Bharati Vidyapeeth

(Deemed to be University)

Pune, India

College of Engineering, Pune

B.Tech. Computer Science and Business Systems (2023 Course)

Program Curriculum

As Per NEP Guidelines

VISION OF UNIVERSITY:

Social Transformation through Dynamic Education

MISSION OF UNIVERSITY:

- To make available quality education in different areas of knowledge to the students as per their choice and inclination.
- To offer education to the students in a conducive ambiance created by enriched infrastructure! and academic facilities in its campuses.
- To bring education within the reach of rural, tribal and girl students by providing them substantive fee concessions and subsidized hostel and mess facilities.
- To make available quality education to the students of rural, tribal and other deprived sections of the population

VISION OF THE INSTITUTE:

To be World Class Institute for Social Transformation Through Dynamic Education.

MISSION OF THE INSTITUTE:

- To provide quality technical education with advanced equipment, qualified faculty members, infrastructure to meet needs of profession and society.
- To provide an environment conducive to innovation, creativity, research and entrepreneurial leadership.
- To practice and promote professional ethics, transparency and accountability for social community, economic and environmental conditions.

VISION OF THE DEPARTMENT

To syndicate industry and institute to impart high quality knowledge through scholarity, research and creative endeavour

MISSION OF THE DEPARTMENT

- To impart contemporary technology conforming to a dynamic curriculum.
- To engage in professional development and scholarly endeavour through knowledge of common business principles.
- To promote the awareness of business discipline and ethical responsibility through industry alliance

Program Educational Objectives (PEOs)

1. Prevail technical competency to concord the industry engrossment.
2. Assimilate business management skills.
3. Instigate business level innovation with societal consideration.

Program Specific Outcomes (PSOs)

Students of B. Tech (CSBS) will be

PSO1: Able to apply pragmatic, innovative and critical thinking approach for solving complex business problems.

PSO2: Able to choose effective business communication techniques in professional Institute/organization.

PSO3: Able to use financial domain understanding to formulate technological strategy.

PSO4: Skilled in contemporary courses from emerging domains such as artificial intelligence, Machine learning and data science.

Program Outcomes (POs)

The students of B.Tech (Computer Science & Business Systems) will be able to

a. Demonstrate logical and programming skills through comprehensive programming foundation.
b. Apply knowledge of mathematics, computer engineering and basic science to comprehend and solve real world problems.
c. Develop software applications and processes for complex problems to provide efficient solutions by assessing its environmental, social and ethical constraints.
d. Investigate and solve complex computing problems with alternate solutions.
e. Use functional skills of modern IT tools and techniques for engineering activities.
f. Understand the social and cultural impact of computing on society.
g. Provide optimized computational solutions that apprehend the societal and environmental aspects.
h. Exhibit the professional, ethical and legal responsibilities related to industry.
i. Perform as an individual and efficient team player to accomplish a goal.
j. Present professional concepts through effective communication skills and documentation.
k. Demonstrate management skills for developing time-bound projects within the available budget and resources.
l. Develop the ability of lifelong learning for new IT practices.

A. DEFINITION OF CREDITS:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
1 Hour Practical (P) per week	0.5 credits
2 Hours Practical (Lab)/week	1 credit

B. STRUCTURE OF UNDERGRADUATE ENGINEERING PROGRAMME:

Sr.No.	Category	Breakup of Credits
1	Basic Science Courses	17
2	Engineering Science Course	12
2	Core Courses and Lab	99
4	Professional Elective Courses	22
5	Project	08
6	Internship	04
7	Skill based Courses	20
**8	Value Based Courses	08(Optional Credit)
9	Humanity/Social	06
TOTAL		180

- **** Indicates optional credits**

C. COURSE CODE AND DEFINITION

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
TW	Term Work
O	Oral
SEE	Semester End Examination
ESC	Engineering Science Courses
BSC	Basic Science Courses
PCC	Professional Core Courses
PEC	Professional Elective courses
VAC	Value added Courses
SBC	Skill Based Courses
HSMC	Humanities/Social and Management Courses
PROJ	Project
MAC	Mandatory Credit Course

Semester wise Credits

Sr.No.	Semester	Credits
1	I	25
2	II	25
3	III	20
4	IV	20
5	V	21
6	VI	22
7	VII	25
8	VIII	23

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester –I (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	L	P	T	Total
1.	BSC		Discrete Mathematics	3	2	-	60	40	25	-	-	125	3	1	-	4
2.	BSC		Introductory Topics in Statistics, Probability and Calculus	4	-	-	60	40	-	-	-	100	4	-	-	4
3.	PCC		Fundamentals of Computer Science	4	2	-	60	40	25	25	-	150	4	1	-	5
4.	ESC		Principles of Electrical Engineering	3	2	-	60	40	25	-	-	125	3	1	-	4
5.	BSC		Physics for Computing Science	3	2	-	60	40	50	-	-	150	3	1	-	4
6.	HSMC		Business Communication & Value Science- I	2	2	-	-	-	25	-	25	50	2	1	-	3
7.	SBC-I		Skill Based Course I- (Computer Aided Drawing and Design)	-	2	-	-	-	25	25	-	50	-	1	-	1
8.			Induction Program (Non-Credit)	-	-	-	-	-	-	-	-	-	-	-	-	-
			Total	**19**	**12**	**0**	**300**	**200**	**175**	**50**	**25**	**750**	**19**	**6**	**0**	**25**

**** indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – II (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	L	P	T	Total
1	BSC		Linear Algebra	3	2	-	60	40	25	-	-	125	3	1	-	4
2	BSC		Statistical Methods & Modelling	4	2	-	60	40	25	-	-	125	4	1	0	5
3	PCC		Data Structure and Algorithms	4	2	-	60	40	25	25	-	150	4	1	0	5
4	ESC		Principles of Electronics	3	2	-	60	40	25	-	25	150	3	1	0	4
5	ESC		Fundamental of Economics	3	-	-	60	40	-	-	-	100	3	-	-	3
6	HSMC		Business Communications & Value Science - II	2	2	-	-	-	25	-	25	50	2	1	-	3
7	SBC-II		Skill Based Course II- (Computer Workshop Technology)	-	2	-	-	-	25	25	-	50	-	1	-	1
8			Environmental Sciences (Non-Credit)	-	-	-	-	-	-	-	-	-	-	-	-	-
			Total	**19**	**12**	**0**	**300**	**200**	**150**	**50**	**50**	**750**	**19**	**6**	**0**	**25**

**** indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – III (NEP 2020 COURSE)

Sr. No.	Category	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	PCC		Formal Language and Automata Theory	3	-	1	60	40	25	-	-	125	3	-	1	4
2.	Interdisciplinary		Computer Organization and Architecture	3	2	-	60	40	25	-	-	125	3	1	-	4
3.	PCC		Software Engineering	3	2	-	60	40	25	25	-	150	3	1	-	4
4.	PCC		Computational Statistics	3	-	-	60	40	-	-	-	100	3	-	-	3
5.	PCC		Object Oriented Programming	3	2	-	60	40	25	-	25	150	3	1	-	4
6.	SBC-III		Skill Based Course III (Data Science with Python)	-	2	-	-	-	25	-	25	50	-	1	-	1
			Total	**15**	**8**	**1**	**300**	**200**	**125**	**25**	**50**	**700**	**15**	**4**	**1**	**20**
7.	*Audit Course-I		Indian Knowledge System	2	-	-	-	100	-	-	-	-	-	-	-	2
8.	*Value Added Course		VAC- I	2	-	-	-	100	-	-	-	-	-	-	-	2

*** Indicate this is mandatory but the credits will not be considered in SGPA/CGPA.(As and when the students complete the course and submit the certificate, it should be reflected in the mark sheet. The student should clear the subject up to 7th Sem of his/her coursework.)**

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – IV (NEP 2020 COURSE)

Sr. No.	Category	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	PCC		Operating Systems	3	2	-	60	40	25	25	-	150	3	1	-	4
2.	PCC		Database Management Systems	3	2	-	60	40	25	-	25	150	3	1	-	4
3.	Interdisciplinary		Introduction to Innovative IP Management & Entrepreneurship	2	-	-	60	40	-	-	-	100	2	-	-	2
4.	PCC		Design Thinking	3	2	-	60	40	25	-	-	125	3	1	-	4
5.	PCC		Operation Research	3	2	-	60	40	25	-	-	125	3	1	-	4
6.	SBC-IV		Skill Based Course IV (Software Design with UML)	-	2	1	-	-	25	-	25	50	-	1	1	2
			Total	**14**	**10**	**1**	**300**	**200**	**125**	**25**	**50**	**700**	**14**	**5**	**1**	**20**
7.	*MOOC/ Swayam NPTEL		MOOC - I	-	-	-	-	-	-	-	-	-	-	-	-	2
8.	*Social Activity			-	-	-	-	-	-	-	-	-	-	-	-	2

*** Indicate this is mandatory but the credits will not be considered in SGPA/CGPA.(As and when the students complete the course and submit the certificate, it should be reflected in the mark sheet. The student should clear the subject up to 7th Sem of his/her coursework.)**

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – V (NEP 2020 COURSE)

Sr. No.	Category	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	Professional Core Course		Design & Analysis of Algorithms	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Professional Core Course		Machine Learning	3	2	-	60	40	25	-	25	150	3	1	0	4
3.	Professional Core Course		Fundamentals of Management	3	-	-	60	40	-	-	-	100	3	0	0	3
4.	Professional Core Course		Cloud Computing	3	-	-	60	40	-	-	-	100	3	0	0	3
5.	Humanities/ Social and management Course		Business Communication & Value Science – III	-	2	-	-	-	25	-	-	25	0	1	0	1
6.	Professional Elective course		Elective I	3	2	-	60	40	25	25	-	150	3	1	0	4
7.	Skill Based Course		Skill Based Course V- (CSBS Skill Lab III)	-	4	-	-	-	25	-	50	75	0	2	0	2
			Total	**15**	**12**	**0**	**300**	**200**	**125**	**25**	**75**	**750**	**15**	**6**	**0**	**21**
8.	**MAC		Environmental Studies	-	-	-	-	-	-	-	-	-	-	-	-	-

**** indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

Elective I	Conversational Systems	Business Strategy	Compiler Design (PCC-CS 601) + Lab (LEX & YACC)

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B. Tech. (CSBS): Semester – VI (NEP 2020 COURSE)

Sr. No.	Category	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	OR	PR	Total	L	P	T	Total
1.	Professional Core Course		Computer Networks	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Professional Core Course		Information Security	4	-	-	60	40	25	-	-	125	4	0	0	4
3.	Professional Core Course		Artificial Intelligence	3	2	-	60	40	25	-	25	150	3	1	0	4
4.	Professional Core Course		Financial Cost and Accounting	3	-	-	60	40	-	-	-	100	3	0	0	3
5.	Professional Elective course		Elective - II	3	2	-	60	40	25	25	-	150	3	1	0	4
6.	Humanities/ Social and management Course		Business Communication & Value Science – IV	-	2	-	-	-	25	-	-	25	0	1	0	1
7.	Skill Based Course		Skill Based Course VI- (CSBS Skill Lab IV)	-	4	-	-	-	25	-	25	50	0	2	0	2
			Total	**16**	**12**	**0**	**300**	**200**	**150**	**25**	**75**	**750**	**16**	**6**	**0**	**22**
8.	**VAC		VAC - II	-	2	-	-	-	-	-	-	-	0	1	0	1

***Internship-I will be for 30 days. It should be done after V Semester Examination is over.**

****** indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

Elective II	Data Mining & Analytics	Robotics & Embedded Systems	Natural Language Processing	Modern Web Application

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COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – VII (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	Professional Core Course		Usability Design of Software Applications	3	-	-	60	40	-	-	-	100	3	0	0	3
2.	Professional Core Course		IT Workshop	3	2	-	60	40	25	-	-	125	3	1	0	4
3.	Professional Core Course		Financial Management	1	2	-	-	-	25	25	-	50	1	1	-	2
4.	Professional Core Course		Human Resource Management	2	-	-	60	40	-	-	-	100	2	0	0	2
5.	Professional Elective course		Elective – III	3	2	-	60	40	25	-	25	150	3	1	0	4
6.	Professional Elective course		Elective - IV	3			60	40	-	-	-	100	3	0	0	3
7.	Skill Based Course		*Internship	-	-	-	-	-	25	-	25	50	0	4	0	4
8.	Project		Project Stage - I	-	2	-	-	-	25	-	50	75	0	3	0	3
			Total	**15**	**8**	**0**	**300**	**200**	**125**	**25**	**100**	**750**	**15**	**10**	**0**	**25**

***Internship will be for60 days. It should be done after VI Semester Examination is over.**
****** indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

Elective III	Cognitive Science & Analytics (DS)	Introduction to IOT (DTS)	Cryptology (DS)	Gen AI
Elective IV	Quantum Computing & Quantum Information (CS)	Advanced Social, Text & Media Analytics (DS)	Mobile Computing (DTS)	Info Retrival

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (CSBS): Semester – VIII (NEP 2020 COURSE)

Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
				L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	Pr/Or	Tut	Total
1.	Professional Core Course		Services Science & Service Operational Management	3	-	-	60	40	-	-	-	100	3	0	0	3
2.	Professional Core Course		IT Project Management	3	2	-	60	40	25	25	-	150	3	1	0	4
3.	Professional Core Course		Marketing Research & Marketing Management	1	2	-	-	-	25	-	25	50	1	1	-	2
4.	Professional Elective course		Elective - V	3	-	-	60	40	-	-	-	100	3	0	0	3
5.	Professional Elective course		Elective - VI	3	2	-	60	40	25	-	25	150	3	1	0	4
6.	Skill Based Course		Skill Based Course VIII- (CSBS Skill Lab VI)	-	4	-	-	-	25	25	-	50	0	2	0	2
7.	Project		Project Stage - II	-	4	-	-	-	75	-	75	150	0	5	0	5
			Total	**13**	**14**	**0**	**300**	**160**	**175**	**50**	**125**	**750**	**13**	**10**	**0**	**23**

***Internship-I will be for 30 days. It should be done after VII Semester Examination is over.**
****** **indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

Elective V	Behavioural Economics (SH)	Computational Finance & Modelling (MS)	Psychology (SH)
Elective VI	Enterprise Systems (DTS)	Advance Finance (MS)	Image processing & Pattern Recognition (DTS)

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
MINOR DEGREE: BUSINESS SYSTEMS

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	ESE	IA	TW	OR	PR	Total	TH	PR/OR	Tut	Total
1		**Sem III** Business Strategy	3	2	-	60	40	25	25	-	150	3	1	-	**4**
2		**Sem IV** Introduction to Innovative IP Management & Entrepreneurship	3	2	-	60	40	25	25	-	150	3	1	-	**4**
3		**Sem V** Marketing Research and Marketing Management	3	2	-	60	40	25	25	-	150	3	1	-	**4**
4		**Sem VI** Financial and Cost Accounting	3	2	-	60	40	25	25	-	150	3	1	-	**4**
5		**Sem VII** Project	-	8	-	-	-	50	50	-	100	-	4	-	**4**
	Total		**12**	**16**	**-**	**240**	**160**	**150**	**150**	**-**	**700**	**12**	**8**	**-**	**20**

DISCRETE MATHEMATICS

TEACHING SCHEME		EXAMINATION SCHEME		CREDITS ALLOTTED	
Theory:	**3 Hours/Week**	**End Semester Examination:**	**60 Marks**	**Theory:**	**3 Credits**
Practical:	**2 Hours/Week**	**Internal Assessment:**	**40 Marks**	**Practical:**	**1Credit**
		Term work:	**25 Marks**	**Total:**	**4 Credits**
		Total:	**125 Marks**		

Course Prerequisite:

Basic Knowledge of Elementary Linear Algebra, Numerical Mathematical Computation, Programming basics.

Course Objective:

The objective is to provide a mathematical foundation and skills those are required in further study of Computer Science. The course Discrete Mathematics deals with discrete objects, countable sets. It helps to develop logical thinking and a wide variety of real-world applications to computer science. It is a very good tool for improving reasoning and problem-solving capabilities.

