New Age International (P) Ltd, Publisher, (1999)
2. Solid State Physics – Kakani and Hemrajani, S. Chand Publication
3. Solid State Physics BySaxena, Gupta and Saxena, PragatiPrakation.
4. Introduction to Solid State Physics- Charles Kittel, John Wiley and Sons, 7th Edition.
5. Solid State Physics-A.J.Dekker, Macmillan India Ltd, (1998)
6. Solid State Physics- R.K. Puri, V.K. Babbar, S. Chand Publication
7. Problems in Solid State Physics-S.O. Pillai, New Age International (P) Ltd.
8. Solid State Physics-Palanyswamy.
9. Solid State Physics- David, Snoke, Pearson Publication

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-54: ADVANCED ELECTRONICS

- 1. Electronic devices:** (6)
Introduction, classification, principle, working and IV characteristics of FET, MOSFET (D-MOSFET and E-MOSFET). Problems on FET, SCR and UJT principle, working and applications of each
- 2. Power supplies:** (6)
Principle of electronically regulated power supply, Series and shunt regulated power supply, electronically regulated power supply using IC 723 (both low voltage and high voltage)
- 3. Amplifiers:** (6)
Idea of A.C. and D.C. load lines, graphical analysis of transformer coupled amplifier and impedance coupled amplifier.
- 4 A. Power amplifiers:** (6)
Class A, Class B, Class C and Class AB amplifiers, calculation of efficiency in case of class A amplifier with resistive load and transformer coupled amplifier
- B. Push-pull amplifiers:** (6)
Class A and Class B push pull amplifiers, idea of cross over distortion, and calculation of efficiency in class B push-pull amplifiers.
- C. Differential amplifier:** (4)
Circuit, operations, common mode, differential mode, CMRR, need for constant current source (No mathematical derivations)
- D. Operational amplifiers:** (6)
IC 741, inverting and non-inverting configurations, concept of virtual ground, parameters, offset, operational amplifier as adder, subtractor, comparator, integrator and differentiator. Problems based on above theory.
- 5. I C Versions:** (2)
Block diagram of IC 555 and its applications as astable multivibrator
- 6. Oscillators:** (6)
Theory of oscillator, RC and LC oscillators - Phase shift, Wein bridge, Colpitt and Hartly oscillator. Problems based on theory.

Reference books:

1. Solid state electronics devices- by B. G. Streetman
2. Integrated electronics - by Millmun-Halkais.
3. Basic electronics - by Grob
4. Digital electronics: principles and applications- by Malvino-Leach.
5. Electronic fundamentals and applications - John D. Ryder.
6. Electronic Devices and Circuits - Allen Mottershed

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-55: CLASSICAL MECHANICS

- 1. Newton's laws and constant fields: (14)**
Conservation laws and mechanics of particles, equation of motion of a particle, applications of Newton's laws to the motion of charged particles under constant electric, magnetic fields and electromagnetic field, Mechanics of system of particles, concept of center of mass, Conservation of angular momentum of the particle, energy of the system., Problems
- 2. Motion in a central force field: (10)**
concept of the central force, Equivalent one body problem, motion of a particle in a central force field, general features of motion like constancy of angular momentum, motion in an inverse square law of force, qualitative discussion of the orbits, equation of orbit, Kepler's laws of planetary motion with proof, problems
- 3. Lagrangian and Hamiltonian formulation: (14)**
General Idea about Lagrangian and Hamiltonian formulation, Constraints, generalized coordinates, D'Alembert's principle, Lagrange's equation from D'Alembert's principle, symmetric and conservation laws, cyclic coordinates, Hamiltonian and Hamilton's equation of motion, simple applications of Hamilton's and Lagrange's equations of motions such as simple pendulum, compound pendulum, projectile motion. Linear harmonic oscillator, Atwood's machine
- 4. Moving coordinate system: (10)**
Coordinate systems with relative translation motions, Galilean relativity and invariance of Newton's laws under Galilean transformations, rotating coordinate system, derivation of $(\frac{d}{dt})_f = (\frac{d}{dt})_r + \omega \times r$ - is expected, Coriolis's force, effect of motion on the Earth, freely falling body in a rotating frame, effect of Coriolis's force, problems

Reference books

1. Introduction to Classical Mechanics, R. G. Takawale, P. S. Puranik, Tata McGraw Hill publishing Company Ltd.
2. Classical Mechanics, N. C. Rana, P. S. Joag, Tata McGraw Hill Publishing company Ltd.
3. Principles of mechanics, J. L. Synge, B. A. Griffith, TataMcGraw Hill Publishing company Ltd.
4. Classical Mechanics, Herbert Goldstein, Narosa Publishing House
5. Classical Mechanics by J.C. Upadhyaya, Himalaya publishing Houses.
6. Problem solution of classical mechanics by P.V.Panat

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-56 : PRACTICAL COURSE – V
SECTION - I

A GENERAL PHYSICS:

1. Surface tension by Quink's method
2. Surface tension by Fergusson method
3. γ by Newton's rings
4. Determination of coefficient of viscosity of a liquid by rotating cylinder method.
3. To study coupled oscillations and hence to determine the coefficient of coupling
4. Moment of Inertia by Bifilar suspension
5. Young's modulus by Newton's rings Young's modulus by Koenig method
6. Hall Effect
7. Kater's pendulum

B. STATISTICAL PHYSICS AND THERMODYNAMICS:

1. Joyll's steam calorimeter.
2. Verification of Stefan's law of radiation.
3. Thermal conductivity of a metal by Forbe's method
4. Thermal continuity of rubber by rubber tubing method.
5. Thermal conductivity of glass.
6. Determination of pressure coefficient of air by constant volume thermometer
7. To study the characteristics of thermostat.
8. Platinum resistance thermometer

Additional Activities (Any One)

1. One educational tour with report equivalent to two experiment including computer aided
2. Any three demonstrations equivalent to two experiment or Mini project equivalent to two experiments

Note:

In semester V students should perform any Five from Section A and any five from Section from B (minimum)

T.Y.B.Sc. (PHYSICS)
SEM.-V (CBCS-2016)
P-57: PRACTICAL COURSE –VI
SECTION - I

A. ELECTRICITY AND ELECTROMAGNETISM:

1. To find unknown inductance by Maxwell's Induction Bridge or Anderson bridge.
2. To determine the core losses in transformer by C.R.O.
3. Hysteresis by ballistic galvanometer (Determination of B and H).
4. To study self and mutual inductance.
5. Electromagnetic pendulum.
6. Core losses in transformers
7. Inductance by Maxwell's bridge

B. ELECTRONICS:

1. Building of E. R. P. S. by using transistor
2. Designing, Building and testing of E. R. P. S. by using IC 723
3. Astable multivibrator using IC 555
4. Characteristics of FET
5. Characteristics of SCR
6. Applications of Opamp as adder and differentiator

C. MODERN PHYSICS AND SOLID STATE PHYSICS

1. To determine a plateau voltage of G. M. tube
2. Verification of Einstein's photo-electric relation using photocell (Determination of h)
3. To determine e/m by Thomson's method.
4. To study the emission spectra of H₂ atom and determination of Rydberg's constant.
5. To determine Zeeman shift (d) by using constant deviation spectrometer.
6. Study of XRD spectra of any matter
7. Inverse square law (γ -rays)
8. Determination of Planck's constant

Additional Activities (Any One)

- 1) One educational tour with report equivalent to two experiment including computer aided
- 2) Demonstrations: any three demonstrations equivalent to two experiment
- 3) Mini project equivalent to two experiments
- 4) Use of plagiarism software to find plagiarism in research work

Note: In semester V, students should perform any Three from Section A, any Three from Section from B and any four from the section c (minimum)

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-58: PRACTICAL COURSE – VII
(PROJECT WORK)

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
Elective I (Student should select any of the following subject)

P-57 A: Elective I (A) Elements of Materials Science

1. Defects in Solids (8)

Introduction of materials science, Material Properties – Mechanical, Electrical and thermal, Impurities in solids, Solid solutions in metals, Rules of solid solubility, Imperfection in crystals, Defects in solids point, line, surface and volume, Atomic diffusions definition, mechanism, Fick's laws.

2. Single Phase Metals (8)

Single phase compound, Deformation, Elastic Deformation and Plastic Deformation, Mechanism of plastic Deformation by slip, Critical resolved shear stress (CRSS), Plastic deformation in poly crystalline materials

3. Molecular Phases (8)

Introduction, Polymers, Polymerization, Molecular weight of polymers, linear polymers addition and condensation, Cross linked polymer vulcanization of rubber

4. Ceramic Materials (8)

Ceramic Phases, Classification of ceramic materials, Ceramic crystals (AX), Mechanical behavior of ceramics, Electromagnetic behavior of ceramics – a) Electric properties dielectrics, semiconductors, piezoelectric b) Magnetic Properties Magnetic Ceramics, hard and soft ferrites

5. Phase Diagrams (10)

Basic terms System, Surrounding, Component, Coordinates, Phase, Equilibrium, Phase Diagram definition, importance and objective, Lever rule, Gibb's phase rule, Phase diagram of a) Sugar water b) NaCl water, Types of phase diagrams with construction a) Type I Lens type CuNi phase diagram, b) Type II Only introduction c) Type III Eutectic type PbSn phase diagram, Isothermal cuts

6. Introduction to smart materials (06)

Definition of smart materials, types and structure of smart materials, Properties of smart Materials, Applications of smart materials

Reference books

1. Elements of materials science and Engineering I.H. Vanvlach (4th Edition)
2. Materials science and Engineering - V. Raghvan

List of experiments

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of FeCl₃
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)

Elective I (Student should select any of the following subject)

P-59 B: Elective I (A): Medical Electronics

- 1. Introduction: (10)**
Terminology of medical instrumentation, Physiological system of body, Sources of bioelectric signals, Origin of bioelectric signals, Analysis of ECG pattern, Nernst equation, Various types of bioelectric signals, Basic medical instrumentation system, Introduction to man instrument system, Problems Reference: 1
- 2. Bio potential Electrodes and sensors: (12)**
Electrode-electrolyte interface Polarizable and non-polarizable electrodes, Electrodes for ECG, EEG, EMG, Resistive sensor, Capacitive sensor, Inductive sensor, Piezoelectric sensor, Radiation sensor, Temperature sensor Problems Reference: 2
- 3. Amplifiers and Signal Processing: (09)**
Introduction, Basic amplifier requirements, The Differential amplifier, Common mode rejection, Instrumentation amplifier, Isolation amplified, Patient safety, Cardiac monitor Problems Reference:- 2
- 4. Clinical Laboratory Instrumentation: (07)**
Spectrophotometry, Spectrophotometer type instruments, Calorimetry and calorimeter, Clinical flame photometer Problems Reference: 1
- 5. Measurements of Pressure and Volume Flow of Blood: (10)**
Direct measurements of blood pressure, Indirect measurements of BP., Heart sounds, Phonocardiography, Ultrasonic blood flow meter, Laser Doppler blood flow meter Problems Reference: 1

Reference Books:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur
2. Medical Instrumentation application design, John G Webster, Houghon Mifflin Co.
3. Introduction to Biomedical Electronics, Joseph DfuBovy, Mc Graw Hill.
4. Clinical Biophysics, P. Narayanan
5. Introduction to Biomedical equipment technology, 4th edition, by Joseph J. Carr and John M. Brown

Practicals:

1. Measurement of BP using Mercury sphygmomanometer and digital BP meter
2. Recording of ECG and its analysis
3. Absorbance using calorimeter/ Absorption spectra using Spectrophotometer
4. Pulse oxymetry
5. Use of biosensor

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-59 C: Elective I: Digital Electronics I

- 1. Karnaugh maps** (10)
Significance of Karnaugh's map, Concept of fundamental product, SOP and POS method, Simplification of 2, 3 & 4 variables.
- 2. Application of gates** (10)
Half and full adders, Four bit adder, four bit adder Subtractors, Parity checkers, Inter conversions of logic gates
- 3. Flip-flops** (10)
Revision of flip-flops, JK flip-flop, Race around condition D and T flip-flop., Edge triggering and level triggering in flip-flops., Examples of commonly used flip-flops and their applications.
- 4. Logic families** (10)
Classification, DTL families, MOS Families, Comparison of logic families
- 5. Counters:** (10)
Synchronous counters, Asynchronous counters, Modular counters,)Study of IC 7490 and IC 74192 / 193.
- 6. Clock Generating circuits** (10)
Study of IC 555, Working of IC 555 as a clock generator, Working of IC 741 as a clock generator (no derivations expected for the above, only formula and problems)

Reference Books

- 1) Digital Electronics by R.P.Jain
- 2) Basic Electronics by B.L.Theraja
- 3) Electronic Principles by Malvino

List of Experiments:

- i) Study of Half and Full adder
- ii) Study of R-S flip-flop
- ii) Study of J-K flip-flop.
- iv) Study of IC 7490 as MOD2, MOD5 & MOD10.
- v) Implementation of Boolean equations.

SEMESTER VI
T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-61: CLASSICAL ELECTRODYNAMICS

1. Electrostatics: (20)

Electrostatic field in vacuum, principles of superposition, electrostatic potential, potential produced by continuous charge distribution

Gauss Law the average potential over a spherical surface in a charge free region, fields produced by some simple charge distribution such as (1) spherical surface (2) infinite sheet of charge on conducting plate and (3) electric dipole.

Poisson's and Laplace's equations, boundary conditions on potentials and field, solution of boundary value problem in Cartesian and spherical coordinate system. Method of images: a point charge near a conducting grounded infinite plane, a point charge near a grounded conducting sphere and insulated charged sphere

Concept of displacement vector, polarization vector, electric field vector at exterior and interior points of dielectric medium, concepts of true and induced charge density, electric susceptibility and dielectric constant

Boundary conditions at the interface of two dielectric media, Boundary value problems in dielectrics. Calculations of electrostatic field involving dielectric e.g. parallel plate capacitor and sphere.

2. Magnetostatics: (18)

Lorentz force on a point charge moving in magnetic field, Biot-Savart law, magnetic induction B due to a current in long straight wire and a circular loop, magnetic induction between two long current carrying wires and Helmholtz's coil. Axial magnetic field of a solenoid. Magnetic force between two current carrying loops, Ampere circuital theorem, long cylindrical current carrying wire and coaxial cable

Magnetic vector potential A , magnetic energy in terms of B , J , A , V and magnetization vector M , calculation of magnetic field at a point inside and outside the sphere placed in magnetic field.

3. Electrodynamics: (10)

Faraday's laws of induction in integral and differential form, modified amperes circuital law, Maxwell's equations in differential and integral form

Wave equations in free space, solution of wave equation for plane wave in free space. Poynting vector in free space, electromagnetic energy, Reflection and refraction of plane wave form nonconducting boundaries (normal incidence only)

Reference Books:

1. Foundation of electromagnetic theory - by Reitz and Milford.
2. Introduction to electrodynamics - by D. J. Griffiths.
3. Electrodynamics - by Gupta, Singh and Kumar.
5. Electrodynamics - by B. B. Laud.
4. Electrodynamics - by Chopra, Agrawal.
6. Feynman lectures series No. II - by B. J. Publication
7. Classical Electrodynamics – by J. D. Jackson.

