Four-Year Undergraduate Programme

Bachelor of Technology

Information Technology

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

1. **Vision of the Department**

    Vision of Information Technology Department of Parul Institute of Engineering & Technology is to develop innovative, employable, self-disciplined and socially responsible skilled IT engineers to meet the ever changing trends in the IT sector through provision of most modern education-training, easy access to necessary IT resources and state-of-art infrastructure.

2. **Mission of the Department**

    M1. To impart career-oriented Graduate and Post Graduate education by teaching both theoretical & applied foundation of Information Technology.

    M2. To effectively apply it to solve real world problems thus amplifying their potential for a fruitful lifelong career in order to serve the society, as well as local, national and international business organizations.

3. **Program Educational Objectives**

    The statements below indicate the career and professional achievements that the B. Tech. Information Technology curriculum enables graduates to attain.

PEO 1	Pursue successful career in engineering involving professional knowledge and skills for analysis, design and solution of real time engineering problems.
PEO 2	Excel in professional career with sound fundamental knowledge and pursue life-long learning including higher education and research.
PEO 3	Demonstrate interpersonal skills, leadership ability and team building to achieve organization goals and serve society with professional ethics and integrity.

4. **Program Learning Outcomes**

    Program Learning outcomes are statements conveying the intent of a program of study.

PLO 1	**Engineering knowledge:**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PLO 2	**Problem analysis:**	Identify, formulate, review research literature, and Analyse complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.
PLO 3	**Design/development of solutions:**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PLO 4	Conduct investigations of complex problems:	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PLO 5	Modern tool usage:	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PLO 6	The engineer and society:	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PLO 7	Environment and sustainability:	Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PLO 8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PLO 9	Individual and team work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PLO 10	Communication:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PLO 11	Project management and finance:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PLO 12	Life-long learning:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

5. Program Specific Learning Outcomes

PSO 1	Demand as per recent development	An ability to Analyse, design, verify, validate, code, and maintain the solution as software of a given problem.
PSO 2	Software skill	An ability to understand, apply and work with one or more domains using knowledge of mathematical techniques and principles with relevant areas of information technology.
PSO 3	Understanding Industry Requirement	An ability to understand the industrial problems, the existing tools and technologies being used in the industry, finding correlation between theory and practices being used in the industry.

6. Credit Framework

Semester wise Credit distribution of the programme	
Semester-1	16
Semester-2	20
Semester-3	22
Semester-4	23
Semester-5	22
Semester-6	23
Semester-7	27
Semester-8	14
Total Credits:	**167**

Category wise Credit distribution of the programme	
Category	Credit
Major Core	68
Minor Stream	0
Multidisciplinary	31
Ability Enhancement Course	9
Skill Enhancement Courses	34
Value added Courses	0
Summer Internship	2
Research Project/Dissertation	23
Total Credits:	**167**

7. Program Curriculum

		Semester 1				
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303104105	Environmental Science	Audit	1	0	0
2	303105103	Open Source Software	2	1	2	0
3	303105104	Computational Thinking for Structured Design-1	4	3	2	0
4	303106103	Electrical and Electronics Engineering	4	3	2	0
5	303191101	Mathematics-I	4	4	0	0
6	303193103	Communication Skills	2	0	0	2
		Total	**16**	**12**	**6**	**2**
		Semester 2				
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
7	303105151	Computational Thinking for Structured Design-2	4	3	2	0
8	303105152	Design Thinking	3	2	2	0
9	303105153	Global Certifications - Fundamentals (Azure, AWS, GCP)	2	2	0	0
10	303107152	ICT workshop	1	0	2	0
11	303191151	Mathematics-II	4	4	0	0
12	303192102	Engineering Physics-II	4	3	2	0
13	303193152	Advanced Communication & Technical Writing	2	0	0	2
		Total	**20**	**14**	**8**	**2**
		Semester 3				