Course Outcomes: On completion of the course, students will have the ability to:

1. Demonstrate the ability to write the sentences in the symbolic logic and evaluate a proof technique.
2. Apply the basic principles of set theory to analyse the data relationship and prove basic properties of set.
3. Analyse the properties of relations and functions to determine their properties.
4. Apply the knowledge of Boolean algebra for building basic electronic and digital circuits.
5. Solve problems of combinatorics and recurrence relations.
6. Model problems in Computer Science using graphs and trees.

Unit I **06 Hours**

Logic: Propositional calculus - propositions and connectives, syntax; Semantics – truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility - natural deduction system and axiom system; Soundness and completeness.

Unit II **06 Hours**

Set Theory: Types of sets, Sets operations and laws, Algebra of Sets, Multisets, Application of the principle of inclusion and exclusion.

Boolean algebra: Introduction of Boolean algebra, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

Unit III **06 Hours**

Relations: Basic definition, properties and types of relations, relations and digraphs, paths in relations and digraphs, equivalence and partially ordered relations.

Functions: Types of functions, Identity functions, Composition of functions, Mathematical functions, Pigeonhole principle.

Unit IV **06 Hours**

Algebraic Structures: Isomorphism and Homomorphism. Algebraic Structures with Binary Operations, rings, Cyclic groups, codes.

Unit V **06 Hours**

Combinatorics: Basic counting, balls and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

Unit VI **06 Hours**

Graph Theory Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four-color theorem.

Textbooks:

1. Topics in Algebra, I. N. Herstein, John Wiley and Sons.
2. Digital Logic & Computer Design, M. Morris Mano, Pearson.
3. Elements of Discrete Mathematics, (Second Edition) C. L. Liu McGraw Hill, New Delhi.
4. Graph Theory with Applications, J. A. Bondy and U. S. R. Murty, Macmillan Press, London.
5. Mathematical Logic for Computer Science,L.Zhongwan, World Scientific, Singapore.

Reference Books:

1. Introduction to linear algebra. Gilbert Strang.
2. Introductory Combinatorics, R. A. Brualdi, North-Holland, New York.
3. Graph Theory with Applications to Engineering and Computer Science, N. Deo, Prentice Hall, Englewood Cliffs.
4. Introduction to Mathematical Logic (Second Edition), E. Mendelsohn, Van-Nostrand, London.

List of Assignments:

The sample class assignments are given below.

1. Given a fact or a statement prove or disprove using suitable technique.
2. Write the given English language sentences represent in the Symbolic logic.
3. Given the statement forms Infer the validity of the statement form.
4. Draw a Hasse diagram and find chains and antichains.
5. Find the number of ways for any event or given sample space.
6. Given a problem represent in a graph and compute the optimal solution.
7. Given a communication network find the path between the given nodes.

List of Laboratory Exercises:

1. Perform set Operations.
2. Compute a power set of a given set.
3. List various properties of Relation and construct a program to evaluate it with a program.
4. Apply Warshall's algorithm to compute a Transitive Closure of a given relation entered by the user (Use any suitable programming language).
5. Solve a programming problem based on application of Eulerian and Hamiltonian Graph.
6. Develop a program using RSA algorithm.
7. Develop a program to apply different algorithms on graph and solve areal tie problem.

List of Project Based Learning Topics:

1. Discrete Mathematics in Railway Planning using graph theory and linear algebra.
2. Object transformations using linear algebra.
3. Discrete mathematics in cryptography.
4. In Google maps to determine fastest driving routes and times.
5. In image processing
6. In relation database using sets.
7. In cyber security using graph theory.
8. Shortest path between two cities using a transportation system.
9. Data compression system with the help of Huffman coding.
10. Find the shortest tour that visits each of a group of cities only once and then ends in the starting city using graphs.

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit – V, Unit - VI

INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs/Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
	Internal Assessment :40 Marks	**Total:4 Credit**
	Total : 100 Marks	

Course Pre-Requisites:

The students should have basic knowledge of high school mathematics and calculus.

Course Objective:

The course introduces fundamental concepts of statistics and probability.

Course Outcomes:

1. Students will be able to use appropriate statistical terms to describe data.

2. Students will be able to use appropriate statistical methods to collect, organize, display and analyse relevant data.

3. Students will be able to apply concepts of various probability distributions to find probabilities and understand mathematical expectation and moments generating function.

4. Students will be able to apply concepts of Normal, Poisson, Binomial, uniform, exponential,t and F-distribution.

5. Students will be able to apply concepts of differentiation.

6. Students will be able to apply concepts of integration to find area and volume using double and triple integral.

UNIT – I **6 Hours**

Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples

Collection of Data**:** Internal and external data, Primary and secondary data. Population and sample, Representative sample.

UNIT – II **6 Hours**

Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution. Linear regression and correlation. Rank correlation.

UNIT III **6 Hours**

Probability Theory: concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem

Mathematical expectation: Expected values & moments: mathematical expectation & its properties, Moments (including variance) & their properties, interpretation, Moment generating function

UNIT – IV **6 Hours**

Probability distributions: Discrete & continuous distributions, Binomial, Poisson & Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions

UNIT – V **6 Hours**

Differential Calculus: Differential equation and its application

UNIT – VI **6 Hours**

Integral Calculus: Multiple integral, application of double and triple integral.

List of Assignments:

Problem sets to be shared by faculty covering the following topics:

Graphical representation of data, Histograms, Descriptive measures - central tendency and dispersion Estimating moments, Distribution parameters.

List of Project Based Learning Topics:

1. Prepare a questionnaire for survey
2. Do the population survey of a certain area
3. Prepare survey model of literate/illiterate
4. Prepare survey model of employed/ unemployed
5. Classify primary and secondary data
6. Collect the raw data, analyze it and plot it using graphs
7. Find the stability of the data using coefficient of variation
8. Use concept of correlation to find coefficient of correlation between different observations
9. Use Rank correlation to find correlation for qualitative data
10. Derive Spearman's Rank correlation
11. Data fitting using linear regression
12. Data fitting using nonlinear regression
13. Find the chance of happening particular event using Bayes' theorem
14. Find the Moment generating function of given function.
15. Use probability theory to estimate the life of electric equipment
16. Find the height, weight of the population using the example of normal distribution
17. Evaluate the electric circuit problem using differential equations
18. Evaluate the heat conduction problem using differential equations
19. Find the area using double integrals
20. Find the volume using triple integrals

Textbooks:

1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.

Reference Books:

1. A first course in Probability, S.M. Ross, Prentice Hall.
2. Probability and Statistics for Engineers (Fourth Edition), I.R. Miller, J.E. Freund and R. Johnson, PHI.
3. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.
4. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
5. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
6. Applied Mathematics, Vol. I & II, P. N. WartikarandJ. N. Wartikar,VidyarthiPrakashan.

Syllabus for Unit Test:

Unit Test –I	UNIT – I, II and III
Unit Test -II	UNIT – IV, V and VI

INTRODUCTORY TOPICS IN STATISTICS, PROBABILITY AND CALCULUS

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :4 Hrs/Week	**Semester Examination :60 Marks**	**Theory :4 Credits**
	Internal Assessment :40 Marks	**Total:4 Credit**
	Total : 100 Marks	

Course Pre-Requisites:

The students should have basic knowledge of high school mathematics and calculus.

Course Objective:

The course introduces fundamental concepts of statistics and probability.

Course Outcomes:

1. Students will be able to use appropriate statistical terms to describe data.

2. Students will be able to use appropriate statistical methods to collect, organize, display and analyse relevant data.

3. Students will be able to apply concepts of various probability distributions to find probabilities and understand mathematical expectation and moments generating function.

4. Students will be able to apply concepts of Normal, Poisson, Binomial, uniform, exponential,t and F-distribution.

5. Students will be able to apply concepts of differentiation.

6. Students will be able to apply concepts of integration to find area and volume using double and triple integral.

UNIT – I **6 Hours**

Introduction to Statistics: Definition of Statistics. Basic objectives. Applications in various branches of science with examples

Collection of Data**:** Internal and external data, Primary and secondary data. Population and sample, Representative sample.

UNIT – II **6 Hours**

Descriptive Statistics: Classification and tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal and conditional frequency distribution. Linear regression and correlation. Rank correlation.

UNIT III **6 Hours**

Probability Theory: concept of experiments, sample space, event. Definition of Combinatorial Probability. Conditional Probability, Bayes Theorem

Mathematical expectation: Expected values & moments: mathematical expectation & its properties, Moments (including variance) & their properties, interpretation, Moment generating function

UNIT – IV **6 Hours**

Probability Distributions: Discrete & continuous distributions, Binomial, Poisson & Geometric distributions, Uniform, Exponential, Normal, Chi-square, t, F distributions

UNIT – V **6 Hours**

Differential Calculus: Differential equation and its application

UNIT – VI **6 Hours**

Integral Calculus: Multiple integral, application of double and triple integral.

List of Assignments:

Problem sets to be shared by faculty covering the following topics:

Graphical representation of data, Histograms, Descriptive measures - central tendency and dispersion Estimating moments, Distribution parameters.

List of Project Based Learning Topics:

21. Prepare a questionnaire for survey
22. Do the population survey of a certain area
23. Prepare survey model of literate/illiterate
24. Prepare survey model of employed/ unemployed
25. Classify primary and secondary data
26. Collect the raw data, analyze it and plot it using graphs
27. Find the stability of the data using coefficient of variation
28. Use concept of correlation to find coefficient of correlation between different observations
29. Use Rank correlation to find correlation for qualitative data
30. Derive Spearman's Rank correlation
31. Data fitting using linear regression
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40. Find the volume using triple integrals

Textbooks:

4. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
5. Fundamentals of Statistics, vol. I & II, A. Goon, M. Gupta and B. Dasgupta, World Press.
6. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.

Reference Books:

7. A first course in Probability, S.M. Ross, Prentice Hall.
8. Probability and Statistics for Engineers (Fourth Edition), I.R. Miller, J.E. Freund and R. Johnson, PHI.
9. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boes, McGraw Hill Education.
10. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Learning.
11. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
12. Applied Mathematics, Vol. I & II, P. N. WartikarandJ. N. Wartikar,VidyarthiPrakashan.

Syllabus for Unit Test:

Unit Test –I	UNIT – I, II and III
Unit Test -II	UNIT – IV, V and VI

FUNDAMENTALS OF COMPUTER SCIENCE

TEACHING SCHEME	EXAMINATION SCHEME		CREDITSALLOTTED
Lectures:4Hrs/Week	**Semester Examination:**	**60 marks**	**Theory:4 Credits**
Practical:2 Hrs/Week	**Internal Assessment:**	**40 marks**	**Practical:1 Credit**
	Term work:	**25 Marks**	**Total:5 Credits**
	Practical:	**25 Marks**	
	Total:	**150 Marks**	

Course Pre-Requisites:

Basic knowledge of computers.

Course Objective:

The course introduces fundamental concepts of computer science

Course Outcomes:

1. Understand the basics of computer science & the process of moving from a problem statement to a computational formulation of a method for solving the problem.
2. Apply the basic concepts of control structures.
3. Understand basic concepts of function.
4. Implement concept of arrays and pointers.
5. Develop an application using the concept of file handling.
6. Describe Unix system interface and programming method.

UNIT – I **6 Hours**

General problem-Solving concepts and Imperative languages: Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops.

Imperative languages: Introduction to imperative language; syntax and constructs of a specific language (ANSI C) .Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, proper variable naming and Hungarian Notation

UNIT – II **6 Hours**

Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while, do, for, break and continue, Goto Labels, structured and un- structured programming

UNIT – III **6 Hours**

Functions and Program Structure with Discussion on Standard Library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialization, Recursion, Pre-processor, Standard Library Functions and return types

UNIT – IV **6 Hours**

Pointers and Arrays: Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialisation of Pointer Arrays, Command line arguments, Pointer to functions, complicated declarations and how they are evaluated.

UNIT – V **6 Hours**

Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral Structures, Table look up, Typedef, Unions, Bit-fields
Input and Output: Standard I/O, Formatted Output – printf, Formated Input – scanf, Variable length argument list, file access including FILE structure, fopen, stdin, sdtout and stderr, Error Handling including exit, perror and error.h, Line I/O, related miscellaneous functions

UNIT – VI **6 Hours**

Unix System Interface: File Descriptor, Low level I/O – read and write, Open, create, close and unlink, Random access – lseek, Discussions on Listing Directory, Storage allocator

Programming Method: Debugging, Macro, User Defined Header, User Defined Library Function, make file utility.

List of Assignments:

1.Define Algorithm. Explain Characteristics of Algorithm.

2.Explain all types of Operators in detail with example.

3.Explain control structures in detail with example.

4.Define function. Explain types of Functions with example.

5.Write a short note on:

i) Pointers ii) Types of Arrays iii) Pointer Array

6.Define Structure. Explain concept of Array of Structure with suitable example.

7.Explain File Descriptor and Storage Allocator in detail.

List of Laboratory Exercises:

1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
    i. Small but tricky codes
    ii. Proper parameter passing

iii. Command line Arguments
iv. Variable parameter
v. Pointer to functions
vi. User defined header
vii. Make file utility
viii. Multi file program and user defined libraries
ix. Interesting substring matching / searching programs
x. Parsing related assignments

List of Project Based Learning Topics:

1. Inventory Management System using File Handling
2. Online Jewellery Shopping System using File Handling
3. Library Management System using File Handling
4. Online Examination System using File Handling
5. Hospital Management System using File Handling
6. Railway Reservation System using File Handling
7. Payroll Management System using File Handling
8. Cooking Recipe Portal using File Handling
9. Art Gallery Management System using File Handling
10. Student Database Management System using File Handling
11. Restaurant Management Database System using File Handling
12. Electric Bill System using File Handling
13. Online Examination System using File Handling
14. Event Management System using File Handling
15. Attendance Management System using File Handling
16. Slam book using File Handling.

Textbooks:

1. B. W. Kernighan and D. M. Ritchi, “The C Programming Language”, Second Edition, PHI.
2. B. Gottfried, “Programming in C”, Second Edition, Schaum Outline Series.

Reference Books:

1. Herbert Schildt, “C: The Complete Reference”, Fourth Edition, McGraw Hill.
2. YashavantKanetkar, “Let Us C”, BPB Publications.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

PRINCIPLES OF ELECTRICAL ENGINEERING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Theory:3 Hours / Week	**End Semester Examination:**	**60 Marks**	**Theory:3 Credits**
Practical:2 Hours / Week	**Internal Assessment:**	**40 Marks**	**Practical:1 Credit**
	Term Work:	**25 Marks**	**Total:4 Credits**
	Total:	**125 Marks**	

Course Pre-requisites:

The students should have knowledge of Mathematics, physics.

Course Objectives:

The course introduces fundamental concepts of DC and AC circuits, Electrostatics electromagnetism, transformer, electrical wiring, and illumination.

Course Outcomes: After learning this course the students will be able to

1. Apply knowledge of basic concepts of work, power, energy for energy conversion and calculate current in electrical network using Kirchhoff's laws.
2. Calculate response of electrical circuit using network theorems.
3. Define basic terms of single phase and three phase ac circuits and supply systems.
4. Describe construction, principle of operation, specifications and applications of capacitors and batteries
5. Describe and apply fundamental concepts of magnetic and electro-mechanics for operation of single-phase transformer.
6. Describe illumination, types of wiring and earthing system.

UNIT – I **6 Hours**

Introduction: Concept of EMF, Potential difference, voltage, current, resistance. Fundamental linear passive and active elements to their functional current-voltage relation, Terminology and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT – II **6 Hours**

DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyze the network (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

UNIT III **6 Hours**

AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Y-Δ & Δ-Y).

UNIT – IV **6 Hours**

Electrostatics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Principle of batteries, types, construction and working, application.

UNIT – V **6 Hours**

Electro-Mechanics: Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Magnetic material and B-H Curve, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, losses in transformer, efficiency and regulation, Determination of Efficiency & Regulation by direct load test, Electromechanical energy conversion

UNIT – VI **6 Hours**

Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems(Current & Single-phase power), Basic concept of indicating and integrating instruments, Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED),Necessity of earthing, Types of earthing, Safety devices & system.

List of Assignments:

Respective subject teacher shall design minimum six assignments on above units.