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T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-62: ATOMIC & MOLECULAR PHYSICS

- 1. Atomic structure: (10)**
Rutherford model of atom, Electron orbits, Bohr atom, Energy levels and spectra (1 to 4 eV), Vector atom model (Concepts of space and quantization and electron spin), Atomic excitation and atomic spectra, Problems
- 2. One and two valence electron systems (08)**
Pauli Exclusion principle and electron configuration, quantum states, Spectral notations of quantum states, Spin-Orbit Interaction (Single valence electron atom), Energy levels of Na atom, selection rules, spectra of sodium atom, sodium Doublet.
- 3. Two valence electron systems (08)**
Spectral terms of two electron atoms, terms for equivalent electrons, LS and JJ coupling schemes, Singlet Triplet separation for interaction energy of LS coupling. Lande's Interval rule, spectra of Helium atom, Problems Ref 1 ch7 Ref. 2 ch8 and ch12
- 4. X ray spectroscopy (06)**
Nature of Xrays, Discrete and continuous Xray spectra, Duane and Hunt's Rule, X-ray emission spectra, Mosley's law and its applications, Auger effect, Problems Ref 2 ch16
- 5. Molecular spectroscopy (08)**
Rotational energy levels, Vibration energy levels, Rotational and Vibrational spectra, Electronic spectra of molecules Problems Ref 1 ch8
- 6. Raman spectroscopy (08)**
Classical theory of Raman Effect, Molecular polarizability, Quantum theory of Raman Effect Experimental set up for Raman Effect, Applications of Raman spectroscopy Ref 3 ch4

Reference Books

1. Concepts of Modern Physics 4th edition Arthur Baiser (McGraw Hill International edition)
2. Introduction to Atomic spectra White.H.E (McGraw Hill International edition)
3. Fundamentals of Molecular spectroscopy, C.N.Banwell and E.M McCash (McGraw Hill International edition)
4. Modern Physics, J.B.Rajam

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T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P- 63: NUCLEAR PHYSICS

- 1. Understanding of Nucleus (12)**
Composition, charge, size, density of nucleus, Nuclear Angular momentum, Nuclear magnetic dipole moment, Electric quadrupole moment, parity and symmetry, Mass defect and Binding energy, packing fraction, classification of nuclei, stability of nuclei (N Vs Z Curve) and problems.
- 2. Radioactivity: (10)**
Radioactivity disintegration, concept of natural and artificial radioactivity, Properties of α , β , γ rays, laws of radioactive decay, half life, mean life, specific activity and its units, successive disintegration and equilibria and radioisotopes, applications of radioactivity (mechanical, biological etc.) Problems Ref 1 ch (8), Ref 2 – ch (15) Problems Ref 4 ch (27, 29)
- 3. Nuclear reactions: (08)**
Theories of nuclear reactions based on nuclear models, conservation laws, Q-value equation, exoergic and endoergic reactions, threshold energy in endoergic reactions,
- 4. Nuclear energy: (08)**
Nuclear fission, nuclear fusion, energy available from fission, controlled chain reactions, nuclear reactors (heterogeneous, swimming pool, breeder reactors)
- 5. Particle Accelerator and Detectors (10)**
Introduction to particle Accelerators, Linear (electron/proton Linac) Cyclic (Cyclotron), Classification of Nuclear Detector, Gas filled Detectors (G. M. counter), Solid state detectors (NaI(Tl) scintillation counter) Problems Ref 1 ch (7,12)

Reference books

1. Introduction to Nuclear Physics H.A. Enge (Addison Wesley co.)
- 2 The Atomic Nucleus R.D. Evans (Tata McGraw Hill co.)
- 3 Concepts of Nuclear Physics – B.L. Cohen (Tata McGraw Hill co.)
- 4 Schaum's Outline Series Modern Physics R. Gaur (McGraw Hill co.)
- 5 Introduction to Nuclear Physics, S. B. Patel
- 6 Atomic and Nuclear Physics Shatendra Sharma (Pearson Education, 1st Edition)
- 7 Nuclear Physics Kaplan (Narosa Publishing House)
- 8 Introduction to Nuclear Physics Y.R. Waghmare (Oxford IBH.)

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T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-64: COMPUTATIONAL PHYSICS

- 1. Introduction: (10)**
Introduction to computer, block diagram of computer, introduction to algorithm and flow chart
Programming languages (1) lower level languages (machine and assembly language), (2)
higher level languages (need and utility against lower level languages, various higher level
languages and their applications), History of 'C' language, introduction to C programming
language
- 2. C fundamentals: (08)**
Structure of 'C' program, C character set, identifies and keywords, data types, constants and
variables, array declaration, expressions statements, symbolic operators, Types of operators,
library functions.
- 3. Data input and output: (04)**
Single character input/output functions - print(), scan(), getchar(), single character function,
putchar(), get(n), gets(), puts()
- 4. Control statements: (06)**
The WHILE statement, DO-WHILE statement, FOR statement, nested loop, IF-ELSE
statement, BREAK statement, CONTINUE statement, SWITCH statement, GOTO statement,
'C' programming based on control statements
- 5. Array and pointers: (10)**
Defining an array, declaring an array, 1D and 2D, processing an array, passing an array to
function, multidimensional array, string (character array), fundamentals of pointers, pointer
declaration, passing a pointer to a function
- 6. Functions and program structure: (04)**
Definition of function, accessing a function, passing an argument to a function, functions
prototypes, recursion, storage classes
- 7. Computer graphics: (02)**
Introduction to graphics, some simple graphic commands
- 8. Computational Physics: (04)**
To find the roots of an algebraic equation, Bisection method, Newton's formula for
differentiation, Simpson's rule for integration, errors in computation, Iterative methods:
Discussion of algorithms and flow charts, Writing 'C' programs.

Reference books

1. The C programming language - by B. W. Kerningham and D. M. Ritchie.
2. Programming with C - by Schaum's outline series.
3. Introduction to methods of numerical analysis - by S. S. Shastri.
4. Let us C - by Y. Kanetkar.
5. Computer orientation numerical methods:- V. Rajaraman

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T.Y.B.Sc. (PHYSICS)

SEM.-IV (CBCS-2016)

P-65: THERMODYNAMICS & STATISTICAL PHYSICS

- 1. Kinetic Theory of Gases (08)**
Introduction, Fundamental assumptions of Kinetic theory of gases, kinetic interpretation of temperature, Mean free path, Transport phenomenon, Viscosity, Thermal conductivity and diffusion, Problems
- 2. Maxwell's thermodynamic relations: (10)**
Basic ideas of thermodynamic functions- internal energy, enthalpy, helmholtz free energy fuction, Gibb's potential energy fuction, Maxwell's relations, applications of Maxwell's relations- first, second and third Tds equations, Energy equations, difference in heat capacity foe ideal gas and real gas, ratio of heat capacities, variation of C_p with volume and variation of C_v with pressure, Problems
- 3. Joule-Thomson effect: (10)**
Joule- Thmoson effect and its applications- Production of low temperature, Porousplug experiment, observations and theory for J-T expansion (cooling effect) for ideal gas, expression of inversion temperature real gas, Liquefaction of gases- principle of regenerative cooling, air liquifier, liquification of Helium, strides toward the asolute Zero-adiabatic demagnetization, experimental set up and thermodynamics of the process, Problems
- 4. Elementary Concepts of Statistics: (08)**
Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem, Calculation of mean values, Probability distribution for large-scale N, Gaussian probability distributions,
- 5. Statistical Distribution of System of Particles: (06)**
Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions
- 6. Statistical Ensembles: (06)**
Micro canonical Ensemble (Isolated System), Canonical ensembles, simple application of Canonical ensemble, Molecules in Ideal gas, Calculation of mean values in canonical ensemble

Reference books

1. Heat and thermodynamics - by Zeemansky.
2. Heat and thermodynamics - by Brijlal and Subramaniam
3. A text book of heat and thermodynamics - by Shah and Shrivastav.
4. Fundamental of statistical physics and thermal physics - by Reif.
5. Statistical physics - by Laud.
6. Theory and experiment on Thermal physics; P. K. Chakrabarti, New Central Book Agency (P) Ltd.
7. Statistical and Thermal physics, By Lokanathan, R.S. Gambhir,
8. Perspectives of modern physics, - By A. Beiser
9. A primer of Statistical Mechanics, - By R.B. Singh
10. Statistical Mechanics, - By Gupta, Kumar

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-66: PRACTICAL COURSE – VIII
SECTION – II

C. ACOUSTICS and LASER:

1. Determination of velocity of sound in liquid by ultrasonic interferometer.
2. Determination of unknown frequency of tuning fork/AC
3. Characteristics of microphone/loudspeaker
4. Frequency response of loudspeaker (twitter, woofer, mid-range)
5. Determination of wavelength of He-Ne laser by using grating.
6. Study of double refraction phenomenon of prism.
7. Determination of wavelength of He-Ne laser by cylindrical obstacle.
8. Study of the characteristics of a laser beam.

D. OPTICS:

1. R.I. of glass and liquid by total internal reflection.
2. Determination of unknown wavelength of a given source using Lloyd's single mirror.
3. To determine the resolving power of grating.
4. To estimate the temperature of sodium flame.
5. Determination of cardinal points of given lens by Searle's Goniometer.
6. Determination of various focal lengths of zone plate and wavelength of light used.
7. Determination of refractive index of liquid using hollow prism.
8. Study of interference by Quinck's method

Additional Activities (Any One)

1. One educational tour with report equivalent to two experiment including computer aided
2. Any three demonstrations equivalent to two experiment or Mini project equivalent to two experiment

Note: In semester VI, students should perform any Five from Section C and any five from Section from D (minimum)

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-67: PRACTICAL COURSE – IX
SECTION - II

D. Any Three experiment from the optional subject (Minimum)

E. C-PROGRAMMING (Any Five)

1. Factorial of a number by simple and recursive method.
2. To find out the first 100 prime numbers
3. Matrix multiplication
4. Graphics (line, circle, arc, ellipse, bar, draw poly)
5. Position time data using kinematic equations
6. Temperature conversion
7. Finding pressure using Vander Waals' equation of state
8. To find maximum/minimum number in a set of given numbers.
9. Sorting an array in ascending/descending order and to find the sum of digits.
10. To find roots of differential equation.
11. Decimal to binary conversion.
12. To display the string in reverse order.

F. COMPUTER INTERFACED PHYSICS EXPERIMENTS/INSTRUMENTATION (Any Three)

1. Charging and discharging of capacitor and RC time constant
2. Measurement of g using simple pendulum
3. Velocity of sound
4. Radiation detection
5. IV Characteristics of diode
6. Temperature controller using AD590
7. Study of IC 7490 as mod 2, mod 5, mod 7 and mod 10 counter

Additional Activities (Any One)

1. One educational tour with report equivalent to two experiment including computer aided
2. Demonstrations: any three demonstrations equivalent to two experiment
3. Mini project equivalent to two experiments
4. Use of plagiarism software to find plagiarism in research work.

Note:

In semester VI, students should perform any Three from Section D, any Four from Section from E and any Three from the section F (minimum)

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-68: PRACTICAL COURSE – X
(PROJECT WORK)

T.Y.B.Sc. (PHYSICS)

SEM.-IV (CBCS-2016)

Elective II (Student should select any of the following subject)

P-69A: Elective II (A) Renewable Energy Sources

- 1. An Introduction to Energy Sources: (10)**
Conventional and non-conventional sources of energy, Structure and characteristics of sun, Solar Constant, Electromagnetic energy spectrum, Solar radiations outside earth atmosphere, Solar radiation at the earth surface, problems.
- 2. Photothermal Applications: (10)**
Liquid flat plate collector, construction and working, Energy balance equation (without thermal analysis) , Concentrating collectors, Advantage and disadvantage, Solar distillation, Solar drying, Solar cooker(box type), Solar water heating systems.
- 3. Photovoltaic systems: (10)**
Introduction , Photovoltaic principle, Power output and conversion efficiency, Limitation to photovoltaic efficiency, Basic photovoltaic system for power Generation, Advantages and disadvantages, Types of solar cells, Application of solar photovoltaic systems.
- 4. Energy from Biomass: (08)**
Introduction , Bio -mass conversion technologies , Bio-gas generation Factors affecting bio-digestion (list of factors) , Methods for obtaining energy from biomass, Thermal gasification of biomass , Working of downdraft gasifier , Advantages and disadvantages of biological conversion of solar energy
- 5. Wind Energy (06)**
Introduction, Classification and description of wind machines, Wind data
- 6. Photocatalysis: (04)**
Introduction, Concept of Photocatalysis, Photocatalysis materials its advantages.

Reference Books:

1. Non conventional Energy sources, G. D. RAI (4th edition), Khanna Publishers, Delhi.
2. Solar Energy, S.P. Sukhatme (second edition), Tata Mc.Graw Hill Ltd, New Delhi.
3. Solar Energy Utilisation, G. D. RAI (5th edition), Khanna Publishers, Delhi.

List of Experiments:

1. Fuel value of wood/charcoal.
2. Study of sensible heat storage using liquid.
3. Selective and Non-selective coatings – Determination of Selectivity ratio.
4. Thermal efficiency of liquid – flat plate collector.
5. Study of box type solar cooker.
6. Determination of instantaneous thermal efficiency of parabolic collector.
7. Efficiency and fill factor of solar cells.

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-69B: Elective II (B) Physics of Nanomaterials

- 1. Introduction to nanomaterials: (10)**
Introduction to nano-sized materials and structures, Brief history of nanomaterials and challenges in nanotechnology, Significance of nano-size and properties, classification of nanostructured materials
- 2. Methods of synthesis of nanomaterials: (10)**
Bottom-up and Top-down approaches, Physical methods: High energy ball milling, Physical vapour deposition, Ionized cluster beam deposition, sputter deposition, Ultrasonic spray pyrolysis etc. Chemical methods: colloidal method, co-precipitation and sol-gel method Hybrid method: Electrochemical and chemical vapour deposition.
- 3. Characterization techniques: (10)**
UV- visible spectroscopy, X-ray diffraction, Scanning electron microscopy, Transmission electron microscopy
- 4. Properties of nanomaterials: (06)**
Mechanical, Electrical, Thermal, Optical, solubility, melting point and Magnetic properties
- 5. Special nanomaterials: (06)**
Carbon nanotubes, quantum dots, Nanocrystalline ZnO and TiO₂
- 6. Applications: (06)**
Nanoelectronics, Medical, Biological, Automobiles, Space, Defense, Sports, Cosmetics, Cloth industry etc

Reference Books:

1. Nanotechnology: Principles and Practices: Sulbha Kulkarni, Capital Publishing Co. New Delhi.
2. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Ownes, Willey Publications.
3. Origin and development of nanotechnology: P.K.Sharma, Vista International publish house.
4. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao, Imperials College Press, London.

List of experiments:

1. Synthesis of metallic nanoparticles by wet chemical method.
2. Study of optical absorption of nanoparticles.
3. Determination of nanoparticles size from X-ray diffraction spectra.
4. Synthesis of silver nanoparticles from silver nitrate by reduction using surfactant.

T.Y.B.Sc. (PHYSICS)
SEM.-IV (CBCS-2016)
P-69C: Elective II (C): Digital Electronics II

- 1. Memory devices and memory Organization (12)**
Types of Memory – volatile and nonvolatile, SRAM and DRAM, Classification and Working principle of memory devices; RAM, ROM, PROM, EPROM, and EEPROM, UVEEPROM, Flash RAM; Concept of Diode Matrix ROM, speed and cost range of memory devices, Memory organization - building the required memory size by using available memory chips, memory address map
- 2. Registers (06)**
Buffer, left shift, right shift, SISO, SIPO, PISO, PIPO Registers Study of IC 74194, 74195, 74198
- 3. Information in digital form (08)**
bit, nibble, byte, word concepts, problems in communication of digital data, codes –Straight binary code, Natural BCD code, Excess-3, gray, alphanumeric code, Error detection and correction code
- 4. Encoders (08)**
Construction, working and application, Decoders construction, working and application, Study of encoder & decoder IC
- 5. Need and advantages of Digital system (14)**
Need of analog to digital, digital to analog converters, Parameters for converter, DAC-weighted Resistor and its limitations, R-2R ladder, specification of D/A converter. Calibration of DAC circuit. Study of DAC IC ADC-principle of conversion, sampling theorem, quantization and encoding, parallel comparator A/D, Successive-approximation A/D, Counting A/D, Dual slope, Specifications of A/D converter, calibration, Study of A/D ICs,

Reference Books

- 1) Digital Electronics by R.P.Jain
- 2) Basic Electronics by B.L.Theraja
- 3) Electronic Principles by Malvino
- 4) Computer architecture and organization by Rifiqzaman and Chandra
- 5) The Intel Microprocessor by Barry.B.Brey

List of Experiments:

- i) Study of diode matrix ROM
- ii) Study of Analog to Digital Converter
- ii) Study of Encoder
- iv) Study of IC 7495 as Shift Register.
- v) Study of R-2R Digital to Analog Converter

“Social Transformation Through Dinamic Education”



BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)

**YASHWANTRAO MOHITE COLLEGE OF ARTS, SCIENCE AND COMMERCE,
PUNE – 411 038**

Accredited with 'A+' Grade (2017) by NAAC
'A' Grade University Status by MHRD, Govt. of India
Accredited (2004) & Reaccredited (2011) with 'A' Grade by NAAC



BACHELOR OF SCIENCE (B.Sc. ZOOLOGY) PROGRAME

CBCS 2016 COURSE STRUCTURE

Under the Faculty of Science

To Be Implemented From Academic Year 2016-17



BHARATI VIDYAPEETH UNIVERSITY

PUNE

CHOICE BASED CREDIT SYSTEM

(2016 Course)

**Proposed Syllabus for F.Y.B.Sc
IN
ZOOLOGY**

(Semester I and Semester II)

