



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

**Faculty of Medical Sciences  
M.Sc. (Combined)  
New Syllabus**

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Anatomy**

**MSc (Anatomy)**

Bharati Vidyapeeth Deemed to be University, Medical College, Pune

Department of Anatomy

Name of Programme: MSc Anatomy

**Programme outcomes:**

**M.Sc. Anatomy or Master of Science in Anatomy** is a three years postgraduate Anatomy course. It provides the scientific study of tissue structures, organ systems and whole bodies together with their cellular and structural components and dynamics. It provides a solid foundation in human anatomy as a basis for teaching as well as basic and applied research. The Course gives the opportunity to learn the anatomy of the human body by dissection and to gain comprehensive knowledge of normal anatomy. This course aims to provide students with a greater understanding of advanced human anatomy including appropriate radiological anatomy, microscopic anatomy, embryology, genetics, neuroanatomy, endocrinology, secretory dynamics, and applications to such topics as aging and disease conditions.

**Programme specific Outcomes:**

After the summative examination at the end of third year when he/she will be declared as passed candidate of Msc Anatomy and will have

- Diverse opportunities in teaching and research and can work as Assistant Professor/ Lecturer, Research Assistant, Medical Scientist.
- It is also beneficial for further studies such as M.Phil and Ph.D. in the same or related domain of study.
- He/She can have different opportunities in different fields of Radiology, Embryology, Genetics

**Programme Structure:**

- The candidate will complete the course of studies in Human Anatomy, Physiology, Biochemistry as orientation course for the period of first two academic terms.
- He/She will attend the Workshop on research methodology conducted by Medical education unit of the college and will come to know the basics of any research.

- Candidate will work himself / herself on the thesis under the guidance of a recognized post graduate teacher.
- Subject of dissertation (Thesis) should be submitted to the University along with a synopsis (about 250 words) after approval of Ethic's Committee and undersigned by the concerned postgraduate teacher, within 6 months after registration or 6 months after completing the orientation course.
- He/she will put in two academic terms for working on thesis.
- The subject of thesis should as far as possible reflect the research priorities of the post graduate department where the work is being done. The department should provide all facilities to the candidate.
- The acceptance of thesis by the examiners shall be a condition to the admission of the candidate for the written and practical examination
- Candidate will undertake whole body dissection in next two academic terms
- Candidate should take part to undergraduate teaching after completion of first two semesters
- He/she should get thorough knowledge of Gross anatomy, Histology, Embryology, Genetics, radiology and recent advances in the last two years
- **Theory Syllabus:** Candidate should study
  - Gross and regional anatomy including general and sectional anatomy and principles of applied anatomy.
  - Embryology including general and systemic embryology.
  - General and systemic histology.
  - Radiological anatomy – Study of X-rays of different parts of human body and the special procedures used.
  - Elements of Genetics – Study of genes, chromosomes and their abnormalities, inheritance.
- **Practical syllabus :**

- Dissection of whole body
- Histological techniques including H and E and some special staining procedures.
- Embalming and preservation of bodies and organs.
- Museum techniques.
- Basic in research work.
- Teaching undergraduates, preparation of teaching material.

- **Elective subject in MSc programme (preferably post MBBS) -**

- Immunohistochemistry

- **Course Outline**

- The Role of Immunohistochemistry (IHC) in the Histology Laboratory.
- Antibodies.
- Fixation.
- Processing and Microtomy.
- Epitope Retrieval.
- Unmasking Methods.
- Immunohistochemical (IHC) Methods.
- Blocking Methods

- Histology technique

- **Course Outline**

- Introduction
- Statutory regulations and. Ethics
- Total Quality Management
- Laboratory Safety
- Specimens
- Laboratory Equipment
- Laboratory Reagents
- Stock Control
- Quality Assurance / Accreditation.
- Quality Control.
- Method Evaluation.
- Personnel documentation

## SYLLABUS

### **SYLLABUS FOR M.Sc. (NON-MEDICAL) IN THE SUBJECT OF ANATOMY**

**1) Title:**

Syllabus for M.Sc. (Non-Medical) course in Anatomy for nonmedical students.

**2) Eligibility Criteria:**

B.Sc. degree with Zoology as Principal subject or as one of the subjects for obtaining B.Sc.

**3) Duration of course:**

Three and half years or seven academic semesters.

**4) Total Number of Seats:** Three

**5) Criteria for Selection:**

By Merit Marks obtained in Zoology of B.Sc. should minimum 50%.

**6) Training Programme/Syllabus:**

Candidate registered under M.Sc. Anatomy must satisfactory complete the course of studies in Human Anatomy, Physiology, Biochemistry as orientation course for the period of first two academic terms.

**a) Theory Syllabus:** Candidate should study

1. Gross and regional anatomy including general and sectional anatomy and principles of applied anatomy.
2. Embryology including general and systemic embryology.
3. General and systemic histology.
4. Radiological anatomy – Study of X-rays of different parts of human body and the special procedures used.
5. Elements of Genetics – Study of genes, chromosomes and their abnormalities, inheritance.
6. Comparative anatomy of vertebrates in detail, including comparative embryology and histology.
7. Evolution – Outline of evolution, fossilman, history of Anatomy.

**b) Practical Work in Anatomy:**

1. Dissection of comparative human body.
2. Histological techniques including H and E and some special staining procedures.
3. Embalming and preservation of bodies and organs.
4. Museum techniques.
5. Basic in research work.
6. Teaching undergraduates ,preparation of teaching material.

### **c) Hospital Postings/Other Postings/Visits: Thesis/Dissertation**

For M.Sc. Anatomy

- i. Candidate will work himself on the thesis under the guidance of a recognized post graduate teacher.
- ii. Subject of dissertation should be submitted to the University along with a synopsis (about 250 words) after approval of Ethic's Committee and undersigned by the concerned postgraduate teacher, within 6 months after registration or 6 months after completing the orientation course.
- iii. Subject and plan of work of the thesis should not be same as that of thesis which has been accepted by the University in the previous three years.
- iv. Minor changes in the topic of thesis should be allowed any time before submitting the final work.
- v. Candidate may change the subject of his/her thesis during the course, with due prior approval of the university authorities and the post graduate teacher.
- vi. He/she will have to put in two academic terms for working on thesis.
- vii. The subject of thesis should as far as possible reflect the research priorities of the post graduate department where the work is being done. The department should provide all facilities to the candidate.
- viii. If the work required for the thesis involves collaboration with other department, the collaboration part will be supervised by a co-guide

designed by the Head of the Institution. The certificate required for submission of the details should be signed by both, the guide and co-guide.

- ix. The acceptance of thesis by the examiners shall be a condition to the admission of the candidate for the written and practical examination.

**d) Undergraduate Coaching assignment:**

Candidate should take part to undergraduate teaching after completion of first semesters.

**e) Seminar/Journal Club/Workshop etc:**

Candidate should take part in seminars, journal club and research projects of the department.

**7) Rules for sanctioning the term:**

During the term excepting the last term i.e. examination term in which he/she can avail the accumulated leave upto a period of three months.

- i. During the remaining six terms of the course the candidate can avail of leave of all types not more than fifteen days per term.
- ii. The registration should be treated as lapsed after the absence for two or more academic terms. Such candidate will have to register again and per in the required duration of course for becoming eligible to appear for the degree examination.

**8) Examination:**

- i. Internal exam at the middle of the term.
- ii. Term end exam at the end of the term
- iii. University Exam

Theory Exam – 4 papers of 100 marks each (3 hrs.)

Practical Exam – 400 marks

**Paper I** – General anatomy, Human Gross anatomy – Head, Face, Neck & Upper extremity

**Paper II** – Human Gross anatomy – Thorax, Abdomen & Lower extremity

**Paper III** – General and Systemic Histology & Embryology

**Paper IV** – Neuroanatomy, Anthropology, Recent advances and Genetics.



**Theory papers will have**

**Section I**-compulsory- having two questions of 15 marks each.

**Section II** Answer any seven questions from eight questions having 10 marks each.

**Practical** – Dissection of part or organ of body, Histology Techniques including Paraffin Block preparation, Block cutting & H. & E. staining procedure.

**9) Eligibility for appearing university exam:**

- i. Satisfactory progress in difficult tests (with 50% marks).
- ii. Satisfactory attendance (80%).
- iii. Approval of dissertation before examination.

**10) Criteria for Passing:**

- i. Candidate will be declared as 'Pass' if he/she gets 50% marks in all the four papers together, with not less than 40% marks in any of the four papers.
- ii. Candidate also should pass in practical with 50% marks at least.
- iii. Candidate must pass separately in theory and practical.

**Bharati Vidyapeeth Deemed to  
be University, Medical College,  
Pune**

**Department of Physiology**

**M.Sc. (Medical Physiology)**

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

**MEDICAL COLLEGE**

**PUNE – 411 043**

**Department of Physiology**

**Name of Programme: M.Sc. (Medical) Physiology**

**1) Eligibility Criteria:**

Candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% marks from any recognized university or B.Sc. with Zoology with minimum 50% marks

**2) Duration of course:**

Three years or six academic semesters.

**3) Total Number of Seats: Three**

**4) Criteria for Selection:**

By merit as decided by the University.

**Programme outcomes:**

The desired outcome of M.Sc. (Medical) Physiology is to produce a competent physiologist who should be able:

- to demonstrate comprehensive understanding of physiology as well as that of applied disciplines;
- to impart education to teach undergraduate and postgraduate students in physiology and paramedical disciplines;
- to plan and conduct research in physiology and to do collaborative research in the field of physiology with allied sciences and biomedical engineering.
- to demonstrate principles of medical education using various tools in the teaching-learning process and methods of evaluation;
- to acquire administrative skills to set up the department and equip physiology laboratories

**Programme specific outcomes:**

**A. Cognitive Domain: The student will be:**

1. Able to understand the basic physiological regulating mechanisms of human body in depth and their applied aspect in pathogenesis of diseases (pathophysiology).

2. Interact with other departments by rendering services in basic laboratory investigations and relevant expert opinion.
3. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
4. Contribute to society by imparting physiological understanding of health problems.
5. Plan a research study and conduct basic investigations.

**B. Affective domain: The student will be able to**

1. Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)
2. Communicate effectively with peers, students and teachers in various teaching-learning activities. (Communication)
3. Demonstrate due respect for the volunteer while conducting clinical practicals. (Ethics & Professionalism)
4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).

**C. Psychomotor Domain - The student will be able to**

1. Acquire competencies in the tasks mentioned under Practicals section of syllabus i.e. human & animal experiments, Haematology experiments & experiments based on biophysical principles.

**Programme structure: M.Sc. (Medical) Physiology candidate**

**During first year of the course:**

- i. To recapitulate undergraduate physiology by attending all UG teaching sessions (lectures, tutorials, practicals)
- ii. To participate in seminars & journal club activity. (once a week)
- iii. To complete the laboratory manual. {Hematology, Clinical Physiology, Animal experiments(Computer assisted learning)}
- iv. To attend research methodology workshop - I
- v. To select & submit the topic of dissertation.
- vi. To do relevant reference work

**During second year of the course:**

- i. To attend research methodology workshop – II
- ii. To do work for dissertation (Sample collection, reference work)

- iii. To conduct UG practical teaching.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level and present poster

### **Elective subject in MSc programme (preferably post MBBS)**

#### **Sports Physiology**

##### **Course Outline**

Origins of Exercise Physiology; Scope, Importance; Application in Competitive sports, Recreation sports, Medical rehabilitation; Human energy transfer in rest and exercise; Concept of Aerobic and anaerobic energy production; Energy expenditure in different activities;

Physiological Adaptations to exercise and training; measurement of exercise and training related changes

Aim and objectives of sports training; Characteristics of sports training; biological process in training; Components of physical fitness (motor abilities)– endurance, strength, speed, flexibility, co-ordination; agility Principles of training - Overload, specificity, progression and reversibility; Meaning and concept of Training load; Adaptation and Recovery, supercompensation, training structure - volume, intensity, frequency; Peaking, errors in training

#### **Physiology in rehabilitation practices**

##### **Course Outline**

##### **Preventive and Community Medicine**

Concept of health, health & illness

Contributing factors influencing health

Personal & environmental hygienic & health

Atmospheric pollution, effect on health, prevention & control

Concept of preventive medicine & community health

Public health organizations & services in India

Food & nutrition

##### **Disability and Related Issues**

Disability, attitudes to disability, misconceptions, beliefs etc.

Situation, reciprocal attitudes/ needs of persons with disability

Issues related to rural/ urban slums

Socio economic status of disabled persons: empowerment in Indian

Global contests - Participatory development

The disabled person, family dynamics and the community  
Main streaming of the disabled  
Access, services, special schemes, public facilities, concessions etc.  
Legislation and disability

### **Causes and Prevention of Impairment**

Disability: genesis, magnitude, futuristic trends  
Disability types and causes  
Disability limitation & prevention  
Preventable disabilities: strategies & approaches  
Early detection & intervention  
Rehabilitation: Definition, aims, objectives & Philosophy of rehabilitation  
Rehabilitation approaches and systems  
Different models of service delivery  
Community based rehabilitation: concepts & approaches  
Information gathering: surveys, record keeping, report writing, community resources  
Devising individual programme, plans & evaluating progress  
Monitoring needs, reviews, discharge, communication, participative evaluation  
Concept of health, health & illness  
Contributing factors influencing health  
Personal & environmental hygienic & health  
Atmospheric pollution, effect on health, prevention & control  
Concept of preventive medicine & community health  
Public health organizations & services in India  
Food & nutrition

### **During third year of the course:**

- i. To complete & submit the dissertation.
- ii. To attend manuscript writing workshop and send at least one article for publication
- iii. To conduct allotted UG practical and lecture sessions.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level
- vi. To do self-study for University examinations.

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Biochemistry**

**MSc (Biochemistry)**

**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Biochemistry Name of Programme: MSc. (Medical Biochemistry)**

**Programme outcomes:**

The broad goal of teaching & training of postgraduate students in Medical Biochemistry is to make them understand the scientific basics of the life processes at the molecular level. At the end of his/her training, the student shall be able to take up a career in Teaching Institution or in diagnostic laboratory or in Research.

**Programme specific outcomes:**

**A) KNOWLEDGE:**

At the end of the course the students shall be able to:

- 1) Explain the structure, function & inter-relationships of biomolecules & their deviation from normal & their consequences.
- 2) Summarize the fundamental aspects of enzymology & alteration on enzymatic activity with reference to clinical applications.
- 3) Explain the molecular & biochemical basis of inherited disorders with their associated sequel.
- 4) Explain the mechanisms involved in maintenance of body fluids & pH homeostasis.
- 5) Integrate the various aspects of metabolism & their regulatory pathways.
- 6) Outline the molecular mechanisms of gene expression & regulation, the principles of genetic engineering & their application in medicine.
- 7) Explain the molecular concept of body defenses & their applications in medicine
- 8) Explain the biochemical basis of environmental health hazards, biochemical basis of cancer & Carcinogenesis.
- 9) Familiarize with the principles of various conventional & specialized laboratory investigations & instrumentation analysis and interpretation of a given data.



10) Effectively organize & supervise diagnostic laboratory to ensure quality control/Assurances.

**B) SKILLS:**

At the end of the course the students shall be able to:

- 1) Make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.
- 2) Analyze & interpret investigative data.
- 3) Demonstrate the skills of solving scientific & clinical problems and decision-making.
- 4) Develop skills as a self-directed learner, recognize continuing educational needs, select & use appropriate learning resources.
- 5) Demonstrate competence in basic concept of research methodology & be able to critically analyze relevant published research literature.

**C) INTEGRATION:**

The knowledge acquired in Biochemistry shall help the students to integrate molecular event with structure & function of the human body in health & disease.

**Programme structure:**

- a) **Eligibility:** The candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or  
B.Sc. with Chemistry /Biochemistry / Biotechnology with minimum 50% of marks.

**b) Period of Training:**

The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

**c) Teaching and Learning Methodology:**

- a. M.Sc.(Medical Biochemistry) students shall attend all Lectures ,Tutorials, and practicals along with 1st M.B.B.s. students. Orientation shall be given to these students in Anatomy and Physiology.
- b. Candidates joining M.Sc.( Medical Biochemistry) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
- c. P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.

- d. P.G. students shall work in central laboratory & would carry out routine, emergency & special investigations during training period.
- e. They shall participate in all P.G. activities ; viz, Seminars ,Group discussion, Journal club etc.
- f. They will be required to participate in the teaching & training programmes of U.G. students.

### **Elective subject in MSc programme (preferably post MBBS)**

#### **Good Laboratory Practices**

1. Introduction to GLP: Good laboratory practices-Introduction, WHO guidelines on GLP and GMP History of Good Laboratory Practices Quality assurances in Good Laboratory Practices
2. Quality Control in Clinical Biochemistry: Quality Assurance and Quality management, Quality control in Preanalytical, Analytical and Postanalytical phases, Accuracy, Precision, Sensitivity, Specificity, Types of Quality control- Internal and External (Proficiency testing), Control material levels and Calibrators, Calibration curve, Levey-Jennings(LJ) graphs, observation of Shifts and Trends in LJ graphs, Westgard's rules for quality control, Types of analytical errors-Random and systematic.
3. Laboratory Accreditation: ISO 15189:2012, ISO 15189:2022 guidelines, Specific criteria for Medical laboratories-NABL 112, Scope of Accreditation.
4. Management and Technical requirements- Standard Operating Procedure(SOP), Quality control, reporting and release of results, Critical alert values.
5. Accreditation bodies – NABL: National accreditation board for testing and calibration laboratories (National) and CAP: College American pathologists (International).  
Accreditation process- Quality manual, Pre-assessment and Final assessment by NABL assessors.  
Six Sigma-Introduction, calculation of sigma metrics using CV%, Total allowable error, bias, preparing standardized QC sigma charts.
6. Metabolic Diseases:
  - Biochemical basis of metabolic disorders such as diabetes, obesity, and inborn errors of metabolism, laboratory diagnosis and their clinical management.
  - Biochemistry of Cancer: Molecular mechanisms underlying cancer development, progression, and treatment, including oncogenes, tumor suppressor genes, and targeted therapies.
  - Neurochemistry: biochemical processes underlying nervous system function and dysfunction, including neurotransmitter synthesis, signalling pathways, and neurodegenerative diseases.

## Molecular Diagnostics:

### 7. PCR Technique

DNA Amplification PCR- Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)- Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

Proteomics: Introduction to techniques for the large-scale study of protein structure, function, and interactions, including mass spectrometry, protein arrays, and bioinformatics analysis.

### DISSERTATION:

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G. teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

**D) Attendance:** They will be granted a term provided they will put 80% attendance during the academic term.

### A) SCHEME OF EXAMINATION

**THEORY EXAMINATION: Total marks 400**

**There shall be four theory papers of 100 marks each. Duration: Three hours**

Pattern of Examination
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions.

**PRATICAL EXAMINATION:**

**Total Marks 400**

**Duration : Two days**

<b>Question</b>	<b>Marks</b>
Q1) Long Clinical Case: 1: 5 investigations based on the diagnosis of a given case	150 Marks
Q2) Enzyme kinetics	50 marks
Q3) Technique (Chromatography /Electrophoresis).	50 marks
Q4) Standardization & interpretation of Quality Control Charts	50 Marks
Q5)Microteaching – to judge the skill of teaching	30 Marks
Q6) General Viva voce examination including Viva on Dissertation	70 Marks

**Syllabus:**

## **Paper I (General Biochemistry and Instrumentation)**

- 1) History & scope of Biochemistry.
- 2) Cell structure & biochemical functions .Membrane structure & functions.
- 3) Transport through biological cell membrane
- 4) Chemistry & biological importance of carbohydrates ,proteins & amino acids, lipids , nucleic acids, porphyrins glycosaminoglycans, glycoproteins.
- 5) Chemistry of blood & hemoglobin, plasma proteins,Blood coagulation.
- 6) Enzymes & coenzymes –chemistry ,nomenclature properties & mode of action of enzymes,Enzyme kinetics, factors affecting enzyme activity,enzyme inhibitions,applications of enzymes & isoenzymes.
- 7) Bioenergetics & biological oxidation-General concept of oxidation & reduction.Electron transport Chain (ETC)- functioning of ETC & inhibitors of ETC, Oxidative phosphorylation,Uncouplers and theories of Biological oxidation & oxidative phosphorylation.
- 8) Principle, working & applications of, a) Colorimetry b)Spectrophotometry c)Flame photometry d) Flurometry e )Atomic absorption spectroscopy g) ultra centrifugation
- 9) Principle, types& applications of , a)Electrophoresis b)chromatography
- 10) Autoanalyzers, Blood gas analyzers
- 11) Automation in clinical chemistry
- 12) pH, electrodes & methods of pH determination.
- 13) Basics of Mass spectroscopy, Nuclear Magnetic Resonance, chemiluminescence and Electron - microscopy
- 14) Environmental Biochemistry – Definition, importance of pollution free & ecofriendly environment, exposure to cold stress, exposure to heat , air pollution water pollution & food pollution
- 15) Immunochemistry – The Immune system, Immunoglobins, antigen –antibody mediated immunity, mononuclear phagocytes –macrophages ,elements of clinical immunity.