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
14	303105201	Design of Data Structures	3	3	0	0
15	303105202	Design of Data Structures Laboratory	2	0	4	0
16	303105203	Database Management System	3	3	0	0
17	303105204	Database Management System Laboratory	1	0	2	0
18	303105205	Object Oriented Programming with JAVA	2	2	0	0
19	303105206	Object Oriented Programming with JAVA Laboratory	1	0	2	0
20	303105220	Digital Electronics	3	3	0	0
21	303105221	Digital Electronics Laboratory	1	0	2	0
22	303191202	Discrete Mathematics	4	4	0	0
23	303193203	Professional Communication Skills	2	0	0	2
		Total	**22**	**15**	**10**	**2**

Semester 4

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
24	303105251	Operating System	3	3	0	0
25	303105252	Operating System Laboratory	1	0	2	0
26	303105255	Computer Network	3	3	0	0
27	303105256	Computer Network Laboratory	1	0	2	0
28	303105257	Programming in Python with Full Stack Development	3	3	0	0
29	303105258	Programming in Python with Full Stack Development Laboratory	1	0	2	0
30	303105259	Competitive Coding	2	0	4	0
31	303108253	Computer Organization and Architecture	3	3	0	0
32	303108254	Computer Organization and Architecture Laboratory	1	0	2	0
33	303191251	Probability, Statistics and Numerical Methods	4	4	0	0
34	303193252	Professional Grooming and Personality Development	1	0	0	1
		Total	**23**	**16**	**12**	**1**

Semester 5

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
35	303105218	Design and Analysis of Algorithm	3	3	0	0
36	303105219	Design and Analysis of Algorithm Laboratory	2	0	4	0
37	303105309	Enterprise Programming using Java	2	2	0	0
38	303105310	Enterprise Programming Using Java Laboratory	1	0	2	0
39	303108301	Theory of Computation	3	3	0	0
40	303108303	Data Mining and Data Visualization	3	3	0	0
41	303108304	Data Mining and Data Visualization Laboratory	1	0	2	0

42	303108305	Software Engineering And Project Management	3	3	0	0
43	303108306	Software Engineering And Project Management laboratory	1	0	2	0
44	303193304	Professionalism & Corporate Ethics	1	0	0	1
45		Open Elective 01 (Compulsory Subjects :1)	2	2	0	0
Total			**22**	**16**	**10**	**1**

Open Elective 01

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303101331	Basic Aircraft Science	2	2	0	0
2	303104305	Disaster Preparedness and Planning	2	2	0	0
3	303105302	Azure Fundamentals	2	2	0	0
4	303105304	Cyber Security	2	2	0	0
5	303105305	Internet of Things	2	2	0	0
6	303107346	Fundamentals of Communication Engineering	2	2	0	0
7	303109346	Renewable Energy Sources	2	2	0	0

Semester 6

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
46	303105307	Artificial Intelligence	3	3	0	0
47	303105308	Artificial Intelligence Laboratory	1	0	2	0
48	303105379	MEA(R)N Stack Web Development	3	3	0	0
49	303105380	MEA(R)N Stack Web Development Laboratory	1	0	2	0
50	303108357	Project-1	3	0	6	0
51	303108361	Quant, and Reasoning	3	3	0	0
52	303193353	Employability Skills	1	0	0	2
53		PEC 01-LAB (Compulsory Subjects :1)	1	0	2	0
54		PEC 01 (Compulsory Subjects :1)	3	3	0	0
55		PEC 02 (Compulsory Subjects :1)	3	3	0	0
56		PEC 02-LAB (Compulsory Subjects :1)	1	0	2	0
Total			**23**	**15**	**14**	**2**

PEC 01

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303105326	Cyber Security	3	3	0	0
2	303105445	Cloud Computing	3	3	0	0
3	303108363	Data Science	3	3	0	0

PEC 01-LAB

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303105327	Cyber Security Laboratory	1	0	2	0

2	303105446	Cloud Computing Laboratory	1	0	2	0
3	303108364	Data Science laboratory	1	0	2	0

PEC 02						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303108391	Mobile Computing	3	3	0	0
2	303108397	Computer Graphics and Visualization	3	3	0	0
3	303105351	.Net Programming	3	3	0	0

PEC 02-LAB						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303108392	Mobile Computing Laboratory	1	0	2	0
2	303108398	Computer Graphics and Visualization Laboratory	1	0	2	0
3	303105352	.Net Programming Laboratory	1	0	2	0