To Be Introduced from Academic Year

2016 – 2017

BHARATI VIDYAPEETH UNIVERSITY, PUNE COURSE STRUCTURE OF THREE YEARS INTEGRATED CHOICE BASED CREDIT AND GRADING SYSTEM BACHELOR OF SCIENCE (B.Sc.) DEGREE COURSE IN ZOOLOGY (CBCS 2016 COURSE) Implemented from the Academic year 2016-17						
Class	Subject Type	Subject Code	Subject Title	Credits	Continuous Internal Assessment CIA	University Examination UEX
B.Sc. I	Core course		Zoology : (Semester- I)			
		Z 11	Animal systematic and Functional Anatomy of Non-chordates- I	03	40	60
		Z 12	Cell Biology and Genetics	03	40	60
		Z 13	Practical course-I	02	40	60
	Foundation Course	UGF12	Youth Development	02	20	30
	Core course		Zoology : (Semester- II)			
		Z 21	Functional Anatomy of Chordates-I	03	40	60
		Z 22	Applied zoology (Vermiculture and Sericulture)	03	40	60
		Z 23	Practical course-II	02	40	60
B.Sc. II	Core course		Zoology : (Semester- III)			
		Z 31	Functional Anatomy of Non-chordates-II and Biodiversity	04	40	60
		Z 32	Histology of Mammals	04	40	60
		Z 33	Practical course-III	02	40	60
	Elective course	SEC 31	English -I	04	40	60
		SEC 32	Marathi -I	04	40	60
	Foundation Course	UGF32	Cyber Law	02	20	30
	Core course		Zoology : (Semester- IV)			
		Z 41	Functional Anatomy of Chordates-II	04	40	60
		Z 42	Physiology of Mammals	04	40	60
		Z 43	Practical Course-IV	02	40	60
	Elective course	SEC 41	English –II	04	40	60
		SEC 42	Marathi -II	04	40	60
B.Sc. III	Core course		Zoology : (Semester- V)			
		Z 51	Developmental Biology	04	40	60
		Z 52	Genetics and evolution	04	40	60
		Z 53	Applied Zoology-Apiculture and Inland fisheries	04	40	60
		Z 54	Parasitology	04	40	60
		Z 55	Ecology and environmental pollution	04	40	60
		Z 56	Practical Course-V	02	40	60
		Z 57	Practical Course-VI	02	40	60
		Z-58	Practical Course-VII	02	40	60
		Z 59B	Comparative Anatomy of Chordates	04	40	60

			and Microtechniques			
		Z 59C	Evolution	04	40	60
	Foundation Course	UGF51	Soft skill	02	20	30
	Core course		Zoology : (Semester- VI) Core course			
		Z 61	General Embryology	04	40	60
		Z 62	Toxicology	04	40	60
		Z 63	Biological Techniques	04	40	60
		Z 64	Functional Anatomy of Chordates-III	04	40	60
		Z 65	Economic Entomology	04	40	60
		Z 66	Practical Course-VIII	02	40	60
		Z 67	Practical Course-IX	02	40	60
		Z 68	Practical Course-X	02	40	60
	Elective course	Z 69A	Biotechnology	04	40	60
		Z 69B	Biostatistics	04	40	60
		Z 69C	Biodiversity and Wild Life	04	40	60

F. Y. B.Sc. Zoology
(C.B.C.S.)(2016 Course)

SEMESTER I

Z 11- Animal systematic and Functional Anatomy of Non-chordates - I
Core Course – Theory; Credits- 03

**Total
lectures
36L**

UNIT I

1. Principals of classification

04L

- i) Importance of classification ii) Binomial nomenclature
- iii) Five kingdom approach

2. Study of Paramecium

08L

- i) Systematic position, habits and habitat ii) General morphology
- iii) Nutrition iv) Reproduction (Binary fission and conjugation)

UNIT II

3. Study of Earthworm

12L

- i) Systematic position and external morphology
- ii) Digestive system
- iii) Circulatory system
- iv) Excretory system
- v) Nervous system
- vi) Reproductive system

UNIT III

12L

4. Study of cockroach

- i) Systematic position and external characters
- ii) Digestive system
- iii) Respiratory system -Thoracic spiracle and Abdominal spiracle structure and function
- iv) Excretory system - Malpighian tubules and physiology of excretion
- v) Nervous system - Central nervous system and Photoreceptor organ
- vi) Reproductive system - Sexual dimorphism, male and female reproductive system.

Reference Books

1. Text book of zoology Invertebrates Vol.1 (1992) - Parker and Haswell.
2. Invertebrate Zoology (1983) - E.L.Jordan and P.S.Verma
3. Modern text book of Zoology – Invertebrate - Kotpal, Agarwal and Khetarpal.
4. Invertebrate structure and function - Barrington.
5. College Zoology - Boolootin and stiles.

6. A manual of Zoology, part-I: Invertebrate - Ekambernath Iyer.
7. Text book of Zoology Invertebrates - Marshall and Williams.
8. Biology of Non-chordates - Nigam.
9. A life of invertebrate - Russel Hunter.
10. Zoology, Non-chordates - Marathe, Agarkar and Joshi
12. Protozoa. Mollusca and Arthropoda.- R.L. Kotpal
13. Invertebrate Zoology- Barnes.
14. A manual of practical Zoology Invertebrates - P.S.Verma.

F. Y. B.Sc. Zoology
(C.B.C.S.)(2016 Course)

SEMESTER I

Z 12- Cell Biology and Genetics	Total Lectures
Core Course – Theory; Credits- 03	36L

Cell Biology

UNIT I

1. Introduction to cell Biology	02L
i. Definition and scope	
ii. General cell structure – Prokaryotic and Eukaryotic cell	
2. Ultrastructure and Function of :	10L
i. Nucleus	
ii. Plasma membrane (Fluid Mosaic model)	
iii. Mitochondria	
iv. Lysosomes	
v. Ribosomes	
vi. Golgi complex	
vii. Endoplasmic reticulum	
viii. Cytoskeleton – Microtubules & Microfilaments	

Genetics

UNIT II

3. Introduction to genetics	12L
i. Mendelian inheritance	
a) Monohybrid cross	
b) Dihybrid cross	
ii. Multiple Alleles	
a) ABO blood group system and its importance	
iii. Incomplete dominance, Co-dominance	

UNIT III	12L

4. Chromosomes	06L
i. Morphology and composition	
ii. Classification	
iii. Types (Autosomes and sex chromosome)	
iv. Aberrations – numerical and structural changes	
5. Introduction to Human genetics	04L
i. Syndromes	
a) Autosomal – Down's (Mangolism), Cri-du-chat.	

b) Sex chromosomal abnormalities in man – Klinefelter and Turner's syndrome

6. Application of genetics

02L

- i. Genetic counselling
- ii. Eugenics

Reference books :

1. Cell and Molecular Biology By De Robertis, EDP. And De Robertis EME, Molt Saunders Inc.
2. Cell Biology By Pawar, CB, Himalaya Publication House
3. Cell and Molecular Biology By Dupraw I, Academic Press, New York
4. Cell Biology By Avers, C.J., Addison Wesley Pub. Co. New York and London
5. Genetics By Verma, PS. And Agarwal VK., S. Chand and Co., New Delhi
6. Genetics By Gupta PK., Rastogi Publication, Meerut
7. Genetics By Sarin, C., Tata McGraw Hill, New Dehi
8. Cell Biology, Genetics, Evolution and Ecology By Verma, PS. And Agarwal S. Chand and Co., New Delhi

F. Y. B.Sc. Zoology
(C.B.C.S.)(2016 Course)

SEMESTER I

Z 13 - Zoology Practical course

Core Course – Practical; Credits- 02

(Practical based on paper: Z-11, Z-12 (SEM - I))

- **Contact hours per practical – 04 h**

1. Study of general and distinguishing characters and classification of non-chordates upto class level with one example of each class.	D
a. Protozoa	
b. Porifera	
c. Coelentrata	
d. Platyhelminthes	
e. Aschelminthes	
f. Annelida	
2. Study of systematic position, external features, binary fission and conjugation of <i>paramecium</i> .	D
3. Study of external characters and Digestive system of Earthworm.	E
4. Study of Nervous system of Earthworm.	E
5. Mounting of Earthworm- Septal nephridium, setae and spermatheca.	E
6. Study of systematic position, external characters and digestive system of Cockroach.	E
7. Study of Nervous system of Cockroach.	E
8. Mounting of Cockroach - Gizzard, salivary glands, mouthparts, Trachea, spiracles.	E
9. Study of prokaryotic and eukaryotic cell with the help of suitable material.	D
10. Study of any 3- cell organelles with the help of suitable material.	D
11. Examples in Genetics: Examples based on Monohybrid cross, Dihybrid cross & Multiple alleles (At least 10 examples must be solved).	E
12. Study of characters of syndromes – Down's, Klinefelter & Turner's Syndrome.	E

Study Tour:

Compulsory visit to large water body / Biodiversity spot / ZSI / Any project
Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

***E** – Experiments

***D** – Demonstration Practical

Reference books:

1. A manual of practical zoology Invertebrates : P. S. Verma
2. A manual of practical zoology Non Chordata Vol. 1 : P. K. G. Nair and K. P. Achar
3. Practical Zoology, Invertebrates : S.S. Lal
4. Practical Invertebrates Zoology : Agarwal.
5. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata : Rastogi Publications
6. Cell and Molecular Biology De Robertis, E.D.P. and E.M.F. De Robertis 1987
7. Genetics: Verma, P.S. and V.K. Agarwal. 1997. S.Chand & Co.
8. Genetics : Gupta P.K. 1995-96, Rastogi publicati

F. Y. B.Sc. Zoology
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SEMESTER II

Z 21- Functional Anatomy of Chordates-I	Total Lectures
Core Course – Theory; Credits - 03	36L

UNIT I

Study of Amphioxus	12L

- i) Systematic position, habits and habitat.
- ii) External characters.
- iii) Digestive system - Alimentary canal, food and feeding and physiology of digestion
- iv) Circulatory system: Arterial and venous system.
- v) Nervous system and sense organs.
- vi) Affinities of Amphioxus - primitive characters, secondary characters and degenerate characters.

UNIT II

2. Study of Frog	24L

- i) Systematic position, Habits and habitat
- ii) External characters and sexual dimorphism.
- iii) Structure of integument and its functions.
- iv) Digestive system - Alimentary canal, digestive glands, food, feeding mechanism and physiology of digestion.
- v) Blood vascular system: Blood and its functions, Heart - structure, Arterial and venous system.
- vi) Nervous system, Brain and its functions,
- vii) Sense organs - Eye - structure and working.
- viii) Reproductive system - Male and female reproductive system.
- ix) Metamorphosis.

• **Reference books :**

1. Modern text book of Zoology - Vertebrates (1992) Kotpal, Agarwal and Khetarpal.
2. Chordate Zoology (1988) R.C. Dalela.
3. Text book of modern Zoology (1991) P.S. Verma and P.C. Shrivastava.
4. Chordate Zoology E.L. Jordan.
5. Chordate Zoology (1996) Kishor Pawar.
6. Non-chordates and chordate Zoology- II Kishor Pawar.
7. A Text book of Zoology - Animal systematics and diversity-II Marathe. Agarkar and Joshi.

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SEMESTER II

Z 22 - Applied zoology (Vermiculture and Sericulture)

Total Lectures

Core Course – Theory; Credits-03

36L

UNIT I

VERMICULTURE

20L

1. Introduction to vermiculture biotechnology
2. Living soil
3. Taxonomy and distribution of useful species of earthworms for vermiculture
4. Manure processing earthworm species
 - i) *Eudrilus eugenia* ii) *Eisenia foetida* iii) *Perionyx excavatus*
6. Soil processing earthworm species
 - i) *Pheretima posthuma* ii) *Pheretima elongata*
7. Earthworm culturing techniques and production of vermicompost
 - i) Vermiculturing in house garden (small scale method).
 - ii) Vermiculturing in the farm (Large Scale)
8. Usefulness of vermiculture
 - i) In agriculture: Advantage of vermiculture farming over chemical farming
 - ii) In sewage treatment
 - iii) In agro industries - Agroindustrial Waste treatment
 - iv) Methods of using vermiculture biotechnology in garden and farms
 - v) Vermiculture biotechnology: Solution of many problems facing the World
9. Economic importance of vermiculture
10. Factors influencing the culturing of earthworms

UNIT II

SERICULTURE

16L

1. Introduction to history of sericulture and sericulture industry in India
2. Taxonomy and distribution of silkworm species
3. Types of silk worm: *Bombyx mori* (Mulberry silkworm), Eri Silkworms, Tasar Silkworms and Muga Silkworms
4. External morphology and life-cycle of *Bombyx mori*
5. Cultivation and harvesting of mulberry
6. Silkworm rearing:
 - i) Requirements iii) Rearing appliances iv) Rearing techniques
7. Important diseases: Bacterial, viral, fungal and protozoan
8. Silkworm pests: Dermestid beetles, Uzi flies and ants

• **REFERENCE BOOKS.**

1. Biology of earthworms -Edwards and Lofty
2. Earthworm ecology -E. S & chell
3. Earthworm biology - J.A.Wallwark
4. Sustainable agriculture - J.P.Reganold
5. Earthworms - K.E.Lee
6. A Text book of Applied Zoology - Kishor Pawar and Desai
7. Waste management - Kharbonda and Stallworthy
8. Annelida. - R.L.Kotpal

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SEMESTER II

Z 23 Zoology Practical Course –II
Core Course – Practical; Credits-02

(Practical based on paper: Z-21, Z-22 (SEM - II))

1. Study of general and distinguishing characters and classification of chordates up to order with one example of each order. **D**
 - a. Urochordata
 - b. Cephalochordata
 - c. Cyclostomata
 - d. Chondrichthyes
 - e. Osteichthyes
 - f. Amphibia
2. Study of Amphioxus – T. S. through pharynx, gonads, intestine and caudal region with the help of microprepared slides. **D**
3. Study of external characters, sexual dimorphism of frog with the help of model / chart. **D**
4. Study of digestive system of Frog with the help of model / chart. **D**
5. Study of Male reproductive system of frog with the help of model / Chart. **D**
6. Study of Female reproductive system of frog with the help of model / Chart. **D**
7. Study of Brain of frog with the help of model / chart. **D**
8. Metamorphosis in frog with the help of larval forms. **D**
9. Study of taxonomy, external characters and distribution of useful species of earthworm for vermiculture. **D**
10. Earthworm culturing in garden (Small Scale). **D**
11. Study of taxonomy, external characters and distribution of useful species of silkworm for sericulture. **D**
12. Life cycle of mulberry silkworm – Eggs, larva, cocoon, adult (male & female), silk. **D**

Study Tour:

Compulsory visit to large water body / Vermiculture unit / Sericulture project / Biodiversity spot / ZSI / Any project

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

***E** – Experiments

***D** – Demonstration Practical

Reference books:

1. A manual of practical zoology Chordata Vol. 2 : P. K. G. Nair and K. P. Achar
2. Hand Book of Animal Husbandary and Dairy: Mudlyer
3. Advanced Practical zoology By J. Sinha, A. K. Chatterjee, P. Chattopadhyay

Examination Pattern : (For Each Semester)

Theory

(A) Continuous Internal Assessment (CIA)	40 Marks
1. Attendance of the Students	10 Marks
2. Home Assignment	10 Marks
3. Mid – Semester	20 Marks
(B) University Examination (UEX)	60 Marks

CBCS 2016 Onwards

University Examination Pattern Theory Question Paper

Total Marks- 60

Time – 3 hrs.

Note : 1) All questions are compulsory and carry equal marks.

2) Figures to the right indicate full marks.

Que. 1. Short answer questions or Multiple Choice Questions. (12)

(No internal options for Question No. 1)

A. Multiple Choice Questions. 6 Marks

B. Short answer questions. 6 Marks

i)

ii)

iii)

iv)

v)

vi)



Answer in one sentence (e.g. Define or What is meant by)

Que. 2. Attempt ANY TWO of the following. (12)

a)

b)

c)

Que. 3. Attempt ANY TWO of the following. (12)

a)

b)

c)

Que. 4. Attempt ANY TWO of the following. (12)

(Write Short notes / Questions)

a)

b)

c)

Que. 5. Attempt ANY TWO short notes of the following. (12)

a)

b)

c)

Total : A+B= 100Marks

Internal Examination Pattern Practical

(A) Continuous assessment

(40 Marks)

a) Regular Practical Attendance	10 Marks
b) Timely Journal Completion	10 Marks
c) Internal Exam (Spotting/Viva)	15 Marks
d) Study Tour Report/Visit	05 Marks

(B) University Practical Examination:

(60 Marks)

Total : A+B= 100Marks



**BHARATI VIDYAPEETH UNIVERSITY
PUNE**

**CHOICE BASED CREDIT SYSTEM
(2016 Course)**

Proposed Syllabus for S.Y.B.Sc.