## **Paper- II: METABOLISM AND NUTRITION**

- 1) Digestion & absorption from gastrointestinal tract.

- 2) Intermediary metabolism, metabolism of Carbohydrates, Lipids, Proteins , and Amino acids , Nucleic acids, Hemoglobin, metabolic control, energy production & regulation.
- 3) Metabolic interrelationships & regulatory mechanisms
- 4) Metabolic changes during starvation
- 5) Energy metabolism-Calorimetry, BMR- its determination & factors affecting it, SDA of food.
- 6) Macro & micro –elements & their role in health & disease, water metabolism & its regulation.
- 7) Vitamins- chemistry, biological importance , deficiency manifestations & recommended daily allowance.
- 8) Principles of Nutrition –Balanced diet & its planning, Nutritive importance of various food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy Malnutrition ( PEM)- Kwashiorkor & Marasmus .
- 9) Diet in management of chronic diseases viz, Diabetes mellitus, Coronary artery disease, Renal disorders, Cancer, Hypertension, Anemia ,Rickets & Osteomalacia.
- 10) Diet for over weight person, pregnant woman and during lactation.

### **PAPER –III CLINICAL BIOCHEMISTRY**

- 1) Chemistry, composition & functions of lymph, CSF, ascitic fluid, pleural fluid, & synovial fluid.

- 2) Urine formation, excretion & urine analysis.
- 3) Composition, chemistry & functions of specialized tissues like muscle, bone, nerve, connective tissue, & brain adipose tissue.
- 4) Chemistry of respiration & acid base balance & imbalance
- 5) Hormones-: Communication among cells & tissues. Hormone- General mechanism of action of hormones, chemistry, functions, synthesis of steroid hormones , polypeptide hormones, & thyroid hormones. Chemistry & functions of hormones of pancreas, and parathyroid. Local hormones. Clinical disorders of hormones, Hormone receptors.
- 6) Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity.
- 7) Organ function tests
  - a) Liver function tests
  - b) Kidney function tests
  - c) Thyroid function tests.
  - d) Adrenal function tests
  - e) Pancreatic function tests
  - f) Gastric function tests
- 8) Radioisotopes & their clinical applications.
- 9) Biochemistry of aging.
- 10) Neurochemistry in Health & Disease.
- 11) Biochemical changes in pregnancy & lactation.
- 12) Water & electrolytes balance & imbalance.
- 13) Total Quality Management of Laboratories.
  - a) Internal Quality control
  - b) External Quality control
  - c) Accreditation of laboratories
- 14) Basics of Medical statistics
- 15) Inborn errors of metabolism.
- 16) Biotransformations of Xenobiotics
- 17) Basic concepts of Biochemical Defense Mechanisms

**Paper IV : MOLECULAR BIOLOGY , BIOTECHNOLOGY & RECENT ADVANCES  
IN CLINICAL BIOCHEMISTRY**

- 1) Central dogma, genetic code, protein biosynthesis & its regulation.
- 2) DNA: structure, functions, replications, Mutation & repair of DNA, Sequencing of nucleotides in DNA, Mitochondrial DNA, and DNA recombination.
- 3) RNA: composition, types, structure & functions.
- 4) Role of Nucleic acids in diagnosis of Molecular diseases & infectious diseases
- 5) Mitochondrial DNA & diseases.
- 6) Human Genome Project.
- 7) Genes & chromosomes, Gene mapping, Chromosome walking etc.
- 8) Gene expression & gene amplification & gene regulation, Oncogenes, & biochemistry of cancer.
- 9) Genetic engineering: Recombinant DNA technology & its applications. Restriction endonucleases, Plasmids, Cosmids, Gene cloning, Gene libraries.
- 10) Basics techniques in genetic engineering.
  - a) Isolation & purification of DNA, Methods of DNA assay.
  - b) Blotting techniques – Southern, Northern & Western blotting.
  - c) Polymerase chain reaction & its applications.
  - d) Ligase chain reaction & its applications.
- 11) Tumor markers & growth factors
- 12) Biotechnology: Gene therapy, Nucleic acid hybridization, and DNA probes, Microarray of gene probes.
- 13) Genomics and Proteomics
- 14) Medical Bioinformatics
- 15) Lipid peroxidation, free radicals & antioxidants, Nitric oxide formation & its metabolism & its role in Medicine.
- 16) Biochemistry of AIDS
- 17) Genetic control of Immunity
- 18) Research Methodology & Medical ethics.

#### **SYLLABUS FOR PRACTICALS :**

- 1) All undergraduate practicals and routine emergency and special investigations carried out in central clinical laboratory of the hospital, which are useful for



diagnosis and prognosis of the disease.

2) Total Quality Management of Laboratory

- a) Specimen collection , handling & storage of sample.
- b) Methods of standardization & calibration.
- c) Methods of quality control & assessment.

3) Fractionation & Identification of,

- a) Amino acids b) Sugar c) Proteins d) Lipoproteins by
- i) Thin Layer Chromatography ii) Paper chromatography (circular, Uni-dimensional & two dimensional iii) Gel electrophoresis- agarose, starch, & Polyacrylamide Gel Electrophoresis iv) paper electrophoresis & cellulose acetate paper electrophoresis .

4) a) Estimation of total activity of following enzymes .

- i. LDH & separation of its isoenzymes by Polyacrylamide gel electrophoresis, Cellulose acetate electrophoresis & quantitation by densitometry.
- ii. AST(GOT)
- iii. ALT(GPT)
- iv. Alkaline phosphatase
- v. Acid phosphatase
- vi. Amylase
- vii. Creatine kinase its Isoenzymes

b) Enzyme kinetics and Determination of  $K_m$  value and effect of pH substrate concentration & temperature on Enzyme activity.

c) Endocrinology: Estimation of Hormones.

5) Isolation of DNA and PCR technique.

6) Estimation of serum lipid profile .

- i) Serum total cholesterol
- ii) Serum HDL cholesterol
- iii) Serum VLDL & LDL
- iv) Serum Triglycerides
- v) Serum Phospholipids

7) Estimation of Fe & Total Iron Binding capacity, & ferritin

8) Estimation of Glycosylated Hb.

9) Body fluid analysis - Urine , CSF, Ascitic fluid , Pleural fluid

10) Estimation of Na, K & Lithium by Flame photometer.

**Books Recommended:**

- 1) Biochemistry Ed Lubert Stryer . W.H. Freeman & company ,New york.
- 2) Principles of Biochemistry . Ed. Lehninger , Nelson & Cox . CBS publishers & distributors .
- 3) Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes & V.W.Rodwell. Appleton & Lange ,Stanford ,Conneticut.
- 4) Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers.
- 5) Genes VI Ed. Benjamin Lewin . Oxford University press.
- 6) Tietz Textbook of Clinical chemistry, Ed. Burtis & Ashwood W.B. Saunders Company.
- 7) Principles & techniques of practical Biochemistry Ed. Keith Wilson & John Walker Cambridge University press .
- 8) Biochemistry Ed. Donald Voet & Judith G. Voet John Wiley & Sons ,Inc.
- 9) Molecular cloning –A laboratory Manual .J. Sambrook , E.F. Fritsch & T.Maniatis Cold Spring Harbor Laboratory Press.
- 10) Molecular cell Biology , H.Lodish,A. Berk, S.L. Zipursky, P. Matsudaira ,D. Baltimore , J.Darnell.
- 11) Bio-technology 1st edition . U. Satyanarayan. Books & Allied Publisher (p) Ltd.Kolkatta.

**Journals:**

1. Clinical Chemistry (I)
2. Clinica Chimica Acta (I)
3. Indian Journal of Biochemistry and Biophysics.(N)
4. Indian Journal of Medical Biochemistry(N)
5. Indian Journal of clinical chemistry(N)

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Microbiology**

**MSc (Microbiology)**

**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Biochemistry Name of Programme: MSc. (Medical Microbiology)**

**Programme outcomes:**

The broad goal of the MSc (Medical Microbiology) is to train the post graduate students to:

- a) Carry out professional obligations ethically in keeping with the objectives of the National health policy.
- b) Have mastered most of the competencies pertaining to medical diagnostic microbiology including molecular diagnostics.
- c) Make them aware of the recent advances in the field of medical diagnostic Microbiology
- d) Help them acquire the spirit of scientific inquiry.
- e) Oriented them to the principles of research methodology.

**Programme specific outcomes:**

**A) Knowledge**

At the end of the course the students shall be able to:-

- 1) State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases.
- 2) State and explain the principles of immunity and immunological phenomenon, which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases
- 3) Establish and practice laboratory medicine for the diagnosis of infectious diseases in the hospital and community in the field of bacteriology, parasitology, virology, mycology, serology and immunology
- 4) Basics of prevention and control of communicable diseases .
- 5) State the recent advances in the field of medical microbiology and apply this knowledge in understanding etiopathogenesis and diagnosis of diseases caused by microorganisms

**B) Skills**

At the end of the course the student should be able to: -

1. Plan the laboratory investigations for the diagnoses of infectious diseases
2. Perform laboratory procedures to reach the etiological diagnoses of infectious diseases including the drug sensitivity profile
3. Perform and interpret immunological and serological tests
4. Perform and interpret molecular diagnostic tests.
5. Operate routine and advanced laboratory instruments
6. Develop microteaching skills

7. Implement the chosen research methodology

**C) INTEGRATION :** The student will be able to integrate the etiopathogenesis of various infectious diseases with the diagnostic modalities available and their interpretation.

#### **Programme structure:**

**A) ELIGIBILITY & DURATION:** – The candidate should have passed Bachelor’s degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or B.Sc. with Microbiology /Biochemistry / Biotechnology with minimum 50% of marks.

**B) PERIOD OF TRAINING:** The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

#### **C) TEACHING AND LEARNING METHODOLOGY:**

Teaching for MSc ( Medical Microbiology) will be done using the following teaching learning methods :

Group teaching sessions

Journal review

Subject seminar presentation

Group discussion

Slides seminar

Clinical case presentation pertaining to infectious diseases

Participation in CME programmes and conferences.

#### **Hands on experience (Practical training)**

Students will be actively involved in day to day working of all the sections.

#### **Schedule of rotation**

1. Bacteriology—11m
2. Hospital infection surveillance—1m
3. Serology/immunology—6m
4. Mycology—3m
5. Virology/HIV—6m
6. Parasitology—3m
7. Clinical Microbiology(OPD)—2m
8. Recent diagnostic techniques—4 m
  - Candidates joining M.Sc.( Medical Microbiology ) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
  - P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.

## 9. Elective Subject in the M.Sc. programme (preferably post MBBS)

### Good Laboratory Practices

- **Introduction to GLP:** Good laboratory practices-Introduction, WHO guidelines on GLP and GMP History of Good Laboratory Practices Quality assurances in Good Laboratory Practices
- **Quality standards and Quality Assurances: Quality Standards-** Advantages and Disadvantages, Concept of Quality Control Quality Assurance- Their functions and advantages Quality assurance and quality management in industry Customer requirement of quality Government and trade standards of quality Federal Food and Drug Law FDA Action BSTI Laws, BSTI action and activities Other food laws (Legalization), Trade and Company Standards Control by National, International, Social Organizations (example: FAO, WHO, UNICEF, CAB), Society (example: NSB, Professional societies)
- **Biosafety:** Introduction: Historical Background Biosafety in Laboratory/institution. Laboratory associated infections and other hazards, assessment of Biological Hazards and levels of biosafety, prudent biosafety practices in the laboratory/institution Introduction to Biological safety cabinets, Primary Containment of Biohazards, Biosafety Levels, Recommended Biosafety Levels for Infectious Agents and Infected animals Bio-safety guidelines, Government of India Guidelines Definition of Genetically Modified Organisms(GMOs)

### PCR techniques

**DNA Amplification PCR-** Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

- **Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)-** Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

DNA Amplification PCR- Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)- Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

### Immunological techniques

- **Methods used in immunology:** Preparation of antigens and antibodies, purification of antibodies, analysis of antibodies and antigens, preparation and uses of various types of vaccines.

- Techniques used in immunology: Types of immunodiffusion methods, ELISA, RIA, Western blot analysis, Electrophoresis and Hybridization techniques, immunohistochemistry, Immuno-flowcytometry, Immuno-fluorescence.
- Applications of antisera in the detection of various diseases. Examples: syphilis and lyme, typhoid, streptococci infections, HIV, various types of Hepatitis
- Antibody engineering, Catalytic antibodies, antibody immunotherapy, productions of drugs to allergies.

### **Hospital Infection control systems**

- Hand hygiene.
- Use of personal protective equipment.
- Safe use and disposal of sharps.
- Reprocessing of reusable medical equipment and instruments.
- Routine environmental cleaning.
- Respiratory hygiene and cough etiquette.
- Aseptic non-touch technique.
- Effective waste management.

**Emergency duty:** -Student will be posted for managing emergency laboratory services in microbiology

During the **first year** of the course the PG student is required to:

1. Attend all the UG teaching sessions(lectures, tutorials, practicals)
2. Participate in seminars and journal club activity
3. Complete the laboratory manual.
4. Select and submit the topic of dissertation
5. Do reference work
6. Do self study

During the **second year** of the course the PG student is required to:

1. Do work for dissertation
2. Participate in activities like seminars, symposium, group discussions and journal club
3. May attend conferences at state and national level
4. Do self study

During the **third year** of the course the PG student is required

1. To complete and submit the dissertation
2. To do participate in activities like seminars, symposia, group discussions and journal club
3. May attend conferences at state and national level
4. To do self study

### **D) Dissertation:**

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G.

teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

#### **E) ATTENDANCE:**

They will be granted a term provided they will put 80% attendance during the academic term

#### **SCHEME OF EXAMINATION**

##### **THEORY EXAMINATION: Total marks 400**

There shall be four theory papers of 100 marks each. Duration: Three hours

<b>Pattern of Examination</b>
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions

Paper1- General Microbiology & Immunology

Paper 2- Systemic bacteriology & Mycology

Paper3- Parasitology and Virology

Paper 4- Recent advances in microbiology

#### **PRACTICALS**

Practical examination shall be conducted on two consecutive days.

Exercises in practical examination conjointly conducted and evaluated by four examiners (Two internals and two externals Examiners)

##### **Marking pattern for practical and oral examination**

Long exercise& media prep.	60
Short exercise	15
Mycology	10
Serology	25
Parasitology	10
Media preparation	10
Identification of slides	30
Viva	40
Total	200

- a) **Long exercise** on clinical bacteriology: Problem based. Brief history along with relevant clinical findings are given. Student is asked to isolate and identify bacteria from given clinical specimen and anti microbial sensitivity of isolated organism to be performed.



- b) Short exercise
  - 1. Exercise in Bacteriology  
Identification of bacteria from given pure culture
- c) Media preparation
- d) Identification of fungi from 1 given cultures-  
One yeast OR mould
- e) Exercise in Parasitology  
Examination of stool for ova/cyst by direct/concentration method and reporting
- f) Serology/ Immunology : Tests for HIV and HbsAg, HCV, dengue, Chikungunya etc  
OR Widal test, VDRL test, Paul Bunnell test, ASO, CRP, RA tests
- g) Identification of microbiological findings in the given set of slides (10 slides)
- h) Oral (viva-voce/Grand viva)  
Student will be examined by all examiners regarding his knowledge of basic aspects and recent advances in the field of microbiology & Presentation and discussion of dissertation

## **THEORY CURRICULUM**

### **GENERAL MICROBIOLOGY:**

- 1 History and Pioneers in Microbiology
- 2 Microscopy
- 3 Morphology of bacteria
- 4 Nomenclature and classification of microbes
- 5 Growth nutrition of bacteria & Bacterial metabolism
- 6 Sterilization and disinfection
- 7 Host parasite relationships
- 8 Bacterial genetics, genetic engineering and its applications
- 9 Antibacterial substances, mechanism of action, mechanism of drug resistance and antibiotic sensitivity
- 10 Quality control and quality assurance in microbiology
11. Laboratory biosafety

### **IMMUNOLOGY:**

1. Structure and function of immune system, immune response
2. Innate and acquired immunity
3. Antigen
4. Immunoglobulins
5. Complement
6. Antigen and antibody reactions
7. Hypersensitivity
8. Immunodeficiency
9. Autoimmunity

## **SYSTEMIC BACTERIOLOGY:**

1. Isolation and identification of bacteria
2. Staphylococcus and Micrococcus, anaerobic gram positive cocci
3. Streptococcus and lactobacillus
4. Neisseria, Branhamella, moraxella
5. Corynebacteria and other coryneform organisms
6. Bacillus: the aerobic spore bearing, anaerobic cocci
7. Clostridium: the spore bearing bacilli
8. Nonsporing anaerobes, Enterobacteriaceae
9. Vibrios, Aeromonas, Plesomonas, campylobacter, h.pylori, spirillum
10. Pseudomonas
11. Yersinia, Pasteurella, Francisella
13. Haemophilus, Bordetella and Brucella
14. Mycobacteria
15. Spirochaetes
16. Actinomyces, Nocardia, Actinobacillus
17. Mycoplasmatales, Mycoplasma, Ureaplasma, Acholeplasma
18. Rickettsiae
19. Chlamydiae
20. Emerging bacterial pathogens
21. Care and breeding of laboratory animals and their use in medical microbiology

## **Virology:**

1. General properties of viruses
2. Laboratory diagnosis of viral infections
3. Genetics of viruses
4. Epidemiology of viral infections
5. Vaccines and antiviral drugs
6. Bacteriophages
7. Pox viruses
8. Herpes viruses
9. Orthomyxoviruses
10. Paramyxoviruses
11. Enteroviruses :-Polio, ECHO and Coxsackie viruses
12. Hepatitis viruses
13. Rhabdoviruses
14. Human Immunodeficiency viruses
15. Oncogenic viruses
16. Arboviruses
17. Emerging viral diseases

## **Parasitology**

1. Protozoan parasites of medical importance  
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosomes, Plasmodium, Toxoplasma,

2. Helminthology
  - a) Cestodes: - all the tapeworms
  - b) Trematodes: - Liver, lung and blood flukes
  - c) Nematodes: - Intestinal and tissue nematodes

### **Mycology**

1. General properties of fungi, morphology, classification, reproduction
2. Laboratory diagnosis of fungal infections
3. Fungi causing superficial mycoses
4. Fungi causing subcutaneous mycoses
5. Fungi causing systemic infections
6. Contaminant and opportunistic fungi

### **Applied Clinical microbiology**

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Recent advances in diagnostic technology
4. Outbreak investigations and disaster management
5. Biological warfare

## **PRACTICAL SKILLS**

### **BACTERIOLOGY:**

1. Care & Operation of microscopes.
2. Preparation of stains viz.: Gram's, Albert's, Ziehl-Neelsen's and other stains.
3. Sterilization of glassware.
4. Operation of laboratory instruments.
5. Care & maintenance of laboratory equipments.
6. Preparation of routine culture media.
7. Preparation of common reagents –Oxidase, Kovac's etc.
8. Tests for beta lactamase including ESBLs.
9. Collection of clinical specimens for microbiological investigations.
10. Preparation, examination and interpretation of direct smears from clinical specimen.
11. Techniques of anaerobiosis- Gas pack system, anaerobic jar.
12. Identification of bacteria of medical importance upto species level.
13. Quantitative and Semiquantitative analysis for significant bacteriuria
14. Plating of clinical specimens on media for isolation, purification and identification.
15. Tests for motility; hanging drop, Craige's tube, dark ground microscopy for Spirochaetes-Treponema and Leptospira
16. In- vitro toxigenicity tests-Elek's test Nagler's reaction.
17. Special tests- Bile solubility, Chick cell agglutination, Sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, Catalase test and slide agglutination tests, and other as applicable in the identification of bacteria upto species level

18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing by Kirby –Bauer disk diffusion method, estimation of MIC and MBC by dilution methods (Tube and plate). Test for drug susceptibility of mycobacterium tuberculosis
19. Skin tests like Mantoux, Lepromin test etc
20. Testing for disinfectants- Phenol coefficient and “In Use” tests
21. Quality control of media reagents etc and validation of sterilization procedures
22. Aseptic practices in laboratory and safety precautions
23. Disposal of contaminated material like cultures
24. Bacteriology of Food, water, milk air
25. Maintenance of Stock cultures

### **IMMUNOLOGY/SEROLOGY**

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues for Widal, Weil-Felix, VDRL, etc and their standardization
3. Raising of antisera in laboratory animals.
4. Performance of serological tests viz. Widal, Brucella tube agglutination indirect Haemagglutination, VDRL, Paul-Bunnell, Rose- Waller, IFA.
5. Immunodiffusion in gels, counter immunoelectrophoresis- visualization and interpretation of bands.
6. Performance and interpretation of ELISA.
7. Latex and Staphylococcal tests

### **MYCOLOGY**

1. Collection of specimens for Mycology
2. Direct examination of specimen using KOH, Gram stain, Lactophenol cotton blue etc.
3. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
4. Special techniques like slide culture etc.
5. Maintenance of stock cultures.