Semester 7						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
57	303105310	Information and Network security	3	3	0	0
58	303105311	Information and Network security Laboratory	1	0	2	0
59	303108401	Project II	6	0	12	0
60	303108402	Summer Internship	2	0	0	0
61	303108443	Applied Machine Learning	3	3	0	0
62	303108444	Applied Machine Learning Laboratory	1	0	2	0
63		Open Elective 02 (Compulsory Subjects :1)	3	3	0	0
64		PEC 03 (Compulsory Subjects :1)	3	3	0	0
65		PEC 03-LAB (Compulsory Subjects :1)	1	0	2	0
66		PEC 04 (Compulsory Subjects :1)	3	3	0	0
67		PEC 04-LAB (Compulsory Subjects :1)	1	0	2	0
Total			**27**	**15**	**20**	**0**

PEC 03						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303105408	Blockchain	3	3	0	0
2	303105415	Augmented and Virtual Reality	3	3	0	0
3	303108471	Computer Vision	3	3	0	0

PEC 03-LAB						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303105409	Blockchain Laboratory	1	0	2	0
2	303105416	Augmented and Virtual Reality Laboratory	1	0	2	0
3	303108472	Computer Vision Laboratory	1	0	2	0

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PEC 04						

Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303108445	Natural Language Processing	3	3	0	0
2	303105443	Big Data Analytics	3	3	0	0
3	303108473	Wireless Sensor Network	3	3	0	0
PEC 04-LAB						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
1	303108446	Natural Language Processing Laboratory	1	0	2	0
2	303105348	Big Data Analytics Laboratory	1	0	2	0
3	303108474	Wireless Sensor Network Laboratory	1	0	2	0
Semester 8						
Sr. No.	Subject Code	Subject	Credit	Lect	Lab	Tut
68	303108452	Industry Internship	14	0	28	
Total			**14**			
Total Credits:			**167**			

1.1 Detailed Syllabus

Semester 1

(1)

a. **Course Name:** Environmental Science
b. **Course Code:** 303104105
c. **Prerequisite:** Knowledge of Physics, Chemistry and Mathematics up to 12th science level and Biology up to 10th science level
d. **Rationale:** Basic knowledge of the environment is essential for all human beings for a good life and sustainable existence

e. **Course Learning Objective:**

CLOBJ 1	Apply systems thinking to analyse the city as a system, demonstrating application
CLOBJ 2	Evaluate the role of smart citizens and approaches for citizen engagement
CLOBJ 3	Identify sources and stressors of water resources, demonstrating understanding
CLOBJ 4	Analyse the causes, effects, and control measures of population explosion

f. **Course Learning Outcomes:**

CLO 1	Understand the interrelation and interdependency of organisms and their interactions with the environment.
CLO 2	Identify eco-friendly measures in engineering projects.
CLO 3	Understand preventive steps for environmental protection.
CLO 4	Act as a responsible individual who is aware of efficient usage of resources and securing sustainable development

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
1	**0**	**0**	Audit	-	50	-	-	-	**50**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours

1	**Environmental Health, Ecology And Quality Of Life** Environmental education: Objective and scope, Impact of technology on the environment, Environmental disasters: Case studies, Global environmental awareness to mitigate stress on the environment, Structure and function of an ecosystem, Ecological pyramids, Pyramid of number, Pyramid of energy and pyramid of biomass.	**25%**	**7**
2	**Pollution Prevention** Air & Noise pollution - Sources & their Effects, Case studies of Major Catastrophes, Structure and composition of the atmosphere, Water, Soil, Marine, Thermal & Marine Pollution: The story of fluoride contamination, Eutrophication of lakes, control measures, Measuring water quality: Water quality index, Waste water treatment (general) primary, secondary and tertiary stages, Municipal Solid waste management: Sources and effects of municipal waste, Biomedical waste, Hazardous waste	**20%**	**6**
3	**Population Growth, Global Environmental Challenges & Latest Developments** Population Explosion - Causes, Effects and Control, an International initiative in population-related issues, Urbanization, Growth of the world's large cities, Water resources: Sources of water, Stress on water resources, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Variation in concentrations of GHG gases in ambient air during last millennium, Role of Environmental Information System (ENVIS) in India and similar programs run by EPA(USA), Role of soft tools like Quantum GIS, Autodesk Building Information Modeling (BIM) and City Finance Approach to Climate-Stabilizing Targets (C- FACT), Life Cycle Assessment, Bioinformatics and Optimization tools for sustainable development.	**25%**	**7**
4	**Smart Cities** Introduction to smart cities - about smart cities, what is a smart city, world urbanization, case studies of Songdo, Rio De Janeiro, what makes cities smart. City as a system of systems – Introduction, systems thinking, Milton Keynes Future Challenges, Rich picture as city challenges, Wicked problems, Development of smart city approach – core elements, open data, sustainability, privacy and ethics, development processes. Smart Citizens – their role, engaging citizens, IES Cities, Energy systems, Approaches for Citizen Engagement, co-creating smart cities, cities unlocked, living labs, city problems, crowdsourcing ideas, redesigning cities for citizens, all age-friendly cities, mobility on demand, motion maps, Infrastructure, Technology and Data – urban infrastructure and its technology, future of lighting, IoT, connected objects, sensing the city, NOx eating paints and air quality sensors, safest, smart citizen kit, sensing your	**30%**	**10**

city, Sensored City, Cyber security for data power, open, shared and closed data, satellite data, open data revolution, Smart City Project Data Innovation – smart innovations, smart city ecosystem, data-driven innovations for smart cities Standards and Capacity Building – the role of Standard, BSI smart city Standards, HyperCat, ITU Smart Sustainable cities, Smart City Readiness, Lessons Learnt from Amsterdam Smart Measurements - metrics and indicators, city indicators, WCCD data portal, value proposition, integrated reporting, smart city learning and education, urban data school.		

i. Text Book and Reference Book:

1. Textbook of Environmental Studies For Undergraduate Courses (TextBook), By Dr Erach Bharucha | Orient BlackSwan | Second Edition, Pub. Year 2013

2. Basics of Environmental Studies, By U K Khare | Tata McGraw Hill

3. Environmental Studies, By Anindita Basak | Drling Kindersley(India)Pvt. Ltd Pearson

4. Environmental Sciences, By Daniel B Botkin & Edward A Keller | John Wiley & Sons

5. Air Pollution, By M N Rao , H .V N Rao | McGraw Hill Publishing Company Limited, New Delhi

6. Environmental Engineering, By Howard S. Peavy, Donald R. Rowe, George Tchobanoglous | McGraw-Hill

(2)

a. **Course Name:** Open Source Software
b. **Course Code:** 303105103
c. **Prerequisite:** Basic knowledge of software applications.
d. **Rationale:** Open Source has acquired a prominent place in software industry. Having knowledge of Open Source and its related technologies is an essential for Computer Science student. This course introduces Open Source methodologies and ecosystem to students.

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain.
CLOBJ 2	Acquire Knowledge regarding Open-Source History, OpenSource Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization
CLOBJ 3	Acquire knowledge of Community and Communication, Contributing to Opensource Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice. Open-Source Ethics and Social Impact: Open source vs. closed source, Open-source Government, Ethics of Opensource,
CLOBJ 4	Understand GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies
CLOBJ 5	Demonstrate apache Web server, BSD, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, WordPress, Git, GCC, GDB, GitHub, Open Office, LibreOffice Study