**IN
ZOOLOGY**

;(Semester III and Semester IV)

**To Be Implemented from Academic Year
2017 – 2018**

BHARATI VIDYAPEETH UNIVERSITY, PUNE
COURSE STRUCTURE OF THREE YEARS INTEGRATED CHOICE BASED CREDIT AND GRADING
SYSTEM BACHELOR OF SCIENCE (B.Sc.) DEGREE COURSE IN ZOOLOGY
(CBCS 2016 COURSE)

Implemented from the Academic Year 2017-18

Implemented from the Academic Year 2017-18						
Class	Subject Type	Subject Code	Subject Title	Credits	Continuous Internal Assessment CIA	University Examination UEX
B.Sc. I	Core course		Zoology : (Semester- I)			
		Z 11	Animal systematic and Functional Anatomy of Non-chordates- I	03	40	60
		Z 12	Cell Biology and Genetics	03	40	60
		Z 13	Practical course-I	02	40	60
	Foundation Course	UGF12	Youth Development	02	20	30
	Core course		Zoology : (Semester- II)			
		Z 21	Functional Anatomy of Chordates-I	03	40	60
		Z 22	Applied zoology (Vermiculture and Sericulture)	03	40	60
		Z 23	Practical course-II	02	40	60
	B.Sc. II	Core course		Zoology : (Semester- III)		
Z 31			Functional Anatomy of Non-chordates-II and Biodiversity	04	40	60
Z 32			Histology of Mammals	04	40	60
Z 33			Practical course-III	02	40	60
Elective course		SEC 31	English -I	04	40	60
		SEC 32	Marathi -I	04	40	60
Foundation Course		UGF32	Cyber Law	02	20	30
Core course			Zoology : (Semester- IV)			
		Z 41	Functional Anatomy of Chordates-II	04	40	60
		Z 42	Physiology of Mammals	04	40	60
		Z 43	Practical Course-IV	02	40	60
		Elective course	SEC 41	English –II	04	40
SEC 42			Marathi -II	04	40	60
B.Sc. III	Core course		Zoology : (Semester- V)			
		Z 51	Developmental Biology	04	40	60
		Z 52	Genetics and evolution	04	40	60
		Z 53	Applied Zoology-Apiculture and Inland fisheries	04	40	60
		Z 54	Parasitology	04	40	60
		Z 55	Ecology and environmental pollution	04	40	60
		Z 56	Practical Course-V	02	40	60
		Z 57	Practical Course-VI	02	40	60
		Z-58	Practical Course-VII	02	40	60

		Z 59B	Comparative Anatomy of Chordates and Microtechniques	04	40	60
		Z 59C	Evolution	04	40	60
	Foundation Course	UGF51	Soft skill	02	20	30
	Core course		Zoology : (Semester- VI) Core course			
		Z 61	General Embryology	04	40	60
		Z 62	Toxicology	04	40	60
		Z 63	Biological Techniques	04	40	60
		Z 64	Functional Anatomy of Chordates-III	04	40	60
		Z 65	Economic Entomology	04	40	60
		Z 66	Practical Course-VIII	02	40	60
		Z 67	Practical Course-IX	02	40	60
		Z 68	Practical Course-X	02	40	60
	Elective course	Z 69A	Biotechnology	04	40	60
		Z 69B	Biostatistics	04	40	60
		Z 69C	Biodiversity and Wild Life	04	40	60

S. Y. B. Sc. (Sem. III and IV)

CORE GROUPS (SELECT ANY ONE GROUP FROM THE FOLLOWING)

Group V :- Chemistry, Botany and Zoology (CBZ)

Group VII :- Chemistry, Zoology and Microbiology (CZM)

Group VIII :- Botany, Zoology and Microbiology (BZM)

Group VIII :- Zoology, Microbiology and Geography (ZMG)

SEMESTER III (From the Academic Year 2017-18)

Subject Type	Course Code	Title of the paper	Hrs/ Week			Credits	Exam Hrs	Maximum Marks		
			L	T	P			Continuous Internal Assessment CIA	University Examination UEX	Total Marks
Core Course	Z 31	Functional Anatomy of Non-chordates-II and Biodiversity	3	1	-	04	03	40	60	100
	Z 32	Histology of Mammals	3	1	-	04	03	40	60	100
	Z 33	Practical course-III	-	-	4	02	03	40	60	100
This course is compulsory for all the students.										
Foundation course	UGF31	Cyber Law	02			02	02	20	30	50

SEMESTER IV (From the Academic Year 2017-18)

Subject Type	Course Code	Title of the paper	Hrs/ Week			Credits	Exam Hrs	Maximum Marks		
			L	T	P			Continuous Internal Assessment CIA	University Examination UEX	Total Marks
Core Course	Z 41	Functional Anatomy of Chordates-II	3	1	-	04	03	40	60	100
	Z 42	Physiology of Mammals	3	1	-	04	03	40	60	100
	Z 43	Practical course-IV	-	-	4	02	03	40	60	100

S. Y. B.Sc. Zoology

(C.B.C.S. 2016 Course)

SEMESTER III

Z - 31 : Functional Anatomy of Non-Chordates II and Biodiversity
Core Course – Theory; Credits- 04

**Total
lectures
48L**

UNIT I

Study of starfish (*Asterias rubens*)

20L

- i) Systematic position, Habits and habitat.
- ii) External characters.
- iii) Structure and types of pedicellariae.
- iv) Digestive system – Alimentary canal, food, feeding mechanism and physiology of digestion.
- v) Water vascular system.
- vi) Nervous system and sense organs.
- vii) Reproductive system, Larval development and metamorphosis.
- viii) Autotomy and regeneration.

UNIT II

Salient features and classification upto classes of the following : (any two examples from each class)

10L

- i) Arthropoda – Crustacea, Arachnida, Insecta, Myriapoda, Onychophora
- ii) Mollusca – Aplousobranchia, Gastropoda, Pelecypoda, Scaphopoda, Cephalopoda
- iii) Echinodermata – Asterozoa, Ophiurozoa, Echinozoa, Crinozoa
- iv) Hemichordata – Enteropneusta, Pterobranchia

UNIT III

Study of following with reference to

15L

- i) Nematoda – Classification and general characters of Nematoda, Nematode development, Some common Nematode parasites of man (Any Four)
- ii) Arthropoda – Metamorphosis in Insects, Mimicry in Insects
- iii) Mollusca – Shell and foot modification in mollusca

UNIT IV

Bioluminescence in Firefly

03L

• **Reference books :**

1. The invertebrates – Hyman L. H.
2. Arthropoda, Mollusca and Echinodermata – Kotpal R.L.
3. Mollusca – Mortan J.E.
4. Echinodermata – Nicholas D.
5. Zoology, Non-chordates – Marathe, Agarkar and Joshi. Narendra Publication.
6. Invertebrate Zoology (1983). – E.L. Jordan and P.S. Verma
7. Biology of higher invertebrates – Russell- Hunter.
8. Invertebrates – Kotpal R.C.
9. A Text book of Invertebrate zoology – Prasad S. N.
10. A Text book of Invertebrate zoology – Srivastava M.
11. Modern text book of zoology – Invertebrates – Kotpal, Agarwal and Khetarpal.
12. Invertebrate structure and function – Barrington.
13. Biology of Non-chordates – Nigam
14. Invertebrate Zoology – Barnes.
15. Textbook of Zoology – Invertebrates Vol.1(1992) – Parker and Haswell.
16. A life of invertebrate – Russel Hunter.
17. College Zoology – Boolootin and stiles.
18. A manual of practical Zoology Invertebrates – P.S. Verma.

S. Y. B.Sc. Zoology

(C.B.C.S. 2016 Course)

SEMESTER III

Z - 3 2 : Histology of Mammals
Core Course – Theory; Credits- 04

**Total
lectures
48L**

UNIT I

12L

Study of Tissues

Review of the following tissues with reference to structure and functions.

i) Epithelial Tissues

- a) Simple epithelial tissue
- b) Compound epithelial tissue
- c) Glandular epithelium

ii) Connective Tissues

- a) Loose connective tissue
- b) Reticular tissue
- c) Adipose tissue.
- d) Skeletal tissue – Cartilage and Bone
- e) Fluid connective tissue – Blood and Blood cells

iii) Muscular tissue

- a) Smooth muscle
- b) Striated muscle
- c) Cardiac muscle

iv) Nervous tissue

- a) Neuron
- b) Nerve fibre

UNIT II

18L

Study of gross histological structure of different system organs Part I.

- i) Skin
- ii) Tooth

- iii) Tongue
- iv) Alimentary canal
 - a) Oesophagus b) Stomach c) Duodenum. d) Ileum
- v) Associated glands
 - a) Salivary glands
 - b) Liver
 - c) Pancreas
- vi) Respiratory system
 - a) Lung
 - b) Trachea

UNIT III

Study of gross histological structure of different system organs Part II.

18L

- i) Kidney
- ii) Spinal cord
- iii) Reproductive organs
 - a) Testis
 - b) Ovary
- iv) Endocrine glands- General idea of endocrine glands
 - a) Pituitary gland
 - b) Thyroid gland
 - c) Adrenal gland

• Reference books :

1. Histology of Mammals by : Athavale M.V. & Latery A.N.Narendra Prakashan,Pune.
2. Bailey's Text Book of Histology by : W.M.Copenhaver R.P. Bunge M.B.Bunge.
3. An Atlas of Histology by : W.H. Freeman B. Bracegirdle.
4. Histology by : A.W. Ham Lippincott.
5. A Text Book of Histology by : W. Bloom D.W. Fawcett(1975) Saunders,Philadelphia.
6. Histology: Greep, R. O. and Well L.

S. Y. B.Sc. Zoology

(C.B.C.S. 2016 Course)

SEMESTER III

Z 33 - Zoology Practical course

Core Course – Practical; Credits- 02

(Practical based on paper: Z-31, Z-32 (SEM - III))

- **Contact hours per practical – 04 h**

Functional Anatomy of Non-Chordates II and Biodiversity

1. Study of general and distinguishing characters and classification of non-chordates upto class level with one example of each class. **D**
(Sketches/Photographs may be used)
 - a. Arthropoda
 - b. Mollusca
 - c. Echinodermata
 - d. Hemichordata
2. Study of systematic position, external features and digestive system of Starfish. **D**
3. A. Study of water vascular system of Starfish. **D**
B. Temporary preparation of gonads and tube feet from star fish. **E**
4. Study of permanent slides of T. S. of an arm of Starfish and bipinnaria larva. **D**
5. Study of shell in mollusca. **D**
6. Study of foot in mollusca. **D**
7. Study of Mimicry in insects. **D**

Histology of mammals

8. Study of permanent slides of tissues. **D**
 - a. Squamous epithelium
 - b. Columnar epithelium
 - c. Areolar connective tissue
 - d. Hyaline cartilage
 - e. Smooth muscle fibre
 - f. Striated muscle fibre
9. Study of permanent slides of following organs. **D**
 - a. Skin – vertical section
 - b. Tooth – vertical section
 - c. Tongue – vertical section
 - d. Oesophagus – cross section
 - e. Stomach – cross section
 - f. Duodenum – cross section

- g. Ileum – cross section
- h. Salivary gland – parotid
- i. Liver – cross section
- j. Pancreas – cross section
- k. Trachea – cross section

10. Study of permanent slides of following organs.

D

- l. Kidney – longitudinal section
- m. Spinal cord - cross section
- n. Testis - cross section
- o. Ovary - cross section
- p. Thyroid gland - cross section
- q. Adrenal gland - cross section
- r. Pituitary gland - cross section

• **Reference books:**

1. A Manual of Practical Zoology Invertebrate : P. S. Verma S.Chand and Co.,New Delhi.
2. A Manual of Practical Zoology Vol. I : Non- Chordata,1994: P. K. G. Nair and K. P. Achar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
3. A Manual of Practical Zoology Vol.II Non Chordata,1994: P. K. G. Nair and K. P. Achar, Himalaya Publishing House,Bombay,Delhi,Nagpur.
4. Practical Zoology, Invertebrate/Vertebrate : S.S. Lal Rastogi Publications,Meerut.
5. Practical Invertebrate Zoology – 1972. V. S. Srivastava. Central Book Depot. Allahabad.
6. Kotpal, R.L., (All Series) Protozoa, Porifera, Coelenterata, Annelida, Arthropoda, Mollusca & Echinodermata - Rastogi Publications.
7. A Text Book of Histology : W. Bloom D.W. Fawcett(1975) Saunders, Philadelphia.

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(C.B.C.S. 2016 Course)

SEMESTER IV

Z - 41 : Functional Anatomy of Chordates-II

Core Course – Theory; Credits- 04

**Total
lectures
48L**

UNIT I

Study of *Scoliodon*

15L

- i) Systematic position, habit and habitat.
- ii) External characters of *scoliodon*
- iii) Digestive system, food and feeding
- iv) Respiratory system
- v) Blood vascular system – Heart, Its structure and working ✓
- vi) Nervous system -Brain its structure and functions
- vii) Sense organs – Olfactory organs, eye, membranous Labyrinth, Ampulla of Lorenzini
- viii) Urinogenital system – Male and Female
- ix) Economic importance of *Scoliodon*

UNIT II

Salient features of the following classes and its subclasses with suitable two examples of each

12L

- i) Reptilia: Subclasses- Anapsida, Diapsida
- ii) Aves: Subclasses- Neornithes- Superorders- Palaeognathae, Neognathae
- iii) Mammalia: Subclasses-Prototheria, Theria- Metatheria, Eutheria

UNIT III

General topics

16L

- i) Poisonous and Non- poisonous snakes (Two examples each) ✓
- ii) Beak and Feet modifications in birds
- iii) Aerial adaptations in birds ✓
- iv) Dentition in mammals ✓

UNIT IV

05L

Animal Ethics

- i) Introduction and Concept
- ii) Animal Protection Act
- iii) Laboratory animal model and application(Any four)

• Reference books :

1. Chordate Zoology (1988) – C.Dalela.
2. Chordate Zoology (1996) , Kishor Pawar.
3. Zoology of chordates – H.C. Nigam.
4. The diversity of life – E.O.Wilson.
5. The biology of diversity – M.kato.
6. Modern text book of zoology – vertebrates (1992) – Kotpal ,Agarwal and Khetarpal.
7. Text book of Modern Zoology (1991) – P.S. Verma and P.C. Shrivastava.
8. Mannual of practical zoology – vertebrates – P.S. Verma.
9. The Life of Vertebrates – Younge J. Z.
10. A Textbook of Zoology –Parker T.J. and Haswell W. A..
11. A Textbook of vertebrate Zoology – Prasad S. N.
12. Introduction to chordates – Manjupuria T. C.
13. A Textbook of vertebrate Zoology- Agarwal and Dalela.
14. Vertebrates – Kotpal R. C.
15. Chordates – Dhami and Dhami.
16. Wild life conservation: Negi S.S (Natraj Publishers)
17. Guidelines for breeding and care of laboratory animals: World Health Organization (WHO) and International Council For Laboratory Animal Science (ICLAS).

S. Y. B.Sc. Zoology

(C.B.C.S. 2016 Course)

SEMESTER IV

Z - 42 : Physiology of Mammals
Core Course – Theory; Credits- 04

**Total
lectures
48L**

UNIT I

Nutrition

10L

- Constituent of balanced diet-
Carbohydrates, Fats, Proteins, Essential Amino acids, Vitamins, Mineral Salts, Water
- Brief outline of sources of energy –
Carbohydrates and carbohydrate requirements, Fats and its requirements, Protein and its requirements.
- Physiology of digestion –
Peristaltic movement, digestion, actions of digestive juices and enzymes on different foods, absorption, assimilation, defecation.