### **PARASITOLOGY**

1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formal-Ether methods) and complete examination for other cellular features
2. Egg counting techniques for helminths
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears
4. Examination of other specimens for e.g. urine, CSF, Bone marrow etc for parasites
5. Histopathology sections- Examination and identification of parasites
6. Performance of stains- Leishman, Giemsa, Modified Acid fast, Toluidine Blue O
7. Identification of common arthropods and other vectors viz. Mosquito, sand fly, ticks, mite and cyclops.
8. Collection of specimens
9. Preservation of parasites- mounting, fixing, staining etc

## **VIROLOGY**

1. Preparation of glassware for tissue culture (washing, sterilization).
2. Preparations of media like Hanks, MEM.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests- ELISA and rapid tests for HIV, RPHA for HbsAg, Haemagglutination inhibition for influenza, AGD and counter immunoelectrophoresis for detection of viral antigens or antiviral antibodies.
5. Chick embryo techniques- inoculation and harvesting.
6. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

## **SUGGESTED READING BOOKS,**

### **Reference books**

1. Tople and Wilson's Microbiology and microbial infections.
2. Color Atlas and textbook of Diagnostic Microbiology-Elmer W Koneman.
3. Mandell, Douglas and Bennet's Principles and Practice of Infectious Diseases.
4. Microbiology and Clinical Practice: Shanson
5. Immunology: Janis Kuby
6. Basic Clinical Immunology: Fudenberg, Stites Caldwell Weills.
7. Bailey & Scott's diagnostic microbiology.
8. Textbook of Parasitology by Chatterjee K.D.
9. Microbiology in Clinical Practice by Shannon. D.C.
10. Beaver's Parasitology Textbook.

### **Further Reading:**

1. Mycology by-Rippons
2. Essentials of immunology- Roitt
3. Virology- Clinical virology by Rich.
4. Gradwohl's Clinical laboratory methods and diagnosis.
5. Biochemical tests for identification of medical bacteria- MacFaddin J F
6. Manual of Clinical Microbiology- ASM Press.

### **Journals:**

1. Indian journal of medical microbiology.
2. Clinical Microbiology Reviews.
3. Journal of Medical Microbiology.
4. Journal of AIDS

5. Indian Journal of Tuberculosis and Lung Disease.

6. Parasitology Today.

7. ICMR Bulletin.

12. WHO bulletin.

**Important Websites:**

1. Center for disease control-[www.cdc.gov](http://www.cdc.gov)
2. World Health Organization- [www.who.int](http://www.who.int).
3. Global infectious disease Epidemiology networks. [www.guideonline.com](http://www.guideonline.com)
4. National Aids Control Organization- [www.nacoindia.org](http://www.nacoindia.org)
5. Tuberculosis Research center- [www.trc-chennai.org](http://www.trc-chennai.org)

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of  
Pharmacology**

**MSc (Pharmacology)**

**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Pharmacology**

**Name of Programme: M.Sc. Pharmacology**

**Programme outcomes:** M.Sc. or Master of Science in Pharmacology is a 3 year postgraduation course. Upon successful completion of the course, graduates of this field may pursue further studies and may complete their Ph.D. or may take up job opportunities associated with this qualification like teaching for MBBS, BDS or Pharmacy students, in quality control department of pharmaceutical industries, in Research institutes or R & D of drugs, etc

Accordingly, a post graduate (MSc) student in Pharmacology should be competent to meet the job requirements at all these places.

**Programme specific outcomes:**

At the end of the 3 yr. course, a trained M.Sc Pharmacologist shall be able to:

***Cognitive domain:***

- I. Apply basic principles of Pharmacology and Therapeutics to rational use of existing drugs and evaluation of new drugs.
- II. Collect, analyze and interpret experimental and clinical data related to drug kinetics or dynamics.
- III. Provide appropriate advice related to selection of drug; drug usage (desirable and undesirable effects, kinetics, interactions); precautions & measures to be taken during administration of drug and treating the ADRs in a given patient taking into consideration physiological, psychological & pathological features.
- IV. Develop the ability for continued self-learning so as to update the knowledge of recent advances in the field of Pharmacology and allied fields.
- V. Teach and train undergraduate and postgraduate medical students and junior doctors in Pharmacology and Therapeutics.
- VI. Plan and carry out both laboratory and basic clinical research with adherence to scientific methodology, legal and ethical aspects and GLP/GCP guidelines.
- VII. Communicate the findings, results and conclusions of scientific research both verbally and in writing.



VIII. Understand the problems associated with evaluation and use of drugs from alternative systems of medicine.

***Psychomotor domain:***

- 1) Perform common experimental techniques required for evaluation of drugs with competence.
- 2) Perform common clinical procedures required for evaluation of drugs in normal volunteers and patients with competence.
- 3) Use teaching learning media effectively.

***Affective domain:***

- 1) Appreciate socio-psychological, cultural and environmental factors affecting health and drug usage.
- 2) Appreciate importance and implementation of National health programmes in context to rational drug utilization
- 3) Adopt ethical principles while conducting experimental and human research
- 4) Develop communication skills to interact with patients, peers and paramedical staff.
- 5) Realize the importance of team work
- 6) Develop attitudes required for professional responsibilities.

**Programme structure:**

**General**

- 1) They should appear for theory and oral examination for the first 3 blocks along with II M.B.B.S.
- 2) All M.Sc. students are supposed to maintain log book of their practical work.
- 3) They are expected to actively participate in research activities and undergraduate teaching whenever possible.
- 4) After 2 terms, they participate in Journal reporting clubs.
- 5) At the end of each term, there will be a written and practical test.

**1<sup>st</sup> Term**

**LECTURES:**

- 1) Specified Course in Anatomy, Physiology and Biochemistry.
- 2) Attending Lectures in Pharmacology

**PRACTICAL:**

- 1) Information, observations and handling of commonly used laboratory animals.
- 2) Common Lab. Techniques –Bleeding, feeding, Intravenous, subcutaneous, intramuscular, and Intraperitoneal injections.
- 3) Use of different anesthetics for animals.
- 4) Use of kymograph smoking and fixing of graph paper
- 5) Orientation to computer simulation experiments

### **2<sup>nd</sup> Term:-**

#### LECTURES:

- 1) Completion of course in Anatomy, Physiology and Biochemistry.
- 2) Attending lectures in Pharmacology

#### PRACTICALS:

- 1) Acute E.D. 50 & LD 50 determination.
- 2) Preparation for isolated tissue experiments – Guinea pig ileum, rat uterus and rat colon.
- 3) Practice computer simulation experiments- vasopressor & vasodepressors, mydriatics & miotics, Dose response curve, etc

### **3<sup>rd</sup> Term:-**

#### THEORY

- 1) Self study- General Pharmacology and ANS

#### PRACTICAL WORK:-

- 1) Bioassays on isolated tissues – Acetylcholine, histamine, etc.
- 2) Experiments- Bioavailability, disintegration, dissolution, Skeletal muscle relaxants, factors affecting drug action, drug antagonism, etc

#### DISSERTATION

Research Methodology workshop, Review of literature for selection of a topic for dissertation work, Prepare synopsis and departmental approval.

### **4<sup>th</sup> Term:-**

#### THEORY

Self study as in 3<sup>rd</sup> Term on Autacoids, CVS and CNS

## **PRACTICAL WORK**

Experiments- evaluation of local anesthetics, general anesthetics, analgesics and antiepileptics

Principles and working of Lab. Instruments

## **DISSERTATION:**

Collecting relevant references, conducting research work and progress report

## **Elective Subject in the M.Sc. programme (preferably post MBBS)**

- **Animal Handling and animal house techniques**
- Animal Care and Guidelines – Importance.
- Physiology of Experimental Animals, Understanding of Humane endpoints.
- Anaesthesia, Fasting,
- Animal Behaviour
- Groups, Kinetic Studies, Time Chart, Retro-orbital Puncture
- Code of conduct in Animal house
- GLP for researchers
- Animal House Proceedings, Flow of Animal House activities
- Identification, Cages, Cage Card, Feed Water, Temperature and Humidity, Light Dark Cycle
- Maintenance of Records and Its importance
- Animal Sacrificing
- Autopsy, Organ identification and sampling for histopathology
- Isolation of organs
  
- **Pharmacovigilance**
- Introduction to Pharmacovigilance
- History of Pharmacovigilance
- Examples of product recalls due to toxicity
- Responsibilities
- Adverse Drug Reactions (ADR)
- Changes that occur from the PV findings
- Governing bodies for Pharmacovigilance
- WHO Pharmacovigilance programme
- Pharmacovigilance programme of India (PVPI)
- Application/Role of Pharmacovigilance
- Pharmacovigilance Methods
- Passive surveillance
- Spontaneous Reports

- Case series
- Stimulated Reporting
- Active surveillance
- Drug event monitoring
- Registries
- Data Management and Case Processing
- Signal Management, ADR Reporting System
- Definition and examples of Adverse Event (AE)
- Adverse Drug Reaction (ADR)
- Regarding marketed medicinal products
- Unexpected Adverse Drug Reaction
- Serious Adverse Event/Reaction (SAE/R)
- Suspected Unexpected Serious Adverse Reaction (SUSAR)
- NARANJO algorithm for assessing the causality
- Commonly used criteria for Adverse Event Relationship to Study Products
- Adverse Event Relationship to Study Products In India

- **Good Clinical Practice**

- Introduction
- Institutional Review Boards
- Informed Consent
- Confidentiality & Privacy
- Participant Safety & Adverse Events
- Quality Assurance
- The Research Protocol
- Documentation & Record-Keeping
- Research Misconduct
- Roles & Responsibilities
- Recruitment & Retention
- Investigational New Drugs

- **Research Methodology**

- Introduction to health Research
- Definitions of Research
- Characteristics of Research
- Research Objectives
- Types of Research
- Major Areas of Health Systems Research
- Some of the Problems encountered by the Researchers
- Identification and Prioritization of Research Problems/areas
- Criteria for Prioritizing Topics for Research

- Nominal Group Technique (
- Literature search
- Formulation of objectives
- Research Questions and hypotheses
- Research Objectives
- Research Questions
- Hypotheses
- Characteristics of Good Hypothesis
- Measurement
- Strategies to Deal with Threats to Validity
- Study Design options in Medical and health Research
- Decision Algorithm for Study to be Chosen
- Observational/Non-experimental/Non-Interventional Studies
- Schematic Diagram of Nested Case-Control Study Design
- Measurements in Various Study
- Study Designs
- Randomized Controlled Trial (RCT)
- Types of Randomized Controlled Trials
- Clinical Trials
- Principles for Maximizing Follow up and Adherence to the Protocol elements to Monitor Clinical Trials
- Research on Diagnostic Tests
- Qualitative Research-Concepts and Methods
- Variables
- Sampling Methods
- Analysis of Quantitative Data
- Analysis of Qualitative Data
- Data Management, Processing and analysis
- Ethical Issues in Health Research

## **5<sup>th</sup> TERM**

### **THEORY**

Self study of Chemotherapy, Endocrinology, Respiratory system and GIT

### **PRACTICAL WORK**

Practice techniques in animal research, isolated tissue mounting and other experiments

### **DISSERTATION**

Work should be completed, analyzed and dissertation presentation and submission.

## **6<sup>th</sup> TERM**

### **THEORY**

Self study of remaining topics in Pharmacology and advances in Pharmacology.

Preparation for M.Sc. Theory and Practical of Preliminary and University Examination.

### **PRACTICAL WORK**

Practice techniques in animal research, isolated tissue mounting and other experiments for university exams

## **TERM III TO VI**

- 1) Assisting in undergraduate teaching as per Departmental directives.
- 2) Active participation in Journal Club/seminar /workshops.
- 3) Attending seminars, workshops and conferences
- 4) Presenting research papers- posters and oral paper in conference
- 5) Manuscript preparation and publication under the guidance of PG teacher

### **Syllabus:**

- 1) **Title:-**  
M.Sc. (Medical) Pharmacology for non-medical graduates  
(the Degree of master of science in Pharmacology in the faculty of Medicine)
- 2) **Eligibility Criteria :-**

1) B.Sc. of a recognized University with Chemistry/ Zoology/Botany/ Microbiology allied subject after H.Sc /( Std.XII) or equivalent examination with Biology as one of the subjects.

Or

2) Bachelor of Pharmacy of any University recognized by the Pharmacy council of India.

Or

3) Bachelor's degree in Biomedical Science of any recognized University.

- Candidate must have graduated in any of the above branches with minimum 50% aggregate marks.

3) **Duration of Course :-**

3 yrs. including initial 1 year orientation in Anatomy, Physiology and Biochemistry.

4) **Total No. seats:-**

P.G. Teacher: P.G. Student ratio of 1:1 per year (Current strength 5/yr.)

5) **Criteria of Selection:-**

Application will be ranked in order of merit according to the aggregate marks obtained at the qualifying graduate examination referred in item 2 above

6) **Training Programme / Syllabus term wise:-** As in Programme structure

7) **Rules for leave / Vacation**

1 Week winter vacation (Diwali) and 2 Week summer vacation / per year

8) **Rules for sanctioning the term**

1) 80 % attendance

2) Satisfactory performance in the term-wise curriculum as indicated by Term-ending Examination results (minimum 50% aggregate marks) and log book.

\* Attendance or Performance less than above may be considered on compassionate basis if it is due to reasons of ill health on recommendations from the P.G. Teacher and Principal of College.

## 9) Examinations :-

### a) **Internal Assessment: Marks :**

Based on log book which must be maintained by every student.

- Formative examinations (Term ending and Preliminary Examinations)
- Dissertation work and presentations
- Overall Assessment by the P.G. Teacher
- Participation and performance in departmental post –graduate activities.

### b) **Term – Ending Examinations :-**

c) 50 marks theory examination at the end of term I & II in the relevant portion of Anatomy, Physiology, Biochemistry.

50 marks theory examination at the end of every term in Pharmacology from term III to VI

### d) **University Examination :-**

The examination shall be by papers, Practical and orals as follows.

Theory papers:-

Paper –I- General Pharmacology, Principles and Methods of Bioassay, Pre-clinical evaluation of drugs, Biostatistics and statistical analysis of Pharmacological data. Principles and Methods of Clinical Pharmacology.

Paper-II –Systemic Pharmacology.

Paper-III- Applied Pharmacology

Paper –IV – Recent advances in Pharmacology

- Each paper of 100 marks will be set and examined by the board of paper setters and examiners in the subject.

Same examiners will examine the candidate during practical and oral examination.

Practical Examination:-

A] Long Experiment:- Estimation of Drug Concentration (100 marks)

- Experiment & set-up (50 marks)
- Graph & calculations (25 marks)
- Viva (25 marks)

B] Short Experiment with Technique demonstration:- (70 marks)

- Procedure (25 marks)
- Viva (25 marks)
- Technique demo (20 marks)



C] Use of common instruments in Pharmacology (50marks)

D] Critical appraisal of Journal article (40marks)

E] Microteaching (40 marks)

F] Viva-Voce:-

- Dissertation (40 marks)
- Theory viva (60 marks)

Collectively will be assessed by all the above examiners.

A candidate will be declared as passed, passed with distinction or failed according to his/her overall performance at the examination.

10) **Eligibility for appearing for University Exam:-** Satisfactory completion of Dissertation work & Satisfactory performance in Internal Assessment

11) **Criteria for passing:** Minimum 50% aggregate marks in University Exam.

Approval of Dissertation by Board of Examiners.



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

**Faculty of Medical Sciences  
M.Sc. (Combined)  
Old Syllabus**

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Anatomy**

**MSc (Anatomy)**

Bharati Vidyapeeth Deemed to be University, Medical College, Pune

Department of Anatomy

Name of Programme: MSc Anatomy

**Programme outcomes:**

**M.Sc. Anatomy or Master of Science in Anatomy** is a three years postgraduate Anatomy course. It provides the scientific study of tissue structures, organ systems and whole bodies together with their cellular and structural components and dynamics. It provides a solid foundation in human anatomy as a basis for teaching as well as basic and applied research. The Course gives the opportunity to learn the anatomy of the human body by dissection and to gain comprehensive knowledge of normal anatomy. This course aims to provide students with a greater understanding of advanced human anatomy including appropriate radiological anatomy, microscopic anatomy, embryology, genetics, neuroanatomy, endocrinology, secretory dynamics, and applications to such topics as aging and disease conditions.

**Programme specific Outcomes:**

After the summative examination at the end of third year when he/she will be declared as passed candidate of Msc Anatomy and will have

- Diverse opportunities in teaching and research and can work as Assistant Professor/ Lecturer, Research Assistant, Medical Scientist.
- It is also beneficial for further studies such as M.Phil and Ph.D. in the same or related domain of study.
- He/She can have different opportunities in different fields of Radiology, Embryology, Genetics

**Programme Structure:**

- The candidate will complete the course of studies in Human Anatomy, Physiology, Biochemistry as orientation course for the period of first two academic terms.
- He/She will attend the Workshop on research methodology conducted by Medical education unit of the college and will come to know the basics of any research.

- Candidate will work himself / herself on the thesis under the guidance of a recognized post graduate teacher.
- Subject of dissertation (Thesis) should be submitted to the University along with a synopsis (about 250 words) after approval of Ethic's Committee and undersigned by the concerned postgraduate teacher, within 6 months after registration or 6 months after completing the orientation course.
- He/she will put in two academic terms for working on thesis.
- The subject of thesis should as far as possible reflect the research priorities of the post graduate department where the work is being done. The department should provide all facilities to the candidate.
- The acceptance of thesis by the examiners shall be a condition to the admission of the candidate for the written and practical examination
- Candidate will undertake whole body dissection in next two academic terms
- Candidate should take part to undergraduate teaching after completion of first two semesters
- He/she should get thorough knowledge of Gross anatomy, Histology, Embryology, Genetics, radiology and recent advances in the last two years
- **Theory Syllabus:** Candidate should study
  - Gross and regional anatomy including general and sectional anatomy and principles of applied anatomy.
  - Embryology including general and systemic embryology.
  - General and systemic histology.
  - Radiological anatomy – Study of X-rays of different parts of human body and the special procedures used.
  - Elements of Genetics – Study of genes, chromosomes and their abnormalities, inheritance.
- **Practical syllabus :**

- Dissection of whole body
- Histological techniques including H and E and some special staining procedures.
- Embalming and preservation of bodies and organs.
- Museum techniques.
- Basic in research work.
- Teaching undergraduates, preparation of teaching material.