List of Laboratory Exercises:

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits.
2. Determination of resistance temperature coefficient
3. Verification of Superposition Theorem
4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Kirchhoff's Laws
7. Verification of Maximum power transfer Theorem
8. Simulation of Time response of RC circuit
9. Study of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$
10. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
11. Direct loading test on Single phase transformer
12. a) Voltage and current ratios.
    b) Efficiency and regulations.
13. Demonstration of measurement of electrical quantities in DC and AC systems.

List of Project Based Learning Topics:

Student shall demonstrate minimum one concept based on syllabus topic.

1. Demonstration of conversion of energy.
2. Study and understand practical specifications of transformer.
3. Demonstration of electrostatics and understand practical specifications of batteries.
4. Demonstration of phenomenon of electromagnetic induction.
5. Demonstration of electromagnetism, electro mechanics and their applications by using professional software tool.

6. Development of practical kits for understanding different theorems related to electrical circuits. (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem, Superposition theorem etc.)
7. Demonstration of illumination system.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

8. Demonstration of distribution system.
9. Study and understand safety practices in electrical system.
10. Study and understand electrical earthing system.

Textbooks:

1. Electric Machinery,(Sixth Edition) A.E. Fitzgerald, KingselyJr Charles, D. Umans Stephen, Tata McGraw Hill.
2. A Textbook of Electrical Technology,(vol. I),B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt& Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.
5. Edward Hughes – "Electrical Technology"- Seventh Edition, Pearson Education Publication
6. H. Cotton – "Elements of Electrical Technology", C.B.S. Publications
7. John Omalley Shawn – "Basic circuits analysis" McGraw Hill Publications
8. Vincent Del Toro – "Principles of Electrical Engineering", PHI Publications

PRINCIPLES OF ELECTRICAL ENGINEERING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Theory:3 Hours / Week	**End Semester Examination:**	**60 Marks**	**Theory:3 Credits**
Practical:2 Hours / Week	**Internal Assessment:**	**40 Marks**	**Practical:1 Credit**
	Term Work:	**25 Marks**	**Total:4 Credits**
	Total:	**125 Marks**	

Course Pre-requisites:

The students should have knowledge of Mathematics, physics.

Course Objectives:

The course introduces fundamental concepts of DC and AC circuits, Electrostatics electromagnetism, transformer, electrical wiring, and illumination.

Course Outcomes: After learning this course the students will be able to

7. Apply knowledge of basic concepts of work, power, energy for energy conversion and calculate current in electrical network using Kirchhoff's laws.
8. Calculate response of electrical circuit using network theorems.
9. Define basic terms of single phase and three phase ac circuits and supply systems.
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AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C,RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form, concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase Balanced AC Circuits (Y-Δ & Δ-Y).

UNIT – IV **6 Hours**

Electrostatics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors, Principle of batteries, types, construction and working, application.

UNIT – V **6 Hours**

Electro-Mechanics: Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Magnetic material and B-H Curve, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, losses in transformer, efficiency and regulation, Determination of Efficiency & Regulation by direct load test, Electromechanical energy conversion

UNIT – VI **6 Hours**

Measurements and Sensors: Introduction to measuring devices/sensors and transducers (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems(Current & Single-phase power), Basic concept of indicating and integrating instruments, Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Different types of lamps (Incandescent, Fluorescent, Sodium Vapour, Mercury Vapour, Metal Halide, CFL, LED),Necessity of earthing, Types of earthing, Safety devices & system.

List of Assignments:

Respective subject teacher shall design minimum six assignments on above units.

List of Laboratory Exercises:

1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits.
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4. Verification of Thevenin's Theorem
5. Verification of Norton's Theorem
6. Verification of Kirchhoff's Laws
7. Verification of Maximum power transfer Theorem
8. Simulation of Time response of RC circuit
9. Study of R-L-C series circuits for $X_L > X_C$, $X_L < X_C$ & $X_L = X_C$
10. Verification of relation in between voltage and current in three phase balanced star and delta connected loads.
11. Direct loading test on Single phase transformer
12. a) Voltage and current ratios.
    b) Efficiency and regulations.
13. Demonstration of measurement of electrical quantities in DC and AC systems.

List of Project Based Learning Topics:

Student shall demonstrate minimum one concept based on syllabus topic.

1. Demonstration of conversion of energy.
2. Study and understand practical specifications of transformer.
3. Demonstration of electrostatics and understand practical specifications of batteries.
4. Demonstration of phenomenon of electromagnetic induction.
5. Demonstration of electromagnetism, electro mechanics and their applications by using professional software tool.

6. Development of practical kits for understanding different theorems related to electrical circuits. (Thevenin's theorem, Norton's Theorem, Maximum Power Transfer theorem, Superposition theorem etc.)
7. Demonstration of illumination system.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

8. Demonstration of distribution system.
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2. A Textbook of Electrical Technology,(vol. I),B. L. Theraja, Chand and Company Ltd., New Delhi.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and Kothari, Prentice Hall of India Pvt. Ltd.

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2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge University Press.
3. Engineering Circuit Analysis, William H. Hayt& Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals of Electrical and Electronics Engineering,Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.
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6. H. Cotton – "Elements of Electrical Technology", C.B.S. Publications
7. John Omalley Shawn – "Basic circuits analysis" McGraw Hill Publications
8. Vincent Del Toro – "Principles of Electrical Engineering", PHI Publications

BUSINESS COMMUNICATION & VALUE SCIENCE-I

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures:2 Hrs./Week	**Term work: 25 Marks**	**Theory: 2 Credits**
Practical:2 Hrs./Week	**Oral: 25 Marks**	**Practical: 1 Credit**
	Total: 50 Marks	**Total: 3 Credits**

Course Prerequisites: -

1. Students should have knowledge of Basic English grammar
2. Students should have basic information of sound system of English language
3. Basics of written communication

Course Objective: -

The course objective of Business Communication & Value Science-I aims to augment student's overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals. The English language topics for this semester focus on the development of basic fluency in English, usage of words and introduce them to the concept and importance of interpersonal skills so as to effectively present their personalities. Understand what life skills are and their importance in leading a happy and well-adjusted life. Motivate students to look within and create a better version of self.

Course Outcomes: -

Graduates will be able to:

1. Recognize the need for life skills, values and own strengths and opportunities and apply the life skills to different situations
2. Understand and apply applications of sounds of English language for correct pronunciation
3. Construct the error free sentences of English language and do implementation of it in the spoken and written business communication
4. Understand communication process and principles to do applications in professional communication
5. Build up the ability to study employment professional communication skills and its proper implications
6. Recognize the core of professional skills and apply them for future venture through activities

Unit 1 Skills and Values and Basics of Grammar: 6 Hours

Recognize the need for life skills and values, **Overview of LOL** (include activity on introducing self), **Self-awareness** – identity, body awareness, forms of tense, articles, preposition, use of auxiliaries and modal auxiliaries, common errors.

Unit II Vocabulary/Phonetics/study of sounds in English: 6 Hours

Vocabulary development through GRAPS-PT, types of sentences voice, direct indirect speech, degree of comparison, Introduction to phonetics, study of speech organs, study of phonetic script, transcriptions of words, articulation of different sounds in English

Unit III Honing Spoken Communication: 6 Hours

Situational conversation, Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening, building team, team communication dynamics

Unit IV Communication Skills 6 Hours

Introduction, forms and function of communication process, non-verbal codes in communication, barriers to communication and overcoming them, digital communication

Unit V Mechanics of Written Communication 6 Hours

Principles of effective writing, Email writing, technical report writing, format, structure and its types, real time report writing, create a podcast on an interested topic, create a musical using the learnings from unit

Unit VI Skill allied to professionalism: 6 Hours

Introduction to professional skills, overview of leadership, dealing with ambiguity, Time management, Pareto Principle (80/20) Rule in time management, Time management matrix, creativity and result orientation, working under pressure, stress management.

List of Laboratory Exercises:

01. Presentation on favourite cricket captain in IPL and the skills and values they demonstrate
02. Learning Vocabulary through activity
03. Self-work with immersion – interviews a maid, watchman etc.
04. Write a newspaper report on an IPL match
05. Expressing self, connecting with emotions, visualizing and experiencing purpose
06. Evaluation on Listening skills – listen to recording and answer questions based on them
07. Written Communication: Summary writing, story writing
08. Understanding Life Skills: Movie based learning-**Pursuit of Happiness**.
09. Multiple Intelligences, Embracing diversity – Activity on appreciation of diversity
10. Life skill: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation etc.

Project: 01 Create a podcast on a topic that will interest college students

02 Create a musical using the learnings from the whole course

List of Project Based Learning Topics:

01. Communication Origami
02. Preparing a model for the LOL activity
03. Investigating values around you and imbibing
04. Vocabulary: play-way method by using cards
05. Investigating into linguistic by creating models
06. Interviewing your role model for situational conversation
07. Honing LSRW: Preparing a model on each skill
08. Knowing body language: Making a video of professional presentation
09. Preparing a model of report writing (preferably real time report)
10. Analysis of Pareto Principle for Time Management
11. Creating a model of Leadership styles and their functions
12. Analysis of Time Management Matrix for effective time Management

Reference Books:

1. Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition,
2. Spoken English- A manual of Speech and Phoonetics by R. K. Bansal, J. B. Harrison published by Orient Blackswan
3. Communication Skills by Sanjay Kumar, PushpLata, published by Oxford University press, second edition
4. Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
5. Developing Communication Skills by Krishna Mohan, MeeraBanerji published by Macmillan India Pvt Ltd

Recommended web-links for enhancing English language and business communication

1. http://www.bbc.co.uk/worldservice/learningenglish
2. http://www.englishlearner.com/tests/test.html

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

COMPUTER AIDED DRAWING & DESIGN

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT CHEME	
Practical:	**2 Hours/Week**	**Term Work:**	**25 Marks**	**Practical:**	**1**
		Practical:	**25 Marks**		
Total	**2 Hours/Week**	**Total:**	**50 Marks**	**Total:**	**1**

Prerequisite:
Basics of programming skill

Course Objective:
1. To have the knowledge of Orthographic and Isometric projections
2. To understand the basic principles of Engineering drawing
3. To have the knowledge of different AutoCAD commands
4. To understand the algorithm for generating different entities on the screen

Course Outcomes: On completion of the course, students will have the ability to:
1. Prepare and understand drawings
2. Use the principles of orthographic projections
3. Use the principles of Isometric projections
4. Able to draw simple drawing using AutoCAD
5. Generate the line by highlighting the pixels
6. Fill the polygon

Unit I **04 Hours**

Orthographic Projection

Dimensioning and conventions strictly as per SP 46:2003 (Revised). Orthographic projection of right regular solids such as cube and prism. Orthographic projection of simple machine blocks

Unit II **04 Hours**

Isometric Projections

Introduction, Isometric axes, Lines & planes, Isometric scale, Isometric projection and Isometric view, Conversion of Isometric to Orthographic Projections

Unit III **04 Hours**

Introduction to AutoCAD

Getting Started with AutoCAD. Line, polyline, Circle, arc Rectangle, polygon Ellipse, Elliptical arc, spline, Xline, Ray, Points Measure, Divide, Region Wipeout, Helix, Donut

Unit IV **04 Hours**

AutoCAD Modify Tools and Dimensioning

Move, copy, Rotate, scale Stretch, fillet, chamfer Erase, offset, explode Array, polar Array, path array Trim, extend, mirror. Annotations Dimensions, dimension setting Linear dimension, Aligned dimension Angular dimensions, arc length, Radius Diameter

Unit V **04 Hours**

Line Drawing Algorithm

The Digital Difference Analyser (DDA) algorithm to draw lines on a screen. Interpolation points based on the difference between the start and end points. Bresenham Line Drawing Algorithm. Numerical examples.

Unit VI **04 Hours**

Flood Fill Algorithm

Concept of seed point, four connected approaches and eight connected. Boundary colour and fill colour. Filling of different polygon.

Textbooks:

1. **"**Elementary Engineering Drawing" by Bhatt, N.D., Charotar publishing Co.
2. "Engineering Graphics" by K.L. Narayana and P.Kannaiah, SCITECH PUBLICATIONS (INDIA) PVT.LTD. October 2008
3. "Engineering Graphics with AutoCAD", D. M. Kulkarni, A. P. Rastogi, and A. K. Sarkar (2009), PHI Learning Private Limited, New Delhi.
4. "Engineering Drawing: With an Introduction to CAD," Jolhe, Dhananjay (2006), Tata Mc Graw Hill, India

List of Laboratory Exercise:

1. Drawing to half imperial size sheet with instruments. Drawing illustrating basic concepts of Orthographic projections and dimensioning.
2. From the given three views draw isometric
3. Introduction to AutoCAD. Student should get familiarise with the GUI of the software.
4. Commands for drawing basic entities
5. AutoCAD Modify Tools and Dimensioning
6. Digital Difference Analyser (DDA) algorithm
7. Bresenham Line Drawing Algorithm
8. Flood Fill Algorithm

B. TECH (Computer Science & Business Systems)

SEMESTER – II

COURSE SYLLABUS

LINEAR ALGEBRA

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures:3Hrs./Week	**Semester Examination: 60 marks**	**Theory:3 Credits**
Practical:2Hr./Week	**Internal Assessment: 40 marks**	**Practical :1 credit**
	Term Work : 25 Marks	**Total:4 Credits**
	Total: 125 Marks	

Course Pre-Requisites:

The students should have basic Knowledge of high school math, Boolean Algebra, and calculus.

Course Objective:

Todevelop ability to use the mathematical techniques, skills, and tools necessary for computer science.

Course Outcomes:

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

1. Apply knowledge of basics of Matrices, Determinants.
2. Solve the consistency of any type of systems.
3. Describe Vector space, Orthogonality and Projection.
4. Apply methods Gram-Schmidt orthogonalization and QR decomposition.
5. Calculate Eigenvalues and Eigenvectors.
6. Describe Singular value decomposition and Principal component analysis.

UNIT – I **6 Hours**

Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.

UNIT – II **6 Hours**

Vectors and linear combinations, Rank of a matrix, Gaussian elimination, LU Decomposition, Solving Systems of Linear Equations using the tools of Matrices.

UNIT – III **6 Hours**

Vector space, Dimension, Basis, Orthogonality, Projection.

UNIT – IV **6 Hours**

Gram-Schmidt orthogonalization and QR decomposition.

UNIT – V **6 Hours**

Eigenvalues and Eigenvectors, Positive definite matrices, Linear transformations, Hermitian and Unitary matrices.

UNIT – VI **6 Hours**

Singular value decomposition and Principal component analysis, Introduction to their applications in Image Processing and Machine Learning.

List of Assignments:

Assignments & tutorials covering the following: Vectors and linear combinations, Matrices, Determinants, Linear transformations, Complete solution to AX=b, Eigenvalues and Eigenvectors.

List of Project Based Learning Topics:

Students are expected prepare report on any one topic, write its definition, applications and illustrate with few examples. Also, write pseudo code for it, wherever applicable.

1. Cramer's rule
2. System of linear equations solution
3. Rank of matrix
4. Gauss elimination
5. LU-decomposition method
6. Dimension and basis
7. Gram Schmidt Orthogonalization
8. QR decomposition
9. Single value decomposition
10. Principal component analysis
11. Eigen values and eigen vectors
12. Hermitian and unitary matrices
13. Positive definite matrices
14. Image processing
15. Machine learning

Textbook:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi.

Reference Books:

1. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil.
2. Advanced Engineering Mathematics, 2e, by M. D. Greenberg, Pearson Education.
3. Introduction to linear algebra, 5^{th} Edition, Gilbert Strang.
4. Applied Mathematics (Volumes I and II) by P. N. Wartikar& J. N. Wartikar, Pune VidyarthiGrihaPrakashan, Pune.
5. Digital Image Processing,R C Gonzalez and R E Woods.
6. https://machinelearningmastery.com/introduction-matrices-machine-learning/

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

STATISTICAL METHODS& MODELLING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures:4 Hrs/Week	**Semester Examination:**	**60 marks**	**Theory:4 Credits**
Practical:2 Hrs/week	**Internal Assessment:**	**40 marks**	**Practical:1 Credit**
	Term Work:	**25 Marks**	**Total:5 Credits**
	Total:	**125 Marks**	

Course Pre-requisites:
Basic of statistics and probability, Basic programming experience (in any language).

Course Objective:
The course introduces fundamental concepts of linear statistical models, estimation methods, hypothesis testing and fundamental concepts of programming in R.