UNIT II

Circulation

06L

- Process of coagulation of blood
- Neurogenic and myogenic heart, cardiac cycle, cardiac output
- Control of heart beats – Nervous, Hormonal and Ionic

UNIT III

Respiration

08L

- Ventilation
- Nervous control of breathing action
- Exchange of gases between lung and plasma, erythrocytes and tissues
- Basal metabolic rate and respiratory quotient

UNIT IV

Excretion

08L

- Formation and composition of urine
- Counter current multiplier theory
- Blood supply of kidney
- Hormonal control of kidney

UNIT V

08L

7. Reproduction

- i) Oestrous cycle and Menstrual cycle
- ii) Pregnancy
- iii) Parturition
- iv) Hormonal control

UNIT VI

08L

9. Vertebrate endocrinology

- i) Pituitary gland hormones :
 - Pars distalis – S. T. H. / G. H, Prolactin, TSH, FSH, LH/ICSH, ACTH
 - Pars intermedia – MSH
 - Pars nervosa – Oxytocin, ADH
- ii) Thyroid gland – Thyroxin, Calcitonin
- iii) Adrenal gland hormones :
 - Adrenal cortex – Mineralocorticoid, Glucocorticoid
 - Adrenal medulla – Adrenalin, Nonadrenalin
- iv) Pancreas (Islets of Langerhans) – Insulin, Glucagon.
- v) Kidney (JG Complex)– Renin, Erythropoietin
- vi) Testis (Cells of Leydig) – Testosterone.
- vii) Ovary : Theca interna-Oestrogen, Corpus luteum -Progesterone, Relaxin

• Reference books :

1. General & Comparative Physiology – By Hoar W.S.
2. An introduction to physiology – Davson (Vol.I & II)
3. Human Physiology – Chatterjee C C (vol. I & II)
4. Textbook of animal physiology – Hmkat & Mathur.
5. Human physiology – Guyton and Hall.
6. Mammalian Physiology – Athavale M.V.
7. Zoology – General Physiology – Pradip Jabde (vol. I & II)
8. Physiology of Reproduction – Hogarth.
9. General & Comparative endocrinology – E.J. W. Barrington.
10. Text book of Endocrinology –R.H. Williams.

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(C.B.C.S. 2016 Course)

SEMESTER IV

Z 43 - Zoology Practical course

Core Course – Practical; Credits- 02

(Practical based on paper: Z-41, Z-42 (SEM - IV))

- Contact hours per practical– 04 h

Functional anatomy of chordates-II

12. Study of general and distinguishing characters and classification of chordates upto order level with one example of each order. **D**

(Sketches/Photographs may be used)

- Class – Reptilia (Order : Chelonia, Squamata- Lacertilia, Ophidia, Crocodilia)
- Class- Aves (Order : Struthioniformes, Anseriformes, Falconiformes, Psitaciformes, Passeriformis and Columbiformes)
- Class – Mammalia (Order : Monotremata, Marsupialia, Chiroptera, Rodentia and Primates)

13. Study of systematic position, external features and digestive system of *Scoliodon*. **D**

14. Study of brain of *Scoliodon*. **D**

15. Study of placoid scales and ampullae of Lorenzini. **D**

16. Study of a) Arterial system of *Scoliodon* (excluding head arteries) **D**

b) Eye ball muscles **D**

17. Identification of poisonous and non- poisonous snakes with the help of identification key with two examples of each **D**

18. Study of modifications of beaks and feet in birds. **D**

a. Beaks: tearing and piercing, fruit eating, mud probing, fish catching, wood chiselling, and flower probing.

b. Feet: perching, raptorial, climbing, swimming, running. **D**

19. Dentition in mammals. **D**

Physiology of Mammals

20. Action of Enzymes . **E**

- Digestion of starch by saliva/ proteins by pepsin.
- Effect of temperature and dilution on enzyme action.
- Specificity of enzyme.

21. Quantitative estimation of hemoglobin in blood and study of colour index. **E**

22. Study of total count of R. B. C. in mammalian blood. **E**

23. Study of total count of W. B. C. in mammalian blood. **E**

24. Study of clotting time by capillary experiment. in mammalian blood. **E**

25. Compulsory submission of field visit report along with at least five photographs/models/sketches of insect pest/fishes/any animal corresponding to theory courses.
26. Compulsory study tour/visit to sea coast/fishery institute/sericulture farm/apiculture institute / agricultural farm.

Students be introduced to learning dissections / anatomy adapting CDS / Web sources.

*E – Experiments

*D – Demonstration Practical

• **Reference books :**

1. A Manual of Practical Zoology Chordata Vol. 2 : P. K. G. Nair and K. P. Achar.
2. A Manual of Practical Vertebrate Zoology and Physiology, 1990. V. B. Rastogi, Kedarnath, Ramnath, Meerut, Delhi.
3. Experimental Physiology: V.V. Kulshreshtha, Vikas Publishing House Pvt. Ltd, New Delhi.
4. Practical Zoology, Vertebrate : S.S. Lal Rastogi Publications, Meerut.



BHARATI VIDYAPEETH UNIVERSITY

PUNE

CHOICE BASED CREDIT SYSTEM

(2016 Course)

Proposed Syllabus for T. Y. B.Sc.

IN

ZOOLOGY

(Semester V and Semester VI)

To Be Implemented from Academic Year

2018 – 2019

BHARATI VIDYAPEETH UNIVERSITY, PUNE COURSE STRUCTURE OF THREE YEARS INTEGRATED CHOICE BASED CREDIT AND GRADING SYSTEM BACHELOR OF SCIENCE (B.Sc.) DEGREE COURSE IN ZOOLOGY (CBCS 2016 COURSE) Implemented from the Academic year 2018-19						
Class	Subject Type	Subject Code	Subject Title	Credits	Continuous Internal Assessment CIA	University Examination UEX
B.Sc. I	Core course		Zoology : (Semester- I)			
		Z 11	Animal systematic and Functional Anatomy of Non-chordates- I	03	40	60
		Z 12	Cell Biology and Genetics	03	40	60
		Z 13	Practical course-I	02	40	60
	Foundation Course	UGF12	Youth Development	02	20	30
	Core course		Zoology : (Semester- II)			
		Z 21	Functional Anatomy of Chordates-I	03	40	60
		Z 22	Applied zoology (Vermiculture and Sericulture)	03	40	60
		Z 23	Practical course-II	02	40	60
B.Sc. II	Core course		Zoology : (Semester- III)			
		Z 31	Functional Anatomy of Non-chordates-II and Biodiversity	04	40	60
		Z 32	Histology of Mammals	04	40	60
		Z 33	Practical course-III	02	40	60
	Elective course	SEC 31	English -I	04	40	60
		SEC 32	Marathi -I	04	40	60
	Foundation Course	UGF32	Cyber Law	02	20	30
	Core course		Zoology : (Semester- IV)			
		Z 41	Functional Anatomy of Chordates-II	04	40	60
		Z 42	Physiology of Mammals	04	40	60
		Z 43	Practical Course-IV	02	40	60
	Elective course	SEC 41	English –II	04	40	60
		SEC 42	Marathi -II	04	40	60
B.Sc. III	Core course		Zoology : (Semester- V)			
		Z 51	Developmental Biology	04	40	60
		Z 52	Genetics and evolution	04	40	60
		Z 53	Applied Zoology-Apiculture and Inland fisheries	04	40	60
		Z 54	Parasitology	04	40	60
		Z 55	Ecology and environmental pollution	04	40	60
		Z 56	Practical Course-V	02	40	60
		Z 57	Practical Course-VI	02	40	60
		Z-58	Practical Course-VII	02	40	60
	Elective course	Z 59A	Biochemistry and Molecular biology	04	40	60
		Z 59B	Comparative Anatomy of Chordates	04	40	60

			and Microtechniques			
		Z 59C	Evolution	04	40	60
	Foundation Course	UGF51	Soft skill	02	20	30
	Core course		Zoology : (Semester- VI) Core course			
		Z 61	General Embryology	04	40	60
		Z 62	Toxicology	04	40	60
		Z 63	Biological Techniques	04	40	60
		Z 64	Functional Anatomy of Chordates-III	04	40	60
		Z 65	Economic Entomology	04	40	60
		Z 66	Practical Course-VIII	02	40	60
		Z 67	Practical Course-IX	02	40	60
		Z 68	Practical Course-X	02	40	60
	Elective course	Z 69A	Biotechnology	04	40	60
		Z 69B	Biostatistics	04	40	60
		Z 69C	Biodiversity and Wild Life	04	40	60

T. Y. B. Sc. (Sem. V and VI)

The student should select any one subject from the core group which he / she has opted at S.Y.B.Sc. (Sem. III and IV) as Principle subject.

SEMESTER V (From the Academic Year 2018-19)

Subject Type	Course Code	Title of the paper	Hrs/ Week			Credits	Exam Hrs	Maximum Marks		
			L	T	P			Continuous Internal Assessment CIA	University Examination UEX	Total Marks
Core Course	Z 51	Developmental Biology	3	1	-	04	03	40	60	100
	Z 52	Genetics and evolution	3	1	-	04	03	40	60	100
	Z 53	Applied Zoology- Apiculture and Inland fisheries	3	1	-	04	03	40	60	100
	Z 54	Parasitology	3	1	-	04	03	40	60	100
	Z 55	Ecology and environmental pollution	3	1	-	04	03	40	60	100
	Z 56	Practical course -V	-	-	4	02	03	40	60	100
	Z 57	Practical course-VI	-	-	4	02	03	40	60	100
	Z 58	Practical course -VII	-	-	4	02	03	40	60	100
Elective course	Any one of the following.									
	Z 59A	Biochemistry and Molecular biology	3	1	-	04	03	40	60	100
	Z 59B	Comparative Anatomy of Chordates and Microtechniques	3	1	-	04	03	40	60	100
	Z 59C	Evolution	3	1	-	04	03	40	60	100
Foundati on course	This course is compulsory for all the students.									
	UGF51	Soft Skill	2			02	02	20	30	50

SEMESTER VI (From the Academic Year 2018-19)

Subject Type	Course Code	Title of the paper	Hrs/ Week			Credits	Exam Hrs	Maximum Marks		
			L	T	P			Continuous Internal Assessment CIA	University Examination UEX	Total Marks
Core Course	Z 60	General Embryology	3	1	-	04	03	40	60	100
	Z 61	Toxicology	3	1	-	04	03	40	60	100
	Z 62	Biological Techniques	3	1	-	04	03	40	60	100
	Z 63	Functional Anatomy of Chordates-III	3	1	-	04	03	40	60	100
	Z 64	Economic Entomology	3	1	-	04	03	40	60	100
	Z 65	Practical course –VIII	-	-	4	02	03	40	60	100
	Z 66	Practical course –IX	-	-	4	02	03	40	60	100
	Z 67	Practical course -X	-	-	4	02	03	40	60	100
Elective course	Any one of the following.									
	Z 68A	Biotechnology	3	1	-	04	03	40	60	100
	Z 68B	Biostatistics	3	1	-	04	03	40	60	100
	Z 68C	Biodiversity and Wild Life	3	1	-	04	03	40	60	100

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-51: Developmental Biology

Core course- Theory; Credits -04

Total Lectures: 48L

UNIT I 14L

1. Introduction 2L
 - i. Definition
 - ii. Normal sequence of events in embryology: Gametogenesis, Fertilization, Cleavage, Gastrulation
2. Gametogenesis 4L
 - i. Formation of germ cells
 - ii. Origin of germ cells in chordates
 - iii. Spermatogenesis : Different phases, spermeogenesis, hormonal control, significance of spermatogenesis
 - iv. Oogenesis : Different phases with special reference to growth phase, previtellogenesis, vitellogenesis, postvitellogenesis, hormonal control and significance of oogenesis
Difference between spermatogenesis and oogenesis
3. Structure of gametes 4L
 - i. Sperm : General structure, sperms of different animals and man, ultra structure of sperm and functions of different parts
 - ii. Ovum : General structure, Different types of ova, egg membranes, ultra structure of ovum
4. Discharge of sex cells 4L
 - i. Process of ovulation in short (Time of ovulation, causes of ovulation) Egg transport, egg viability, semination, sperm storage
 - ii. Sperms liberation process, longevity of sperms, sperm transport, viability, limitations

UNIT II 20L

5. Fertilization 8L
 - i. Concept and types
 - ii. Approximation of gametes, mutual identification of gametes, sperm attraction, chemotaxis (Fertilizin- antifertilizin) agglutination

- iii. Capacitation, the acrosome reaction, release of acrosomal content, acrosomal tube formation, fusion of egg and sperm plasma lemma
- iv. Fertilization, cone formation, cortical reactions, ionic changes within the egg cytoplasm
- v. Paths of pronuclei, penetration path, copulation path
- vi. Fusion of haploid pronuclei, changes occurring in the egg at and after fertilization
- vii. Significance of fertilization
- 6. Cleavage 4L
 - i. Peculiarities of cell division on cleavage.
 - ii. Types of cleavage
 - iii. Factors affecting rate of cleavage
 - iv. Significance of cleavage
- 7. Morula and blastula 4L
 - i. Morula and morulation
 - ii. Blastula and blastulation
 - iii. Blastulation in centrolecithal egg and telolecithal egg
 - iv. Significance of blastula stage
- 8. Gastrulation 4L
 - i. Concept and general processes involved in gastrulation .
 - ii. Basic cell movements in gastrulation.
 - iii. Significance of gastrulation
 - iv. Organizer : Primary, Secondary

UNIT III 10L

- 9. Development of frog 10L

Ovulation, Spawning, Organization of the unfertilized egg, Fertilization, Gray crescent, Symmetry of the egg, Zygote and future embryo, Cleavage, Blastula, The fate map, Gastrulation, Neurulation, Development of notochord, Differentiation of mesoderm, Formation of coelom, Fate of the primary germ layers, Post neural development, Formation of tadpole larva, Hatching, Metamorphosis, Physiological control of metamorphosis in Anura

UNIT IV

- 10. General topics 4L

Brief idea of all this is to be given :

 - i. Regeneration
 - ii. Cloning techniques, significance
 - iii. Cryopreservation

Reference Books

1. An Introduction to Embryology 1981, Balinsky B.L., Saunders College, Philadelphia.
2. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.
3. Developmental Biology, 1997, 3rd Edition, Gilbert S.F. Saunder Associates Inc. U.S.A.
4. Developmental Biology, 1992 3rd edition, Browder L.W. Erickson C.A. & Williams, R J. Saunders College, Publications, London.
5. A Text Book of Embryology, Dr. Puranik P. G., S. Chand & Co.
6. Developmental Biology, 1984, Browder L.W. , Saunders College Publicaions, U.S.A.
7. Development of Chick embryo, 1972, Lillie.
8. Developmental Biology, 1991, 3rd Edition, Sinaur Associates, Inc. U.S.A.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-52: Genetics and Evolution

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 14L

1. Gene interaction and modified Mendelian ratios 6L
 - i. Complementary factor (9:7) ratio
 - ii. Recessive epistasis (9:3:4) ratio
 - iii. Dominant epistasis (12:3:1) ratio
 - iv. Duplicate factor (15:1) ratio
2. Lethal gene – Concept 2L
Coat color in mice (2:1) ratio
3. Sex determination 6L
 - i. Discovery of sex chromosomes and chromosomal methods of sex determination.
XY Method, XO Method, ZW Method, Honey Bee Method
 - ii. Gynandromorphs
 - iii. Sex influenced genes (Baldness in man)
 - iv. Holandric genes- Hypertrichosis

UNIT II 12L

4. Linkage 6L
 - i. Difference in linkage and independent assortment
 - ii. Coupling and repulsion hypothesis of Bateson and Punnett
 - iii. Chromosome theory of linkage
 - iv. Kinds of linkage – Linkage groups and significance of linkage
5. Crossing over 6L
 - i. Mechanism of meiotic crossing over – Synapsis
 - ii. Duplication of chromosomes, crossing over, terminalization
 - iii. Theories about the mechanism of crossing over
 - iv. Kinds of crossing over
 - v. Factors affecting and significance of crossing over

UNIT III 14L

6. A. Human genetics 8L
 - i. Human Karyotype

- ii. Kinds of hereditary characters
- iii. Mental traits intelligence quotient (IQ)
- iv. Heredity of Twins
 - a. Various kinds of twins
 - b. Significance of twins
- 7. Population genetics 6L
 - i. Basic concept in population genetics:
Mendelian population, gene pool, gene frequency, chance mating (Panmictic mating)
 - ii. Hardy Weinberg Law and its equilibrium

UNIT IV Organic Evolution 8L

- i. Introduction, origin of life
- ii. Origin of eukaryotic cell (Origin of mitochondria, Plastids and Symbionts)4L
- iii. Isolation- Isolating mechanism
- iv. Classification of isolating mechanism- Pre-zygotic and post –zygotic 4L