- **Elective subject in MSc programme (preferably post MBBS) -**

- Immunohistochemistry

- **Course Outline**

- The Role of Immunohistochemistry (IHC) in the Histology Laboratory.
- Antibodies.
- Fixation.
- Processing and Microtomy.
- Epitope Retrieval.
- Unmasking Methods.
- Immunohistochemical (IHC) Methods.
- Blocking Methods

- Histology technique

- **Course Outline**

- Introduction
- Statutory regulations and. Ethics
- Total Quality Management
- Laboratory Safety
- Specimens
- Laboratory Equipment
- Laboratory Reagents
- Stock Control
- Quality Assurance / Accreditation.
- Quality Control.
- Method Evaluation.
- Personnel documentation

## SYLLABUS

### **SYLLABUS FOR M.Sc. (NON-MEDICAL) IN THE SUBJECT OF ANATOMY**

**1) Title:**

Syllabus for M.Sc. (Non-Medical) course in Anatomy for nonmedical students.

**2) Eligibility Criteria:**

B.Sc. degree with Zoology as Principal subject or as one of the subjects for obtaining B.Sc.

**3) Duration of course:**

Three and half years or seven academic semesters.

**4) Total Number of Seats:** Three

**5) Criteria for Selection:**

By Merit Marks obtained in Zoology of B.Sc. should minimum 50%.

**6) Training Programme/Syllabus:**

Candidate registered under M.Sc. Anatomy must satisfactory complete the course of studies in Human Anatomy, Physiology, Biochemistry as orientation course for the period of first two academic terms.

**a) Theory Syllabus:** Candidate should study

1. Gross and regional anatomy including general and sectional anatomy and principles of applied anatomy.
2. Embryology including general and systemic embryology.
3. General and systemic histology.
4. Radiological anatomy – Study of X-rays of different parts of human body and the special procedures used.
5. Elements of Genetics – Study of genes, chromosomes and their abnormalities, inheritance.
6. Comparative anatomy of vertebrates in detail, including comparative embryology and histology.
7. Evolution – Outline of evolution, fossilman, history of Anatomy.

**b) Practical Work in Anatomy:**

1. Dissection of comparative human body.
2. Histological techniques including H and E and some special staining procedures.
3. Embalming and preservation of bodies and organs.
4. Museum techniques.
5. Basic in research work.
6. Teaching undergraduates ,preparation of teaching material.

### **c) Hospital Postings/Other Postings/Visits: Thesis/Dissertation**

For M.Sc. Anatomy

- i. Candidate will work himself on the thesis under the guidance of a recognized post graduate teacher.
- ii. Subject of dissertation should be submitted to the University along with a synopsis (about 250 words) after approval of Ethic's Committee and undersigned by the concerned postgraduate teacher, within 6 months after registration or 6 months after completing the orientation course.
- iii. Subject and plan of work of the thesis should not be same as that of thesis which has been accepted by the University in the previous three years.
- iv. Minor changes in the topic of thesis should be allowed any time before submitting the final work.
- v. Candidate may change the subject of his/her thesis during the course, with due prior approval of the university authorities and the post graduate teacher.
- vi. He/she will have to put in two academic terms for working on thesis.
- vii. The subject of thesis should as far as possible reflect the research priorities of the post graduate department where the work is being done. The department should provide all facilities to the candidate.
- viii. If the work required for the thesis involves collaboration with other department, the collaboration part will be supervised by a co-guide



designed by the Head of the Institution. The certificate required for submission of the details should be signed by both, the guide and co-guide.

- ix. The acceptance of thesis by the examiners shall be a condition to the admission of the candidate for the written and practical examination.

**d) Undergraduate Coaching assignment:**

Candidate should take part to undergraduate teaching after completion of first semesters.

**e) Seminar/Journal Club/Workshop etc:**

Candidate should take part in seminars, journal club and research projects of the department.

**7) Rules for sanctioning the term:**

During the term excepting the last term i.e. examination term in which he/she can avail the accumulated leave upto a period of three months.

- i. During the remaining six terms of the course the candidate can avail of leave of all types not more than fifteen days per term.
- ii. The registration should be treated as lapsed after the absence for two or more academic terms. Such candidate will have to register again and per in the required duration of course for becoming eligible to appear for the degree examination.

**8) Examination:**

- i. Internal exam at the middle of the term.
- ii. Term end exam at the end of the term
- iii. University Exam

Theory Exam – 4 papers of 100 marks each (3 hrs.)

Practical Exam – 400 marks

**Paper I** – General anatomy, Human Gross anatomy – Head, Face, Neck & Upper extremity

**Paper II** – Human Gross anatomy – Thorax, Abdomen & Lower extremity

**Paper III** – General and Systemic Histology & Embryology

**Paper IV** – Neuroanatomy, Anthropology, Recent advances and Genetics.

**Theory papers will have**

**Section I**-compulsory- having two questions of 15 marks each.

**Section II** Answer any seven questions from eight questions having 10 marks each.

**Practical** – Dissection of part or organ of body, Histology Techniques including Paraffin Block preparation, Block cutting & H. & E. staining procedure.

**9) Eligibility for appearing university exam:**

- i. Satisfactory progress in difficult tests (with 50% marks).
- ii. Satisfactory attendance (80%).
- iii. Approval of dissertation before examination.

**10) Criteria for Passing:**

- i. Candidate will be declared as 'Pass' if he/she gets 50% marks in all the four papers together, with not less than 40% marks in any of the four papers.
- ii. Candidate also should pass in practical with 50% marks at least.
- iii. Candidate must pass separately in theory and practical.

**Bharati Vidyapeeth Deemed to  
be University, Medical College,  
Pune**

**Department of Physiology**

**M.Sc. (Medical Physiology)**

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

**MEDICAL COLLEGE**

**PUNE – 411 043**

**Department of Physiology**

**Name of Programme: M.Sc. (Medical) Physiology**

**1) Eligibility Criteria:**

Candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% marks from any recognized university or B.Sc. with Zoology with minimum 50% marks

**2) Duration of course:**

Three years or six academic semesters.

**3) Total Number of Seats: Three**

**4) Criteria for Selection:**

By merit as decided by the University.

**Programme outcomes:**

The desired outcome of M.Sc. (Medical) Physiology is to produce a competent physiologist who should be able:

- to demonstrate comprehensive understanding of physiology as well as that of applied disciplines;
- to impart education to teach undergraduate and postgraduate students in physiology and paramedical disciplines;
- to plan and conduct research in physiology and to do collaborative research in the field of physiology with allied sciences and biomedical engineering.
- to demonstrate principles of medical education using various tools in the teaching-learning process and methods of evaluation;
- to acquire administrative skills to set up the department and equip physiology laboratories

**Programme specific outcomes:**

**A. Cognitive Domain: The student will be:**

1. Able to understand the basic physiological regulating mechanisms of human body in depth and their applied aspect in pathogenesis of diseases (pathophysiology).

2. Interact with other departments by rendering services in basic laboratory investigations and relevant expert opinion.
3. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
4. Contribute to society by imparting physiological understanding of health problems.
5. Plan a research study and conduct basic investigations.

### **B. Affective domain: The student will be able to**

1. Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)
2. Communicate effectively with peers, students and teachers in various teaching-learning activities. (Communication)
3. Demonstrate due respect for the volunteer while conducting clinical practicals. (Ethics & Professionalism)
4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).

### **C. Psychomotor Domain - The student will be able to**

1. Acquire competencies in the tasks mentioned under Practicals section of syllabus i.e. human & animal experiments, Haematology experiments & experiments based on biophysical principles.

### **Programme structure: M.Sc. (Medical) Physiology candidate**

#### **During first year of the course:**

- i. To recapitulate undergraduate physiology by attending all UG teaching sessions (lectures, tutorials, practicals)
- ii. To participate in seminars & journal club activity. (once a week)
- iii. To complete the laboratory manual. {Hematology, Clinical Physiology, Animal experiments(Computer assisted learning)}
- iv. To attend research methodology workshop - I
- v. To select & submit the topic of dissertation.
- vi. To do relevant reference work

#### **During second year of the course:**

- i. To attend research methodology workshop – II
- ii. To do work for dissertation (Sample collection, reference work)

- iii. To conduct UG practical teaching.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level and present poster

### **Elective subject in MSc programme (preferably post MBBS)**

#### **Sports Physiology**

##### **Course Outline**

Origins of Exercise Physiology; Scope, Importance; Application in Competitive sports, Recreation sports, Medical rehabilitation; Human energy transfer in rest and exercise; Concept of Aerobic and anaerobic energy production; Energy expenditure in different activities;

Physiological Adaptations to exercise and training; measurement of exercise and training related changes

Aim and objectives of sports training; Characteristics of sports training; biological process in training; Components of physical fitness (motor abilities)– endurance, strength, speed, flexibility, co-ordination; agility Principles of training - Overload, specificity, progression and reversibility; Meaning and concept of Training load; Adaptation and Recovery, supercompensation, training structure - volume, intensity, frequency; Peaking, errors in training

#### **Physiology in rehabilitation practices**

##### **Course Outline**

##### **Preventive and Community Medicine**

Concept of health, health & illness

Contributing factors influencing health

Personal & environmental hygienic & health

Atmospheric pollution, effect on health, prevention & control

Concept of preventive medicine & community health

Public health organizations & services in India

Food & nutrition

##### **Disability and Related Issues**

Disability, attitudes to disability, misconceptions, beliefs etc.

Situation, reciprocal attitudes/ needs of persons with disability

Issues related to rural/ urban slums

Socio economic status of disabled persons: empowerment in Indian

Global contests - Participatory development

The disabled person, family dynamics and the community  
Main streaming of the disabled  
Access, services, special schemes, public facilities, concessions etc.  
Legislation and disability

### **Causes and Prevention of Impairment**

Disability: genesis, magnitude, futuristic trends  
Disability types and causes  
Disability limitation & prevention  
Preventable disabilities: strategies & approaches  
Early detection & intervention  
Rehabilitation: Definition, aims, objectives & Philosophy of rehabilitation  
Rehabilitation approaches and systems  
Different models of service delivery  
Community based rehabilitation: concepts & approaches  
Information gathering: surveys, record keeping, report writing, community resources  
Devising individual programme, plans & evaluating progress  
Monitoring needs, reviews, discharge, communication, participative evaluation  
Concept of health, health & illness  
Contributing factors influencing health  
Personal & environmental hygienic & health  
Atmospheric pollution, effect on health, prevention & control  
Concept of preventive medicine & community health  
Public health organizations & services in India  
Food & nutrition

### **During third year of the course:**

- i. To complete & submit the dissertation.
- ii. To attend manuscript writing workshop and send at least one article for publication
- iii. To conduct allotted UG practical and lecture sessions.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level
- vi. To do self-study for University examinations.

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Biochemistry**

**MSc (Biochemistry)**



**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Biochemistry Name of Programme: MSc. (Medical Biochemistry)**

**Programme outcomes:**

The broad goal of teaching & training of postgraduate students in Medical Biochemistry is to make them understand the scientific basics of the life processes at the molecular level. At the end of his/her training, the student shall be able to take up a career in Teaching Institution or in diagnostic laboratory or in Research.

**Programme specific outcomes:**

**A) KNOWLEDGE:**

At the end of the course the students shall be able to:

- 1) Explain the structure, function & inter-relationships of biomolecules & their deviation from normal & their consequences.
- 2) Summarize the fundamental aspects of enzymology & alteration on enzymatic activity with reference to clinical applications.
- 3) Explain the molecular & biochemical basis of inherited disorders with their associated sequel.
- 4) Explain the mechanisms involved in maintenance of body fluids & pH homeostasis.
- 5) Integrate the various aspects of metabolism & their regulatory pathways.
- 6) Outline the molecular mechanisms of gene expression & regulation, the principles of genetic engineering & their application in medicine.
- 7) Explain the molecular concept of body defenses & their applications in medicine
- 8) Explain the biochemical basis of environmental health hazards, biochemical basis of cancer & Carcinogenesis.
- 9) Familiarize with the principles of various conventional & specialized laboratory investigations & instrumentation analysis and interpretation of a given data.

10) Effectively organize & supervise diagnostic laboratory to ensure quality control/Assurances.

## **B) SKILLS:**

At the end of the course the students shall be able to:

- 1) Make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.
- 2) Analyze & interpret investigative data.
- 3) Demonstrate the skills of solving scientific & clinical problems and decision-making.
- 4) Develop skills as a self-directed learner, recognize continuing educational needs, select & use appropriate learning resources.
- 5) Demonstrate competence in basic concept of research methodology & be able to critically analyze relevant published research literature.

## **C) INTEGRATION:**

The knowledge acquired in Biochemistry shall help the students to integrate molecular event with structure & function of the human body in health & disease.

## **Programme structure:**

- a) Eligibility:** The candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or  
B.Sc. with Chemistry /Biochemistry / Biotechnology with minimum 50% of marks.

### **b) Period of Training:**

The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

### **c) Teaching and Learning Methodology:**

- a. M.Sc.(Medical Biochemistry) students shall attend all Lectures ,Tutorials, and practicals along with 1st M.B.B.s. students. Orientation shall be given to these students in Anatomy and Physiology.
- b. Candidates joining M.Sc.( Medical Biochemistry) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
- c. P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.

- d. P.G. students shall work in central laboratory & would carry out routine, emergency & special investigations during training period.
- e. They shall participate in all P.G. activities ; viz, Seminars ,Group discussion, Journal club etc.
- f. They will be required to participate in the teaching & training programmes of U.G. students.

### **Elective subject in MSc programme (preferably post MBBS)**

#### **Good Laboratory Practices**

1. Introduction to GLP: Good laboratory practices-Introduction, WHO guidelines on GLP and GMP History of Good Laboratory Practices Quality assurances in Good Laboratory Practices
2. Quality Control in Clinical Biochemistry: Quality Assurance and Quality management, Quality control in Preanalytical, Analytical and Postanalytical phases, Accuracy, Precision, Sensitivity, Specificity, Types of Quality control- Internal and External (Proficiency testing), Control material levels and Calibrators, Calibration curve, Levey-Jennings(LJ) graphs, observation of Shifts and Trends in LJ graphs, Westgard's rules for quality control, Types of analytical errors-Random and systematic.
3. Laboratory Accreditation: ISO 15189:2012, ISO 15189:2022 guidelines, Specific criteria for Medical laboratories-NABL 112, Scope of Accreditation.
4. Management and Technical requirements- Standard Operating Procedure(SOP), Quality control, reporting and release of results, Critical alert values.
5. Accreditation bodies – NABL: National accreditation board for testing and calibration laboratories (National) and CAP: College American pathologists (International).  
Accreditation process- Quality manual, Pre-assessment and Final assessment by NABL assessors.  
Six Sigma-Introduction, calculation of sigma metrics using CV%, Total allowable error, bias, preparing standardized QC sigma charts.
6. Metabolic Diseases:
  - Biochemical basis of metabolic disorders such as diabetes, obesity, and inborn errors of metabolism, laboratory diagnosis and their clinical management.
  - Biochemistry of Cancer: Molecular mechanisms underlying cancer development, progression, and treatment, including oncogenes, tumor suppressor genes, and targeted therapies.
  - Neurochemistry: biochemical processes underlying nervous system function and dysfunction, including neurotransmitter synthesis, signalling pathways, and neurodegenerative diseases.

## Molecular Diagnostics:

### 7. PCR Technique

DNA Amplification PCR- Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)- Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

Proteomics: Introduction to techniques for the large-scale study of protein structure, function, and interactions, including mass spectrometry, protein arrays, and bioinformatics analysis.

### DISSERTATION:

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G. teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

**D) Attendance:** They will be granted a term provided they will put 80% attendance during the academic term.

### A) SCHEME OF EXAMINATION

**THEORY EXAMINATION: Total marks 400**

**There shall be four theory papers of 100 marks each. Duration: Three hours**

Pattern of Examination
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions.

**PRATICAL EXAMINATION:**

**Total Marks 400**

**Duration : Two days**

<b>Question</b>	<b>Marks</b>
Q1) Long Clinical Case: 1: 5 investigations based on the diagnosis of a given case	150 Marks
Q2) Enzyme kinetics	50 marks
Q3) Technique (Chromatography /Electrophoresis).	50 marks
Q4) Standardization & interpretation of Quality Control Charts	50 Marks
Q5)Microteaching – to judge the skill of teaching	30 Marks
Q6) General Viva voce examination including Viva on Dissertation	70 Marks

**Syllabus:**

## **Paper I (General Biochemistry and Instrumentation)**

- 1) History & scope of Biochemistry.
- 2) Cell structure & biochemical functions .Membrane structure & functions.
- 3) Transport through biological cell membrane
- 4) Chemistry & biological importance of carbohydrates ,proteins & amino acids, lipids , nucleic acids, porphyrins glycosaminoglycans, glycoproteins.
- 5) Chemistry of blood & hemoglobin, plasma proteins,Blood coagulation.
- 6) Enzymes & coenzymes –chemistry ,nomenclature properties & mode of action of enzymes,Enzyme kinetics, factors affecting enzyme activity,enzyme inhibitions,applications of enzymes & isoenzymes.
- 7) Bioenergetics & biological oxidation-General concept of oxidation & reduction.Electron transport Chain (ETC)- functioning of ETC & inhibitors of ETC, Oxidative phosphorylation,Uncouplers and theories of Biological oxidation & oxidative phosphorylation.
- 8) Principle, working & applications of, a) Colorimetry b)Spectrophotometry c)Flame photometry d) Flurometry e )Atomic absorption spectroscopy g) ultra centrifugation
- 9) Principle, types& applications of , a)Electrophoresis b)chromatography
- 10) Autoanalyzers, Blood gas analyzers
- 11) Automation in clinical chemistry
- 12) pH, electrodes & methods of pH determination.
- 13) Basics of Mass spectroscopy, Nuclear Magnetic Resonance, chemiluminescence and Electron - microscopy
- 14) Environmental Biochemistry – Definition, importance of pollution free & ecofriendly environment, exposure to cold stress, exposure to heat , air pollution water pollution & food pollution
- 15) Immunochemistry – The Immune system, Immunoglobins, antigen –antibody mediated immunity, mononuclear phagocytes –macrophages ,elements of clinical immunity.

## **Paper- II: METABOLISM AND NUTRITION**

- 1) Digestion & absorption from gastrointestinal tract.

- 2) Intermediary metabolism, metabolism of Carbohydrates, Lipids, Proteins , and Amino acids , Nucleic acids,Hemoglobin, metabolic control, energy production & regulation.
- 3) Metabolic interrelationships & regulatory mechanisms
- 4) Metabolic changes during starvation
- 5) Energy metabolism-Calorimetry, BMR- its determination & factors affecting it, SDA of food.
- 6) Macro & micro –elements & their role in health & disease, water metabolism & its regulation.
- 7) Vitamins- chemistry, biological importance , deficiency manifestations & recommended daily allowance.
- 8) Principles of Nutrition –Balanced diet & its planning, Nutritive importance of various food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy Malnutrition ( PEM)- Kwashirkor & Marasmus .
- 9) Diet in management of chronic diseases viz, Diabetes mellitus, Coronary artery disease, Renal disorders, Cancer, Hypertension, Anemia ,Rickets & Osteomalacia.
- 10) Diet for over weight person, pregnant woman and during lactation.

### **PAPER –III CLINICAL BIOCHEMISTRY**

- 1) Chemistry, composition & functions of lymph, CSF, ascitic fluid, pleural fluid, & synovial fluid.