Course Outcomes:
The students completing this course will be able to

1. Understand the basic concepts of Statistical Inference,
2. Understand the basic concepts of Estimation methods,
3. Understand the basic concepts of Hypothesis Testing
4. Understand the basic concepts of linear statistical models.
5. Understand Introductory R language fundamentals, basic syntax and how to use R; what R is and how it's used to perform data analysis.
6. Understand major R data structures and create visualizations using R.

UNIT – I **6 Hours**

Sampling Techniques: Random sampling. Sampling from finite and infinite populations. Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling

UNIT – II **6 Hours**

Linear Statistical Models: Scatter diagram. Linear regression and correlation. Least squares method. Rank correlation. Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions. Multiple correlation, Analysis of variance (one way, two way with as well as without interaction)

UNIT – III **6 Hours**

Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.

UNIT – IV **6 Hours**

Test of hypothesis: Concept & formulation, Type I and Type II errors, Neyman Pearson lemma, Procedures of testing

UNIT – V **6 Hours**

Non-parametric Inference: Comparison with parametric inference, Use of order statistics. Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test**.**

UNIT – VI **6 Hours**

Basics of Time Series Analysis & Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

List of Assignments:
Problem sets to be shared by faculty covering the following topics:Estimation Methods: Parametric & Non – Parametric, Hypothesis Testing

List of Laboratory Exercises:

R statistical programming language: Introduction to R, Functions, Control flow and Loops, Working with Vectors and Matrices, Reading in Data, Writing Data, Working with Data, Manipulating Data, Simulation, Linear model, Data Frame, Graphics in R

List of Project Based Learning Topics:

Project Based learning topics:

Students are expected prepare report on any one topic, write its definition,applications and analyze the hypothetical data. Also, write pseudo code for it, wherever applicable.

1. Random Sampling
2. Stratified random sampling
3. Linear regression
4. Rank correlation
5. Method of least squares
6. Multiple correlation
7. One way analysis of variance
8. Two way analysis of variance
9. Estimation
10. Maximum likelihood estimation
11. Testing of hypothesis
12. Types of errors
13. Nonparametric tests
14. Time series
15. Forecasting

Textbooks:

1. Probability and Statistics for Engineers (4th Edition) - I.R. Miller, J.E. Freund and R. Johnson.
2. Fundamentals of Statistics (vol. I and vol. II) - A. Goon, M. Gupta and B. Dasgupta.
3. Hands-on Programming with R - Garrett Grolemund
4. R for Everyone: Advanced Analytics and Graphics - Jared P. Lander

Reference Books:

1. Statistical Theory with Engineering Application - A. Hald.
2. Statistical Methods - G.W. Snedicor and W.G. Cochran.
3. Statistical Concepts & Methods - G.K. Bhattacharyya and R.A. Johnson.
4. Introduction to Linear Regression Analysis - D.C. Montgomery &E.Peck
5. Introduction to the Theory of Statistics - A.M. Mood, F.A. Graybill& D.C. Boes.
6. Practical Non-Parametric Statistics - W.J. Conover
7. Applied Regression Analysis - N. Draper & H. Smith

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

DATA STRUCTURES AND ALGORITHMS

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures:4 Hrs./ Week	**Semester Examination:**	**60 Marks**	**Theory:4 Credits**
Lab:2 Hrs./ Week	**Internal Assessment:**	**40 Marks**	**Practical:1 Credits**
	Term work:	**25 Marks**	**Total:5 Credits**
	Practical:	**25 Marks**	
	Total:	**150 Marks**	

Course Pre-Requisites:

Students should have knowledge of Fundamentals of data types and programming concepts

Course Objective:

The course is aimed to provide an understanding of key concepts underlying the choice and implementation of data structures, algorithms and step by step approach in solving problems with the help of these fundamental data structures.

Course Outcomes:

Students will be able to:

1. Understand the fundamentals and analysis of algorithms
2. Implement Linear data structures
3. Implement Non-Linear data structure of Trees.
4. Implement Non-Linear data structure of Graphs.
5. Implement the sorting algorithms
6. Understand the concepts of different file system organisation.

UNIT – I **6 Hours**

Basic Terminologies & Introduction to Algorithm and Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

UNIT – II **6 Hours**

Linear Data Structure: Array, Stack, Queue, Linked list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT – III **6 Hours**

Non-linear Data Structure Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree), Various Representations, Operations: search and traversal algorithms and complexity analysis Applications of Trees.

UNIT – IV **6 Hours**

Non-linear Data Structure Graphs: Graphs: Directed and Undirected, Various Representations

Operations: Search and traversal algorithms and complexity analysis

Applications of Graphs.

UNIT – V **6 Hours**

Searching and Sorting: Sequential Search, Binary Search, Breadth First Search, Depth First Search, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heap Sort, Introduction to Hashing

UNIT – VI **6 Hours**

File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Trees with all operations.
4. All graph algorithms.
5. Saving / retrieving non-linear data structure in/from a file

List of Project Based Learning Topics:

1.Create an appropriate data structure for student data and result representation. Provide operations on these structures.
2. Develop a string reverser using stack. The stack operations called herein should be defined in file other than the reverser.
3. Develop a polynomial multiplier. The polynomials should be stored using linked lists.
4. Develop a phonebook using double linked list.
5. Demonstrate the bubble sort technique on doubly linked list.
6. Develop a two way threaded binary tree with its traversals.
7. Develop a customer database using direct access file which provides functions to read, write, modify, add and search records.
8.Write students information to a sequential file. Extract these records and construct a binary search tree out of these records. Use any parameter of the information for search/arranging criteria.
9.Develop a file merge application. It should have provision to create new files or add records to existing files. Any selected two or more files should be merged into a single new one.
10. Convert a graph representation using adjacency matrix to represent the same using adjacency list.

Textbooks:

1. Fundamentals of Data Structures, E. Horowitz and S. Sahni, 1977.
2. Data Structures and Algorithms, Alfred V. Aho, John E. Hopperoft, Jeffrey D. UIlman

Reference Books:

1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Open Data Structures: An Introduction (Open Paths to Enriched Learning)), 31st ed. Edition , Pat Morin

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

PRINCIPLES OF ELECTRONICS ENGINEERING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures:3 Hrs/Week	Semester Examination:	60 Marks	Theory:3 Credits
Practical:2 Hrs/ Week	Internal Assessment:	40 Marks	Practical :1 Credit
	Term Work:	25 Marks	Total:4 Credits
	Oral :	25 Marks	
	Total:	150 Marks	

Course Pre-Requisites:

The students should have knowledge of Class XII level Electronics, Physics & Mathematics

Course Objective:

The course introduces fundamental concepts of electronics

Course Outcomes:

Students will be able to,

1. Identify semiconductor materials, draw band-diagrams and distinguish between intrinsic and extrinsic semiconductors.
2. Explain the phenomenon of rectification, draw the I-V characteristics and calculate ripple factor.
3. Explain the I-V characteristics of BJTs: Input and output, learn to bias transistors as an amplifier.
4. Describe FET and MOSFET and differentiate between BJT, FET and MOSFET.
5. Explain the fundamentals of feedback amplifiers, Oscillators and Operational Amplifier.
6. Demonstrate the knowledge of Boolean algebra including simplification techniques and operation of basic types of flip-flops.

UNIT – I **6 Hours**

Semiconductors: Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers.

UNIT –II **6 Hours**

Diodes and Diode Circuits: Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

UNIT – III **6 Hours**

Bipolar Junction Transistors: Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor.

UNIT – IV **6 Hours**

Field Effect Transistors: Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles

UNIT – V **6 Hours**

Feed Back Amplifier, Oscillators and Operational Amplifiers: Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator.

UNIT – VI **6 Hours**

Digital Electronics Fundamentals: Difference between analog and digital signals, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

List of Assignments: -

1. Describe applications of diodes as Clippers and Clampers.
2. Describe application of Zener diode as Voltage regulator.
3. Study of characteristic curves for CB configuration of BJT using Virtual Lab.
4. Simulation of BJT amplifier using Virtual Lab.
5. Design and Implementation of Various Arithmetic Circuits using Virtual Lab.
6. To design, built and test any electronic circuit (Group activity)/ Presentation on any Electronic circuit application.

List ofLaboratory Exercises:

1. To plot V-I characteristics of PN junction diode.
2. To plot regulation characteristics of half wave rectifier
3. To plot regulation characteristics of Full wave rectifier
4. To plot input-output characteristics of CE configuration of BJT.
5. To study Biasing techniques of BJT- to find stability factor of selfbias, collector to base bias, fixed bias circuits.
6. To plot frequency response of single stage FET amplifier (CS/CD configuration) and find its bandwidth.
7. To study Colpitts Oscillator.
8. Study of OP-AMP circuits: Inverting and Non-inverting Amplifier.
9. Implementation and verification of DeMorgan,s theorem .
10. Implementation and verification of half adder and full adder.

List of Project Based Learning Topics:

1. Water Level Indicator.
2. LED Emergency Light.
3. Security control System
4. AC to DC converter.
5. Automatic Street Light controller
6. Rain Alarm system.
7. Flashing LED
8. Dancing Light
9. Voltage regulator using Zener diode.
10. Amplifier using Op-Amp.

11. JFET as an analog switch.
12. BJTs as a digital switch.
13. Sine wave generator
14. Adder/ Subtractor circuit
15. Up/Down counter

Textbooks:

1. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press.
2. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education.
3. Digital Logic & Computer Design, M. Morris Mano, Pearson

Reference Books:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad, Louis Nashelsky.
2. Solid State Electronic Devices, 6th Edition, Ben Streetman, Sanjay Banerjee
3. Electronic Principle, Albert Paul Malvino.
4. Electronics Circuits: Discrete& Integrated, D Schilling C Belove T Apelewicz R Saccardi.
5. Microelectronics, Jacob Millman, Arvin Grabel.
6. Electronics Devices & Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj
7. Electronic Devices & Circuit Theory, 11th Edition, Robert L. Boylestad, Louis Nashelsky

FUNDAMENTALS OF ECONOMICS

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures:3 Hrs/Week	**Semester Examination:60 marks**	**Theory: 3 Credits**
	Internal Assessment: 40 marks	**Total: 3 Credits**
	Total: 100 Marks	

Course Pre-Requisites:

Knowledge of Class XII level Mathematics

Course Objective:

1. To impart knowledge, with respect to concepts, principles of Economics, which govern the functioning of a firm/organization.
2. To explain the students about concept of production, cost, national income, an aggregate supply and aggregate demand consumption.

Course Outcomes:

After completing this course, students should be able to:
1. Demonstrate an understanding of the methods and principles of microeconomic and macroeconomic theory, including tradeoffs, opportunity costs, and marginal decision making.
2. Explain how markets work and how market prices are determined using principles of supply and demand.
3. Assess the impact of market failure such as externalities, and public goods and evaluate possible public policy remedies.
4. Analyze financial markets and investments, including the stock market, and their relation to the economy.
5. Evaluate key economic indicators (including GDP, unemployment, inflation) and their use in evaluating macroeconomic conditions.
6. Understand major macroeconomic tools, including fiscal and monetary policies, and their use in managing the economy. Also apply ethical principles in a variety of economic contexts.

UNIT – I **6 Hours**

Microeconomics

Principles of Demand and Supply – Supply Curves of Firms – Elasticity of Supply Demand Curves of Households – Elasticity of Demand Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve) Welfare Analysis – Consumers' and Producers' Surplus – Price Ceilings and Price Floors

UNIT –II **6 Hours**

Consumer Behaviour – Axioms of Choice – Budget Constraints and Indifference Curves Consumer's Equilibrium – Effects of a Price Change, Income and Substitution Effects – Derivation of a Demand Curve,Applications – Tax and Subsidies – Intertemporal Consumption – Suppliers' Income Effect

UNIT – III **6 Hours**

Theory of Production – Production Function and Iso-quants – Cost Minimization Cost Curves – Total, Average and Marginal Costs – Long Run and Short Run Costs, Equilibrium of a Firm Under Perfect Competition Monopoly and Monopolistic Competition

UNIT – IV **6 Hours**

Macroeconomics

National Income and its Components – GNP, NNP, GDP, NDP Consumption Function Investment Simple Keynesian Model of Income Determination and the Keynesian Multiplier

Government Sector – Taxes and Subsidies External Sector – Exports and Imports

UNIT – V **6 Hours**

Money – Definitions, Demand for Money – Transitionary and Speculative Demand

Supply of Money – Bank's Credit Creation Multiplier, Integrating Money and Commodity Markets – IS, LM Model, Business Cycles and Stabilization – Monetary and Fiscal Policy – Central Bank and the Government.

UNIT – VI **6 Hours**

The Classical Paradigm – Price and Wage Rigidities – Voluntary and Involuntary Unemployment.

List of Assignments: -

In the discussion topics mentioned above, students should be asked to prepare in advance in groups and present in class.

List of Project Based Learning Topics:

1. Types of markets (Monopoly, Monopolistic, Perfect Competition) and their real time examples in the economy.
2. Fiscal and Monetary Policy of India.
3. Concept of Price Ceilings and Price Floors and it's practical working in the economy.
4. Elasticity of Demand and it's types.
5. Elasticity of Supply and it's types.
6. Types of Costs in a Firm.
7. Money and it's demand
8. Understanding Credit Creation by banks using real time data from various banks.
9. Studying Unemployment and its types and the type of unemployment prevailing in India.

Textbooks:

1. Microeconomics- Pindyck, Robert S., and Daniel L. Rubinfeld Microeconomics
2. Macroeconomics- Dornbusch, Fischer and Startz

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

BUSINESS COMMUNICATION & VALUE SCIENCE – II

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures:2 Hrs/Week	**Term work: 25 Marks**	**Theory: 2 Credits**
Practical:2 Hrs/ Week	**Oral: 25 Marks**	**Practical: 1 Credits**
	Total: 50 Marks	**Total: 3 Credits**

Course Prerequisites: -

Basic knowledge of the parts of speech in English.
Vocabulary covered in the previous semester along with basic knowledge of verbs & adverbs.
Basic awareness of the need of speaking skills within social circle.
The elements of team dynamics done during the previous semester with proper application and basic awareness of the concepts of feedback, criticism.
The various common conflicts that may arise at varied situations

Course Objective: -

The course objective of Business Communication & Value Science-I aims to augment student's overall communication and interpersonal skills by engaging them in group activities and thus aid in helping them to emerge as professionals. The soft skills topics for this semester are intended to develop student's expertise on public speaking skills and to deal positively with criticism and to effectively present their personalities

Course Outcomes: -

Graduates will able to:

1. To understand the concept of soft skills, Business Values and its implication at workplace
2. To construct the error free sentences of English language and develop proper reading Skills for Oral and written business communication
3. To develop team building and leadership skills by applying motivational factors
4. To construct effective business presentation and do effective implementation of it through activities
5. To inculcate appropriate business ethics and etiquettes for effective professionalism
6. To understand the concept of Diversity and Inclusion and its application at workplace

Unit I Importance of Soft skills and Values Sciences: 6 Hours

Soft skills, meaning, need and importance, difference between soft skills and hard skills, life skills and personal skills, applying soft skills across culture values of a good manager, Respect for Individual and Integrity. Importance of Ethics and Values in Business World.