Reference books

1. Principles of Genetics, 1997, P. D. Snustad, M. L. Simmons J. B. Jenkins, John Wiley & Sons, USA
2. Genetics, 2014, 9th Edn., Verma P. S. and Agarwal V. K., S. Chand and Co., New Delhi
3. Genetics, 2014, 4th rev Edn., 3rd reprint, Gupta P. K., Rastogi Publications, Meerut
4. Genetics, 2004, 1st Edn. Sarin, C., Tata McGraw Hill, New Delhi.
5. Principles of Genetics, 2006, 8th Edn., Gardner E. J., Simmons M. J. and Snustad D. P., Wiley India Pvt Ltd
6. Genetics, 1997, 3rd Edn., D. L. Hartl, Jones and Bartlett Publishers, USA
7. Genetics, 1985, 3rd revised Edn., Strickberger M. W., Macmillan USA
8. Molecular Biology of the Cell, 2007, 5th Edn., Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Taylor & Francis, UK
9. Gene V & VI, 1994, Lewin Boxford University Press ,Oxford
10. Molecular Biology of the gene, 1993, Watson J. Hopkins, Roberts, Steitz and Weiner, Benjamin Cummings.
11. Animal evolution – Carter
12. Evolution- De Beer G. R.
13. Organic evolution- Lull R. S.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-53: Applied Zoology- Apiculture and Inland fisheries

Core course- Theory credits -04

Total Lectures: 48L

UNIT I	15L
1. Introduction	2L
i. Introduction to apiculture	
ii. Brief history of bee keeping	
2. Taxonomy and distribution of honey bees	5L
i. Wild species of honey bees	
a. <i>Apis dorsata</i>	
b. <i>Apis florae</i>	
c. Stingless bees	
ii. Domesticated species of honey bees	
a. <i>Apis cerana indica</i> .	
b. <i>Apis mellifera</i> .	
3. Colony organization and polymorphism	4L
Nest architecture, Cohesive force (Queen), Multiplication of colonies	
Caste differentiation, Division of labour	
4. External Characters and Life Cycle of <i>Apis indica</i>	4L
i. General external characters with special reference to mouth parts and sting apparatus	
ii. Life Cycle – Egg, Larva, Pupa, Adult	
UNIT II	10L
5. Bee products and their uses	3L
Pollen, propolis (bee glue), honey, wax, venom, royal jelly	
6. Bee Management	5L
i. Routine management	
ii. Seasonal management of bee colonies	
iii. Queen rearing	
iv. Temperature and humidity control of hive	
7. Economics of bee keeping	2L

UNIT III **13L**

8. Economic value of Fishes in Brief 4L
Fish as human food, Fish manure, Fish oil, Fish glue and Isinglass
Fish leather, Biological control, For manufacture of artificial pearls, Industries
9. Construction and Maintenance of Fish Farm 5L
i. Location of fish farm
Topography, Soil type, Water supply
ii. Layout of fish farm
Hatching pits, Nursery ponds, Rearing ponds, Stocking ponds
10. Pond maintenance and Improvement 4L
i. Controlling the vegetation
ii. Clearing the vegetation
iii. Liming
iv. Fertilization
v. Artificial Feeding

UNIT IV **10L**

11. Role of Physico – Chemical and biological factors during fish culture 6L
i. Physical factors
Depth, Shore conditions, Pressure and movement of water, Turbidity, Light
ii. Chemical factors
O₂, CO₂, pH, Total hardness of water, Dissolved solids
iii. Biological factors
Animals and Plant communities in various Zones of Pond
12. Common Diseases of Fish and there Cure 4L
i. Skin Parasites and Diseases : Fish louse – Argulus, Anchor Worm,
Fish leech, Yellow grubs
ii. Diseases of gills- Twin Worm, Oxhead Worm, Protozoan parasites, Gill rot
iii. Bacterial and Viral Diseases :Tail rot, Dropsy
iv. Control measures

Reference Books

1. Fishes of India-Zingran
2. Fish Culture - K. H. Alikuhni.
3. Fish Culture - Lagter.
4. Fishes of India. - Khanna.
5. Bee keeping in India - Sardar Sing.
6. Bee Keeping in India- M. G. Smith.
7. Applied Zoology –Dr.Kishore R. Pawar and Dr. Ashok Desai. Nirali Prakashan.
8. Economic Zoology – Sarkar Kundu Chaki New Central Book Agency (P) Ltd London.
9. Applied Zoology- Tarit Kumar Banerjee New Central Book Agency (P) Ltd London.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-54: Parasitology

Core course- Theory credits -04

Total Lectures: 48L

UNIT I	4L
1. Introduction to parasitism, animal associations, types of parasites and types of hosts	4L
UNIT II	20L
2. Study of following parasites with reference to	20L
i. Systematic position	
ii. Geographical distribution	
iii. Habits and habitat	
iv. Morphology	
v. Life – cycle	
vi. Mode of infection	
vii. Pathogenecity	
viii. Control measures – prophylaxis and treatment	
ix. Parasitic adaptations	
x. Diagnostic procedures.	
1. <u>Entamoeba histolytica</u>	
2. <u>Plasmodium vivax.</u>	
3. <u>Taenia solium</u>	
4. <u>Ascaris lumbricoides.</u>	
UNIT III	16L
3. Effect of parasites on host	2L
4. Response of host to the parasites, brief introduction to human defense mechanism, Antigens and antibodies	4L
5. Types of vectors, methods of transmission, indirect mechanical transmission, direct mechanical transmission, biological transmission and control of vectors	4L
6. General adaptations of parasites	2L
7. Adaptations of parasites for transmission	4L

UNIT IV

8L

8. Prevention and control of parasites, natural control and artificial control	4L
9. Epidemic diseases	4L
Typhoid, Cholera, Small pox; their occurrence and eradication programmes	

Reference Books

1. Comparative Protozoology: Ecology, Parasitology, Life history, 1988, Anderson, O.R. Springer Verlag, Berlin.
2. Parasites and parasitism, Cameron, 1958, T. W. M. Methuen, London
3. An Introduction to Parasitology, 1961, Chandler, A.C. & C. P. Read, Wiley, New York
4. Parasitology and Helminthology in relation to Clinical Medicine, 1980, Edn.12 Chatterjee, K.D., Chatterjee Medical publishers, Calcutta.
5. The biology of animal parasites, 1964, Cheng T.C., Saunders, Philadelphia.
6. Symbiosis, 1970, Cheng T.C., Pegasus, New York.
7. Parasitology –The biology of animal parasites, 1971, Noble E.R. & G. A. Noble, Lea and Febiger, Philadelphia U.S.A.
8. Animal Parasitism, 1972, C.P. Read, Prentice Hall, Englewood Cliffs, N.J., U.S.A.
9. Parasites: Lice, Ticks & Fleas (Free Kindle), 2014, C.D. Shelton.

T.Y.B.Sc. (ZOOLOGY)

SEMESTER-V

(CBCS 2016 Course)

Z-55: Ecology and Environmental pollution

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 11L

1. Introduction to Ecology 4L
 - i. Definition and integrated study
 - ii. Subdivision of ecology
Autecology, Synecology, Habit ecology, Population ecology, Ecosystem ecology, Conservation ecology, Production ecology, Palaeo ecology, Radiation ecology, Gene ecology, Space ecology, Taxonomic ecology, Human ecology
 - iii. Approaches to study of ecology
 - iv. Scope and significance of ecology
2. Review of organization of biosphere 7L
 - i. Levels of organization (Brief study)
Biosphere, Ecosystems, Communities, Populations
 - ii. Concept of ecosystem and types of ecosystem (Brief study)
Lakes and ponds, Streams and rivers, Forests
Grasslands, Deserts, Marine ecosystems: Seas, oceans, seashore and estuaries
 - iii. Components of an ecosystem
 - a. Abiotic : Material, Energy
 - b. Biotic : Producers, Consumers, Decomposers

UNIT II 13L

3. Population ecology 8L
 - i. Review of attributes of populations
Population size, Population density, Birth rate
Death rate, Dispersal, Age composition, Sex ratio
 - ii. Population growth
 - a. Limiting factors
Liebig's law of minimum, Sehellford's law of Tolerance
 - b. Growth from J shaped curve and sigmoid curve
 - iii. Population dynamics
Growth, Decline , Oscillation, Fluctuation, Extinction
4. Biogeochemical cycles 5L

- i. Concept of integration of biological, Geochemical components.
- ii. Cyclical phenomenon
Oxygen, Carbon, Nitrogen, Phosphorus, Sulphur

UNIT III	17L
5. Introduction to environmental pollution	4L
i. Types : Air, Water and soil	
ii. Environmental compartments and their inter relationship	
iii. Biodegradable and non biodegradable pollutants	
6. Air pollution	6L
i. General problem	
ii. Sources of air pollutants, particulate matter (Aerosols) and their effects	
iii. Gaseous pollutants Sulphur oxides, Nitrogen oxides, acid rain, smog and photochemical smog Carbon monoxide, Carbon dioxide, green house effect and global warming	
7. Water pollution	7L
i. General problems	
ii. Sources of water pollution Domestic waste and sewage, Industrial waste and effluents Agricultural discharge, Harmful effects of pesticides on animals Harmful effects of heavy metals on animals, Faunal changes in river due to sewage pollution, Various effects of industrial wastes on aquatic ecosystem, Eutrophication	
UNIT IV	7L
8. Introduction to sound pollution, radiation pollution and its effects on human health	4L
9. Introduction to pollution control technology	3L

Reference books

1. Ecology and environment, 2014, 12th revised Edition, P. D. Sharma, Rastogi Publ. Meerat.
2. Environmental Biology, 1996, P. S. Verma and V. K. Agrawal, S. Chand and Co. New Delhi.
3. Ecology, 2007, 1st Edn. Mohan P. Arora, Himalaya Publ. House, Delhi.
4. Fundamentals of ecology, 2009, 3rd Edn., M. C. Dash, Tata Mcgraw Hill, New Delhi.
5. Elements of ecology, 1967, George L. Clarke, John Wiley and Sons, New York.
7. Concepts of Ecology, 1996, E.J. Kormondy, Prentice Hall of India. New Delhi
8. Modern concept of Ecology, 1995, 8th Edn. H. D. Kumar, Vikas Publishing House, New Delhi
9. Fundamentals of Ecology, 2006, 5th Edn., E. P. Odum, Oxford & IBM Publi.Co. New Delhi.
10. Environmental problems and Solution, 1998, 2nd Edn. D. K. Asthana, Meera Asthana, S. Chand Publi., New Delhi.

Z-56 Practical Course –V

Practicals Based on Z- 51 Developmental Biology and Z- 52 Genetics and Evolution

Core Course – Practical; Credits- 02

1. Study of eggs of insect, amphioxus, frog, chick.	D
2. Study of cleavage, blastula and gastrula -Frog.	D
3. Study of Ascidian tadpole and stages of metamorphosis in frog.	D
4. Genetic examples based on Interaction of genes.	2E
5. Study of some genetically variable human traits.	E
6. Study of human karyotype.	E
7. Temporary preparation of polytene chromosome from suitable material.	E
8. Study of Hardy –Weinberg law with suitable recording of genetic traits.	2E

Z-57 Practical Course –VI

Practicals Based on Z- 53 Applied Zoology – Apiculture and Inland Fisheries and Z-54 Parasitology

Core Course – Practical; Credits- 02

1. Study of types and castes of bees, honeycomb, mouthparts , pollen basket and sting apparatus of honey bees. D
2. Observations of techniques of bee keeping and bee products : Honey, Bee wax, Bee venom and royal jelly. D
3. Study of Indian species of honey bees, study of life cycle and architecture of bee hive. 2D
4. Economic importance of Shark, Pamphret, oil Sardine, Mackerel, Bombay duck, Eel, Catla, Rohu, Mrigal and Cyprinus. D
5. Study of fish byproducts- fish meal, fish glue, fish liver oil, fish body oil, fish manure and shagreen. D
6. Study of Life cycle of *Plasmodium vivax* and *Entamoeba histolytica* (whole mounts of life stages) D
7. Study of Life Cycle –*Ascaris lumbricoides* and *Taenia solium* (whole mounts of life stages) D
8. Study of morphology and pathogenicity of Head louse, Tick and Mite. D
9. Field trip to Bee Research Institute/ Visit to fish farm/Any Project D

Z-58 Practical Course –VII

**Practicals Based on Z-55 Ecology and Environmental Pollution with any one of the
Elective Course Z 59A/ 59B/ 59C**

Core Course – Practical; Credits- 02

1. Study of physiochemical properties of soil sample (using analysis kit) E
2. Estimation of dissolved oxygen in water by Winkler's method E
3. Estimation of dissolved CO₂ in water. E
4. Estimation of Oxygen consumption in any aquatic animal. E
5. Water analysis: Physical properties as pH, temperature, turbidity and hardness. E
6. Water analysis: Chemical properties as acidity, Alkalinity and productivity. E
7. Any suitable project to be selected by student (Two students per project) under the guidance of teacher and report is to be submitted at the time of practical examination.
8. Compulsory visit to an ecosystem such as cultivated farm a lake, a river, a river or forest.
Report of such a visit to be presented along with the laboratory journals.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-59A: Biochemistry and Molecular Biology

Elective course- Theory credits -04

Total Lectures: 48L

Biochemistry

UNIT I 11L

1. pH and buffers 4L
 - i. Water : Properties of water, its biological significance, dissociation of water and its ionic products
 - ii. pH : Definition, Dissociation of strong electrolytes, Ionization of weak acid and bases, Henderson – Hasselbalch equation.
 - iii. Buffers: Definition and concept, Buffers in biological system, Theory of acid-base balance.
2. Carbohydrates 4L
 - i. Classification
 - ii. Stereochemical properties of carbohydrates
 - iii. Biological and chemical significance
 - iv. Physical and chemical properties of carbohydrates
3. Lipids 3L
 - i. Introduction and Classification
 - ii. Fatty acids, prostaglandins, acyl glycerol waves
 - iii. Phospholipids, sphingolipids, glycolipids and their biological significance
 - iv. Lipoproteins
 - v. Biological significance of lipids
 - vi. Distribution of lipids in pro and eukaryotic cells

UNIT II 13L

4. Proteins 7L
 - i. Amino acids : Structure, essential and non essential amino acids
 - ii. Non protein amino acids
 - iii. Properties of amino acids: Physical properties, reactions of amino acids, carboxyl group of amino acids, R group simple peptides.
 - iv. Classification of proteins : Primary, Secondary, tertiary and quaternary
 - v. Fibrous proteins : Keratin silk collagen

- vi. Globular proteins: Cytochrome C, Antibodies, blood proteins, Hormones, enzymes
- 5. Enzymes 6L
 - i. Classification
 - ii. Properties : Enzyme –Substrate complex, specificity, effect of concentration and dilution of enzyme, effect of pH and temperature, Inhibition and activation

UNIT III 19L

- 6. Nucleic acids 4L
 - i. DNA-Structure, properties, Watson-Crick model, physiochemical properties of DNA and biological significance
 - ii. RNA-structure, types and functions
- 7. Evidences for DNA as a genetic material 5L
 - i. Transformation
 - ii. Transduction
 - iii. Conjugation
- 8. Replication of DNA 2L
- 9. DNA damage and repair mechanism 2L
- 10. Protein Synthesis 6L
 - a. Transcription
 - i. Process of transcription in prokaryotes
 - ii. RNA polymerases.
 - iii. Post transcriptional modifications in RNA.
 - b. Translation
 - i. Activation of amino acids
 - ii. Binding or transfer of amino acid to t RNA.
 - iii. Initiation
 - iv. Elongation
 - v. Termination

UNIT IV 5L

- 11. Genetic Code 3L
 - i. Properties of Genetic Code
 - ii. Codon assignments.
 - a. Initiation codon
 - b. termination codon
 - c. Codon and anticodon pairing
 - d. Wobble hypothesis
- 12. Regulation of gene expression –With reference to Lac- operon concept 2L

Reference books

1. Cell and Molecular Biology, 8th Edition, De Robertis EDP and De Robertis Jr. EMF, Lippincott Williams & Wilkins, Philadelphia.
2. Cell Biology, C.B. Powar, Himalaya Publication House.
3. Cell and Molecular Biology, E.J. Dupraw, Academic Press, New York.
4. Cell Structure and Function – A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
5. Molecular Biology of the Cell – 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts & James D. Watson, Garland Publishing, New York.
6. Biochemistry – U. Satyanarayan & U. Chakrapani
7. Essentials of Biochemistry - Herbert J. Fromm, Mark Hargrove
8. Text book of Molecular Biology, 1994, K. Shivrama Sastry, G. Padmanabham & C. Subramanyam, McMillan India.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z--59B: Comparative Anatomy of Chordates and Microtechniques