- 2) Urine formation, excretion & urine analysis.
- 3) Composition, chemistry & functions of specialized tissues like muscle, bone, nerve, connective tissue, & brain adipose tissue.
- 4) Chemistry of respiration & acid base balance & imbalance
- 5) Hormones-: Communication among cells & tissues. Hormone- General mechanism of action of hormones, chemistry, functions, synthesis of steroid hormones , polypeptide hormones, & thyroid hormones. Chemistry & functions of hormones of pancreas, and parathyroid. Local hormones. Clinical disorders of hormones, Hormone receptors.
- 6) Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity.
- 7) Organ function tests
  - a) Liver function tests
  - b) Kidney function tests
  - c) Thyroid function tests.
  - d) Adrenal function tests
  - e) Pancreatic function tests
  - f) Gastric function tests
- 8) Radioisotopes & their clinical applications.
- 9) Biochemistry of aging.
- 10) Neurochemistry in Health & Disease.
- 11) Biochemical changes in pregnancy & lactation.
- 12) Water & electrolytes balance & imbalance.
- 13) Total Quality Management of Laboratories.
  - a) Internal Quality control
  - b) External Quality control
  - c) Accreditation of laboratories
- 14) Basics of Medical statistics
- 15) Inborn errors of metabolism.
- 16) Biotransformations of Xenobiotics
- 17) Basic concepts of Biochemical Defense Mechanisms

**Paper IV : MOLECULAR BIOLOGY , BIOTECHNOLOGY & RECENT ADVANCES  
IN CLINICAL BIOCHEMISTRY**



- 1) Central dogma, genetic code, protein biosynthesis & its regulation.
- 2) DNA: structure, functions, replications, Mutation & repair of DNA, Sequencing of nucleotides in DNA, Mitochondrial DNA, and DNA recombination.
- 3) RNA: composition, types, structure & functions.
- 4) Role of Nucleic acids in diagnosis of Molecular diseases & infectious diseases
- 5) Mitochondrial DNA & diseases.
- 6) Human Genome Project.
- 7) Genes & chromosomes, Gene mapping, Chromosome walking etc.
- 8) Gene expression & gene amplification & gene regulation, Oncogenes, & biochemistry of cancer.
- 9) Genetic engineering: Recombinant DNA technology & its applications. Restriction endonucleases, Plasmids, Cosmids, Gene cloning, Gene libraries.
- 10) Basics techniques in genetic engineering.
  - a) Isolation & purification of DNA, Methods of DNA assay.
  - b) Blotting techniques – Southern, Northern & Western blotting.
  - c) Polymerase chain reaction & its applications.
  - d) Ligase chain reaction & its applications.
- 11) Tumor markers & growth factors
- 12) Biotechnology: Gene therapy, Nucleic acid hybridization, and DNA probes, Microarray of gene probes.
- 13) Genomics and Proteomics
- 14) Medical Bioinformatics
- 15) Lipid peroxidation, free radicals & antioxidants, Nitric oxide formation & its metabolism & its role in Medicine.
- 16) Biochemistry of AIDS
- 17) Genetic control of Immunity
- 18) Research Methodology & Medical ethics.

#### **SYLLABUS FOR PRACTICALS :**

- 1) All undergraduate practicals and routine emergency and special investigations carried out in central clinical laboratory of the hospital, which are useful for

diagnosis and prognosis of the disease.

2) Total Quality Management of Laboratory

- a) Specimen collection , handling & storage of sample.
- b) Methods of standardization & calibration.
- c) Methods of quality control & assessment.

3) Fractionation & Identification of,

- a) Amino acids b) Sugar c) Proteins d) Lipoproteins by
- i) Thin Layer Chromatography ii) Paper chromatography (circular, Uni-dimensional & two dimensional iii) Gel electrophoresis- agarose, starch, & Polyacrylamide Gel Electrophoresis iv) paper electrophoresis & cellulose acetate paper electrophoresis .

4) a) Estimation of total activity of following enzymes .

- i. LDH & separation of its isoenzymes by Polyacrylamide gel electrophoresis, Cellulose acetate electrophoresis & quantitation by densitometry.
- ii. AST(GOT)
- iii. ALT(GPT)
- iv. Alkaline phosphatase
- v. Acid phosphatase
- vi. Amylase
- vii. Creatine kinase its Isoenzymes

b) Enzyme kinetics and Determination of  $K_m$  value and effect of pH substrate concentration & temperature on Enzyme activity.

c) Endocrinology: Estimation of Hormones.

5) Isolation of DNA and PCR technique.

6) Estimation of serum lipid profile .

- i) Serum total cholesterol
- ii) Serum HDL cholesterol
- iii) Serum VLDL & LDL
- iv) Serum Triglycerides
- v) Serum Phospholipids

7) Estimation of Fe & Total Iron Binding capacity, & ferritin

8) Estimation of Glycosylated Hb.

9) Body fluid analysis - Urine , CSF, Ascitic fluid , Pleural fluid

10) Estimation of Na, K & Lithium by Flame photometer.

**Books Recommended:**

1) Biochemistry Ed Lubert Stryer . W.H. Freeman & company ,New york.

2) Principles of Biochemistry . Ed. Lehninger , Nelson & Cox . CBS publishers & distributors .

3) Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes & V.W.Rodwell. Appleton & Lange ,Stanford ,Conneticut.

4) Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers.

5) Genes VI Ed. Benjamin Lewin . Oxford University press.

6) Tietz Textbook of Clinical chemistry, Ed. Burtis & Ashwood W.B. Saunders Company.

7) Principles & techniques of practical Biochemistry Ed. Keith Wilson & John Walker Cambridge University press .

8) Biochemistry Ed. Donald Voet & Judith G. Voet John Wiley & Sons ,Inc.

9) Molecular cloning –A laboratory Manual .J. Sambrook , E.F. Fritsch & T.Maniatis Cold Spring Harbor Laboratory Press.

10) Molecular cell Biology , H.Lodish,A. Berk, S.L. Zipursky, P. Matsudaira ,D. Baltimore , J.Darnell.

11) Bio-technology 1st edition . U. Satyanarayan. Books & Allied Publisher (p) Ltd.Kolkatta.

**Journals:**

1. Clinical Chemistry (I)

2. Clinica Chimica Acta (I)

3. Indian Journal of Biochemistry and Biophysics.(N)

4. Indian Journal of Medical Biochemistry(N)

5. Indian Journal of clinical chemistry(N)

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of Microbiology**

**MSc (Microbiology)**

**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Biochemistry Name of Programme: MSc. (Medical Microbiology)**

**Programme outcomes:**

The broad goal of the MSc (Medical Microbiology) is to train the post graduate students to:

- a) Carry out professional obligations ethically in keeping with the objectives of the National health policy.
- b) Have mastered most of the competencies pertaining to medical diagnostic microbiology including molecular diagnostics.
- c) Make them aware of the recent advances in the field of medical diagnostic Microbiology
- d) Help them acquire the spirit of scientific inquiry.
- e) Oriented them to the principles of research methodology.

**Programme specific outcomes:**

**A) Knowledge**

At the end of the course the students shall be able to:-

- 1) State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases.
- 2) State and explain the principles of immunity and immunological phenomenon, which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases
- 3) Establish and practice laboratory medicine for the diagnosis of infectious diseases in the hospital and community in the field of bacteriology, parasitology, virology, mycology, serology and immunology
- 4) Basics of prevention and control of communicable diseases .
- 5) State the recent advances in the field of medical microbiology and apply this knowledge in understanding etiopathogenesis and diagnosis of diseases caused by microorganisms

**B) Skills**

At the end of the course the student should be able to: -

1. Plan the laboratory investigations for the diagnoses of infectious diseases
2. Perform laboratory procedures to reach the etiological diagnoses of infectious diseases including the drug sensitivity profile
3. Perform and interpret immunological and serological tests
4. Perform and interpret molecular diagnostic tests.
5. Operate routine and advanced laboratory instruments
6. Develop microteaching skills

7. Implement the chosen research methodology

**C) INTEGRATION :** The student will be able to integrate the etiopathogenesis of various infectious diseases with the diagnostic modalities available and their interpretation.

**Programme structure:**

**A) ELIGIBILITY & DURATION:** – The candidate should have passed Bachelor’s degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or B.Sc. with Microbiology /Biochemistry / Biotechnology with minimum 50% of marks.

**B) PERIOD OF TRAINING:** The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

**C) TEACHING AND LEARNING METHODOLOGY:**

Teaching for MSc ( Medical Microbiology) will be done using the following teaching learning methods :

Group teaching sessions

Journal review

Subject seminar presentation

Group discussion

Slides seminar

Clinical case presentation pertaining to infectious diseases

Participation in CME programmes and conferences.

**Hands on experience (Practical training)**

Students will be actively involved in day to day working of all the sections.

**Schedule of rotation**

1. Bacteriology—11m
2. Hospital infection surveillance—1m
3. Serology/immunology—6m
4. Mycology—3m
5. Virology/HIV—6m
6. Parasitology—3m
7. Clinical Microbiology(OPD)—2m
8. Recent diagnostic techniques—4 m
  - Candidates joining M.Sc.( Medical Microbiology ) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
  - P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.

## 9. Elective Subject in the M.Sc. programme (preferably post MBBS)

### Good Laboratory Practices

- **Introduction to GLP:** Good laboratory practices-Introduction, WHO guidelines on GLP and GMP History of Good Laboratory Practices Quality assurances in Good Laboratory Practices
- **Quality standards and Quality Assurances: Quality Standards-** Advantages and Disadvantages, Concept of Quality Control Quality Assurance- Their functions and advantages Quality assurance and quality management in industry Customer requirement of quality Government and trade standards of quality Federal Food and Drug Law FDA Action BSTI Laws, BSTI action and activities Other food laws (Legalization), Trade and Company Standards Control by National, International, Social Organizations (example: FAO, WHO, UNICEF, CAB), Society (example: NSB, Professional societies)
- **Biosafety:** Introduction: Historical Background Biosafety in Laboratory/institution. Laboratory associated infections and other hazards, assessment of Biological Hazards and levels of biosafety, prudent biosafety practices in the laboratory/institution Introduction to Biological safety cabinets, Primary Containment of Biohazards, Biosafety Levels, Recommended Biosafety Levels for Infectious Agents and Infected animals Bio-safety guidelines, Government of India Guidelines Definition of Genetically Modified Organisms(GMOs)

### PCR techniques

**DNA Amplification PCR-** Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

- **Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)-** Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

DNA Amplification PCR- Process of setting up a PCR reaction- Different Approaches to amplify a DNA Latest PCR methodologies (Multiplex PCR, LAMP, etc.)- Primers for LAMP, Multiplex PCR and RPA- Basics and Details of PCR- Different factors- Optimal values- PCR setup process of qPCR, RT PCR & qRT PCR- Role of PCR & RT-PCR in numerous fields- Use in Diagnostics and Research- Past, Present & Future of PCR- Latest Discoveries (RPA) Scope of PCR in Research.

Primer Design Factors to be considered while designing a primer (Temperature, GC, etc.)- Different types of primer based on the PCR Type- Primer design for a straightforward PCR & a qPCR Primer design for a RT PCR & a qRT PCR.

### Immunological techniques

- **Methods used in immunology:** Preparation of antigens and antibodies, purification of antibodies, analysis of antibodies and antigens, preparation and uses of various types of vaccines.

- Techniques used in immunology: Types of immunodiffusion methods, ELISA, RIA, Western blot analysis, Electrophoresis and Hybridization techniques, immunohistochemistry, Immuno-flowcytometry, Immuno-fluorescence.
- Applications of antisera in the detection of various diseases. Examples: syphilis and lyme, typhoid, streptococci infections, HIV, various types of Hepatitis
- Antibody engineering, Catalytic antibodies, antibody immunotherapy, productions of drugs to allergies.

### **Hospital Infection control systems**

- Hand hygiene.
- Use of personal protective equipment.
- Safe use and disposal of sharps.
- Reprocessing of reusable medical equipment and instruments.
- Routine environmental cleaning.
- Respiratory hygiene and cough etiquette.
- Aseptic non-touch technique.
- Effective waste management.

**Emergency duty:** -Student will be posted for managing emergency laboratory services in microbiology

During the **first year** of the course the PG student is required to:

1. Attend all the UG teaching sessions(lectures, tutorials, practicals)
2. Participate in seminars and journal club activity
3. Complete the laboratory manual.
4. Select and submit the topic of dissertation
5. Do reference work
6. Do self study

During the **second year** of the course the PG student is required to:

1. Do work for dissertation
2. Participate in activities like seminars, symposium, group discussions and journal club
3. May attend conferences at state and national level
4. Do self study

During the **third year** of the course the PG student is required

1. To complete and submit the dissertation
2. To do participate in activities like seminars, symposia, group discussions and journal club
3. May attend conferences at state and national level
4. To do self study

### **D) Dissertation:**

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G.



teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

#### **E) ATTENDANCE:**

They will be granted a term provided they will put 80% attendance during the academic term

#### **SCHEME OF EXAMINATION**

##### **THEORY EXAMINATION: Total marks 400**

There shall be four theory papers of 100 marks each. Duration: Three hours

<b>Pattern of Examination</b>
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions

Paper1- General Microbiology & Immunology

Paper 2- Systemic bacteriology & Mycology

Paper3- Parasitology and Virology

Paper 4- Recent advances in microbiology

#### **PRACTICALS**

Practical examination shall be conducted on two consecutive days.

Exercises in practical examination conjointly conducted and evaluated by four examiners (Two internals and two externals Examiners)

##### **Marking pattern for practical and oral examination**

Long exercise& media prep.	60
Short exercise	15
Mycology	10
Serology	25
Parasitology	10
Media preparation	10
Identification of slides	30
Viva	40
Total	200

- a) **Long exercise** on clinical bacteriology: Problem based. Brief history along with relevant clinical findings are given. Student is asked to isolate and identify bacteria from given clinical specimen and anti microbial sensitivity of isolated organism to be performed.

- b) Short exercise
  - 1. Exercise in Bacteriology  
Identification of bacteria from given pure culture
- c) Media preparation
- d) Identification of fungi from 1 given cultures-  
One yeast OR mould
- e) Exercise in Parasitology  
Examination of stool for ova/cyst by direct/concentration method and reporting
- f) Serology/ Immunology : Tests for HIV and HbsAg, HCV, dengue, Chikungunya etc  
OR Widal test, VDRL test, Paul Bunnell test, ASO, CRP, RA tests
- g) Identification of microbiological findings in the given set of slides (10 slides)
- h) Oral (viva-voce/Grand viva)  
Student will be examined by all examiners regarding his knowledge of basic aspects and recent advances in the field of microbiology & Presentation and discussion of dissertation

## **THEORY CURRICULUM**

### **GENERAL MICROBIOLOGY:**

- 1 History and Pioneers in Microbiology
- 2 Microscopy
- 3 Morphology of bacteria
- 4 Nomenclature and classification of microbes
- 5 Growth nutrition of bacteria & Bacterial metabolism
- 6 Sterilization and disinfection
- 7 Host parasite relationships
- 8 Bacterial genetics, genetic engineering and its applications
- 9 Antibacterial substances, mechanism of action, mechanism of drug resistance and antibiotic sensitivity
- 10 Quality control and quality assurance in microbiology
- 11. Laboratory biosafety

### **IMMUNOLOGY:**

- 1. Structure and function of immune system, immune response
- 2. Innate and acquired immunity
- 3. Antigen
- 4. Immunoglobulins
- 5. Complement
- 6. Antigen and antibody reactions
- 7. Hypersensitivity
- 8. Immunodeficiency
- 9. Autoimmunity

## **SYSTEMIC BACTERIOLOGY:**

1. Isolation and identification of bacteria
2. Staphylococcus and Micrococcus, anaerobic gram positive cocci
3. Streptococcus and lactobacillus
4. Neisseria, Branhamella, moraxella
5. Corynebacteria and other coryneform organisms
6. Bacillus: the aerobic spore bearing, anaerobic cocci
7. Clostridium: the spore bearing bacilli
8. Nonsporing anaerobes, Enterobacteriaceae
9. Vibrios, Aeromonas, Plesomonas, campylobacter, h.pylori, spirillum
10. Pseudomonas
11. Yersinia, Pasteurella, Francisella
13. Haemophilus, Bordetella and Brucella
14. Mycobacteria
15. Spirochaetes
16. Actinomyces, Nocardia, Actinobacillus
17. Mycoplasmatales, Mycoplasma, Ureaplasma, Acholeplasma
18. Rickettsiae
19. Chlamydiae
20. Emerging bacterial pathogens
21. Care and breeding of laboratory animals and their use in medical microbiology

## **Virology:**

1. General properties of viruses
2. Laboratory diagnosis of viral infections
3. Genetics of viruses
4. Epidemiology of viral infections
5. Vaccines and antiviral drugs
6. Bacteriophages
7. Pox viruses
8. Herpes viruses
9. Orthomyxoviruses
10. Paramyxoviruses
11. Enteroviruses :-Polio, ECHO and Coxsackie viruses
12. Hepatitis viruses
13. Rhabdoviruses
14. Human Immunodeficiency viruses
15. Oncogenic viruses
16. Arboviruses
17. Emerging viral diseases

## **Parasitology**

1. Protozoan parasites of medical importance  
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosomes, Plasmodium, Toxoplasma,

2. Helminthology
  - a) Cestodes: - all the tapeworms
  - b) Trematodes: - Liver, lung and blood flukes
  - c) Nematodes: - Intestinal and tissue nematodes

### **Mycology**

1. General properties of fungi, morphology, classification, reproduction
2. Laboratory diagnosis of fungal infections
3. Fungi causing superficial mycoses
4. Fungi causing subcutaneous mycoses
5. Fungi causing systemic infections
6. Contaminant and opportunistic fungi

### **Applied Clinical microbiology**

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Recent advances in diagnostic technology
4. Outbreak investigations and disaster management
5. Biological warfare

## **PRACTICAL SKILLS**

### **BACTERIOLOGY:**

1. Care & Operation of microscopes.
2. Preparation of stains viz.: Gram's, Albert's, Ziehl-Neelsen's and other stains.
3. Sterilization of glassware.
4. Operation of laboratory instruments.
5. Care & maintenance of laboratory equipments.
6. Preparation of routine culture media.
7. Preparation of common reagents –Oxidase, Kovac's etc.
8. Tests for beta lactamase including ESBLs.
9. Collection of clinical specimens for microbiological investigations.
10. Preparation, examination and interpretation of direct smears from clinical specimen.
11. Techniques of anaerobiosis- Gas pack system, anaerobic jar.
12. Identification of bacteria of medical importance upto species level.
13. Quantitative and Semiquantitative analysis for significant bacteriuria
14. Plating of clinical specimens on media for isolation, purification and identification.
15. Tests for motility; hanging drop, Craige's tube, dark ground microscopy for Spirochaetes-Treponema and Leptospira
16. In- vitro toxigenicity tests-Elek's test Nagler's reaction.
17. Special tests- Bile solubility, Chick cell agglutination, Sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, Catalase test and slide agglutination tests, and other as applicable in the identification of bacteria upto species level

18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing by Kirby –Bauer disk diffusion method, estimation of MIC and MBC by dilution methods (Tube and plate). Test for drug susceptibility of mycobacterium tuberculosis
19. Skin tests like Mantoux, Lepromin test etc
20. Testing for disinfectants- Phenol coefficient and “In Use” tests
21. Quality control of media reagents etc and validation of sterilization procedures
22. Aseptic practices in laboratory and safety precautions
23. Disposal of contaminated material like cultures
24. Bacteriology of Food, water, milk air
25. Maintenance of Stock cultures

### **IMMUNOLOGY/SEROLOGY**

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues for Widal, Weil-Felix, VDRL, etc and their standardization
3. Raising of antisera in laboratory animals.
4. Performance of serological tests viz. Widal, Brucella tube agglutination indirect Haemagglutination, VDRL, Paul-Bunnell, Rose- Waller, IFA.
5. Immunodiffusion in gels, counter immunoelectrophoresis- visualization and interpretation of bands.
6. Performance and interpretation of ELISA.
7. Latex and Staphylococcal tests

### **MYCOLOGY**

1. Collection of specimens for Mycology
2. Direct examination of specimen using KOH, Gram stain, Lactophenol cotton blue etc.
3. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
4. Special techniques like slide culture etc.
5. Maintenance of stock cultures.