Unit II Enhancing Writing and Reading Skills: 6 Hours

Good and Bad Writing. Common errors, punctuation rules, use of words Formation of an E-magazine, Blog writing, writing notice, agenda and Minutes of meeting, Introduction to skimming and scanning Techniques of Good Reading, Bad reading Habits

Unit III Developing interpersonal skills: 6 Hours

Team Building Skills, Team dynamics, Types of teams Classification of teams, Bruce Tuckman's Team Building Model, Challenges and Remedies of Team Development Belbin's 8 Team Roles and Lindgren's Big 5 personality traits. Belbin's 8 team player styles Leadership Skills: Good Leadership Skills, Difference between Leadership and Management Defining Qualities and Strengths of leadership

Unit IV Public Speaking and Presentation Skills: 6 Hours

Public Speaking: fundamentals of effective public speaking, types- Extempore speech, manuscript speech, and ways to enhance public speaking skills, storytelling, oral review Power Point presentations, Effective ways to structure the presentation, importance of body language Group discussion, interview skills

Unit V Corporate / Business Etiquettes: 6 Hours

Corporate grooming & dressing, etiquettes in social & office Setting-Understand the importance of professional behaviour at the workplace, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting. Importance of first impression, Grooming

Unit VI Diversity and Inclusion: 6 Hours

Concepts**,** Advantages and Disadvantages, Different forms of Diversity in our society. Socio-Cultural and Cross-Cultural Sensitivities at the Workplace: PWD and LGBT at the workplace, learning disabilities at the workplace; Caste, class, regionalism, religion and poverty: the different identities of Indian employees and employers and how to include everyone; Global diversity identities of race, religion, nationhood; Appropriate Social Media Use

List of Laboratory Exercises:

1) Join Hands Movement'. Individual identification of social Issues
2) SATORI – Participants share the personal take away acquired from GD, writing and reading skills activities captured in their handbook
3) Form an NGO. Create Vision, Mission, Value statement, tagline and Design a logo.
4) Plan and design an E Magazine.
5) Lucid Writing, Catherine Morris and Joanie McMahon's writing techniques.
6) Speed Reading session: Introduction to skimming and scanning; practice the same.
7) Design a skit- a) write the script articulating the message of their respective NGOs. Read out the script. (Skit time-5 minutes).
8) Promote the play through a social media and gather your audience. Enact the play. Capture the numbers of likes and reviews
9) Team Falcon Practical to identify individual personality traits with Belbin's 8 team player styles
10) Ten minutes of your time – a short film on diversity. Play the video, Discuss the concept of empathy
11) Touch the target (Blind man) - Debriefing of the Practical. Film: "The fish and I'' by Babak Habibifar"
12) To create a story – 10 minutes of a person's life affected by the social issue groups
13) Research on a book, incident or film based on the topic of your respective NGO and Discuss
14) Interviews of people from diverse groups (Ask 5 questions). Share the recordings in FB
15) Prepared speech- Every student will narrate the challenges faced by a member of a diverse group in 4 minutes (speech in first person)
16) Discussion on TCS values, Respect for Individual and Integrity.

Project: 01 Form an NGO with a social cause in a group and make an awareness among people by doing different activities

List of Project Based Learning Topics:

1. Analysing difference between Soft Skills and Hard skills
2. Preparing a model for evaluating Values and Ethics of Good Managers
3. Developing Reading and writing Skills: Preparing a model on each skill
4. Form a model for communicative writing which avoid grammar mistakes and common errors
5. Develop Bruce Tuchman's Team Building Models with classmates/Teammates
6. Analysing difference between Leadership and Management skills
7. Watch and listen the best videos of Good Public Speaker s and list out their Qualities and Attributes
8. Knowing body language and Paralinguistic Features for the Presentation: Making a video of professional presentation

9. Visit one nearest origination/Firm and find out what etiquettes and mannerism are being used there that enhance the capacity of their work place
10. Preparing a model of dress codes and attire for different professional situations
11. Analysing the major aspects of diversity and inclusion in the workplace
12. Creating a good model for increasing diversity and enhancing the proper inclusion that will help in achieve the goal of the origination effectively
13. Analysing markers of global identities for inclusive work culture

Reference Books:

1. Business Communication Today by Bovee, Thill, Raina
2. Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition,
3. Spoken English- A manual of Speech and Phoonetics by R. K. Bansal, J. B. Harrison published by Orient Blackswan
4. Communication Skills by Sanjay Kumar, PushpLata, published by Oxford University press, second edition
5. Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
6. Developing Communication Skills by Krishna Mohan, MeeraBanerji published by Macmillan India Pvt Ltd
7. Strategic Communication by Charles Marsh
8. English vocabulary in use – Alan Mc'carthy and O'dell
9. Business Communication – Dr.SarojHiremath

Web References:

01. Ethics fundamentals and approaches to ethics
    https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
02. A Framework for Making Ethical Decisions
    https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions
03. Five Basic Approaches to Ethical Decision-
    http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

COMPUTER WORKSHOP TECHNOLOGY

TEACHING SCHEME		EXAMINATION SCHEME		CREDIT SCHEME	
Practical:	**2 Hours/Week**	**Term Work:**	**25 Marks**	**Practical:**	**1**
		Practical:	**25 Marks**		
Total	**2 Hours/Week**	**Total:**	**50 Marks**	**Total:**	**1**

Course Objective:
To acquire the knowledge of basic manufacturing processes used in computer engineering technology

Prerequisite:
Basics of Engineering materials. Basics of computer and laptop.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand the basics parts used in the computer and laptop.
2. Understand fundamental concepts of assembly of electronics components (PCB).
3. Understand the various joining processes
4. Develop plastic moulding component used in computer engineering.
5. Developing the component used in computer engineering by use of 3D printing technology.
6. Understand the knowledge of making fasteners used for computer and laptop.

Unit I **04 Hours**

Assembly of Computer: Introduction to hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation of processors. Working of SMPS. Study of various ports. Steps and precautions to assemble computer, Tools used in computer hardware

Unit II **04 Hours**

Printed Circuit Boards Assembly (PCB): Study of joining processes, Resistance welding and Soldering processes, why and how flux, tip tinner, solder wick, and post-soldering cleaners are used in the hand soldering process. Laser welding, orbital welding. Advantages and disadvantages of welding processes.

Unit III **04 Hours**

CPU Cabinet Manufacturing Process: Introduction to machines in sheet metal Industry: shearing machine, bending machine, circular profile cutting machines. Different types of sheet metal folds. Rivets and its different parts, selection of rivet heads, types of rivets and its uses. Punching, blanking, shearing, bending, and piercing.

Unit IV **04 Hours**

Plastic Molding Process: Introduction to plastic molding. Types of plastics. Types of plastic molding. Exercise on plastic molding machine ,manufacturing of plastic moulded job.

Unit V **04 Hours**

3D Printing Technology: Introduction to Additive Manufacturing, Need for Additive Manufacturing, Generic AM process, Classification of AM Processes, 3D Printing process. Steps in AM process, Advantages of AM, Major Applications

Unit VI **04 Hours**

Study of Machining Processes: Introduction to machining processes, Different types of turning and grinding operations, by using turning operations making of simple fastener used in computer engineering.

Textbooks:

1. Khanna O.P. and Lal. M., " Production Technology", Dhanpatrai Publications (P) Ltd., New Delhi.
2. Jain R.K., "Production Technology", Khanna Publishers, Delhi
3. The Complete Reference PC Hardware, Craig Zacker, John Rourke

Reference Books:

1. ChoudharyHajra S. k., ChoudharyHajra A. k. "Elements of Workshop Technology Vol 2 Machine Tools, Publisher: Media Publishers & Promoters, India.
2. Rajput R. K ., "Manufacturing Technology", Laxmi Publications (P)Ltd, New Delhi..

List of Laboratory Exercise:

1. Practical on introduction to hardware and different tools used in workshop technology for computer engineering.
2. Experiment and demonstration of soldering processes on electronics components such as PCB assembly.
3. Practical on resistance welding processes.
4. Practical demonstration on shearing machine, bending machine, circular profile cuttingmachines used in sheet metal operations for manufacturing of cabinet used in computer.
5. Practical demonstration on Punching, blanking, shearing, bending, and piercing.
6. Practical demonstration on plastic molding machine.
7. Practical demonstration on 3 D printing machine
8. Practical demonstration on making fastener for computer by machining processes .
9. Industrial visit to the manufacturing industry.

B. TECH (Computer Science & Business Systems)

SEMESTER – III

COURSE SYLLABUS

FORMAL LANGUAGE & AUTOMATA THEORY

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3Hrs./Week	**Semester Examination :60 marks**	**Theory :3 Credits**
Tutorials :1Hr./Week	**Internal Assessment :40 marks**	**Tutorial :1 Credit**
	Term Work :25 Marks	**Total :4 Credits**
	Total :125 marks	

Course Pre-Requisites:

The students should have basic Knowledge Set algebra, elementary formal logic, constructing proofs, recurrence relations, Discrete Structures and Data structures and problem solving.

Course Objective:

1) To understand problem classification and problem solving by machines.
2) To understand the basics of automata theory and its operations.
3) To study computing machines by describing, classifying, and comparing different types of computational. models.
4) Encourage students to study theory of computability and complexity.
5) To understand the P and NP class problems and its classification.
6) To understand the fundamentals of problem decidability and reducibility.

Course Outcomes:

1) Understand the Graphs and Trees related concepts.
2) Design the Finite Automata Machines and its operations.
3) Understand Context Free Grammar and Context Free languages.
4) Construct Turing Machine for formal languages.
5) Identify and Design the equivalence of languages described by Pushdown Automata
6) Identify NP Hard and NP- Complete problems.

UNIT – I **6 Hours**

Introduction: Alphabet, Strings and languages, Graphs, Directed Graphs, Trees, FSM.

UNIT – II **6 Hours**

Regular Languages and Finite Automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, Keene's theorem, pumping lemma for regular languages, Myhill-Nerode theorem and its uses, minimization of finite automata.

UNIT – III **6 Hours**

Context-Free Languages and Pushdown Automata: Productions and Derivation, Context-free grammars (CFG) and languages (CFL), Chomsky hierarchy of languages, Chomsky Normal Forms and Greibach normal forms, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Context-Sensitive Languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

UNIT – IV **6 Hours**

Turing Machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT – V **6 Hours**

Push Down Automata (PDA): Introduction, Pushdown Automata (PDA), Transition Diagrams, Functions and Tables, Deterministic Push- down Automata (DPDA) - definition, Nondeterministic Pushdown Automata (NPDA), Equivalence of context-free grammars and PDA, properties of context-free languages.

UNIT – VI **6 Hours**

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP-completeness, Cook's Theorem, and other NP-Complete problems.

Undecidability: Church-Turing thesis, Universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

List of Assignments:

YACC, the parser-generating tool (Chapter 5 of Introduction to Automata Theory, Languages, and Computation (John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman.)

List of Project Based Learning Topics:

1. Design a FA for Vending Machine
2. Explain Pigeon hole Principle
3. Implement Push Down Automata
4. Implement Regular Expression
5. Implement lexical Analyzer
6. Implement Turing Machine for Mathematical Expression
7. Design an application to search a string from given text using FA
8. Implement a FSM for residing mod 3.
9. Provide solutions for Missionaries and Cannibals problems.

Textbooks:

1. Introduction to Automata Theory, Languages, and Computation John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman. Pearson Publication.

Reference Books:

1. Elements of the Theory of Computation, Harry R. Lewis and Christos H. Papadimitriou.
2. Automata and Computability, Dexter C. Kozen.
3. Introduction to the Theory of Computation, Michael Sipser.
4. Introduction to Languages and the Theory of Computation, John Martin.
5. Computers and Intractability: A Guide to the Theory of NP Completeness, M. R. Garey and D. S. Johnson.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

COMPUTER ORGANIZATION & ARCHITECTURE

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Theory :3 Hours / Week	**End Semester Examination :60 Marks**	**Theory :3 Credits**
Lab : 2 Hours / Week	**Internal Assessment :40 Marks**	**Practical :1 Credit**
	Term work :25 Marks	
	Total :125 Marks	**Total :4 Credits**

Course Pre-Requisites:

The students should have basic Knowledge Digital electronics and computer system.

Course Objective:

To understand the design of the various functional units of computer system.

Course Outcomes:
After completion of this course students will be able to
1. Identify various components of a computer and their interconnection.
2. Explain the functions & organization of various blocks of CPU.
3. Understand CPU instruction characteristics, enhancement features of CPU.
4. Describe an assortment of memory types (with their characteristics) used in computer systems and basic principle of interfacing input and output devices.
5. Describe the I/O organization and interconnections.
6. Infer parallel processing and multiprocessor configuration.

UNIT – I **6 Hours**

Revision of basics in Boolean logic and Combinational/Sequential Circuits.

Functional Blocks of a Computer: CPU, memory, input-output subsystems, control unit.

Introduction to x86 Architecture

Instruction Set Architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

UNIT – II **6 Hours**

Data Representation: Signed number representation, fixed and floating-point representations, character representation.

Computer Arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format.

UNIT – III **6 Hours**

CPU Control Unit Design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

UNIT – IV **6 Hours**

Memory System Design: Semiconductor memory technologies, memory organization.

Memory Organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

UNIT – V **6 Hours**

Peripheral Devices and Their Characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCSI, USB

UNIT – VI **6 Hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

List of Assignments:

Assignments covering the following topics should be given

1. Booth's algorithm for multiplication
2. Restoring and non-restoring division
3. Fixed point and floating-point representation
4. Programmer's model of 80386
5. Hardwired and micro-programmed design approaches.
6. Characteristics of Memory system
7. Cache organization and address mapping
8. Virtual memory and replacement algorithms
9. Calculating throughput and speed in pipelining
10. Multiprocessor architecture

List of Laboratory Experiments

1. Boolean Logic Gates Implementation: Design and simulate basic logic gates (AND, OR, NOT, etc.) using software like Logisim or Verilog.
2. Write assembly language program for simple tasks like arithmetic operations, control flow using x86 instructions.
3. Fixed and Floating-Point Representations: Study the representation of numbers in fixed-point and floating-point formats. Perform arithmetic operations on fixed-point and floating-point numbers.
4. Hardwired Control Unit Design: Design a hardwired control unit for a simple CPU architecture. Implement control signals for various instructions.
5. Semiconductor Memory Technologies: Study different semiconductor memory technologies (DRAM, SRAM, Flash, etc.) and their characteristics.
6. Cache Memory Simulation: Simulate cache memory with varying cache sizes, block sizes, mapping functions, and replacement algorithms. Analyse cache hit/miss rates and access time.
7. I/O Device Interface Implementation: Implement interfaces for different I/O devices (e.g., keyboard, mouse, display) using programming languages like C or Python.
8. Introduction to Parallel Processors: Study the architecture and organization of parallel processors. Analyze the benefits of parallelism in terms of performance and scalability.

List of Project Based Learning Topics:

1. Automatic night lamp with morning alarm
2. Traffic light with sensor + 7segment
3. Multi pattern running lights.
4. Washing machine
5. Simple Lock Using Keypad and 7 segment
6. Electronic quiz table
7. Electronic Digital Clock
8. Temperature controller
9. Plant Irrigation System
10. Car Parking Management
11. Customer counter for supermarket
12. Electronic queue management system in food stall
13. Safety box
14. Shop lot automatic door with 7segment display
15. Bank queue management system
16. Water level controller
17. Automatic home system
18. Commuter system
19. Automatic room light control
20. Elevator control system

Textbooks:

1. Computer System Architecture M. M. Mano: 3rd ed., Prentice Hall of India, New Delhi, 1993.
2. Computer Organization and Design: The Hardware/Software Interface, David A. Patterson and John L. Hennessy.
3. Computer Organization and Embedded Systems, Carl Hamacher.

Reference Books:

1. Computer Architecture and Organization, John P. Hayes.
2. Computer Organization and Architecture: Designing for Performance, William Stallings

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

SOFTWARE ENGINEERING

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 Marks**	**Theory :3 Credits**
Lab :2Hrs./Week	**Internal Assessment :40 Marks**	
	Term work :25 Marks	**Practical :1 Credit**
	Oral :25 Marks	
	Total :150 Marks	**Total :4 Credits**

Course Pre-Requisites:

The students should have sound knowledge of data structures, programming experience and an extensive hands-on experience of using software.

Course Objective:

The course introduces key aspects of software engineering processes for the development of a complex software system.

Course Outcomes:

1. Learn importance of software engineering process and its principles
2. Understand the software development life cycle with appropriate models
3. Understand software quality concepts
4. Document user requirements using suitable techniques
5. Analyze the software design from and Object-Oriented perspective.
6. Apply appropriate testing techniques on a software

UNIT – I **6 Hours**

Introduction: Programming in the small vs. programming in the large; software project failures and importance of software quality and timely availability; engineering approach to software development; role of software engineering towards successful execution of large software projects; emergence of software engineering as a discipline.

UNIT – II **6 Hours**

Software Project Management: Basic concepts of life cycle models – different models and milestones; software project planning –identification of activities and resources; concepts of feasibility study; techniques for estimation of schedule and effort; software cost estimation models and concepts of software engineering economics; techniques of software project control and reporting; introduction to measurement of software size; introduction to the concepts of risk and its mitigation; configuration management.