Elective course- Theory credits -04

Total Lectures: 48L

UNIT I 20L

1. Comparative study of following topics in vertebrates 20L
 - i. Integument: Skin of *Scoliodon*, Frog, *Calotes*, Pigeon & Rat
 - ii. Heart: Structure of heart of *Scoliodon*, Frog, *Calotes*, Pigeon & Rat
 - iii. Kidney: Evolution of Archinephros, Pronephros, Mesonephros, Metanephros
 - iv. Brain: Morphological variation in the different regions of the brain of *Scoliodon*, Frog, *Calotes*, Pigeon and Rat/Rabbit

UNIT II 12L

2. Micro technique 12L
 - i. Procurement of tissues and precautions to be taken to avoid tissue damage during procurement
 - ii. Fixatives: Classification of fixatives and importance of fixation of tissues
 - iii. Methods of fixation
 - iv. Dehydration, clearing, impregnation and block making:
 - v. Clearing and alcoholising agents
 - vi. Clearing and dealcoholisation
 - vii. Impregnation and Embedding: Types of embedding media, methods of embedding and block making. Comments on hardening of paraffin

UNIT III 8L

3. Microtomes and Knives 8L
 - i. Types of microtomes
 - ii. Types of microtome knives
 - iii. Section cutting: Microtomy- steps and precautions, common faults in section cutting reasons & remedies. Mounting and spreading of ribbons

UNIT IV 8L

4. Stains and Staining 8L
 - i. Classification of stains
 - ii. Methods and types of staining

- iii. General procedure for staining of sections
- iv. Vital Stains
- v. Mounting and labeling of sections: Classification of mounting media, refractive indices of mounting media

Reference Books

1. A text book of Zoology, Vol.II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi.
1. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.
2. Chordate Zoology, 1982, P. S. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.
3. The life of Vertebrates, 3rd edn.1993, J. Z. Young, Oxford University Press, USA.
4. The Phylum Chordata: Biology of Vertebrates and their Kin, 1987, H. H. Newman, Distributor Satish book enterprise, Agra.
5. A text book of Zoology, 1984, R. D. Vidyarthi, S. Chand and Co., New Delhi.
6. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr,9thEdn., 2001, McGraw Hill, Boston, USA
7. Notes on Microscopical Techniques for Zoologist, 1964, Pantin C. F.A.: Cambridge University Press
8. Elementary Microtechnique, 1973, 4th Edn., Peacock H.A., Edward Arnold Publ. Ltd., UK
9. Handbook of basic Microtechnique, 1958, 2nd Edn., Gray P., McGraw-Hill, USA
10. Histopathological technique and Practical Histochemistry, 1976, 4th Edn, Lillie R.D McGraw-Hill, USA
- 11 . Histological and Histochemical Methods, Theory and Practice, 2008, 4th Edn., John A. Kiernan, Scion Publishing Ltd, UK
- 12 Cytological techniques: The Principles Underlying Routine Methods, 1963, Baker J.R, Methuen & Co, London
13. Davenport H. A.: Histological and Histochemical techniques.
14. Staining methods (Histological and Histochemical), 1960, Mc Manus J. F. A. And Mowry R.W., Paul B. Hoeber, Inc.; Harper & Brothers, NY
15. Histochemistry, 1968, Pearse A.G.E., Vol. I & II., W.B. Saunders Company (WBS) of Philadelphia

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-V

Z-59C : Evolution

Elective course- Theory credits -04

Total Lectures:48L

UNIT I 16L

1. Introduction to the concept of organic evolution. 3L
2. Various hypothesis explaining origin of life. 5L
3. Evidences in support of Evolution. 8L
 - i. Anatomical
 - ii. Embryological
 - iii. Physiological
 - iv. Zoogeographical
 - v. Genetical
 - vi. Taxonomical
 - vii. Palaentological

UNIT II 16L

4. Sources of variation 4L
 - i. Mutaion
 - ii. Recombinations
5. Process of Speciation 6L
 - i. Deme
 - ii. Race
 - iii. Species
6. Synthetic theory of Organic Evolution 6L
 - i. Role of natural selection
 - ii. Mutations
 - iii. Recombinations

UNIT III 16L

7. Geological time scale 8L
Pre Cambrian life, Archaeozoic era, Proterozoic era, Palaeozoic era, Mesozoic era and Cenozoic era
8. Evolution of man 8L
 - i. Early ancestors

- a. Monkey stock
 - b. Ape stock
- ii. Homonid stock
Oreopithecus, Australopithecus, Paranthropus, Zinanthropus
- iii. Pre- Historic man
Homo habilis, Homo erectus, Atlantic man, Soloman, Rhodesian man, Heidelberg man, Neanderthal man and Cro-magnon man
- iv. Modern man- Homo sapiens

Reference Books

1. Animal evolution – Carter
2. Evolution- DeBeer G.R.
3. Organic evolution- Lull R.S.
4. Evolution- Savage
5. Major features of evolution- Simpson G.G.
6. Evolution- Dodson

Practicals Based on Z -59 A Biochemistry and Molecule Biology

Elective Course- Practical.

1. Identification of Carbohydrates	E
i. Thymol test	
ii. Iodine test	
iii. Phosphoric acid test	
iv. Benedict's test	
v. Cupric acetate test	
1. Isolation of starch from potato	E
2. Factors affecting enzymatic reactions	E
i. Urea- Urease reaction	
ii. Effect of heat , alkali, acid, alcohol, inhibitors, activators with reference to urea- Urease reaction.	E
3. To find out codon sequences for known polypeptide chain of ten amino acids or to find out amino acid sequence from given codon (chart will be provided)	D
4. Preparation of DNA paper model.	E

**Practicals based on Z -59 B Comparative Anatomy of Chordates and
Microtechniques**

Elective Course- Practical.

Comparative study of following

1. V.S. of skin of vertebrates (T.S. /V.S.)	D
2. Hearts of Vertebrates	D
3. Brains of Vertebrates	D
4. Study of Microtechnique-	5E

Preparation of permanent histological slides of organs of Frog/ Rat by HE technique.

5. Submission of 5 permanent slide of H.E. staining technique.

Practicals based on Z -59 C Evolution

Elective Course- Practical.

1. Study of successive stages of evolution of man. D
 - i. Australopithecus
 - i. *Homo erectus*
 - ii. *Homo neanderthalis*
 - iii. *Homo eromagnonis*
 - iv. *Homo sapiens*
2. Study of morphological similarities and differences between man and ape. D
3. Study of types of fossils with the help of specimens / charts / photos. D
4. Study of evidences of evolution – embryological, palaentological, connecting links, morphology and comparative anatomy. D
5. Study of animal adaptation in Turtle, Draco, Exocoetus, Bat and Parrot. D

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-61: General Embryology

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 6L

1. Introduction 3L
 - i. Definition and scope of Embryology
 - ii. The phases of Ontogenetic development
 - iii. Historical Review of Embryology
 - iv. The Recapitulation Principle of Biogenetic law
 - v. Branches of Embryology
2. The Egg 3L
 - i. Size, shape, Organization of a mature Graafian follicle
 - ii. Egg membranes
 - iii. Types of eggs
 - iv. Polarity of egg

UNIT II 18L

3. Development of Chick 15L
 - i. Nature of the fertilized egg
 - ii. The ovum
 - iii. Fertilization and the meiosis
 - iv. The application of accessory layers around the fertilization ovum
 - v. Cleavage and blastulation
 - vi. The fate map of Chick embryo
 - vii. Gastrulation
 - viii. Differentiation of mesoderm
 - ix. The coelom
 - x. Disappearance of the primitive streak
 - xi. Neurulation, 4-Somite stage
 - xii. Extra embryonic areas; Area vasculature and Area vitellina
4. Extra embryonic Membranes of chick 3L
 - i. Types of extra embryonic Membranes : Yolk sac, Amnion, Chorion, and Allantois
 - ii. Functions of extra embryonic Membranes

UNIT III **10L**

- 5. Placentation in Mammals 6L
 - i. Classification of mammalian placentae: according to the Nature of Foetal Membranes
 - ii. Histology
 - iii. Fate of endometrium (non-deciduous)
 - iv. Arrangement of Villi on the Blastocyst
 - v. Physiology of the placenta : Positive and Negative role
- 6. Regeneration 4L
 - i. Types of regeneration
 - ii. Mechanism of regeneration
 - iii. Regenerative ability in animals
 - iv. Reconstitution from isolated cells
 - v. Physiological processes involved in regeneration
 - vi. Factors affecting regeneration

UNIT IV **14L**

- 7. Embryonic Induction and Organizers 8L
 - i. Transplantation
 - ii. Spemann's experiment and Embryonic Induction
 - iii. Primary ,secondary, tertiary and Quaternary organizer
 - iv. Regional specificity of the organizer
 - v. Survey of Organizer in the chordates
 - vi. The nature of Induction
 - vii. Competence
- 8. General Considerations on Differentiation and growth 6L
 - i. Types of Differentiation: Morphological, Physiological, chemical
 - ii. Growth : Definition, Measurements and Graphic Representation

Reference Books

- 1. An Introduction to Embryology 2012, 5thEdn., Balinsky B. L., Fabian B. C. Brooks Cole Pub. Co., USA.
- 2. Developmental Biology, 2013, 10thEdn. Gilbert S. F., Sinauer Associates Inc.
- 3. Introduction to Embryology- A. K. Berry, Emkay publication.
- 4. 7. Development of Chick embryo, 1972, Lillie.
- 5. An Introduction to Embryology 1981, Balinsky B.L., Saunders College, Philadelphia.
- 6. Developmental Biology; Patterns/Principles/Problems, 1982, Saunders J. W. Collier MacMillan, Publishers, London.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-62: Toxicology

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 14L

1. Concept and Scope of Toxicology 4L
 - i. Introduction
 - ii. Definition of Toxicology
 - iii. History of Toxicology
The Early era, The Middle Era
 - iv. Scope and Branches of Toxicology
2. Toxicants and their classification 10L
Environmental Carcinogens, Cardiotoxicants, Immunotoxicants, Teratogens,
Occupationally Inhaled Toxicants, Hepatotoxicants, Mutagenic Agents

UNIT II 16L

3. Toxic Agents 10L
 - Pesticides 10L
 - i. Definition
 - ii. Classification
 - iii. Herbicides-Categories, Mechanism
 - iv. Fungicides
Organomercurials, Chlorophenols and Nitrophenols, Thiaram and sulphur
 - v. Other Pesticides
 - a. Rodenticides
ANTU, Red Squill, Alphachloralose, Fluoroacetates, Zinc phosphate,
strychnine, Reserpine. Crimidine, Pindone, Noxbromide.
 - vi. Molluscicides
 - vii. Piscicides
Uses, Effect, Fates, Features
 - viii. Biological Magnification
 - ix. Control of Pesticidal Pollution
Pesticides in integrated Pest Management
4. Toxic Agents 10L
 - Heavy metals

Introduction, Principle of Metal Toxicity, Important Toxic Metals
Uses of Pollutational Sources, Effects on Humans and Animals

UNIT III

8L

5. Mechanism of Action of Commonly used Toxicants 6L
 - a. Mechanism of Toxic Action of Metals
 - b. Mechanism of Action of Pesticides
 - c. Mechanism of Action of Environmental carcinogens
 - d. Mechanism of Action of Teratogens
 - e. Mechanism of Action of ionizing and non-ionizing Radiations
6. Factors influencing toxicity (pH, temperature, reproductive status, age, physiological state) 2L

UNIT IV

10L

7. Toxicity Tests 10L
 - i. Introduction
 - ii. Types of Toxicity test
 - a. Based on number and conditions of species
 - b. Based on exposure of toxicants
 - c. Based on length of exposure
 - iii. Acute Toxicity Test
 - a. Objectives
 - b. Experimental design
 - c. Bioassay
 - d. Median Lethal Dose
 - e. Median Lethal Concentration
 - f. Toxicant Bioassay(LC₅₀) Using Fish
Selection, size, Test, Characteristic, Range
 - g. Calculation :Graphical Interpolation Method, Statistical Method
 - h. Significance of Acute Toxicity Data
 - i. Experimental Factors Affecting Acute Toxicity Tests
 - iv. Sub-Acute Toxicity Tests
 - a. Objective
 - b. Experimental design
 - v. Chronic Toxicity Test
 - a. Objective
 - b. Experimental design
 - vi. Toxic Effects
 - a. Categories of Toxic Effects
 - b. Local and Systemic Effects
Reversible and Irreversible Effects

Immediate and Delayed Effects
Allergic and Idiosyncratic Reactions
Application Factor (AF)

Reference books

1. Fundamentals of Toxicology- Kamleshwar Pandey, J.P. Shukla, S.P. Trivedi
2. Principles and methods of Toxicology – Hayes (Edited A. Wallae Hayes Publications, Raven Press, N. Y.)
3. Medicine and Toxicology – Parekh
4. Toxicology – Principles and Methods, 2010, 2nd Edn., M. A. Subramanian,, M J P Publishers, Chennai.
5. Selective Toxicity, 1973, A. Albert, Chapman and Hall, London.
6. Environmental Toxicology, 2003, M. Satake, Y. Mido, Discovery Publi. House, NewDelhi. Introduction to General Toxicology, 1976, E. J. Ariens; A. M. Simonis; J. Offermeier, Academic Press, London.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-63: Biological Techniques

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 14L

1. Microscopy

- i. Light microscope
- ii. Phase contrast microscope
- iii. Electron microscope (SEM and TEM)
- iv. Micrometry
- v. Camera Lucida

UNIT II 6L

2. Introduction to biological techniques
Solution/strengths of chemicals: Percentage, Normality, Molarity,
Molality, Osmolarity, Osmolality, ppm, ppb

UNIT III 16L

3. Separation techniques: principle and applications, techniques related to isolation, purification and characterization of bio molecules
4. Chromatography (paper, ion-exchange), gel filtration
5. Electrophoresis-(Agarose, Polyacrylamide)
6. Ultracentrifugation
7. Colorimetry and spectroscopy

UNIT IV 12L

8. Scientific methods of investigation content
- a. Introduction
 - b. Objectives
 - c. The Scientific Methods
Observing and Communicating, Observation, Interpretation, Prediction, Repetition,
Consensus, Experiment, Keeping record of your investigation
 - d. Writing a report of Scientific Investigation
 - i. Introduction

- ii. Materials
- iii. Methods
- iv. Results
- v. Discussion
- vi. Conclusion
- e. Communicating Scientific findings
People, Journal, Reports, Patent, Trade Literature, Conclusion

Reference books

1. Introduction of Medical Laboratory Technique, 1998, 7th Edn., Baker F. J., Silverton R. E., Pallister C. J., Butterworth-Heinemann, UK
2. Histological and Histochemical Methods, Theory and Practice, 2008, 4th Edn., John A. Kiernan, Scion Publishing Ltd, UK
3. Basic Separation Techniques in Biochemistry, 1998, Okotore R. O., New Age International, New Delhi.
4. Cytological techniques: The Principles Underlying Routine Methods, 1963, Baker J.R, Methuen & Co, London
5. Davenport H. A.: Histological and Histochemical techniques.
6. Handbook of basic Microtechnique, 1958, 2nd Edn., Gray P., McGraw-Hill, USA
7. The microscope and how to use it, 1970, George Stehli, Dover Publications Inc., New York.
8. Histopathological technique and Practical Histochemistry, 1976, 4th Edn, Lillie R.D McGraw-Hill, USA
9. Staining methods (Histological and Histochemical), 1960, Mc Manus J. F. A. And Mowry R.W., Paul B. Hoeber, Inc.; Harper & Brothers, NY
10. Notes on Microscopical Techniques for Zoologist, 1964, Pantin C. F.A.: Cambridge University Press
11. Elementary Microtechnique, 1973, 4th Edn., Peacock H.A., Edward Arnold Publ. Ltd., UK
12. Histochemistry, 1968, Pearse A.G.E., Vol. I & II., W.B. Saunders Company (WBS) of Philadelphia
13. Microscope and microscopic life, 1979, 2nd Edn., Peter Healey, Hamlyn, UK
14. Biological Instrumentation and methodology, 2008, 2nd Revised Edition, P.K. Bajpai, S. Chand and Co. Ltd., New Delhi.
15. Adebajo Afolabi. (1995). Science: History, philosophy and Importance to Mankind. Akol Press Ibadan 19-24.
16. Beveridge, W. I. B. (1978). The Art of Scientific Investigation. Heinemann, London.
17. Giere, R. N. (1979). Understanding Scientific Reasoning. Macmillan Press, New York.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-64: Functional Anatomy of Chordates –III

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 18L

1. Study of Rat with reference to the following 18L

- i. Systematic position, habit, habitat and External characters, Sexual dimorphism
- ii. Digestive system (Functional Anatomy only)
- iii. Respiratory system and mechanism of respiration
- iv. Blood vascular system : blood and its function, Heart its structure and working, Arterial and venous system
- v. Brain and its functions
- vi. Sense organs: Structure of an ear and its working
- vii. Reproductive (male and Female)