### **PARASITOLOGY**

1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formal-Ether methods) and complete examination for other cellular features
2. Egg counting techniques for helminths
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears
4. Examination of other specimens for e.g. urine, CSF, Bone marrow etc for parasites
5. Histopathology sections- Examination and identification of parasites
6. Performance of stains- Leishman, Giemsa, Modified Acid fast, Toluidine Blue O
7. Identification of common arthropods and other vectors viz. Mosquito, sand fly, ticks, mite and cyclops.
8. Collection of specimens
9. Preservation of parasites- mounting, fixing, staining etc

## **VIROLOGY**

1. Preparation of glassware for tissue culture (washing, sterilization).
2. Preparations of media like Hanks, MEM.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests- ELISA and rapid tests for JIV, RPHA for HbsAg, Haemagglutination inhibition for influenza, AGD and counter immunoelectrophoresis for detection of viral antigens or antiviral antibodies.
5. Chick embryo techniques- inoculation and harvesting.
6. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

## **SUGGESTED READING BOOKS,**

### **Reference books**

1. Tople and Wilson's Microbiology and microbial infections.
2. Color Atlas and textbook of Diagnostic Microbiology-Elmer W Koneman.
3. Mandell, Douglas and Bennet's Principles and Practice of Infectious Diseases.
4. Microbiology and Clinical Practice: Shanson
5. Immunology: Janis Kuby
6. Basic Clinical Immunology: Fudenberg, Stites Caldwell Weills.
7. Bailey & Scott's diagnostic microbiology.
8. Textbook of Parasitology by Chatterjee K.D.
9. Microbiology in Clinical Practice by Shannon. D.C.
10. Beaver's Parasitology Textbook.

### **Further Reading:**

1. Mycology by-Rippons
2. Essentials of immunology- Roitt
3. Virology- Clinical virology by Rich.
4. Gradwohls Clinical laboratory methods and diagnosis.
5. Biochemical tests for identification of medical bacteria- MacFaddin J F
6. Manual of Clinical Microbiology- ASM Press.

### **Journals:**

1. Indian journal of medical microbiology.
2. Clinical Microbiology Reviews.
3. Journal of Medical Microbiology.
4. Journal of AIDS

5. Indian Journal of Tuberculosis and Lung Disease.

6. Parasitology Today.

7. ICMR Bulletin.

12. WHO bulletin.

**Important Websites:**

1. Center for disease control-[www.cdc.gov](http://www.cdc.gov)
2. World Health Organization- [www.who.int](http://www.who.int).
3. Global infectious disease Epidemiology networks. [www.guideonline.com](http://www.guideonline.com)
4. National Aids Control Organization- [www.nacoindia.org](http://www.nacoindia.org)
5. Tuberculosis Research center- [www.trc-chennai.org](http://www.trc-chennai.org)

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of  
Pharmacology**

**MSc (Pharmacology)**



**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Pharmacology**

**Name of Programme: M.Sc. Pharmacology**

**Programme outcomes:** M.Sc. or Master of Science in Pharmacology is a 3 year postgraduation course. Upon successful completion of the course, graduates of this field may pursue further studies and may complete their Ph.D. or may take up job opportunities associated with this qualification like teaching for MBBS, BDS or Pharmacy students, in quality control department of pharmaceutical industries, in Research institutes or R & D of drugs, etc

Accordingly, a post graduate (MSc) student in Pharmacology should be competent to meet the job requirements at all these places.

**Programme specific outcomes:**

At the end of the 3 yr. course, a trained M.Sc Pharmacologist shall be able to:

***Cognitive domain:***

- I. Apply basic principles of Pharmacology and Therapeutics to rational use of existing drugs and evaluation of new drugs.
- II. Collect, analyze and interpret experimental and clinical data related to drug kinetics or dynamics.
- III. Provide appropriate advice related to selection of drug; drug usage (desirable and undesirable effects, kinetics, interactions); precautions & measures to be taken during administration of drug and treating the ADRs in a given patient taking into consideration physiological, psychological & pathological features.
- IV. Develop the ability for continued self-learning so as to update the knowledge of recent advances in the field of Pharmacology and allied fields.
- V. Teach and train undergraduate and postgraduate medical students and junior doctors in Pharmacology and Therapeutics.
- VI. Plan and carry out both laboratory and basic clinical research with adherence to scientific methodology, legal and ethical aspects and GLP/GCP guidelines.
- VII. Communicate the findings, results and conclusions of scientific research both verbally and in writing.

VIII. Understand the problems associated with evaluation and use of drugs from alternative systems of medicine.

***Psychomotor domain:***

- 1) Perform common experimental techniques required for evaluation of drugs with competence.
- 2) Perform common clinical procedures required for evaluation of drugs in normal volunteers and patients with competence.
- 3) Use teaching learning media effectively.

***Affective domain:***

- 1) Appreciate socio-psychological, cultural and environmental factors affecting health and drug usage.
- 2) Appreciate importance and implementation of National health programmes in context to rational drug utilization
- 3) Adopt ethical principles while conducting experimental and human research
- 4) Develop communication skills to interact with patients, peers and paramedical staff.
- 5) Realize the importance of team work
- 6) Develop attitudes required for professional responsibilities.

**Programme structure:**

**General**

- 1) They should appear for theory and oral examination for the first 3 blocks along with II M.B.B.S.
- 2) All M.Sc. students are supposed to maintain log book of their practical work.
- 3) They are expected to actively participate in research activities and undergraduate teaching whenever possible.
- 4) After 2 terms, they participate in Journal reporting clubs.
- 5) At the end of each term, there will be a written and practical test.

**1<sup>st</sup> Term**

**LECTURES:**

- 1) Specified Course in Anatomy, Physiology and Biochemistry.
- 2) Attending Lectures in Pharmacology

**PRACTICAL:**

- 1) Information, observations and handling of commonly used laboratory animals.
- 2) Common Lab. Techniques –Bleeding, feeding, Intravenous, subcutaneous, intramuscular, and Intraperitoneal injections.
- 3) Use of different anesthetics for animals.
- 4) Use of kymograph smoking and fixing of graph paper
- 5) Orientation to computer simulation experiments

### **2<sup>nd</sup> Term:-**

#### LECTURES:

- 1) Completion of course in Anatomy, Physiology and Biochemistry.
- 2) Attending lectures in Pharmacology

#### PRACTICALS:

- 1) Acute E.D. 50 & LD 50 determination.
- 2) Preparation for isolated tissue experiments – Guinea pig ileum, rat uterus and rat colon.
- 3) Practice computer simulation experiments- vasopressor & vasodepressors, mydriatics & miotics, Dose response curve, etc

### **3<sup>rd</sup> Term:-**

#### THEORY

- 1) Self study- General Pharmacology and ANS

#### PRACTICAL WORK:-

- 1) Bioassays on isolated tissues – Acetylcholine, histamine, etc.
- 2) Experiments- Bioavailability, disintegration, dissolution, Skeletal muscle relaxants, factors affecting drug action, drug antagonism, etc

#### DISSERTATION

Research Methodology workshop, Review of literature for selection of a topic for dissertation work, Prepare synopsis and departmental approval.

### **4<sup>th</sup> Term:-**

#### THEORY

Self study as in 3<sup>rd</sup> Term on Autacoids, CVS and CNS

## **PRACTICAL WORK**

Experiments- evaluation of local anesthetics, general anesthetics, analgesics and antiepileptics

Principles and working of Lab. Instruments

## **DISSERTATION:**

Collecting relevant references, conducting research work and progress report

## **Elective Subject in the M.Sc. programme (preferably post MBBS)**

- **Animal Handling and animal house techniques**
- Animal Care and Guidelines – Importance.
- Physiology of Experimental Animals, Understanding of Humane endpoints.
- Anaesthesia, Fasting,
- Animal Behaviour
- Groups, Kinetic Studies, Time Chart, Retro-orbital Puncture
- Code of conduct in Animal house
- GLP for researchers
- Animal House Proceedings, Flow of Animal House activities
- Identification, Cages, Cage Card, Feed Water, Temperature and Humidity, Light Dark Cycle
- Maintenance of Records and Its importance
- Animal Sacrificing
- Autopsy, Organ identification and sampling for histopathology
- Isolation of organs
  
- **Pharmacovigilance**
- Introduction to Pharmacovigilance
- History of Pharmacovigilance
- Examples of product recalls due to toxicity
- Responsibilities
- Adverse Drug Reactions (ADR)
- Changes that occur from the PV findings
- Governing bodies for Pharmacovigilance
- WHO Pharmacovigilance programme
- Pharmacovigilance programme of India (PVPI)
- Application/Role of Pharmacovigilance
- Pharmacovigilance Methods
- Passive surveillance
- Spontaneous Reports

- Case series
- Stimulated Reporting
- Active surveillance
- Drug event monitoring
- Registries
- Data Management and Case Processing
- Signal Management, ADR Reporting System
- Definition and examples of Adverse Event (AE)
- Adverse Drug Reaction (ADR)
- Regarding marketed medicinal products
- Unexpected Adverse Drug Reaction
- Serious Adverse Event/Reaction (SAE/R)
- Suspected Unexpected Serious Adverse Reaction (SUSAR)
- NARANJO algorithm for assessing the causality
- Commonly used criteria for Adverse Event Relationship to Study Products
- Adverse Event Relationship to Study Products In India

- **Good Clinical Practice**

- Introduction
- Institutional Review Boards
- Informed Consent
- Confidentiality & Privacy
- Participant Safety & Adverse Events
- Quality Assurance
- The Research Protocol
- Documentation & Record-Keeping
- Research Misconduct
- Roles & Responsibilities
- Recruitment & Retention
- Investigational New Drugs

- **Research Methodology**

- Introduction to health Research
- Definitions of Research
- Characteristics of Research
- Research Objectives
- Types of Research
- Major Areas of Health Systems Research
- Some of the Problems encountered by the Researchers
- Identification and Prioritization of Research Problems/areas
- Criteria for Prioritizing Topics for Research

- Nominal Group Technique (
- Literature search
- Formulation of objectives
- Research Questions and hypotheses
- Research Objectives
- Research Questions
- Hypotheses
- Characteristics of Good Hypothesis
- Measurement
- Strategies to Deal with Threats to Validity
- Study Design options in Medical and health Research
- Decision Algorithm for Study to be Chosen
- Observational/Non-experimental/Non-Interventional Studies
- Schematic Diagram of Nested Case-Control Study Design
- Measurements in Various Study
- Study Designs
- Randomized Controlled Trial (RCT)
- Types of Randomized Controlled Trials
- Clinical Trials
- Principles for Maximizing Follow up and Adherence to the Protocol elements to Monitor Clinical Trials
- Research on Diagnostic Tests
- Qualitative Research-Concepts and Methods
- Variables
- Sampling Methods
- Analysis of Quantitative Data
- Analysis of Qualitative Data
- Data Management, Processing and analysis
- Ethical Issues in Health Research

## **5<sup>th</sup> TERM**

### **THEORY**

Self study of Chemotherapy, Endocrinology, Respiratory system and GIT

### **PRACTICAL WORK**

Practice techniques in animal research, isolated tissue mounting and other experiments

### **DISSERTATION**

Work should be completed, analyzed and dissertation presentation and submission.

## **6<sup>th</sup> TERM**

### **THEORY**

Self study of remaining topics in Pharmacology and advances in Pharmacology.

Preparation for M.Sc. Theory and Practical of Preliminary and University Examination.

### **PRACTICAL WORK**

Practice techniques in animal research, isolated tissue mounting and other experiments for university exams

## **TERM III TO VI**

- 1) Assisting in undergraduate teaching as per Departmental directives.
- 2) Active participation in Journal Club/seminar /workshops.
- 3) Attending seminars, workshops and conferences
- 4) Presenting research papers- posters and oral paper in conference
- 5) Manuscript preparation and publication under the guidance of PG teacher

### **Syllabus:**

- 1) **Title:-**  
M.Sc. (Medical) Pharmacology for non-medical graduates  
(the Degree of master of science in Pharmacology in the faculty of Medicine)
- 2) **Eligibility Criteria :-**

1) B.Sc. of a recognized University with Chemistry/ Zoology/Botany/ Microbiology allied subject after H.Sc /( Std.XII) or equivalent examination with Biology as one of the subjects.

Or

2) Bachelor of Pharmacy of any University recognized by the Pharmacy council of India.

Or

3) Bachelor's degree in Biomedical Science of any recognized University.

- Candidate must have graduated in any of the above branches with minimum 50% aggregate marks.

3) **Duration of Course :-**

3 yrs. including initial 1 year orientation in Anatomy, Physiology and Biochemistry.

4) **Total No. seats:-**

P.G. Teacher: P.G. Student ratio of 1:1 per year (Current strength 5/yr.)

5) **Criteria of Selection:-**

Application will be ranked in order of merit according to the aggregate marks obtained at the qualifying graduate examination referred in item 2 above

6) **Training Programme / Syllabus term wise:-** As in Programme structure

7) **Rules for leave / Vacation**

1 Week winter vacation (Diwali) and 2 Week summer vacation / per year

8) **Rules for sanctioning the term**

1) 80 % attendance

2) Satisfactory performance in the term-wise curriculum as indicated by Term-ending Examination results (minimum 50% aggregate marks) and log book.



\* Attendance or Performance less than above may be considered on compassionate basis if it is due to reasons of ill health on recommendations from the P.G. Teacher and Principal of College.

## 9) Examinations :-

### a) **Internal Assessment: Marks :**

Based on log book which must be maintained by every student.

- Formative examinations (Term ending and Preliminary Examinations)
- Dissertation work and presentations
- Overall Assessment by the P.G. Teacher
- Participation and performance in departmental post –graduate activities.

### b) **Term – Ending Examinations :-**

c) 50 marks theory examination at the end of term I & II in the relevant portion of Anatomy, Physiology, Biochemistry.

50 marks theory examination at the end of every term in Pharmacology from term III to VI

### d) **University Examination :-**

The examination shall be by papers, Practical and orals as follows.

Theory papers:-

Paper –I- General Pharmacology, Principles and Methods of Bioassay, Pre-clinical evaluation of drugs, Biostatistics and statistical analysis of Pharmacological data. Principles and Methods of Clinical Pharmacology.

Paper-II –Systemic Pharmacology.

Paper-III- Applied Pharmacology

Paper –IV – Recent advances in Pharmacology

- Each paper of 100 marks will be set and examined by the board of paper setters and examiners in the subject.

Same examiners will examine the candidate during practical and oral examination.

Practical Examination:-

A] Long Experiment:- Estimation of Drug Concentration (100 marks)

- Experiment & set-up (50 marks)
- Graph & calculations (25 marks)
- Viva (25 marks)

B] Short Experiment with Technique demonstration:- (70 marks)

- Procedure (25 marks)
- Viva (25 marks)
- Technique demo (20 marks)

C] Use of common instruments in Pharmacology (50marks)

D] Critical appraisal of Journal article (40marks)

E] Microteaching (40 marks)

F] Viva-Voce:-

- Dissertation (40 marks)
- Theory viva (60 marks)

Collectively will be assessed by all the above examiners.

A candidate will be declared as passed, passed with distinction or failed according to his/her overall performance at the examination.

10) **Eligibility for appearing for University Exam:-** Satisfactory completion of Dissertation work & Satisfactory performance in Internal Assessment

11) **Criteria for passing:** Minimum 50% aggregate marks in University Exam.

Approval of Dissertation by Board of Examiners.

**Bharati Vidyapeeth Deemed to  
be University, Medical College,  
Pune**

**Department of Physiology**

**M.Sc. (Medical Physiology)**

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

**MEDICAL COLLEGE**

**PUNE – 411 043**

**Department of Physiology**

**Name of Programme: M.Sc. (Medical) Physiology**

**1) Eligibility Criteria:**

Candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% marks from any recognized university or B.Sc. with Zoology with minimum 50% marks

**2) Duration of course:**

Three years or six academic semesters.

**3) Total Number of Seats: Three**

**4) Criteria for Selection:**

By merit as decided by the University.

**Programme outcomes:**

The desired outcome of M.Sc. (Medical) Physiology is to produce a competent physiologist who should be able:

- to demonstrate comprehensive understanding of physiology as well as that of applied disciplines;
- to impart education to teach undergraduate and postgraduate students in physiology and paramedical disciplines;
- to plan and conduct research in physiology and to do collaborative research in the field of physiology with allied sciences and biomedical engineering.
- to demonstrate principles of medical education using various tools in the teaching-learning process and methods of evaluation;
- to acquire administrative skills to set up the department and equip physiology laboratories

**Programme specific outcomes:**

**A. Cognitive Domain: The student will be:**

1. Able to understand the basic physiological regulating mechanisms of human body in depth and their applied aspect in pathogenesis of diseases (pathophysiology).

2. Interact with other departments by rendering services in basic laboratory investigations and relevant expert opinion.
3. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
4. Contribute to society by imparting physiological understanding of health problems.
5. Plan a research study and conduct basic investigations.

**B. Affective domain: The student will be able to**

1. Demonstrate self-awareness and personal development in routine conduct. (Self-awareness)
2. Communicate effectively with peers, students and teachers in various teaching-learning activities. (Communication)
3. Demonstrate due respect for the volunteer while conducting clinical practicals. (Ethics & Professionalism)
4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).

**C. Psychomotor Domain - The student will be able to**

1. Acquire competencies in the tasks mentioned under Practicals section of syllabus i.e. human & animal experiments, Haematology experiments & experiments based on biophysical principles.

**Programme structure: M.Sc. (Medical) Physiology candidate**

**During first year of the course:**

- i. To recapitulate undergraduate physiology by attending all UG teaching sessions (lectures, tutorials, practicals)
- ii. To participate in seminars & journal club activity. (once a week)
- iii. To complete the laboratory manual.{Hematology, Clinical Physiology, Animal experiments(Computer assisted learning)}
- iv. To attend research methodology workshop - I
- v. To select & submit the topic of dissertation.
- vi. To do relevant reference work

**During second year of the course:**

- i. To attend research methodology workshop – II
- ii. To do work for dissertation (Sample collection, reference work)

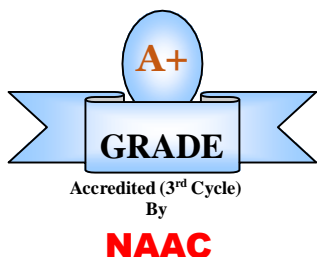
- iii. To conduct UG practical teaching.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level and present poster

**Elective subject in MSc programme (preferably post MBBS)**

- Sports Physiology
- Physiology in rehabilitation practices

**During third year of the course:**

- i. To complete & submit the dissertation.
- ii. To attend manuscript writing workshop and send at least one article for publication
- iii. To conduct allotted UG practical and lecture sessions.
- iv. To participate in activities like seminars, symposia, group discussions & journal club.
- v. To attend conferences at state & national level
- vi. To do self-study for University examinations.



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

**Medical College,**

**PUNE – SATARA ROAD, PUNE – 411 043**

**Department of Biochemistry**

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**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Biochemistry Name of Programme: MSc. (Medical Biochemistry)**

**Programme outcomes:**

The broad goal of teaching & training of postgraduate students in Medical Biochemistry is to make them understand the scientific basics of the life processes at the molecular level. At the end of his/her training, the student shall be able to take up a career in Teaching Institution or in diagnostic laboratory or in Research.

**Programme specific outcomes:**

**A) KNOWLEDGE:**

At the end of the course the students shall be able to:

- 1) Explain the structure, function & inter-relationships of biomolecules & their deviation from normal & their consequences.
- 2) Summarize the fundamental aspects of enzymology & alteration on enzymatic activity with reference to clinical applications.
- 3) Explain the molecular & biochemical basis of inherited disorders with their associated sequel.
- 4) Explain the mechanisms involved in maintenance of body fluids & pH homeostasis.
- 5) Integrate the various aspects of metabolism & their regulatory pathways.
- 6) Outline the molecular mechanisms of gene expression & regulation, the principles of genetic engineering & their application in medicine.
- 7) Explain the molecular concept of body defenses & their applications in medicine
- 8) Explain the biochemical basis of environmental health hazards, biochemical basis of cancer & Carcinogenesis.
- 9) Familiarize with the principles of various conventional & specialized laboratory investigations & instrumentation analysis and interpretation of a given data.

10) Effectively organize & supervise diagnostic laboratory to ensure quality control/Assurances.

**B) SKILLS:**

At the end of the course the students shall be able to:

- 1) Make use of conventional techniques/instruments to perform biochemical analysis relevant to clinical screening & diagnosis.
- 2) Analyze & interpret investigative data.
- 3) Demonstrate the skills of solving scientific & clinical problems and decision-making.
- 4) Develop skills as a self-directed learner, recognize continuing educational needs, select & use appropriate learning resources.
- 5) Demonstrate competence in basic concept of research methodology & be able to critically analyze relevant published research literature.

**C) INTEGRATION:**

The knowledge acquired in Biochemistry shall help the students to integrate molecular event with structure & function of the human body in health & disease.