UNIT – III **6 Hours**

Software Quality and Reliability: Internal and external qualities; process and product quality; principles to achieve software quality; introduction to different software quality models like McCall, Boehm, FURPS / FURPS+, Dromey, ISO – 9126; introduction to Capability Maturity Models (CMM and CMMI); introduction to software reliability, reliability models and estimation.

UNIT – IV **6 Hours**

Software Requirements Analysis, Design and Construction: Introduction to Software Requirements Specifications (SRS) and requirement elicitation techniques; techniques for requirement modeling – decision tables, event tables, state transition tables, Petri nets; requirements documentation through use cases; introduction to UML, introduction to software metrics and metrics-based control methods; measures of code and design quality.

UNIT – V **6 Hours**

Object Oriented Analysis, Design and Construction: Concepts -- the principles of abstraction, modularity, specification, encapsulation and information hiding; concepts of abstract data type; Class Responsibility Collaborator (CRC) model; quality of design; design measurements; concepts of design patterns; Refactoring; object-oriented construction principles; object-oriented metrics.

UNIT – VI **6 Hours**

Software Testing: Introduction to faults and failures; basic testing concepts; concepts of verification and validation; black box and white box tests; white box test coverage – code coverage, condition coverage, branch coverage; basic concepts of black-box tests – equivalence classes, boundary value tests, usage of state tables; testing use cases; transaction-based testing; testing for non-functional requirements – volume, performance and efficiency; concepts of inspection.

List of Assignments:

Teaching faculty will design home assignment on following topics.

1. Software development Models
2. Software Requirement Specification
3. Data Flow Diagrams
4. Testing
5. Object Oriented Analysis, Design and Construction
6. Software project covering various software development methodology techniques will be implemented.

List of Laboratory Exercises:

1. Develop Flow-Charts for (any open-ended problem statement) to understand basic problem-solving technique using suitable tool.
2. Perform domain analysis for given problem.
3. Develop requirements specification document as per IEEE format for a given problem
4. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project under consideration.
5. Perform Structured design for the developed DFD model.
6. Calculate Cyclomatic complexity for given code snippet.
7. Identify the usage of regression testing.
8. Identify the different types of performance testing

List of Project Based Learning Topics:

1. Fingerprint voting system
2. Weather forecasting system
3. Android local train ticketing system
4. Railway tracking and arrival time prediction system
5. Android Patient Tracker
6. Opinion mining for social networking platforms
7. Automated payroll system with GPS tracking and image capture

8. Data leakage detection system
9. Credit card fraud detection
10. AI shopping system
11. Camera motion sensor system
12. Bug tracker
13. e-Learning platform
14. Smart health prediction system
15. Software piracy protection system

Text Books:

1. Software Engineering, Ian Sommerville
2. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson

Reference Books:

1. Fundamentals of Software Engineering, Carlo Ghezzi, Jazayeri Mehdi, Mandrioli Dino
2. Software Requirements and Specification: A Lexicon of Practice, Principles and Prejudices, MichaelJackson
3. The Unified Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh
4. Design Patterns: Elements of Object-Oriented Reusable Software, Erich Gamma, Richard Helm,Ralph Johnson, John Vlissides
5. Software Metrics: A Rigorous and Practical Approach, Norman E Fenton, Shari Lawrence Pfleeger
6. Software Engineering: Theory and Practice, Shari Lawrence Pfleeger and Joanne M. Atlee
7. Object-Oriented Software Construction, Bertrand Meyer
8. Object Oriented Software Engineering: A Use Case Driven Approach --Ivar Jacobson
9. Touch of Class: Learning to Program Well with Objects and Contracts --Bertrand Meyer
10. UML Distilled: A Brief Guide to the Standard Object Modeling Language --Martin Fowler

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

COMPUTATIONAL STATISTICS

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Theory :3 Hours / Week	**End Semester Examination :60 Marks**	**Theory :3 Credits**
Lab :0 Hours / Week	**Internal Assessment :40 Marks**	
	Total : 100 Marks	**Total :3 Credits**

Course Pre-requisites: The Students should have knowledge of basics of statistics.

Course Objectives:

The aim of this course is to give graduate students knowledge of statistical concepts like factor analysis, regression analysis and Python programming. The course objective is to exercise students for data set handling, data wrangling, data visualization etc. using Python.

Course Outcomes:

1. Learn methods of Data Wrangling.
2. Understand importance of different Group Operations and Time series using real time datasets.
3. Apply knowledge of Normal Distribution and Design Simple and Multiple Linear Regression Models.
4. Create Multivariate Regression Model and Understand Discriminant Analysis
5. Understand and Demonstrate Dimension Reduction Techniques.
6. Demonstrate the use of Clustering on real time datasets.

UNIT – I **6 Hours**

Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing.
Data Wrangling: Combining and Merging Datasets, Reshaping and Pivoting, Data Transformation, String Manipulation, Regular Expressions

UNIT – II **6 Hours**

Data Aggregation, Group Operations, Time Series: GroupBy Mechanics, Data Aggregation, Groupwise Operations and Transformations, Pivot Tables and Cross Tabulations, Time Series Basics, Data Ranges, Frequencies and Shifting.

UNIT – III **6 Hours**

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.
Multiple Linear Regression Model: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

UNIT – IV **6 Hours**

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance.
Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

UNIT - V **6 Hours**

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.
Factor Analysis: Factor analysis model, extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

UNIT – VI **6 Hours**

Clustering and Segmentation Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

List of Assignments:
Respective subject teacher shall design any six assignments on above units.

Textbooks:

1. An Introduction to Multivariate Statistical Analysis, T.W. Anderson.
2. Applied Multivariate Data Analysis, Vol I & II, J.D. Jobson.
3. Statistical Tests for Multivariate Analysis, H. Kris.
4. Programming Python, Mark Lutz.
5. Python 3 for Absolute Beginners, Tim Hall and J-P Stacey.
6. Beginning Python: From Novice to Professional, Magnus Lie Hetland. Edition, 2005.

List of Project Based Learning Topics:

1. Design and development of Student management system using object-oriented approach and file structure.
2. Development of student performance analysis system (Use of file, OO Python and regression model, Graphical dashboard).
3. Development of multivariate predictive model for rain forecasting (use rainfall data for last 50 years).
4. Development of multivariate predictive model for gold rate. (Use daily gold rate data for last 10 years).
5. Development of multivariate predictive model for patrol rate. (Use daily patrol rate data for last 10 years).
6. Comparative analysis of predictions of single multivariate predictive model against multiple linear predictive models.
7. Comparative analysis of dimensionality reduction performance using principle component analysis (PCA) and linear discriminant analysis (LDA).
8. Comparative analysis of classification performance of principle component analysis (PCA) and linear discriminant analysis (LDA) techniques.
9. Study of effectiveness of analysis of variance (ANOVA) and analysis of covariance (ANCOVA) for predictive analysis.
10. Comparing operating differences of various clustering Techniques.
11. Comparative analysis of performance for parameter (variable/factors) selection using principal component analysis (PCA) and factor analysis (FA) for multivariate analysis.

Reference Books:

1. Regression Diagnostics , Identifying Influential Data and Sources of Collinearety, D.A. Belsey, E. Kuh and R.E. Welsch
2. Applied Linear Regression Models, J. Neter, W. Wasserman and M.H. Kutner.
3. The Foundations of Factor Analysis, A.S. Mulaik.
4. Introduction to Linear Regression Analysis, D.C. Montgomery and E.A. Peck.
5. Cluster Analysis for Applications, M.R. Anderberg.
6. Multivariate Statistical Analysis, D.F. Morrison.
7. Python for Data Analysis, Wes Mc Kinney.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT –IV

OBJECT ORIENTED PROGRAMMING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Theory :3 Hours / Week	**End Semester Examination**	**:60 Marks**	**Theory :3 Credits**
Lab :2 Hours / Week	**Internal Assessment**	**:40 Marks**	**Practical: 1 Credit**
	Termwork	**:25 Marks**	
	Practical	**:25 Marks**	**Total :4 Credits**
	Total	**: 150 Marks**	

Course Pre-Requisites:

The students should have basic Knowledge of "C" programming language.

Course Objective:

The course introduces fundamental concepts of Object-oriented programming.

Course Outcomes:

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

1. Understand basic concepts of Procedural programming and the overview of C programming language.
2. Understand some basic differences between C and C++.
3. Understand basic concepts of Object-Oriented Programming, classes and objects in OOP.
4. Apply the concept of Access Specifier, friend function, constructor, destructor and Error Handling using C++ programs.
5. Implement the concept of polymorphism, virtual functions and inheritance using C++.
6. Develop OOP applications using Templates and file Handling.

UNIT – I **6 Hours**

Procedural Programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (C-way), Library Functions (string, math, stdlib), Command line arguments, Pre-processor directive

UNIT – II **6 Hours**

Some Difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, #define constant vs const, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments.

UNIT – III **6 Hours**

The Fundamentals of Object-Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

UNIT – IV **6 Hours**

More Extensions to C in C++ to Provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

UNIT – V **6 Hours**

Essentials of Object-Oriented Programming: overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling.

UNIT – VI **6 Hours**

Generic Programming: Template concept, class template, function template, template specialization
Input and Output: Streams, Files, Library functions, formatted output
Object Oriented Design and Modelling: UML concept, use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

List of Assignments:

1. Define Procedural Oriented Programming. Explain basic concepts of procedural oriented programming.
2. Differentiate between C and C++ in detail with suitable example.
3. Explain basic concepts of Object-Oriented Programming in detail with suitable example.
4. Write short note on:
5. Scope Resolution Operator ii)Access Specifiers
6. Explain Virtual Function and Function Overloading in detail with Example.
7. Explain Concepts of Object-Oriented Design and Modelling.

List of Laboratory Exercises:

1. Parameter passing: passing parameter by value vs by reference, passing array as constant pointer
2. Function overloading: writing string operations like strcat and strncat, strcpy and strncpy as overloaded functions.
3. Dynamically allocating space for a pointer depending on input and doing this repeatedly, depending on different inputs and finally de-allocating the pointer.
4. Define class complex with all possible operations: constructor, destructor, copy constructor, assignment operator with the data members stored as pointer to integers.
5. Define class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators
6. Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators
7. Define class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators
8. Define class stack, queue, linked-list, array, set using some data-type (int) with data members kept as private and functions kept in both protected and public sections.
9. Define class complex with all possible operators: constructor, destructor, copy constructor, assignment operator and operators >, <, >=, <=, ==, ++ (pre and post), +, +=, ( ), with the data members stored as pointer to integers.
10. Define class vector of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( )
11. Define class matrix of integers with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).
12. Define class matrix of integers using vector, with all possible operations like constructor, destructor, copy constructor and assignment operators>, <, >=, <=, ==, ++ (pre and post), +, +=, ( ).
13. Define stack and queue inherited from array class, with standard functions and operators
14. Define a class called ‘array’ with data type passed as template type with constructor, destructor, copy constructor and assignment operators and index operator.
15. Define template functions for compare and use it in the algorithms like bubble sort, insertion sort, merge sort.
16. Formatted input-output examples
17. Input manipulators

18. Overriding operators <<, >>
19. Define class model for complex number, student class, book class and show it using UML diagram as
a. well as concrete class.
20. Show behavioural modelling through sequence diagram and activity diagram for workflow in a typical log-in, log-out situation.

List of Project Based Learning Topics:

1. Employee Management System.
2. Trading Software.
3. Billing System.
4. Intuitive Gadgets.
5. Traffic Management System
6. Security Systems.
7. Car Rental System.
8. Login and Registration System.
9. Bookshop inventory system.
10. Student Report Management System.
11. Calendar application.

Text Books:

1. The C++ Programming Language, BjarneStroustrup.
2. C++ and Object-Oriented Programming Paradigm, Debasish Jana

Reference Books:

1. Programming – Principles and Practice Using C++, BjarneStroustrup.
2. The Design and Evolution of C++, BjarneStroustrup.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

SKILL LAB – III (DATA SCIENCE WITH PYTHON)

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Theory :0 Hours / Week	**Termwork**	**:25Marks**	**Practical :1 Credits**
Lab :2 Hours / Week	**Practical**	**:25 Marks**	
	Total	**: 50 Marks**	**Total :1 Credits**

Course Objective:

To develop analytical skills among the students using data analysis methods and Python.

Prerequisite:

The students should have knowledge of basics of statistics.

Course Outcomes: On completion of the course, students will have the ability to:

1. Understand and Demonstrate fundamentals of Python programming.
2. Demonstrate visualization in Python using different Packages and Libraries.
3. Understand and Visualize various distributions using real time datasets.
4. Design models for simple and multiple linear regression models.
5. Develop a model for PCA to understand the effects of dimension reduction.
6. Design various clusters using real time datasets.

Unit I : **04 Hours**

Python Basics: Python Programming Environment, Statements in Python, Data Structures, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files- Reading and Writing.

Unit II : **04 Hours**

Packages and Libraries used for Plotting in Visualization: Various Packages and Libraries used for plotting, Plotting Graphs, Controlling Graph, Adding Text, Different types of Graphs, Getting and Setting values in Graph.

Unit III: **04 Hours**

Distributions: Type of data, Bernoulli Distribution, Uniform Distribution, Binomial Distribution, Normal Distribution, Poisson Distribution, Exponential Distribution. Visualization of Distribution.

Unit IV: **04 Hours**

Linear Regression: Linear Regression Model, Model Assumptions, Validation of model.

Multiple Linear Regression: Multiple Linear Regression Model, Model Assumptions, Validation of model.

Unit V: **04 Hours**

Principal Component Analysis: Principal Components, Algorithm for conducting Principal Component Analysis, Factors to decide retention of Principal Components.

Unit VI: **04 Hours**

Clustering: Introduction to Clustering, Types of Clustering, Correlations and Distance Measures, Hierarchical Clustering and Non-Hierarchical Clustering, Profiling and Interpreting Clusters.

Textbooks

1. Tim Hall and J-P Stacey “Python 3 for Absolute Beginners”, A press.
2. Wes Mc Kinney. “Python for Data Analysis”,O'Reilly Media, Inc.

Reference Books

1. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”O'Reilly Media
2. David Spiegel halter “The Art of Statistics”Pelican

List of Laboratory Exercises

1. Introduction to python programming (String operation, Mathematical operation, loops, branching)
2. Write a program to perform basic operations using Python Functions.
3. Write a program to perform to read, write and modify text file data using OO Python.
4. Implement various pre-defined libraries in Python like Panda, NumPy, Cbor (Drawing of statistical graph)
5. Exercise different functionalities of Matplotlib package.
6. Write a program to measure central tendency and dispersion of given data.
7. Write a program to visualize different types of distributions.
8. Write a program to develop linear and multiple regression models using real time datasets
9. Implementation of clustering using real time datasets.

B. TECH (Computer Science & Business Systems)

SEMESTER – IV

COURSE SYLLABUS

OPERATING SYSTEM

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures :3Hrs./Week	**Semester Examination**	**:60 Marks**	**Theory :3 Credits**
Lab :2Hrs./Week	**Internal Assessment**	**:40 Marks**	
	Term Work	**:25 Marks**	**Practical :1 Credit**
	Oral	**:25 Marks**	
	Total	**:150 Marks**	**Total :4 Credits**

Course Pre-Requisites:

Prerequisites for this course include thorough knowledge in some high-level programming language as C or C++ and UNIX / Linux operating system environment. As programs are to be implemented by writing C code during the course and will cover the details of C and its close relationship to UNIX and Linux in the case study in 6^{th}unit.

Course Objectives:

1. To learn the basic concepts of Operating Systems.
2. To learn the mechanisms of OS to handle processes and threads and their communication.
3. To learn the methods of process scheduling.
4. To gain knowledge on Mutual exclusion, deadlock detection algorithms.
5. To know the concept of memory management and virtual memory.
6. To learn programmatically file management techniques.

Course Outcomes:

1. To learn and apply the basic concept of operating system.
2. To infer the concept of process and process state transition and concept of thread and multithreading.
3. Understand the importance of scheduling and types of scheduling algorithms.
4. To gain the knowledge of inter process communication strategies, concept of deadlock along with its avoidance.
5. To analyse the memory management techniques, paging, and segmentation.
6. To understand the file management and disk management techniques.