f. **Course Learning Outcomes:**

CLO 1	Differentiate between Open Source and Proprietary software and Licensing.
CLO 2	Recognize the applications, benefits, and features of Open-Source Technologies
CLO 3	Gain knowledge to start, manage open-source projects.
CLO 4	Worked with Open-Source ecosystem, its use, impact, and importance.
CLO 5	learn Open-Source methodologies, case studies with real life examples.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
1	-	2	2	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Open-Source** Open Source, Need and Principles of OSS, Open-Source Standards, Requirements for Software, OSS success, Free Software, Examples, Licensing, Free Vs. Proprietary Software, Free Software Vs. Open-Source Software, Public Domain. History of free software, Proprietary Vs Open-Source Licensing Model, use of Open- Source Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.	15%	1
2	**Open-Source Principles and Methodology** Open-Source History, Open Source Initiatives, Open Standards Principles, Methodologies, Philosophy, Software freedom, Open-Source Software Development, Licenses, Copyright vs. Copy left, Patents, Zero marginal cost, Income-generation Opportunities, Internationalization. Licensing: What Is A License, How to create your own Licenses, Important FOSS Licenses (Apache, BSD, PL, LGPL), copyrights and copy lefts, Patent	20%	3
3	**Open-Source projects** Starting and maintaining own Open- Source Project, Open-Source Hardware, Open-Source Design, Open-source Teaching, Open source media. Collaboration: Community and Communication, Contributing to Open source Projects Introduction to GitHub, interacting with the community on GitHub, Communication and etiquette, testing open-source code, reporting issues, contributing code. Introduction to Wikipedia, contributing to Wikipedia or contributing to any prominent open-source project of student's choice. Open-Source Ethics and Social Impact: Open source vs. closed source, Open-source Government, Ethics of Open-source, Social and Financial impacts of open-source technology, Shared software, Shared source, Open Source as a Business Strategy	20%	3
4	**Understanding Open-Source Ecosystem** Open-Source Operating Systems: GNU/Linux, Android, Free BSD, Open Solaris. Open-Source Hardware, Virtualization	20%	4

5	**Case Studies**	25%	4
	Example Projects, Apache Web server, BSD, GNU/Linux, Android, Mozilla (Firefox), Wikipedia, Drupal, WordPress, Git, GCC, GDB, GitHub, Open Office, LibreOffice Study: Understanding the developmental models, licensing, mode of funding, commercial/non-commercial use.		

	Technologies, Containerization Technologies: Docker, Development tools, IDEs, Debuggers, Programming languages, LAMP, Open-Source Database technologies		

i. Text Book and Reference Book:

1. Open-Source Technology", Kailash Vadera & Bhavyesh Gandhi, University Science Press, Laxmi Publications, 2009, Software Engineering, Sommerville (TextBook)
2. Open-Source Technology and Policy", Fadi P. Deek and James A. M. McHugh, Cambridge University Press, 2008Software Engineering Pankaj Jalote; Wiley India
3. Perspectives on Free and Open-Source Software", Clay Shirky and Michael Cusumano, MIT press

j. List of Experiment:

1.	Demonstration of Basic Linux commands.
2.	Execute C Program using gcc compiler.
3.	Demonstration of gprof command using Linux.
4.	Create and Edit documents using Google Docs.
5.	Create Presentation using Google Slides.
6.	Demonstration of different Arithmetic and Logical Formulas using OpenOffice Calc.
7.	Use of HTML to create simple web page.
8.	Demonstration of MathML – a markup language for describing mathematical notation.
9.	Demonstration of virtualization using Docker Container.
10.	Demonstration GitHub Facility.

(3)

a. **Course Name:** Computational Thinking for Structured Design-1
b. **Course Code:** 303105104
c. **Prerequisite:** Basic knowledge of Programming
d. **Rationale:** To understand the various steps involved in programming development. To understand the Basic concepts of programming Language To learn how to learn and write modular and readable c programming To introduce the students to the basics of linear data structure concepts like arrays.

e. **Course Learning Objective:**

CLOBJ 1	Understand the basic Knowledge of computer hardware and software.
CLOBJ 2	To apply solving and logical skills to programming in c language and also in other languages.
CLOBJ 3	To understand Decision Making and Looping to solve real time problems.
CLOBJ 4	To understand the concept of functions for adaptive programming.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate the basic Knowledge of computer hardware and software.
CLO 2	Ability to apply solving and logical skills to programming in c language and also in other languages.
CLO 3	Apply Decision Making and Looping to solve real time problems.
CLO 4	Understand the concept of functions for adaptive programming.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to C language** History of C language, Program Development Steps, Structure of C program	10%	3