UNIT II 14L

2. Study of *Calotes versicolor* with reference to the following

- i. Systematic position, habit, habitat and External characters
- ii. Functional Anatomy – Digestive system, Circulatory system, Excretory system, Reproductive system, Nervous system and Sense organs

UNIT III- Mammalia General Account 16L

- i. Aquatic mammals and adaptations 3L
- ii. Flying mammals and adaptations 3L
- iii. Adaptive radiation in mammals 3L
- iv. Adaptive convergence in mammals 2L
- v. Origin and ancestry of mammals 2L
- vi. Economic importance of mammals 3L

Reference books

1. A text book of Zoology, Vol.II, 1990, T. J. Parker and W. A. Haswell, Low price Publication, Delhi.
2. Modern Text Book of Zoology, 1992, R. L. Kotpal, Rastogi Publication, Meerut.
3. Chordate Zoology, 1982, P. S. Dhami and J. K. Dhami, R. Chand and Co., New Delhi.
4. The life of Vertebrates, 3rd edn.1993, J. Z. Young, Oxford University Press, USA.
5. The Phylum Chordata: Biology of Vertebrates and their Kin, 1987, H. H. Newman, Distributor Satish book enterprise, Agra.
6. A text book of Zoology, 1984, R. D. Vidyarthi, S. Chand and Co., New Delhi.
7. Comparative Anatomy of the Vertebrates, G. C. Kent, R. K Carr, 9thEdn., 2001, McGraw Hill, Boston, USA.
8. Rat: A Mammalian Type - G. R. Kshirsagar ,G.Y. Rane Prakashan,

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-6 5 : Economic Entomology

Core course- Theory credits -04

Total Lectures: 48L

UNIT I 14L

1. Introduction to Economic entomology, Scope 2L
2. Fundamentals of Agricultural, Forest, Medical and Veterinary Entomology 2L
3. Introduction to medical entomology 4L
 - a. Morphology and anatomy of insects
4. Veterinary entomology- Insects as disease spreading agents in general 2L
5. Insects as social groups 4L
 - i. Definition, intraspecific and interspecific relationships among insects
 - ii. Social organization in wasps and termites
 - iii. Significance of social organizations

UNIT II 10L

6. Methods of collection and preservation of insect 2L
7. Study of class insecta upto order with one examples each 8L
 - Thysanura
 - Collembella
 - Lepidoptera
 - Diptera
 - Coeloptera
 - Hymenoptera

UNIT III 12L

8. House hold and Human insect pest 12L
 - Bed bugs, Mosquito, Rat Flea, and House fly, Cockroach, Pediculus

UNIT IV

12L

9. Lac culture

12L

- i. Introduction
- ii. Distribution
- iii. Taxonomy of lac insect
- iv. Importance of lac cultivation
- v. Strains of lac insect and lac crops
- vi. Lac insect life cycle
- vii. Important lac host plants and their distribution
- viii. Lac culture practice in India
- ix. General measures for improved lac culture
- x. Processing of lac
- xi. Composition and properties of lac
- xii. Lac products and their uses
- xiii. Enemies of lac insects and their control
- xiv. Prevention and control of insect enemies
- xv. Pests of lac host plant
- xvi. Problems of lac culture in India
- xvii. Measures taken for advancement in lac culture

Reference books

1. Introduction to economic zoology – Sarkar, Kundu, Chaki
2. Destructive and useful insects –C.L. Metcalf and V.P. Flint: Tata Mc Graw Hill, New Delhi
3. Biological control- R. V. Eosch and P.S. Messenge
4. Animal parasitism- Clarl P. R. : Prentice Hall of India , New Delhi
5. Entomology.Edn.10 Vols.1&2 McGraw Hill,New York.
6. Applied Zoology –Dr.Kishore R. Pawar and Dr. Ashok Desai. Nirali Prakashan.
7. Economic Zoology – Sarkar Kundu Chaki New Central Book Agency (P) Ltd London.
8. Applied Zoology- Tarit Kumar Banerjee New Central Book Agency (P) Ltd London.

Z -66 Practical Course –VIII

Practicals Based on Z- 61 General Embryology and Z-62 Toxicology

Core Course – Practical; Credits- 02

1. Study of types of eggs (insect, amphioxus, frog and hen)	D
2. Study of whole mount slides of chick embryology 18hr, 24hr, 33hr ,48 hr and 72hr.	D
3. To study the sections of chick embryo 24hr, 33hr and 48 hr.	D
4. Temporary preparation of chick embryo.	2E
5. Study of placenta Rat/ Human.	D
6. Hypothetical problem to determine LC_{50} and LD_{50} .	2E
7. Effect of pollutant / Toxicants on aquatic animals.	E
8. Compulsory visit to polluted river, pond, lake or polluted location and water. Report should be presented along with the laboratory journals.	

Z -67 Practical Course –IX

Practicals Based on Z- 63 Biological Techniques and Z- 64 Functional Anatomy of Chordates-III

Core Course – Practical; Credits- 02

1. Study of Systematic position, External characters and Sexual dimorphism of rat. D
2. Study of Digestive system, Respiratory system. D
3. Study of Male Reproductive system of rat. D
4. Study of Female Reproductive system of rat. D
5. Study of Brain of rat. D
6. Study of principle & use of camera Lucida. E
7. Study of principle and application of colorimeter and spectrophotometer. 2D
8. Separation of amino acid mixture by ascending paper chromatography/Thin Layer Chromatography (TLC) E
9. Compulsory study tour/visit to sea coast/fishery institute/sericulture farm/apiculture institute / agricultural farm/ ZSI.

Compulsory submission of field visit report along with at least five photographs / models/ sketches of insect pest/fishes/any animal corresponding to theory courses.

Z -68 Practical Course –X

Practicals Based on Z - 6 5 Economic Entomology with any one of the Elective Course Z-69 A/ 69B/ 69C

Core Course – Practical; Credits- 02

1. Pest- Identification and control measures: House hold pest-Cockroach, Silverfish. D
2. Pest- Identification and control measures: Crop pests- Woolly aphid, White flies. D
3. Pest- Identification and control measures : Store grain pests- Rice moth,
Rice weevil. D
4. Lac Culture – Lac D
5. Study of social Behaviors of Ants, Termites. D
6. Visit to Apiculture centre /Vermiculture / Emu farm / Goat farm / Poultry farm is
compulsory. D

A report of one of the visits is to be submitted at the time of practical examination.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-69A: Biotechnology

Elective course- Theory credits -04

Total Lectures: 48L

UNIT I 18L

1. Biotechnology –An overview 4L
 - i. Origin and definition
 - ii. Old Vs New biotechnology
 - iii. Scope and importance of biotechnology
 - iv. Biotechnology in India
2. Recombinant DNA Technology 14L
 - i. Restriction enzymes, DNA ligase, DNA polymerase
 - ii. Cloning vectors
 - iii. Polymerase chain reaction
 - iv. DNA probes
 - v. Southern Blotting
 - vi. DNA fingerprinting

UNIT II 12L

3. Animal Cell and tissue Culture 12L
 - i. Introduction and principle, Requirements and applications
 - ii. Stem cells and their culture
 - iii. Tissue and organ culture
 - iv. Embryo culture, tissue engineering (artificial skin and artificial cartilage)

UNIT III 10L

4. Applications of biotechnology in Medicine, Animal Husbandry and Agriculture. 4L
5. Transfection Method and transgenic animals 6L
 - i. Gene transfer
 - ii. Targeted gene transfer
 - iii. Transgenic animals (mice, sheep, pigs, rabbits, goats, cows, fish)

UNIT IV 8L

6. In vitro fertilization and embryo transfer in human and livestock 8L
 - i. In vitro fertilization (IVF) in humans
 - ii. Embryo Transfer (ET) in humans

- iii. Super ovulation
- iv. IVF and embryo culture in farm animals (e.g. cow)
- v. Embryo transfer in cattle

Reference books

1. Cell and Molecular Biology, 8th Edition, De. Robertis EDP and De Robertis Jr. EMF, Lippincott Williams and Wilkins, Philadelphia.
2. Cell Biology, C.B. Powar, Himalaya Publication House.
3. Cell and Molecular Biology, EJ. Dupraw, Academic Press, New York.
4. Cell Structure and Function - A. G. Loewy, P. Siekevitz, J. R. Meninger & J. A. N. Gallant, Saunder College, Philadelphia.
5. Molecular Biology of the Cell - 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, K. Roberts & James D. Watson, Garlan Publishing, New York.
6. Elements of Biotechnology - P. K. Gupta, Rastogi Publications.
7. Gene V & VI, 1994, Lewin B., Oxford University Press, Oxford.
8. Concept of Genes-Pearson Edition
9. Cell and Molecular Biology- Pragya Khanna I.K International .Paabliishing House Pvt. Ltd.

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-69B : Biostatistics

Elective course- Theory credits -04

Total Lectures:48L

UNIT I 4L

1. Introduction and Development of statistics
 - i. Origin and Development of statistics
 - ii. Definition of statistics
 - iii. Importance and scope of statistics
 - iv. Limitations of statistics

UNIT II 8L

2. Collection of Data
 - i. Introduction
 - ii. Objective and scope of the enquiry
 - iii. Sources of data
 - iv. Methods of data collection

UNIT III 12L

3. Classification and Tabulation 4L
 - i. Functions of classification
 - ii. Rules of classification
 - iii. Bases of classification
4. Frequency distribution 4L
 - i. Principles of frequency distribution
 - ii. Types of frequency distribution
 - iii. Tabulation- Meaning and importance
 - iv. Parts of table
 - v. Types of tabulation
5. Graphical representation 4L
 - i. Histogram
 - ii. Frequency polygon
 - iii. Frequency curve
 - iv. Ogive curve

UNIT IV

6. Measures of Central Tendency	12L
a) Mean	03L
i. Step deviation method for computing arithmetic mean	
ii. Merits and demerits of mean	
b) Median	03L
i. Calculation of median	
ii. Merits and demerits of median	
c) Mode	03L
i. Computation of mode	
ii. Merits and demerits of mode	
d) Empirical relation between mean, median and mode	03L

UNIT V

7. Measures of dispersion	12L
a) Mean deviation	6L
i. Introduction and meaning	
ii. Mean deviation – Introduction	
iii. Computation of mean deviation	
iv. Merits and demerits of mean deviation	
b) Standard Deviation	6L
i. Properties of standard deviation.	
ii. Merits and Demerits of standard deviation.	
iii. Variance and mean square deviation.	
iv. Interpreting standard deviation	

Reference Books

1. Introduction to Biostatistics- Pranab Kumar Banerjee. S. Chand and Company. New Delhi.
2. Methods in Biostatistics for Medical Students and Research Workers- Arun Bhadra Khanal.
3. Biostatistics in Brief Made Easy- K Visweswara Rao.
4. Fundamentals of Statistics-S.C. Gupta
5. Fundamentals of Biostatistics –Veer Bala Rastogi
6. A Text Book of Biostatistics- B Annadurai

T.Y.B.Sc. (ZOOLOGY)

(CBCS 2016 Course)

SEMESTER-VI

Z-69C: Biodiversity and Wildlife

Elective course- Theory credits -04

Total Lectures:48L

UNIT I	12L
i. Concept of Biodiversity- Introduction	02L
ii. Definition of Biodiversity, its use and importance and status in India	03L
iii. Brief account on the diversity of unicellular and multicellular animal	02L
iv. Types of biodiversity – Species, Genetic ecosystem diversity,	05L
v. Terrestrial and aquatic biodiversity, Agro biodiversity	
UNIT II	12L
i. Hotspots of biodiversity in India	04L
ii. Levels of biodiversity	02L
iii. Causes for the threat and loss of biodiversity	03L
iv. Extinct, endangered and threatened animal species	03L
UNIT III	18L
5. Biodiversity conservation and its necessity	
i. Objectives, implications and action plans	02L
ii. Biodiversity conservation methods – Ex-situ and In-situ conservation	04L
iii. Conservation of Gene pool, Species and Cryopreservation of micro organisms	03L
iv. National Parks and Sanctuaries	03L
v. Biodiversity (Natural resources) and their sustainable utilization	03L
vi. Role of NGO's in conservation activities and conservation and sustainable development	03L

UNIT IV

06L

i.	Wildlife of India	02L
ii.	Wild Life Protection Act	02L
iii.	Need of Wild Life Management / Conservation	02L

Reference Books

1. Biodiversity and environment- S. K. Agarawal, S. Tiwari and P. S. Dubey 1996
2. The Biological diversity act 2002 and Rules 2004 : National Biodiversity authority, India, 475, 9th South Cross st. Neelangarai, Chennai- 60041.
3. Biodiversity Coservation : Global agreement and National Concern – Ranson sites, CBD, Quarantine, Regulations, National Forestry Policy, Biodiversity Act, Wildlife Life Protection Act.
4. Biodiversity Principles and Conservation - Kumar and Asija, Agrobios (India)
5. Status report on biodiversity conservation : Western Himalaya Ecosystem. IIPA, New Delhi: Arora G.S. and Julka J. M. (1993)
6. Biodiversity and Biotechnology – Ray Samit and Ray A.K. (2006), New Central Book Agency Pvt. Ltd.
7. Biodiversity National Academic Press (1988) – Wilson E. O.
8. Biodiversity Status and Prospects – Tondon
9. Biodiversity and its Significance – Y. A. Abrol
10. Modern Pattern of Biodiversity Conservation- Chanchan
11. An advanced Text Book on Biodiversity, Principles and Practice : K.V. Krishnamurthy
12. The Nature of Biological Diversity- Allen J. M.
13. Conservation Biology- S.K. Jain
14. The Preservation of Species, The value of Biological Diversity- Norton B.G.

Practicals Based on Z- 69 A Biotechnology

1. Chromatography, Separation of Serum proteins by Paper or Thin Layer Chromatography (TLC)	E
2. DNA Isolation.	E
3. Tissue culture / Embryo culture.	D
4. Study of IVF.	D
5. Study of any two transgenic animals.	

Practicals Based on Z- 69 B Biostatistics

1. Examples based on mean. (Any two)	E
2. Examples based on mode. (Any two)	E
3. Examples based on median. (Any two)	E
4. Examples based on standard deviation. (Any four)	2E
5. Classification of data : Analysis of Frequencies, Histograms and. Bar Diagrams.	E

Practicals Based on Z- 69 C Biodiversity and Wild Life

1. Preparation of endangered / threatened species album.	2E
2. Assessment of protected areas like sacred groves for conservation of biodiversity and benefit of society around.	2E
3. Effective use of modern media in creating environmental awareness by developing new tools.	2E

UGF 31: Soft Skills

Objectives of the course:

- a) To inculcate the value system among students
- b) To develop a multi-faceted personality of students
- c) To enhance the desirable life skills
- d) To convert capacities into capabilities to create better human resources
- e) To create an accountable and responsible citizen

Course Contents

24 Lectures

1. Soft Skills: Meaning and definition; Employability skills, Life skills, Corporate skills.
2. Developing positive attitude: Ethics, Values, Manners & Etiquettes
3. SWOT analysis and Career Planning: Strengths, Weaknesses, Opportunities and Threats
4. Communication: Concept of communication; Written as well as Spoken; body language
5. Curriculum Vitae, Resume, Bio-Data: Types of personal and educational information, preparing CV according to the job requirements
6. Interview Techniques: Types of interviews, Personal appearance, basic research, Confidence, knowledge preparation, interview style
7. Time Management: Competency-building skills; identifying use of time, management of on-time task, identifying reasons for poor time management, and taking corrective action; overall time-planning; and learning where to go for information or guidance
8. Stress Management: coping with stress and anger; recognizing/understanding others' point of view; problem solving; peer negotiation and resistance; conflict management; active listening and effective communication; acceptance and/or tolerance of diversity groups; and telephone skills
9. Teamwork and Leadership: Group discussion, effective communication skills, Group behaviour, helping nature
10. Developing work culture: sincerity, negotiation techniques, summarizing information; summarizing information about specific points; organizing studies

* * *

Reference

1. Covey Sean, *Seven Habits of Highly Effective Teens*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, *How to win Friends and Influence People*, New York: Simon & Schuster, 1998.
3. Daniel Coleman, *Emotional Intelligence*, Bantam Book, 2006
4. Fredrick H. Wentz, *Soft skills Training – A workbook to develop skills for employment*
5. Barun K. Mitra *Personality Development and Soft skills*, Oxford University Press