UNIT – I **6 Hours**

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT – II **6 Hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.
Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

UNIT – III **6 Hours**

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
Scheduling Algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT – IV **6 Hours**

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem.
Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.
Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

UNIT – V **6 Hours**

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT – VI **6 Hours**

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O. File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed),Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.
Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.
Case Study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

List of Assignments:

1. To learn evolution and structure of operating system.
2. To understand the concept of Real Time scheduling.
3. To analyse the problem of process synchronization.
4. To implement the shell programming in UNIX OS.

List of Laboratory Exercises:

1. Unix commands (files directory, data manipulation, network communication etc), shell programming and vi editor
2. C program implementation of the following:
    a. Scheduling Algorithms
    b. Shared memory
    c. Thread and Multi Thread
    d. Inter Process Communication
    e. Deadlock Avoidance and Deadlock Detection
    f. Semaphore
    g. Memory Management
    h. Indexing and Hashing

List of Project Based Learning Topics:

1. Virtual traffic management system using threads with semaphore to control traffic.
2. Virtual memory management system.
3. File system handling.
4. A Client -Server application, use of IPC.
5. A simple web browser.
6. Device driver for some device.
7. Design of mail system project.
8. Design of RTOS for embedded system.
9. Mini project on Linux Shell.
10. Railway reservation system using scheduling.

Textbooks:

1. Operating System Concepts Essentials. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

1. Operating Systems: Internals and Design Principles. William Stallings.
2. Operating System: A Design-oriented Approach. Charles Patrick Crowley.
3. Operating Systems: A Modern Perspective. Gary J. Nutt.
4. Design of the Unix Operating Systems. Maurice J. Bach.
5. Understanding the Linux Kernel, Daniel Pierre Bovet, .*Marco Cesati*

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

DATABASE MANAGEMENT SYSTEMS

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 marks**	**Theory :3 Credits**
Lab :2 Hrs./Week	**Internal Assessment :40 marks**	
	Term work :25 Marks	**Practical :1 credit**
	Practical :25 Marks	
	Total :150 Marks	**Total :4 Credits**

Course Prerequisites:

Students should have knowledge of

1. Basic understanding of data and data structure
2. Basic understanding of programming language

Course Objectives:

1. Identify various techniques to communicate with database.
2. Relate relevant data for effective processing of data.
3. Construct a database to maintain data adroitly.
4. Study various queries and tools to deal with the data.
5. Understand the relation between data set and respective means to access it.
6. Understand the influence of data in the effective development of software.

Course Outcomes:

After successful completion of this course students will be able to:

1. Model an application's data requirements using conceptual modeling tools.
2. Demonstrate concepts of relational algebra and queries
3. Demonstrate concepts of relational database design
4. Interpret the query processing and optimization activities in database.
5. Interpret the transaction activities in database.
6. Recognize the emerging database applications and security concerns.

UNIT – I **6 Hours**

Introduction: Introduction to Database. Hierarchical, Network and Relational Models. Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

UNIT – II **6 Hours**

Relational Query Languages: Relational algebra, Tuple and domain relational calculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL,ORACLE, DB2, SQL server.

UNIT – III **6 Hours**

Relational Database Design: Domain and data dependency, Armstrong's axioms, Functional Dependencies, Normal forms, Dependency preservation, Lossless design.

UNIT – IV **6 Hours**

Query Processing and Optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Storage strategies: Indices, B-trees, Hashing.

UNIT – V **6 Hours**

Transaction Processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp-based schedulers, multi-version and optimistic Concurrency Control schemes, Database recovery.

UNIT – VI **6 Hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.
Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

Assignments & tutorials covering the relational database design and operations in SQL and PL/SQL

List of Project Based Learning Topics:

1. Make a project to maintain employee data using files and dynamic object/structure. The project should be able to read, write, modify, add and search records. Also demonstrate the effect of performing change in employer data definition after few records have been added.
2. Make an extended ER diagram for insurance management system. Transform this into relation design and implement these relations with appropriate domain and integrity constraints.
3. Employ various data control restrictions on databases, relations and attributes of relations.
4. Create a phonebook which enables user to save contacts with additional information and provides various retrieval mechanisms. Provisions should be made to view data in multiple ways.
5. Design and develop a library management system. The relations in the system should be normalized up to BCNF
7. Design and develop a inventory management system and create multiple views on the relations so that users not authorised to edit the relations should be able to views the data.
8. Implement of audit trails and backup on relations.
9. Create a student result calculation system. However when updating final results after calculation should be only of students who paid complete fees, such that transaction of each row is executed separately. Hint- use explicit cursor
10. Develop a student data management system using hash files.
11. Installation of a NoSQL database and implementing a simple student database to compare with SQL database.

Textbooks:

1. Database System Concepts. Abraham Silberschatz, Henry F. Korth and S. Sudarshan.

Reference Books:

1. Principles of Database and Knowledge – Base Systems, Vol 1 by J. D. Ullman.
2. Fundamentals of Database Systems. R. Elmasri and S. Navathe.
3. Foundations of Databases. Serge Abiteboul, Richard Hull, VictorVianu.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

INTRODUCTION TO INNOVATION, IP MANAGEMENT & ENTREPRENEURSHIP

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures : 2 Hrs./Week	Semester Examination	:60 marks	Theory	:2 Credits
	Internal Assessment	:40 marks		
	Total	:100 Marks	Total	:2 Credits

Course Pre-Requisites:

Good knowledge of Fundamentals of Management.

Course Objective:

The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

Course Outcomes:

1. Learn to be familiar with creative and innovative thinking styles.
2. Learn opportunity reorganization and entrepreneurship skills.
3. Learn to investigate, understand and internalize the process of founding a startup.
4. Understand financial aspects of Entrepreneurship.
5. Learn to manage various types of IPR to protect competitive advantage.
6. Understand the types of IP.

UNIT – I **4 Hours**

Innovation: What and Why?
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.
Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II **4 Hours**

Building an Innovative Organization
Creating new products and services, exploiting open innovation and collaboration, use of innovation for starting a new venture
Class Discussion- Innovation: Co-operating across networks vs. ‘go-it-alone’ approach.

UNIT – III **4 Hours**

Entrepreneurship:
Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Maintaining Competitive Advantage- Use of IPR to protect Innovation.

UNIT – IV **4 Hours**

Entrepreneurship- Financial Planning: Financial Projections and Valuation. Stages of financing, Debt, Venture Capital, and other forms of Financing

UNIT – V **4 Hours**

Intellectual Property Rights (IPR): Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing.

UNIT – VI **4 Hours**

Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protect?
Class Discussion- Major Court battles regarding violation of patents between corporate companies.

List of Assignments:

1. Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.
2. Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.
3. Topic 1- Is innovation manageable or just a random gambling activity?
4. Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach.
5. Topic 3- Major Court battles regarding violation of patents between corporate companies.

List of Project Based Learning Topics:

Design case studies for based on any of the following technologies.

1. Artificial intelligence
2. Machine Learning
3. Cloud Computing
4. IOT
5. HCI
6. Brain Computer Interface
7. Web Designing
8. Blockchain

Textbooks:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion

Syllabus for Unit Test:	**Unit**
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

DESIGN THINKING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 marks**	**Theory**	**:3 Credits**
Lab :2 Hrs./Week	**Internal Assessment**	**:40 marks**	**Practical/Oral**	**:1 Credit**
	Term Work	**:25 Marks**		
	Total	**:125 Marks**	**Total**	**:4 Credits**

Course Pre-Requisites:
Students should be well versed Completion of all units from Semesters 1, 2, 3 and 4

Course Objective:

1. Recognize the importance of DT
2. Explain the phases in the DT process
3. List the steps required to complete each phase in DT process
4. Apply each phase in the DT process
5. Use doodling and storytelling in presenting ideas and prototypes
6. Create value proposition statements as part of their presentations
7. Recognize how DT can help in functional work
8. Recognize how Agile and DT complement each other to deliver customersatisfaction

Course Outcomes:

After successful completion of this course students will be able to:

1. Understand and Implement the Phases in the DT process
2. Analyze the steps required to conduct an immersion activity
3. Evaluate the personas to create problem statements in the define phase of DT
4. Apply the steps in the ideate phase of DT
5. Implement a prototype to create a value proposition statement
6. Develop and Test a prototype through a DT process

UNIT – I **6 Hours**

Introduction: Recognize the importance of Design Thinking why is Design Thinkingimportant for business? Why is Design Thinking important for you? , Identify the steps in the DT process What is DT? Empathize (search for rich stories and find some love), Define (user need and insights – their POV), Ideate (ideas, ideas, ideas), Prototype (build to learn), Test (show, don't tell)

UNIT – II **6 Hours**

Empathy Phase: Recognize the steps in the empathize phase of DT, What is empathy? Ask What? How? Why?, Different types to developing Empathy towards People Identify the steps required to conduct an immersion activity, How to empathize?, Intro to Immersion Activity, Conduct an immersion activity and fill up the DT question template, Immersion activity

UNIT – III **6 Hours**

Define Phase: Creating personas: Recognize the steps to create personas in the definephase of DT, What is a persona and how do I create one? Four Different Perspectives on Personas 1)Goal-directed Personas 2)Role-Based Personas 3) Engaging Personas 4) Fictional Personas, 10 steps to Creating Your Engaging Personas and Scenarios Recognize the steps to create problem statements in the define phase of DT, Problem statements, Defining problem statements, Define the problem statements in the define phase of DT

UNIT – IV **6 Hours**

Ideate Phase: How to Ideate?, Recognize the steps in the ideate phase of DT, Apply the steps in the ideate phase of DT, Ideation games: Game 1: Six Thinking Hats, Game 2: Million-dollar idea, Ideate to find solutions, Characteristics Required for Successful Ideation, Recognize how doodling can help to express ideas, Recognize the importance storytelling in presenting ideas and prototypes, What is Storytelling in DT?

UNIT – V **6 Hours**

Prototype Phase: Recognize the importance of the prototype phase in DT, Prototype your idea, Create a prototype: Types of Prototyping 1)Low-Fidelity Prototyping 2) High-Fidelity Prototyping , Guidelines for Prototyping, Recognize the importance of service value proposition, Create a value proposition statement

UNIT – VI **6 Hours**

Testing Phase: Testing in Design Thinking, Test the Prototype, Role of DT in your work, discuss How DT can help me to become a better coder?, Agile and DT complement each other to deliver customer satisfaction, Share your Satori.

Text Books:

Design Thinking by Mr.Sambhrant Srivastava, Mr.Vijay Kumar, Dr.Pramod Kumar Srivastava.

Reference Books:

Hooked by Nir Eyal. The Art of Creative Thinking by Rod JudkinsStart-Up nation by Dan Senor and Saul singerStart with Why by Simon Sinek

List of Laboratory Exercises:

1. Foundations of DT, Course outline, Group roles
2. Intro and Problem Definition of project (phase 1 – Hear)
3. Idea Generation of project (phase 2 - Create)
4. Concept Development and Design project (phase 3 - Create)
5. Project Teams meet to discuss and continue to prepare their work
6. Testing and Project Documentation on project (phase 4 - Deliver)
7. Final group project presentation

List of Project-Based Learning:

1. Case study on Airbnb
2. Case study on Pill pack
3. Case study on Clean Team
4. Case study on IBM
5. Case study on Stanford hospital
6. Case study on Uber eats
7. Case study on Bank of America

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

OPERATION RESEARCH

TEACHING SCHEME	EXAMINATION SCHEME	CREDITS ALLOTTED
Lectures :3 Hrs./Week	**Semester Examination :60 marks**	**Theory :3 Credits**
Lab :2 Hrs./Week	**Internal Assessment :40 marks**	**Practical :1 Credit**
	Term Work :25 Marks	
	Total :125 Marks	**Total :4 Credits**

Course Pre-Requisites:

Good knowledge of mathematics.

Course Objective:

The students will be able to understand various models in operations research used in industries to solve problems.

Course Outcomes:

As a part of this course, students will:

1. Understand OR problem and associated models.
2. Understand Linear Algebra.
3. Use transportation and assignment problems.
4. Use PERT for modeling.
5. Use Inventory Control System.
6. Apply queuing theory and modulation techniques.

UNIT – I **6 Hours**

Introduction to OR:
Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

UNIT – II **6 Hours**

Linear Programming:
Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP. Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence/Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.
Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy &degeneracy, Sensitivity analysis.
Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.
Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT – III **6 Hours**

Transportation and Assignment Problems:
TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.
AP - Examples, Definitions – decision variables, constraints, formulation, Balanced &unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT – IV **6 Hours**

PERT – CPM:
Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

UNIT – V **6 Hours**

Inventory Control:
Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known/unknown stock out situations, models under prescribed policy, Probabilistic situations.

UNIT – VI **6 Hours**

Queuing Theory:
Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase). Kendall's notation, Little's law, steady state behavior, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.
Simulation Methodology:
Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

List of Assignments:

Respective subject teacher shall design any six assignments on above units.

List of Laboratory Exercises:

1. Formulation of linear programming problems.
2. Solution of linear programming problem using graphical method with:
    i. Multiple constraints
    ii. Unbounded solution
    iii. Infeasible solution
    iv. Alternative or multiple solution
3. Enumeration of all basic solutions for linear programming problem.
4. Solution of linear programming problem with simplex method.
5. Problem solving using Big M method.
6. Problem solving using two phase method.
7. Solution on primal problem as well as dual problem.
8. Solution based on dual simplex method.
9. Verification of weak duality, strong duality and complementary slackness property.
10. Solution of transportation problem.
11. Solution of assignment problem.
12. Solution of integer programming problem using Branch and Bound method.
13. Solution of integer programming problem using Gomory's cutting plane method.
14. Simulation: Random number generation.
15. Monte Carlo method.
16. Performance measures for M/M/1 queuing model.
17. ABC analysis.
18. Inventory model.

List of Project Based Learning Topics:

1. Students must work on one of the projects listed below (but not limited to) during the semester
2. Find the companies that used OR as a tool to sort a problem successfully and unsuccessfully. Compare them and analyze as to why certain strategies worked and others failed.
3. Visit any industry and choose one of their products. Develop a LPP for maximizing profits on the sale of that product considering the various constraints on it. Solve the LPP and make suggestions of the same for the company.
4. Develop a software that helps in making timetable for the department by making and solving an LPP.
5. Visit a small departmental store/hotel, collect data, and make an LPP for optimum use of space. Solve the LPP and make relevant suggestions
6. Write a research paper on how LPP helps companies to solve problems referencing latest papers.
7. Write a research paper on how assignment tools help companies to solve problems referencing latest papers.
8. Write a research paper on how transportation tools help companies to solve problems referencing latest papers.
9. Visit a small-scale industry. Collect data and make WBS and a network diagram. Solve it by CPS and PERT methods ad make relevant suggestions
10. Write a research paper on how network analysis tools help companies to solve problems referencing latest papers.
11. Write a research paper on how queuing models help companies to solve problems referencing latest papers.
12. Go to a nearby petrol pump, bank, departmental store, hotel. Record the arrival and service rates for multiple day. Analyze the data and make relevant suggestions
13. Write a research paper on how inventory models help companies to solve problems referencing latest papers.
14. Go to a nearby petrol pump, departmental store, hotel. Record inventory levels and inventory practices for multiple day. Analyze the data and make relevant suggestions.

Textbooks:

1. Operations Research: An Introduction. H.A. Taha.

Reference Books:

1. Linear Programming. K.G. Murthy.
2. Linear Programming. G. Hadley.
3. Principles of OR with Application to Managerial Decisions. H.M. Wagner.
4. Introduction to Operations Research. F.S. Hiller and G.J. Lieberman.
5. Elements of Queuing Theory. Thomas L. Saaty.
6. Operations Research and Management Science, Handbook: Edited By A. Ravi Ravindran.
7. Management Guide to PERT/CPM. Wiest& Levy.
8. Modern Inventory Management. J.W. Prichard and R.H. Eagle.

Syllabus for Unit Test:	**Unit**
Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

SKILL LAB – IV (SOFTWARE DESIGN WITH UML)

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED
Lectures :0 Hrs./Week	**Term work**	**: 25 Marks**	**Theory :0 Credits**
Lab :2 Hrs./Week	**Practical**	**: 25 Mark**	**Practical :1 Credit**
Tutorial: 1 Hrs./Week			**Tutorial :1 Credit**
	Total	**:50 Marks**	**Total :2 Credits**

Course Pre-Requisites:

The students should have sound knowledge software engineering and programming experience using data structures.