2	**Data Types, User I/O and Operators Data Types** Primitive, Extended and Derived Data types, Variables **User I/O** Formatted, predefined Functions of stdio.h header file **Operators** Types of operators, Precedence, Associativity	**10%**	**6**
3	**Conditional Flow Statements, Iterative Statements, Jumping Statements and Pointers** **Conditional Flow Statements** Simple if,if-else, else-if ladder, switch case Decision Making using conditional statements **Iterative Statements** Control Entry and Control Exit Loops **Jumping Statements** break, continue, forward and backwardgoto. **Pointers** Typed single double, triple wild, NULL, Const, untyped: void	**15%**	**9**
4	**Functions** **Functions** Call by value, call by references, Types of Functions. **Pointer Functions** Calling A function through function pointer, Passing A function's address as an Argument to otherfunction, Types of Pointer function Creation. **Recursion** Types of Recursions: Direct Recursion, Indirect Recursion, Tail Recursion, No tail/Head Recursion, TreeRecursion, Nested Recursion. **Storage classes** Auto, register, static and Extern	**30%**	**10**
5	**Arrays** **Arrays** Types of arrays, Declaration and Defining an array **Pointer and Arrays** Types of Accessing Array elements Subscripting pointer variables Pointer to an array, Array ofpointers, Pointers and two dimensional arrays Subscripting pointer To an array **Array of Functions** **Strings** Strings v/s character arrays, Initializing strings, Reading and Displaying string Types of string format Specifiers. puts() functions, MultiLine string Input String pointers, Two-dimensional character arrays or array ofstring Array of pointers to strings, String handling functions	**35%**	**14**

i. Text Book and Reference Book:

1. C programing by Bala Guru Swamy (TextBook)
2. C for all by s.Thammarai Selvi ,R Murugesan, Anuradha Publications
3. Programing in c Ajay Mittal, Pearson

j. List of Experiments:

Sr. No.	List of Experiment
1.	Installation C IDE, Basic Structure of C program. Format Specifiers, Escape Character. Run time input/output Programs.
2.	1. Write a c program to calculate Area of Rectangle, Perimeter of a Rectangle and Diagonal of a Rectangle. 2. Write a c program to calculate Area of square, Perimeter of a square and Diagonal of a square. Write a c program to calculate total area of Cylinder and volume of a cylinder.
3.	1. The total distance traveled by vehicle in 't seconds is given by distance s = ut+1/2at? where 'u' and 'a' are the initial velocity (m/sec.) and acceleration(m/sec?). Write a C program to find the distance traveled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,", /, % and use Switch Statement)
4.	1. Write a C program to find the sum of individual digits of a positive integer. 2. A Fibonacci sequence is defined as follows: the first and second terms in the sequences are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
5.	1. Write a C program to calculate the following Sum: Sum=1-x^2/2! +x^4/4!-x^6/6!+x^8/8!-x^10/10!. Write a C program to find the roots of a quadratic equation.
6.	Write C programs that use both recursive and non-recursive functions. 1. To find the factorial of a given integer. To find the GCD (greatest common divisor) of two given integers.
7.	1. Write a C program to find the largest integer in a list of integers, 2. Write a C program that uses functions to perform the following: 1. Addition of Two Matrices Multiplication of Two Matrices

8.	1. Write a C program that uses functions to perform the following operation;
	   1. To insert a sub-string into a given main string from a given position.
	   2. To delete n Characters from a given position in a given string,
	Write a C program to determine if the given string is a palindrome or not.

9.	1. Write a C program that displays the position or index in the string S where the string T begins, or -1 if S doesn't contain T. 2. Write a C program to count the lines, words and characters in a given text.
10.	1. Write a C program to generate Pascal's triangle. Write a C program to construct a pyramid of numbers.
11.	Write a C program to read in two numbers, x and n, and then compute the sum of this geometric progression: $1+x+x^2+x^3+... x^n$.