**Programme structure:**

- a) Eligibility:** The candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or  
B.Sc. with Chemistry /Biochemistry / Biotechnology with minimum 50% of marks.

**b) Period of Training:**

The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

**c) Teaching and Learning Methodology:**

- a. M.Sc.(Medical Biochemistry) students shall attend all Lectures ,Tutorials, and practicals along with 1st M.B.B.s. students. Orientation shall be given to these students in Anatomy and Physiology.
- b. Candidates joining M.Sc.( Medical Biochemistry) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
- c. P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.



- d. P.G. students shall work in central laboratory & would carry out routine, emergency & special investigations during training period.
- e. They shall participate in all P.G. activities ; viz, Seminars ,Group discussion, Journal club etc.
- f. They will be required to participate in the teaching & training programmes of U.G. students.

**Elective subject in MSc programme (preferably post MBBS)**

- a. Good laboratory practices
- b. PCR Technique

**D) DISSERTATION:**

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G. teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

**E) Attendance:** They will be granted a term provided they will put 80% attendance during the academic term.

**A) SCHEME OF EXAMINATION**

**THEORY EXAMINATION: Total marks 400**

**There shall be four theory papers of 100 marks each. Duration: Three hours**

Pattern of Examination
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions.

**PRATICAL EXAMINATION:**

**Total Marks 400**

**Duration : Two days**

Question	Marks
Q1) Long Clinical Case: 1: 5 investigations based on the diagnosis of a given case	150 Marks
Q2) Enzyme kinetics	50 marks
Q3) Technique (Chromatography /Electrophoresis).	50 marks

Q4) Standardization & interpretation of Quality Control Charts	50 Marks
Q5) Microteaching – to judge the skill of teaching	30 Marks
Q6) General Viva voce examination including Viva on Dissertation	70 Marks

**Syllabus:**

## **Paper I (General Biochemistry and Instrumentation)**

- 1) History & scope of Biochemistry.
- 2) Cell structure & biochemical functions .Membrane structure & functions.
- 3) Transport through biological cell membrane
- 4) Chemistry & biological importance of carbohydrates ,proteins & amino acids, lipids , nucleic acids, porphyrins glycosaminoglycans, glycoproteins.
- 5) Chemistry of blood & hemoglobin, plasma proteins,Blood coagulation.
- 6) Enzymes & coenzymes –chemistry ,nomenclature properties & mode of action of enzymes,Enzyme kinetics, factors affecting enzyme activity,enzyme inhibitions,applications of enzymes & isoenzymes.
- 7) Bioenergetics & biological oxidation-General concept of oxidation & reduction.Electron transport Chain (ETC)- functioning of ETC & inhibitors of ETC, Oxidative phosphorylation,Uncouplers and theories of Biological oxidation & oxidative phosphorylation.
- 8) Principle, working & applications of, a) Colorimetry b)Spectrophotometry c)Flame photometry d) Flurometry e )Atomic absorption spectroscopy g) ultra centrifugation
- 9) Principle, types& applications of , a)Electrophoresis b)chromatography
- 10) Autoanalyzers, Blood gas analyzers
- 11) Automation in clinical chemistry
- 12) pH, electrodes & methods of pH determination.
- 13) Basics of Mass spectroscopy, Nuclear Magnetic Resonance, chemiluminescence and Electron - microscopy
- 14) Environmental Biochemistry – Definition, importance of pollution free & ecofriendly environment, exposure to cold stress, exposure to heat , air pollution water pollution & food pollution
- 15) Immunochemistry – The Immune system, Immunoglobins, antigen –antibody mediated immunity, mononuclear phagocytes –macrophages ,elements of clinical immunity.

## **Paper- II: METABOLISM AND NUTRITION**

- 1) Digestion & absorption from gastrointestinal tract.

- 2) Intermediary metabolism, metabolism of Carbohydrates, Lipids, Proteins , and Amino acids , Nucleic acids,Hemoglobin, metabolic control, energy production & regulation.
- 3) Metabolic interrelationships & regulatory mechanisms
- 4) Metabolic changes during starvation
- 5) Energy metabolism-Calorimetry, BMR- its determination & factors affecting it, SDA of food.
- 6) Macro & micro –elements & their role in health & disease, water metabolism & its regulation.
- 7) Vitamins- chemistry, biological importance , deficiency manifestations & recommended daily allowance.
- 8) Principles of Nutrition –Balanced diet & its planning, Nutritive importance of various food sources, Calorific value of food , toxins & additives , Obesity, Protein Energy Malnutrition ( PEM)- Kwashirkor & Marasmus .
- 9) Diet in management of chronic diseases viz, Diabetes mellitus, Coronary artery disease, Renal disorders, Cancer, Hypertension, Anemia ,Rickets & Osteomalacia.
- 10) Diet for over weight person, pregnant woman and during lactation.

### **PAPER –III CLINICAL BIOCHEMISTRY**

- 1) Chemistry, composition & functions of lymph, CSF, ascitic fluid, pleural fluid, & synovial fluid.

- 2) Urine formation, excretion & urine analysis.
- 3) Composition, chemistry & functions of specialized tissues like muscle, bone, nerve, connective tissue, & brain adipose tissue.
- 4) Chemistry of respiration & acid base balance & imbalance
- 5) Hormones-: Communication among cells & tissues. Hormone- General mechanism of action of hormones, chemistry, functions, synthesis of steroid hormones , polypeptide hormones, & thyroid hormones. Chemistry & functions of hormones of pancreas, and parathyroid. Local hormones. Clinical disorders of hormones, Hormone receptors.
- 6) Biochemistry of Diabetes mellitus, Atherosclerosis, Fatty liver, and obesity.
- 7) Organ function tests
  - a) Liver function tests
  - b) Kidney function tests
  - c) Thyroid function tests.
  - d) Adrenal function tests
  - e) Pancreatic function tests
  - f) Gastric function tests
- 8) Radioisotopes & their clinical applications.
- 9) Biochemistry of aging.
- 10) Neurochemistry in Health & Disease.
- 11) Biochemical changes in pregnancy & lactation.
- 12) Water & electrolytes balance & imbalance.
- 13) Total Quality Management of Laboratories.
  - a) Internal Quality control
  - b) External Quality control
  - c) Accreditation of laboratories
- 14) Basics of Medical statistics
- 15) Inborn errors of metabolism.
- 16) Biotransformations of Xenobiotics
- 17) Basic concepts of Biochemical Defense Mechanisms

**Paper IV : MOLECULAR BIOLOGY , BIOTECHNOLOGY & RECENT ADVANCES  
IN CLINICAL BIOCHEMISTRY**

- 1) Central dogma, genetic code, protein biosynthesis & its regulation.
- 2) DNA: structure, functions, replications, Mutation & repair of DNA, Sequencing of nucleotides in DNA, Mitochondrial DNA, and DNA recombination.
- 3) RNA: composition, types, structure & functions.
- 4) Role of Nucleic acids in diagnosis of Molecular diseases & infectious diseases
- 5) Mitochondrial DNA & diseases.
- 6) Human Genome Project.
- 7) Genes & chromosomes, Gene mapping, Chromosome walking etc.
- 8) Gene expression & gene amplification & gene regulation, Oncogenes, & biochemistry of cancer.
- 9) Genetic engineering: Recombinant DNA technology & its applications. Restriction endonucleases, Plasmids, Cosmids, Gene cloning, Gene libraries.
- 10) Basics techniques in genetic engineering.
  - a) Isolation & purification of DNA, Methods of DNA assay.
  - b) Blotting techniques – Southern, Northern & Western blotting.
  - c) Polymerase chain reaction & its applications.
  - d) Ligase chain reaction & its applications.
- 11) Tumor markers & growth factors
- 12) Biotechnology: Gene therapy, Nucleic acid hybridization, and DNA probes, Microarray of gene probes.
- 13) Genomics and Proteomics
- 14) Medical Bioinformatics
- 15) Lipid peroxidation, free radicals & antioxidants, Nitric oxide formation & its metabolism & its role in Medicine.
- 16) Biochemistry of AIDS
- 17) Genetic control of Immunity
- 18) Research Methodology & Medical ethics.

#### **SYLLABUS FOR PRACTICALS :**

- 1) All undergraduate practicals and routine emergency and special investigations carried out in central clinical laboratory of the hospital, which are useful for

diagnosis and prognosis of the disease.

2) Total Quality Management of Laboratory

- a) Specimen collection , handling & storage of sample.
- b) Methods of standardization & calibration.
- c) Methods of quality control & assessment.

3) Fractionation & Identification of,

- a) Amino acids b) Sugar c) Proteins d) Lipoproteins by
- i) Thin Layer Chromatography ii) Paper chromatography (circular, Uni-dimensional & two dimensional iii) Gel electrophoresis- agarose, starch, & Polyacrylamide Gel Electrophoresis iv) paper electrophoresis & cellulose acetate paper electrophoresis .

4) a) Estimation of total activity of following enzymes .

- i. LDH & separation of its isoenzymes by Polyacrylamide gel electrophoresis, Cellulose acetate electrophoresis & quantitation by densitometry.
- ii. AST(GOT)
- iii. ALT(GPT)
- iv. Alkaline phosphatase
- v. Acid phosphatase
- vi. Amylase
- vii. Creatine kinase its Isoenzymes

b) Enzyme kinetics and Determination of  $K_m$  value and effect of pH substrate concentration & temperature on Enzyme activity.

c) Endocrinology: Estimation of Hormones.

5) Isolation of DNA and PCR technique.

6) Estimation of serum lipid profile .

- i) Serum total cholesterol
- ii) Serum HDL cholesterol
- iii) Serum VLDL & LDL
- iv) Serum Triglycerides
- v) Serum Phospholipids

7) Estimation of Fe & Total Iron Binding capacity, & ferritin

8) Estimation of Glycosylated Hb.

9) Body fluid analysis - Urine , CSF, Ascitic fluid , Pleural fluid

10) Estimation of Na, K & Lithium by Flame photometer.

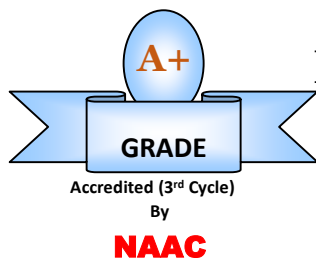
**Books Recommended:**

- 1) Biochemistry Ed Lubert Stryer . W.H. Freeman & company ,New york.
- 2) Principles of Biochemistry . Ed. Lehninger , Nelson & Cox . CBS publishers & distributors .
- 3) Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes & V.W.Rodwell. Appleton & Lange ,Stanford ,Conneticut.
- 4) Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers.
- 5) Genes VI Ed. Benjamin Lewin . Oxford University press.
- 6) Tietz Textbook of Clinical chemistry, Ed. Burtis & Ashwood W.B. Saunders Company.
- 7) Principles & techniques of practical Biochemistry Ed. Keith Wilson & John Walker Cambridge University press .
- 8) Biochemistry Ed. Donald Voet & Judith G. Voet John Wiley & Sons ,Inc.
- 9) Molecular cloning –A laboratory Manual .J. Sambrook , E.F. Fritsch & T.Maniatis Cold Spring Harbor Laboratory Press.
- 10) Molecular cell Biology , H.Lodish,A. Berk, S.L. Zipursky, P. Matsudaira ,D. Baltimore , J.Darnell.
- 11) Bio-technology 1st edition . U. Satyanarayan. Books & Allied Publisher (p) Ltd.Kolkatta.

**Journals:**

1. Clinical Chemistry (I)
2. Clinica Chimica Acta (I)
3. Indian Journal of Biochemistry and Biophysics.(N)
4. Indian Journal of Medical Biochemistry(N)
5. Indian Journal of clinical chemistry(N)





# BHARATI VIDYAPEETH

(DEEMED TO BE UNIVERSITY)

## Medical College,

PUNE – SATARA ROAD, PUNE – 411 043

## Department of Microbiology

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Bharati Vidyapeeth Deemed to be University, Medical College, Pune

Department of Biochemistry Name of Programme: MSc. (Medical Microbiology )

### Programme outcomes:

The broad goal of the MSc ( Medical Microbiology) is to train the post graduate students to :

- a) Carry out professional obligations ethically in keeping with the objectives of the National health policy.
- b) Have mastered most of the competencies pertaining to medical diagnostic microbiology including molecular diagnostics.
- c) Make them aware of the recent advances in the field of medical diagnostic Microbiology
- d) Help them acquire the spirit of scientific inquiry.
- e) Oriented them to the principles of research methodology .

### Programme specific outcomes:

#### A) **Knowledge**

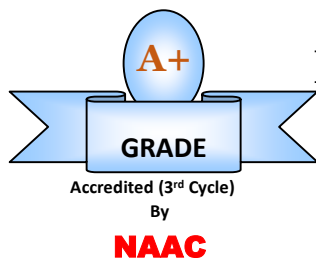
At the end of the course the students shall be able to:-

- 1) State and explain the clinical features, etiology, pathogenesis and methods of laboratory diagnosis of infectious diseases.
- 2) State and explain the principles of immunity and immunological phenomenon, which help to understand the pathogenesis, laboratory diagnosis of infectious and non-infectious diseases
- 3) Establish and practice laboratory medicine for the diagnosis of infectious diseases in the hospital and community in the field of bacteriology, parasitology, virology, mycology, serology and immunology
- 4) Basics of prevention and control of communicable diseases .
- 5) State the recent advances in the field of medical microbiology and apply this knowledge in understanding etiopathogenesis and diagnosis of diseases caused by microorganisms

#### B) **Skills**

At the end of the course the student should be able to: -

1. Plan the laboratory investigations for the diagnoses of infectious diseases
2. Perform laboratory procedures to reach the etiological diagnoses of infectious diseases including the drug sensitivity profile
3. Perform and interpret immunological and serological tests
4. Perform and interpret molecular diagnostic tests.



# BHARATI VIDYAPEETH

(DEEMED TO BE UNIVERSITY)

## Medical College,

PUNE – SATARA ROAD, PUNE – 411 043

### Department of Microbiology

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5. Operate routine and advanced laboratory instruments
6. Develop microteaching skills
7. Implement the chosen research methodology

**C) INTEGRATION:** The student will be able to integrate the etiopathogenesis of various infectious diseases with the diagnostic modalities available and their interpretation.

#### Programme structure:

**A) ELIGIBILITY & DURATION:** – The candidate should have passed Bachelor's degree of any branch of Health Sciences with minimum 50% of marks from any recognized university. Or B.Sc. with Microbiology /Biochemistry / Biotechnology with minimum 50% of marks.

**B) PERIOD OF TRAINING:** The period of training for M.Sc. (Medical Biochemistry) shall be of three years that is, six academic terms after registration as a post graduate student.

#### **C) TEACHING AND LEARNING METHODOLOGY:**

Teaching for MSc ( Medical Microbiology) will be done using the following teaching learning methods :

Group teaching sessions

Journal review

Subject seminar presentation

Group discussion

Slides seminar

Clinical case presentation pertaining to infectious diseases

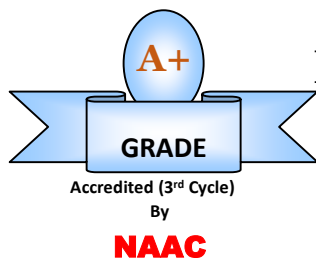
Participation in CME programmes and conferences.

#### **Hands on experience (Practical training)**

Students will be actively involved in day to day working of all the sections.

#### Schedule of rotation

1. Bacteriology—11m
2. Hospital infection surveillance—1m
3. Serology/immunology—6m
4. Mycology—3m
5. Virology/HIV—6m
6. Parasitology—3m



# BHARATI VIDYAPEETH

(DEEMED TO BE UNIVERSITY)

## Medical College,

PUNE – SATARA ROAD, PUNE – 411 043

## Department of Microbiology

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7. Clinical Microbiology(OPD)—2m
8. Recent diagnostic techniques—4 m
  - Candidates joining M.Sc.( Medical Microbiology ) course shall work as full time P.G. student & he/she will not be paid any stipend during the training period & he/she will be given full time responsibility, assignments & participation in all facets of the educational process .
  - P.G. student shall maintain a record (log) book of the work carried out by them & will be checked & assessed by his/her P.G. teacher & H.O.D.
9. **Elective Subject in the M.Sc. programme (preferably post MBBS)**
  - Good Laboratory Practices
  - PCR techniques
  - Immunological techniques
  - Hospital Infection control systems

**Emergency duty:** -Student will be posted for managing emergency laboratory services in microbiology

During the **first year** of the course the PG student is required to:

1. Attend all the UG teaching sessions(lectures, tutorials, practicals)
2. Participate in seminars and journal club activity
3. Complete the laboratory manual.
4. Select and submit the topic of dissertation
5. Do reference work
6. Do self study

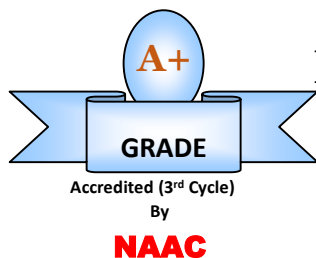
During the **second year** of the course the PG student is required to:

1. Do work for dissertation
2. Participate in activities like seminars, symposium, group discussions and journal club
3. May attend conferences at state and national level
4. Do self study

During the **third year** of the course the PG student is required

1. To complete and submit the dissertation
2. To do participate in activities like seminars, symposia, group discussions and journal club
3. May attend conferences at state and national level
4. To do self study

### D) Dissertation:



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### Department of Microbiology

The dissertation is compulsory for candidates registered for P.G. degree & should include candidates own work under a supervisor, qualified for the purpose & recognized as a P.G. teacher by the University. The subject of dissertation along with synopsis (about 200 words) signed by P.G. teacher, H.O.D. & Head of the Institution will be submitted to the Ethics Committee of the Institution must approve the topic of dissertation. Completed dissertation will be submitted to the University in the 5th term, that 6 months before the date of final examination.

#### E) ATTENDANCE:

They will be granted a term provided they will put 80% attendance during the academic term

#### SCHEME OF EXAMINATION

##### THEORY EXAMINATION: Total marks 400

There shall be four theory papers of 100 marks each. Duration: Three hours

Pattern of Examination
1. There will be Total Ten (10) Questions.
2. Question 1 and Question 2 will be of 15 marks each and compulsory
3. Question 3 to Question 10 will be of 10 marks each and students have to attempt any seven out of these eight questions

Paper1- General Microbiology & Immunology

Paper 2- Systemic bacteriology & Mycology

Paper3- Parasitology and Virology

Paper 4- Recent advances in microbiology

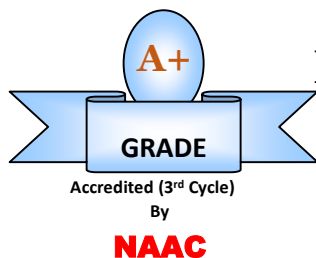
#### PRACTICALS

Practical examination shall be conducted on two consecutive days.