Course Objective:

To model software solutions, application structures, system behaviour and business processes using UML.

Course Outcomes:

1. Apply Unified Modelling Language (UML) for representation of an object-oriented system using different modelling views.
2. Analyse requirements to represent logical design that is recognized by various object relationships.
3. Identify interaction among structural elements to translate analysis model into design model.
4. Model dependencies among packages and package able element ownership.
5. Model dynamic behavior of the system and message flow from one object to other.
6. Envision the topology of the physical components of a system where the software components are utilized.

UNIT – I **4 Hours**

Introduction to on Object Oriented Technologies and the UML Method: Software development process: The Waterfall Model vs. The Spiral Model; The Software Crisis, description of the real world using the Objects Model; Classes, inheritance and multiple configurations; Quality software characteristics; Description of the Object-Oriented Analysis process vs. the Structure Analysis Model. UML Language: Standards; Elements of the language; General description of various models; The process of Object-Oriented software development; Description of Design Patterns; Technological Description of Distributed Systems.

UNIT – II **4 Hours**

Requirements Analysis Using Case Modeling AND The Logical View Design: Analysis of system requirements; Actor definitions; Writing a case goal; Use Case Diagrams; Use Case Relationships. **The Static** Structure Diagrams: The Class Diagram Model; Attributes descriptions; Operations descriptions; Connections descriptions in the Static Model; Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.

UNIT – III **4 Hours**

Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams: Description of goal; Defining UML Method, Operation, Object Interface, Class; Sequence Diagram; Finding objects from Flow of Events; Describing the process of finding objects using a Sequence Diagram; Describing the process of finding objects using a Collaboration Diagram.

UNIT – IV **4 Hours**

Package Diagram Model: Description of the model; White box, black box; Connections between packagers; Interfaces; Create Package Diagram; Drill Down.

UNIT – V **4 Hours**

Dynamic Model: State Diagram / Activity Diagram: Description of the State Diagram; Events Handling; Description of the Activity Diagram; Exercise in State Machines.

UNIT – VI **4 Hours**

Component Diagram Model: Physical Aspect; Logical Aspect; Connections and Dependencies; User face; Initial DB design in a UML environment. Deployment Model: Processors; Connections; Components; Tasks; Threads; Signals and Events.

List of Assignments:

Teaching faculty will take assignment on following topic for internal assessment.

1. Study of UML notations
2. Class diagram
3. Interaction diagrams
4. Activity diagram
5. State diagram
6. Software project covering various software development methodology techniques will be implemented.

List of Laboratory Exercises:

1. For Object Oriented Modelling, choose a hypothetical system of significant complexity (on your project topic) and write an SRS.
2. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include various scenarios as per template.
3. Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships.
4. Draw sequence diagrams with advanced notation for your system to show objects and their message exchanges.
5. Draw activity diagrams to display either business flows or activity flow.
6. Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime architecture of your system.
8. Implement Singleton Pattern, Abstract Factory Pattern and Singleton Pattern using Java.

List of Project Based Learning Topics:

1. Implementation level UML class diagram to illustrate usage of Android Camera API
   Deployment diagram for Android application deployment.
2. Online shopping UML diagrams
3. Ticket vending machine UML diagrams
4. Bank ATM UML diagrams.
5. Hospital management UML diagrams
6. Airport check-in and security screening Use case modelling and Requirement analysis
7. e-Library online public access UML
8. Coffee vending machine UML diagrams.
9. Online order Processing UML diagrams.

Textbooks:

1. Object-Oriented Software Engineering: using UML, Patterns, and Java. Bernd Bruegge and Allen H. Dutoit.
2. The Unified Modelling Language User Guide. Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

Reference Books:

1. Design Patterns: Elements of Reusable Object-Oriented Software. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlassises.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

SYLLABUS

MINOR DEGREE: BUSINESS SYSTEMS

BUSINESS STRATEGY

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 marks**	**Theory**	**:3 Credits**
Practical :2 Hrs./Week	**Internal Assessment**	**:40 marks**	**Oral**	**:1 Credit**
	Termwork	**:25 Marks**	**Total**	**:4 Credits**
	Oral	**:25 Marks**		
	Total	**:150 Marks**		

Course Pre Requisites:

Introductory awareness of Business terminologies and functions.

Course Objective:

Familiarize the fundamental principles and practices of business development.

Course Outcomes:

This course will help students,

1. To summarize the important concepts of strategic management
2. To identify the process and capabilities for internal environment of a firm.
3. To understand the strategies applicable for external environments of firm
4. To examine corporate strategies
5. To compare the various business growth strategies
6. To understand the process of strategy implementation

UNIT – I **6 Hours**

Introduction to Strategic Management: Importance of Strategic Management**,** Vision and Objectives**,** Schools of thought in Strategic Management**,** Strategy Content, Process, and Practice**,** Fit Concept and Configuration Perspective in Strategic Management

UNIT – II **6 Hours**

Internal Environment of Firm- Recognizing a Firm's Intellectual Assets: Core Competence as the Root of Competitive Advantage**,** Sources of Sustained Competitive Advantage**,** Business Processes and Capabilities-based Approach to Strategy

UNIT – III **6 Hours**

External Environments of Firm- Competitive Strategy: Five Forces of Industry Attractiveness that Shape Strategy**,** The concept of Strategic Groups, and Industry Life Cycle**,** Generic Strategies**,** Generic Strategies and the Value Chain

UNIT – IV **6 Hours**

Corporate Strategy: The Motive for Diversification**,** Related and Unrelated Diversification**,** Business Portfolio Analysis

UNIT – V **6 Hours**

Growth Strategies: Expansion, Integration and Diversification**,** Strategic Alliances, Joint Ventures, and Mergers & Acquisitions

UNIT – VI **6 Hours**

Strategy Implementation: Structure and Systems: The 7S Framework**,** Strategic Control and Corporate Governance

Project Based Learning:

1. Choose an organization and do analysis of Vision Mission and Objectives
2. Case study of an organization through the lens of ten school of thoughts
3. Select an organization and do analysis of it from the perspective of fit concepts and configuration.
4. Study a research paper related to core competencies and build your opinion related to taking advantage of core competencies.
5. Analyse the process of Business Processes and Capabilities-based Approach to Strategy
6. Case study on Porter's Five forces
7. Do generic study of different strategies and prepare a research paper on them.
8. Do a case study on motives of diversifications.
9. Choose an organization and prepare a business portfolio.
10. Make an analysis of different expansion strategy and prepare a research paper on it.

Text Books:

1. Robert M. Grant (2012). Contemporary Strategic Management, Blackwell, 7th Edition.

Reference Books:

1 . M.E. Porter, Competitive Strategy, 1980. M.E. Porter,
2 . Competitive Advantage, 1985 Richard Rumelt (2011).
3 . Good Strategy Bad Strategy: The Difference and Why It Matters.

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI

INTRODUCTION TO INNOVATION, IP MANAGEMENT & ENTREPRENEURSHIP

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 marks**	**Theory**	**:3 Credits**
Practical :2 Hrs./Week	**Internal Assessment**	**:40 marks**	**Oral**	**:1 Credit**
	Termwork	**:25 Marks**	**Total**	**:4 Credits**
	Oral	**:25 Marks**		
	Total	**:150 Marks**		

Course Pre-Requisites:

Good Knowledge of Fundamentals of Management.

Course Objective:

The major emphasis of the course will be on creating a learning system through which management students can enhance their innovation and creative thinking skills, acquaint themselves with the special challenges of starting new ventures and use IPR as an effective tool to protect their innovations and intangible assets from exploitation.

Course Outcomes:

1. Learn to be familiar with creative and innovative thinking styles.
2. Learn opportunity reorganization and entrepreneurship skills.
3. Learn to investigate, understand and internalize the process of founding a startup.
4. Understand financial aspects of Entrepreneurship.
5. Learn to manage various types of IPR to protect competitive advantage.
6. Understand the types of IP.

UNIT – I **4 Hours**

Innovation: What and Why?
Innovation as a core business process, Sources of innovation, Knowledge push vs. need pull innovations.
Class Discussion- Is innovation manageable or just a random gambling activity?

UNIT – II **4 Hours**

Building an Innovative Organization
Creating new products and services, exploiting open innovation and collaboration, use of innovation for starting a new venture
Class Discussion- Innovation: Co-operating across networks vs. ‘go-it-alone’ approach.

UNIT – III **4 Hours**

Entrepreneurship:
Opportunity recognition and entry strategies, Entrepreneurship as a Style of Management, Maintaining Competitive Advantage- Use of IPR to protect Innovation.

UNIT – IV **4 Hours**

Entrepreneurship- Financial Planning: Financial Projections and Valuation. Stages of financing, Debt, Venture Capital, and other forms of Financing

UNIT – V **4 Hours**

Intellectual Property Rights (IPR): Introduction and the economics behind development of IPR: Business Perspective, IPR in India – Genesis and Development, International Context, Concept of IP Management, Use in marketing.

UNIT – VI **4 Hours**

Types of Intellectual Property: Patent- Procedure, Licensing and Assignment, Infringement and Penalty, Trademark- Use in marketing, example of trademarks- Domain name, Geographical Indications- What is GI, Why protect them? Copyright- What is copyright, Industrial Designs- What is design? How to protect?
Class Discussion- Major Court battles regarding violation of patents between corporate companies.

List of Assignments:

1. Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.
2. Further, the topic for class discussion will be mentioned beforehand and students should be ready to discuss these topics (in groups) in class. Students are required to meet in groups before coming to class and prepare on the topic. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.
3. Topic 1- Is innovation manageable or just a random gambling activity?
4. Topic 2- Innovation: Co-operating across networks vs. 'go-it-alone' approach.
5. Topic 3- Major Court battles regarding violation of patents between corporate companies.

List of Project Based Learning Topics:

Design case studies for based on any of the following technologies.

1. Artificial Intelligence
2. Machine Learning
3. Cloud Computing
4. IOT
5. HCI
6. Brain Computer Interface
7. Web Designing
8. Blockchain

Textbooks:

1. Joe Tidd, John Bessant. Managing Innovation: Integrating Technological, Market and Organizational Change
2. Case Study Materials: To be distributed for class discussion.

Syllabus for Unit Test:	**Unit**
Unit Test -1	UNIT – I, UNIT – II, UNIT – III
Unit Test -2	UNIT – IV, UNIT – V, UNIT – VI

MARKETING RESEARCH & MARKETING MANAGEMENT

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 marks**	**Theory**	**:3 Credits**
Practical :2 Hrs./Week	**Internal Assessment**	**:40 marks**	**Oral**	**:1 Credit**
	Termwork	**:25 Marks**	**Total**	**:4 Credits**
	Oral	**:25 Marks**		
	Total	**:150 Marks**		

Course Overview:

Course includes concepts of Marketing, Product Management, Business Marketing and marketing management.

Prerequisite:

Students should have basic knowledge about marketing skills.

Course Outcomes:

On completion of the course, students will have the ability to:

1. Understand the basic marketing concepts.
2. Comprehend the concept of Product Life cycle and Product development.
3. Understand the basics of Pricing, Promotion and Distribution Strategy.
4. Comprehend the dynamics of marketing and analyze how its various components interact with each other in the real world.
5. Leverage marketing concepts for effective Internet Marketing.
6. Understand basic concepts and application of statistical tools in Marketing research.

Unit I **06 Hours**

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.
Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social.
Understanding the consumer: Determinants of consumer behaviour, Factors influencing consumer behaviour.
Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning.

Unit II **06 Hours**

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

Unit III **06 Hours**

Pricing, Promotion and Distribution Strategy: Policies & Practices –Pricing Methods & Price determination Policies. Marketing Communication– The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising.

Unit IV **06 Hours**

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations, Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis **Testing, Multivariate Analysis** - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis.

Unit V **06 Hours**

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing.

Unit VI **06 Hours**

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationships, networks and customer relationship management. Business to Business marketing strategy.

Textbooks

1. Marketing Management (Analysis, Planning, Implementation & Control) – Philip Kotler
2. Fundamentals of Marketing – William J. Stanton & Others
3. Marketing Research – Rajendra Nargundkar
4. Marketing Management – V.S. Ramaswamy and S. Namakumari
5. Market Research – G.C. Beri
6. Market Research, Concepts, & Cases – Cooper Schindler

Reference Books

1. Marketing Management – Rajan Saxena
2. Marketing Management – S.A. Sherlekar
3. Service Marketing – S.M. Zha
4. Journals – The IUP Journal of Marketing Management, Harvard Business Review
5. Research for Marketing Decisions by Paul Green, Donald, Tull
6. Business Statistics, A First Course, David M Levine at al, Pearson Publication

Project Based Learning:

1. Make a case study on consumer behavior, and market segmentation with referring any product or service
2. Find a company and make a model of its Product Life Cycle and highlight their strategies of launching a new product
3. Make a short model on promotion mix, pricing and 5 M's of Advertising Management for considering your product or services
4. 4 Make a tools (questionnaire,) for market research and discuss its outcomes and usages
5. Make a case study of the company which is using internet marketing effectively and productively highlight their strategies
6. Do the study of the firm which is good at B2B marketing discus its policies and tools are used by it

Syllabus for Unit Tests:

Unit Test -1	Unit – I, Unit – II, Unit - III
Unit Test -2	Unit – IV, Unit-V, Unit-VI

FINANCIAL AND COST ACCOUNTING

TEACHING SCHEME	EXAMINATION SCHEME		CREDITS ALLOTTED	
Lectures :3 Hrs./Week	**Semester Examination**	**:60 marks**	**Theory**	**:3 Credits**
Practical :2 Hrs./Week	**Internal Assessment**	**:40 marks**	**Oral**	**:1 Credit**
	Termwork	**:25 Marks**	**Total**	**:4 Credits**
	Oral	**:25 Marks**		
	Total	**:150 Marks**		

Course Pre-Requisites: familiarity with common concepts and terminologies in economics and accounts.

Course Objective*:*

1. To impart knowledge about different ways of accounting process
2. Understanding and interpreting financial statements.

Course Outcomes:

After successful completion of this course students will be able to

1. Understand the important concepts of accounting and their importance in management
2. Interpret the accounting process
3. Analyze financial statements
4. Review the cash flow and fund flow techniques
5. Interpret the costing systems
6. Infer the accounts and reports

UNIT – I **6 Hours**

Accounting Concept: Introduction, Techniques and Conventions, Financial Statements- Understanding & Interpreting Financial Statements

UNIT – II **6 Hours**

Accounting Process: Book Keeping and Record Maintenance**,** Fundamental Principles and Double Entry**,** Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts**,** Cash Book and Subsidiary Books, Rectification of Errors

UNIT – III **6 Hours**

Financial Statements: Form and Contents of Financial Statements, Analyzing and Interpreting Financial Statements, Accounting Standards.
Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam

UNIT – IV **6 Hours**
Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them

UNIT – V **6 Hours**

Costing Systems: Elements of Cost**,** Cost Behavior, Cost Allocation, OH Allocation**,** Unit Costing, Process Costing, Job Costing**,** Absorption Costing, Marginal Costing, Cost Volume Profit Analysis**,** Budgets**,** ABC Analysis
Class Discussion: Application of costing concepts in the Service Sector

UNIT – VI **6 Hours**

Company Accounts and Annual Reports: Audit Reports and Statutory Requirements**,** Directors Report**,** Notes to Accounts**,** Pitfalls

Text Books:

1. Robert N Anthony, David Hawkins, Kenneth Marchant, Accounting: Texts and Cases, McGraw- Hill
2. Case Study Materials: To be distributed for class discussion.

Reference Books:

Cost Accounting: Texts and Problems Reference Book By M. C. Shukla

Project Based Learning:

1. Effectiveness of human relations in the banking industry.
2. An evaluation of the impact of wages and salaries policies on the performance of workers.
3. An appraisal of the relevance of financial incentives to workers MOTIVATION**.**

Syllabus for Unit Test:

Unit Test -1	UNIT – I, UNIT – II, UNIT - III
Unit Test -2	UNIT – IV, UNIT – V, UNIT - VI