	For example: if n is 3 and x is 5, then the program computes 1+5+25+125.Print x, n, the sum. Perform error checking. For example, the formula does not make sense for negative exponents — if n is less than 0. Have your program print an error - message if n<0, then go back and read in the next pair of numbers without computing the sum. Are any values of x also illegal? If so, test for them too.
12.	1. 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary Number. Write a C program to convert a Roman numeral to its decimal Equivalent.
13.	1. Write a c program on Given an unsorted array arr[] of size N. Rotate the array to the left (counter-clockwise direction) by D steps, where D is a positive integer. 2. Write a c Program on given two sorted arrays arr1 and arr2 of size N and M respectively and an element K. The task is tofind the element that would be at the k'th position of the final sorted array.Explanation: Input: Array 1 - 1 4 2 3 5 Array 2 - 7 8 6 k = 5 Output: 5 Because The final sorted array would be -1, 2, 3, 4, 5, 6, 7, 8, The 5th element of this array is 6.
14.	1. Write a c program to take multiline string input and print individual string length. Write a c program to reverse the individual word of a given string Explanation: input: Welcome To Bytexl output: emocleWoT lxetyB.

(4)

a. **Course Name:** Electrical and Electronics Engineering
b. **Course Code:** 303106103
c. **Prerequisite:** Knowledge of Physics and Mathematics up to 12thscience level.
d. **Rationale:** The course provides introductory treatment of the field of Electrical Engineering to the students of various branches of engineering

e. **Course Learning Objective:**

CLOBJ 1	To Understand the basic definitions of electrical and electronics engineering.
CLOBJ 2	To apply the knowledge of theorems/laws to Analyse the simple circuits.
CLOBJ 3	To use the principles of electromagnetic induction in electrical applications.
CLOBJ 4	To Understand contemporary issues in electrical and electronics engineering practice.

f. **Course Learning Outcomes:**

CLO 1	To Illustrate basic concepts of various laws, principles and theorems associated with DC circuits for networks analysis.
CLO 2	To apply concepts of sinusoidal voltages, power relationships and showcasing knowledge of AC circuit theory using numerical and graphical representation.
CLO 3	To Compare and apply diode and transistor fundamentals, including characteristics, operation, and applications, demonstrating awareness of electronics principles.
CLO 4	To design, and implement various types of voltage regulator circuits, and understanding of power supply concepts and practical applications.
CLO 5	To adept, classify, and apply various electronic sensors and transducers, for understanding of their principles and real-world applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**DC Circuits** Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Simplifications of networks using series and parallel combinations and star-delta conversions. Superposition, Thevenin's and Norton Theorems.	10%	5
2	**AC Circuits** Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of instantaneous, peak (maximum), average and R.M.S. values, frequency, cycle, period, peak factor and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors, examples based on theory. Study of A.C. circuits consisting of pure resistance, pure inductance, pure capacitance and voltage-current voltage- current phasor diagrams and waveforms. The Development of concept of reactance, study of series R-L, R-C, R-L-C circuit the and resonance, study of parallel R-L, R-C and R-LC circuit, concept of impedance, admittance, conductance and susceptance in case of the above combinations and relevant voltage- current phasor diagrams, concept of active, reactive and apparent power and power factor, examples based on the three-phaset of three phase supply and phase sequence. Voltages, currents and power relations in three-phase balanced star-delta-connected delta-connected loads along with phasor diagrams,	30%	15
3	**Diode and Transistors** Introduction to Ideal Diode, Effect of temperature Ideal diodes, unbiased diode and Forward and reverse bias of Diode. PIV, surge current, Diode as Uncontrolled switch. Rectifiers: Half wave, Full wave, and bridge wave. Ripple factor, PIV rating. Choke and Capacitor input filter rectifiers, Clipper and Clamper circuits, Voltage multiplier: Construction and working of BJT, Characteristics & specifications of BJT (PNP & NPN transistors), Biased and unbiased BJT, Configuration of the transistor, the concept of gain & BW, Operation of BJT in the cut-off, saturation & active regions (DC analysis), BJT as a switch, Transistor as an amplifier, Voltage divider bias and analysis, VDB load line and Q point.	30%	15
4	**Voltage Regulator** Basic series and shunt regulator, Types of voltage regulator IC: Fixed and adjustable positive and negative linear voltage regulator, IC linear fixed voltage regulator (78XX, 79XX, LM340 Series), Linear Adjustable Regulator	15%	5