Exercises in practical examination conjointly conducted and evaluated by four examiners (Two internals and two externals Examiners)

##### Marking pattern for practical and oral examination

Long exercise& media prep.	60
Short exercise	15
Mycology	10
Serology	25
Parasitology	10
Media preparation	10



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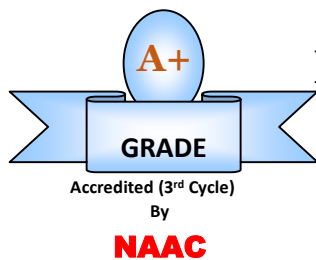
Identification of slides	30
Viva	40
Total	200

- a) **Long exercise** on clinical bacteriology: Problem based. Brief history along with relevant clinical findings are given. Student is asked to isolate and identify bacteria from given clinical specimen and anti microbial sensitivity of isolated organism to be performed.
- b) Short exercise
1. Exercise in Bacteriology  
Identification of bacteria from given pure culture
- c) Media preparation
- d) Identification of fungi from 1 given cultures-  
One yeast OR mould
- e) Exercise in Parasitology  
Examination of stool for ova/cyst by direct/concentration method and reporting
- f) Serology/ Immunology : Tests for HIV and HbsAg, HCV, dengue, Chikungunya etc  
OR Widal test, VDRL test, Paul Bunnell test, ASO, CRP, RA tests
- g) Identification of microbiological findings in the given set of slides (10 slides)
- h) Oral (viva-voce/Grand viva)  
Student will be examined by all examiners regarding his knowledge of basic aspects and recent advances in the field of microbiology & Presentation and discussion of dissertation

#### THEORY CURRICULUM

##### GENERAL MICROBIOLOGY:

- 1 History and Pioneers in Microbiology
- 2 Microscopy
- 3 Morphology of bacteria
- 4 Nomenclature and classification of microbes
- 5 Growth nutrition of bacteria & Bacterial metabolism
- 6 Sterilization and disinfection
- 7 Host parasite relationships
- 8 Bacterial genetics, genetic engineering and its applications
- 9 Antibacterial substances, mechanism of action, mechanism of drug resistance and antibiotic sensitivity
- 10 Quality control and quality assurance in microbiology



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### 11. Laboratory biosafety

#### **IMMUNOLOGY:**

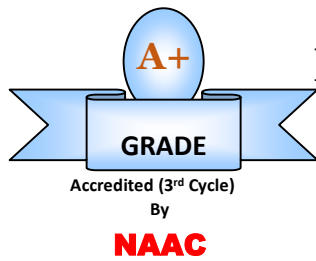
1. Structure and function of immune system, immune response
2. Innate and acquired immunity
3. Antigen
4. Immunoglobulins
5. Complement
6. Antigen and antibody reactions
7. Hypersensitivity
8. Immunodeficiency
9. Autoimmunity

#### **SYSTEMIC BACTERIOLOGY:**

1. Isolation and identification of bacteria
2. Staphylococcus and Micrococcus, anaerobic gram positive cocci
3. Streptococcus and lactobacillus
4. Neisseria, Branhamella, moraxella
5. Corynebacteria and other coryneform organisms
6. Bacillus: the aerobic spore bearing, anaerobic cocci
7. Clostridium: the spore bearing bacilli
8. Nonsporing anaerobes, Enterobacteriaceae
9. Vibrios, Aeromonas, Plesomonas, campylobacter, h.pylori, spirillum
10. Pseudomonas
11. Yersinia, Pasteurella, Francisella
13. Haemophilus, Bordetella and Brucella
14. Mycobacteria
15. Spirochaetes
16. Actinomyces, Nocardia, Actinobacillus
17. Mycoplasmatales, Mycoplasma, Ureaplasma, Acholeplasma
18. Rickettsiae
19. Chlamydiae
20. Emerging bacterial pathogens
21. Care and breeding of laboratory animals and their use in medical microbiology

#### **Virology:**

1. General properties of viruses
2. Laboratory diagnosis of viral infections
3. Genetics of viruses



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4. Epidemiology of viral infections
5. Vaccines and antiviral drugs
6. Bacteriophages
7. Pox viruses
8. Herpes viruses
9. Orthomyxoviruses
10. Paramyxoviruses
11. Enteroviruses :-Polio, ECHO and Coxsackie viruses
12. Hepatitis viruses
13. Rhabdoviruses
14. Human Immunodeficiency viruses
15. Oncogenic viruses
16. Arboviruses
17. Emerging viral diseases

### Parasitology

1. Protozoan parasites of medical importance  
Entamoeba, Giardia, Trichomonas, Leishmania, Trypanosomes, Plasmodium, Toxoplasma,
2. Helminthology
  - a) Cestodes: - all the tapeworms
  - b) Trematodes: - Liver, lung and blood flukes
  - c) Nematodes: - Intestinal and tissue nematodes

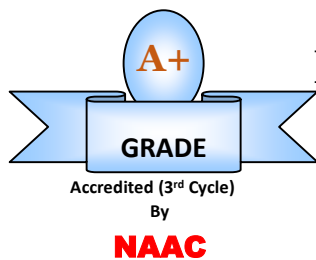
### Mycology

1. General properties of fungi, morphology, classification, reproduction
2. Laboratory diagnosis of fungal infections
3. Fungi causing superficial mycoses
4. Fungi causing subcutaneous mycoses
5. Fungi causing systemic infections
6. Contaminant and opportunistic fungi

### Applied Clinical microbiology

1. Epidemiology of infectious diseases
2. Hospital acquired infections
3. Recent advances in diagnostic technology
4. Outbreak investigations and disaster management
5. Biological warfare

### PRACTICAL SKILLS



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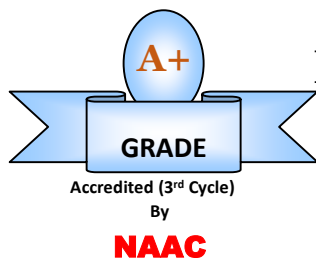
### BACTERIOLOGY:

1. Care & Operation of microscopes.
2. Preparation of stains viz.: Gram's, Albert's, Ziehl-Neelsen's and other stains.
3. Sterilization of glassware.
4. Operation of laboratory instruments.
5. Care & maintenance of laboratory equipments.
6. Preparation of routine culture media.
7. Preparation of common reagents –Oxidase, Kovac's etc.
8. Tests for beta lactamase including ESBLs.
9. Collection of clinical specimens for microbiological investigations.
10. Preparation, examination and interpretation of direct smears from clinical specimen.
11. Techniques of anaerobiosis- Gas pack system, anaerobic jar.
12. Identification of bacteria of medical importance upto species level.
13. Quantitative and Semiquantitative analysis for significant bacteriuria
14. Plating of clinical specimens on media for isolation, purification and identification.
15. Tests for motility; hanging drop, Craige's tube, dark ground microscopy for Spirochaetes-Treponema and Leptospira
16. In- vitro toxigenicity tests-Elek's test Nagler's reaction.
17. Special tests- Bile solubility, Chick cell agglutination, Sheep cell haemolysis, niacin and catalase tests for mycobacterium, satellitism, CAMP test, Catalase test and slide agglutination tests, and other as applicable in the identification of bacteria upto species level
18. Preparation of antibiotic discs; performance of antimicrobial susceptibility testing by Kirby –Bauer disk diffusion method, estimation of MIC and MBC by dilution methods (Tube and plate). Test for drug susceptibility of mycobacterium tuberculosis
19. Skin tests like Mantoux, Lepromin test etc
20. Testing for disinfectants- Phenol coefficient and "In Use" tests
21. Quality control of media reagents etc and validation of sterilization procedures
22. Aseptic practices in laboratory and safety precautions
23. Disposal of contaminated material like cultures
24. Bacteriology of Food, water, milk air
25. Maintenance of Stock cultures

### IMMUNOLOGY/SEROLOGY

1. Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods
2. Preparation of antigens from bacteria or tissues for Widal, Weil-Felix, VDRL, etc and their standardization
3. Raising of antisera in laboratory animals.
4. Performance of serological tests viz. Widal, Brucella tube agglutination indirect Haemagglutination, VDRL, Paul-Bunnell, Rose- Waller, IFA.
5. Immunodiffusion in gels, counter immunoelectrophoresis- visualization and interpretation of bands.





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6. Performance and interpretation of ELISA.
7. Latex and Staphylococcal tests

#### **MYCOLOGY**

1. Collection of specimens for Mycology
2. Direct examination of specimen using KOH, Gram stain, Lactophenol cotton blue etc.
3. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
4. Special techniques like slide culture etc.
5. Maintenance of stock cultures.

#### **PARASITOLOGY**

1. Examination of faeces for parasitic ova and cysts etc. by direct and concentration methods (salt floatation and formal-Ether methods) and complete examination for other cellular features
2. Egg counting techniques for helminths
3. Examination of blood for protozoa and helminths by wet mount, thin and thick stained smears
4. Examination of other specimens for e.g. urine, CSF, Bone marrow etc for parasites
5. Histopathology sections- Examination and identification of parasites
6. Performance of stains- Leishman, Giemsa, Modified Acid fast, Toluidine Blue O
7. Identification of common arthropods and other vectors viz. Mosquito, sand fly, ticks, mite and cyclops.
8. Collection of specimens
9. Preservation of parasites- mounting, fixing, staining etc

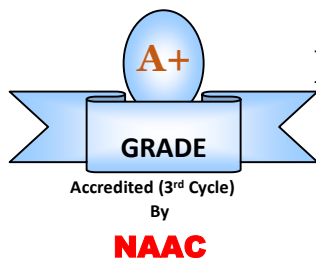
#### **VIROLOGY**

1. Preparation of glassware for tissue culture (washing, sterilization).
2. Preparations of media like Hanks, MEM.
3. Preparation of clinical specimens for isolation of viruses.
4. Serological tests- ELISA and rapid tests for JIV, RPHA for HbsAg, Haemagglutination inhibition for influenza, AGD and counter immunoelectrophoresis for detection of viral antigens or antiviral antibodies.
5. Chick embryo techniques- inoculation and harvesting.
6. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

#### **SUGGESTED READING BOOKS,**

##### **Reference books**

1. Tople and Wilson's Microbiology and microbial infections.
2. Color Atlas and textbook of Diagnostic Microbiology-Elmer W Koneman.



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3. Mandell, Douglas and Bennet's Principles and Practice of Infectious Diseases.
4. Microbiology and Clinical Practice: Shanson
5. Immunology: Janis Kuby
6. Basic Clinical Immunology: Fudenberg, Stites Caldwell Weills.
7. Bailey & Scott's diagnostic microbiology.
8. Textbook of Parasitology by Chatterjee K.D.
9. Microbiology in Clinical Practice by Shannon. D.C.
10. Beaver's Parasitology Textbook.

### Further Reading:

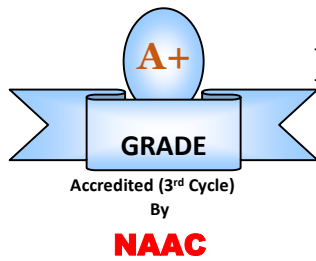
1. Mycology by-Rippons
2. Essentials of immunology- Roitt
3. Virology- Clinical virology by Rich.
4. Gradwohl's Clinical laboratory methods and diagnosis.
5. Biochemical tests for identification of medical bacteria- MacFaddin J F
6. Manual of Clinical Microbiology- ASM Press.

### Journals:

1. Indian journal of medical microbiology.
2. Clinical Microbiology Reviews.
3. Journal of Medical Microbiology.
4. Journal of AIDS
5. Indian Journal of Tuberculosis and Lung Disease.
6. Parasitology Today.
7. ICMR Bulletin.
12. WHO bulletin.

### Important Websites:

1. Center for disease control-[www.cdc.gov](http://www.cdc.gov)
2. World Health Organization- [www.who.int](http://www.who.int).



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3. Global infectious disease Epidemiology networks. [www.guideonline.com](http://www.guideonline.com)
4. National Aids Control Organization- [www.nacoindia.org](http://www.nacoindia.org)
5. Tuberculosis Research center- [www. Trc-chennai.org](http://www.Trc-chennai.org)

**Bharati Vidyapeeth Deemed  
to be University, Medical  
College, Pune**

**Department of  
Pharmacology**

**MSc (Pharmacology)**

**Bharati Vidyapeeth Deemed to be University, Medical College, Pune**

**Department of Pharmacology**

**Name of Programme: M.Sc. Pharmacology**

**Programme outcomes:** M.Sc. or Master of Science in Pharmacology is a 3 year postgraduation course. Upon successful completion of the course, graduates of this field may pursue further studies and may complete their Ph.D. or may take up job opportunities associated with this qualification like teaching for MBBS, BDS or Pharmacy students, in quality control department of pharmaceutical industries, in Research institutes or R & D of drugs, etc

Accordingly, a post graduate (MSc) student in Pharmacology should be competent to meet the job requirements at all these places.

**Programme specific outcomes:**

At the end of the 3 yr. course, a trained M.Sc Pharmacologist shall be able to:

***Cognitive domain:***

- I. Apply basic principles of Pharmacology and Therapeutics to rational use of existing drugs and evaluation of new drugs.
- II. Collect, analyze and interpret experimental and clinical data related to drug kinetics or dynamics.
- III. Provide appropriate advice related to selection of drug; drug usage (desirable and undesirable effects, kinetics, interactions); precautions & measures to be taken during administration of drug and treating the ADRs in a given patient taking into consideration physiological, psychological & pathological features.
- IV. Develop the ability for continued self-learning so as to update the knowledge of recent advances in the field of Pharmacology and allied fields.
- V. Teach and train undergraduate and postgraduate medical students and junior doctors in Pharmacology and Therapeutics.
- VI. Plan and carry out both laboratory and basic clinical research with adherence to scientific methodology, legal and ethical aspects and GLP/GCP guidelines.
- VII. Communicate the findings, results and conclusions of scientific research both verbally and in writing.

VIII. Understand the problems associated with evaluation and use of drugs from alternative systems of medicine.

***Psychomotor domain:***

- 1) Perform common experimental techniques required for evaluation of drugs with competence.
- 2) Perform common clinical procedures required for evaluation of drugs in normal volunteers and patients with competence.
- 3) Use teaching learning media effectively.

***Affective domain:***

- 1) Appreciate socio-psychological, cultural and environmental factors affecting health and drug usage.
- 2) Appreciate importance and implementation of National health programmes in context to rational drug utilization
- 3) Adopt ethical principles while conducting experimental and human research
- 4) Develop communication skills to interact with patients, peers and paramedical staff.
- 5) Realize the importance of team work
- 6) Develop attitudes required for professional responsibilities.

**Programme structure:**

**General**

- 1) They should appear for theory and oral examination for the first 3 blocks along with II M.B.B.S.
- 2) All M.Sc. students are supposed to maintain log book of their practical work.
- 3) They are expected to actively participate in research activities and undergraduate teaching whenever possible.
- 4) After 2 terms, they participate in Journal reporting clubs.
- 5) At the end of each term, there will be a written and practical test.

**1<sup>st</sup> Term**

**LECTURES:**

- 1) Specified Course in Anatomy, Physiology and Biochemistry.
- 2) Attending Lectures in Pharmacology

**PRACTICAL:**

- 1) Information, observations and handling of commonly used laboratory animals.
- 2) Common Lab. Techniques –Bleeding, feeding, Intravenous, subcutaneous, intramuscular, and Intraperitoneal injections.
- 3) Use of different anesthetics for animals.
- 4) Use of kymograph smoking and fixing of graph paper
- 5) Orientation to computer simulation experiments

### **2<sup>nd</sup> Term:-**

#### LECTURES:

- 1) Completion of course in Anatomy, Physiology and Biochemistry.
- 2) Attending lectures in Pharmacology

#### PRACTICALS:

- 1) Acute E.D. 50 & LD 50 determination.
- 2) Preparation for isolated tissue experiments – Guinea pig ileum, rat uterus and rat colon.
- 3) Practice computer simulation experiments- vasopressor & vasodepressors, mydriatics & miotics, Dose response curve, etc

### **3<sup>rd</sup> Term:-**

#### THEORY

- 1) Self study- General Pharmacology and ANS

#### PRACTICAL WORK:-

- 1) Bioassays on isolated tissues – Acetylcholine, histamine, etc.
- 2) Experiments- Bioavailability, disintegration, dissolution, Skeletal muscle relaxants, factors affecting drug action, drug antagonism, etc

#### DISSERTATION

Research Methodology workshop, Review of literature for selection of a topic for dissertation work, Prepare synopsis and departmental approval.

### **4<sup>th</sup> Term:-**

#### THEORY

Self study as in 3<sup>rd</sup> Term on Autacoids, CVS and CNS

## PRACTICAL WORK

Experiments- evaluation of local anesthetics, general anesthetics, analgesics and antiepileptics

Principles and working of Lab. Instruments

## DISSERTATION:

Collecting relevant references, conducting research work and progress report

## Elective Subject in the M.Sc. programme (preferably post MBBS)

- Animal Handling and animal house techniques
- Pharmacovigilance
- Good Clinical Practice
- Research Methodology

## 5<sup>th</sup> TERM

### THEORY

Self study of Chemotherapy, Endocrinology, Respiratory system and GIT

### PRACTICAL WORK

Practice techniques in animal research, isolated tissue mounting and other experiments

### DISSERTATION

Work should be completed, analyzed and dissertation presentation and submission.

## 6<sup>th</sup> TERM

### THEORY

Self study of remaining topics in Pharmacology and advances in Pharmacology.

Preparation for M.Sc. Theory and Practical of Preliminary and University Examination.

### PRACTICAL WORK



Practice techniques in animal research, isolated tissue mounting and other experiments for university exams

### **TERM III TO VI**

- 1) Assisting in undergraduate teaching as per Departmental directives.
- 2) Active participation in Journal Club/seminar /workshops.
- 3) Attending seminars, workshops and conferences
- 4) Presenting research papers- posters and oral paper in conference
- 5) Manuscript preparation and publication under the guidance of PG teacher

### **Syllabus:**

1) **Title:-**

M.Sc. (Medical) Pharmacology for non-medical graduates  
(the Degree of master of science in Pharmacology in the faculty of Medicine)

2) **Eligibility Criteria :-**

- 1) B.Sc. of a recognized University with Chemistry/ Zoology/Botany/ Microbiology allied subject after H.Sc /( Std.XII) or equivalent examination with Biology as one of the subjects.

Or

- 2) Bachelor of Pharmacy of any University recognized by the Pharmacy council of India.

Or

- 3) Bachelor's degree in Biomedical Science of any recognized University.
  - Candidate must have graduated in any of the above branches with minimum 50% aggregate marks.

3) **Duration of Course :-**

3 yrs. including initial 1 year orientation in Anatomy, Physiology and Biochemistry.

4) **Total No. seats:-**

P.G. Teacher: P.G. Student ratio of 1:1 per year (Current strength 5/yr.)

### 5) **Criteria of Selection:-**

Application will be ranked in order of merit according to the aggregate marks obtained at the qualifying graduate examination referred in item 2 above

### 6) **Training Programme / Syllabus term wise:-** As in Programme structure

### 7) **Rules for leave / Vacation**

1 Week winter vacation (Diwali) and 2 Week summer vacation / per year

### 8) **Rules for sanctioning the term**

1) 80 % attendance

2) Satisfactory performance in the term-wise curriculum as indicated by Term-ending Examination results (minimum 50% aggregate marks) and log book.

\* Attendance or Performance less than above may be considered on compassionate basis if it is due to reasons of ill health on recommendations from the P.G. Teacher and Principal of College.

### 9) **Examinations :-**

#### a) **Internal Assessment: Marks :**

Based on log book which must be maintained by every student.

- Formative examinations (Term ending and Preliminary Examinations)
- Dissertation work and presentations
- Overall Assessment by the P.G. Teacher
- Participation and performance in departmental post –graduate activities.

#### b) **Term – Ending Examinations :-**

c) 50 marks theory examination at the end of term I & II in the relevant portion of Anatomy, Physiology, Biochemistry.

50 marks theory examination at the end of every term in Pharmacology from term III to VI

#### d) **University Examination :-**

The examination shall be by papers, Practical and orals as follows.

Theory papers:-

Paper –I- General Pharmacology, Principles and Methods of Bioassay, Pre-clinical evaluation of drugs, Biostatistics and statistical analysis of Pharmacological data. Principles and Methods of Clinical Pharmacology.

Paper-II –Systemic Pharmacology.

Paper-III- Applied Pharmacology

Paper –IV – Recent advances in Pharmacology

- Each paper of 100 marks will be set and examined by the board of paper setters and examiners in the subject.

Same examiners will examine the candidate during practical and oral examination.

Practical Examination:-

A] Long Experiment:- Estimation of Drug Concentration (100 marks)

- Experiment & set-up (50 marks)
- Graph & calculations (25 marks)
- Viva (25 marks)

B] Short Experiment with Technique demonstration:- (70 marks)

- Procedure (25 marks)
- Viva (25 marks)
- Technique demo (20 marks)

C] Use of common instruments in Pharmacology (50marks)

D] Critical appraisal of Journal article (40marks)

E] Microteaching (40 marks)

F] Viva-Voce:-

- Dissertation (40 marks)
- Theory viva (60 marks)

Collectively will be assessed by all the above examiners.

A candidate will be declared as passed, passed with distinction or failed according to his/her overall performance at the examination.

10) **Eligibility for appearing for University Exam:-** Satisfactory completion of Dissertation work & Satisfactory performance in Internal Assessment

11) **Criteria for passing:** Minimum 50% aggregate marks in University Exam.

Approval of Dissertation by Board of Examiners.