5	**Sensors and Transducers** Introduction to sensors and Transducers, Comparison between sensors and Transducers, Applications of Sensors and Transducers, Types of Electronic sensors, Types of Transducers.	**15%**	**5**

The first row of the table (continuation from previous page):

	(IC LM317, LM337, and IC 723 IC regulator), DC Regulated Power supply, Switched-mode power supply (SMPS).		

i. Text Book and Reference Book:

1. A text book of Electrical technology Vol2
   By B.L.Theraja | S. Chand Publication
2. Electrical Engineering Fundamentals (TextBook)
   By V. D. Toro | Prentice Hall India | 2, Pub. Year 1989
3. Electrical and Electronics Technology
   By E. Hughes | Pearson | 10, Pub. Year 2010
4. Basic Electrical Engineering
   By D. P. Kothari and I. J. Nagrath, | Tata McGraw Hill | 3, Pub. Year 2010
5. Basic Electrical Engineering
   By D. C. Kulshreshtha | McGraw Hill | 1, Pub. Year 2009
6. Fundamentals of Electrical Engineering
   By Leonard S. Bobrow | Oxford University Press | 2, Pub. Year 1996

j. List of Experiment:

Sr. No.	List of Experiment
1.	To Study about Various Electrical and Electronics Symbols and demonstrate various measuring instruments used in Basic electrical Engineering laboratory.
2.	To Perform and Solve Electrical Networks with Series and Parallel Combinations of Resistors Using Kirchhoff's Laws.
3.	To Obtain Inductance, Power and Power Factor of the Series RL Circuit With AC Supply Using Phasor Diagram.
4.	To Obtain Capacitance, Power and Power Factor of the Series RC Circuit With AC Supply Using Phasor Diagram.
5.	To Obtain Inductance, Capacitance, Power and Power Factor of the Series R-L-C Circuit With AC Supply Using Phasor Diagram.
6.	Verification of superposition theorem with dc source.
7.	Verification of Thevenin's theorem with dc source.
8.	Verification of Norton's theorems in dc circuits.
9.	Verification of Current and Voltage Relations in Three Phase Balanced Star and Delta Connected Loads.
10.	To study the cut-section of a dc machine, single phase induction machine and three phase induction machine.
11.	Find out the Efficiency and Voltage Regulation of Single Phase Transformer by Direct Load Test.
12.	To Plot V-I characteristics Diodes. (a) PN junction diode Characteristics, (b) Zener Diode characteristics.

13.	To Observe Rectifier Circuit (a) Half wave Rectifier without filter, (b) Full wave rectifier without filter, (c) Half wave
14.	To Observe Response of Clipping and Clamping circuits using diodes (a) Diode Positive Clipper without and with Biased clipper, (b) Diode Negative Clipper without and with Biased clipper, (c) Biased Positive Negative Clipper (Combinational Clipper), and (d) Positive Clamper, and Negative Clamper.
15.	Designing of power supply using IC regulator circuit. (a) Designing of +5 Volt DC Power Supply using 7805, (b) Designing of -5 Volt DC Power Supply using 7905, (c) Designing of +12 Volt DC Power Supply using 7812, and (d) Designing of -12 Volt DC Power Supply using 7912.
16.	(a)To Plot and Study input-output characteristics of Common Base (B) configuration of the Transistor and (b) To Plot and Study input-output characteristics of common Emitter (CE) configuration of Transistor.
17.	To study the Voltage divider bias circuit: (a) To observe the effect of change in base current on the Q-operating point, and (b) To set Q point for operation of a transistor amplifier in the linear region.
18.	To plot characteristics of Schottky and Varactor diode.
19.	Designing of Linear Adjustable Regulator using IC LM317.
20.	Introduction to Sensors and Transducers.

(5)

a. **Course Name:** Mathematics-I
b. **Course Code:** 303191101
c. **Prerequisite:** Knowledge of Mathematics up to 12th science level
d. **Rationale:** To acquire fundamental knowledge and apply in Engineering discipline
e. **Course Learning Objective:**

CLOBJ 1	Develop a comprehensive understanding of definite and improper integrals, including the application of integration techniques to find areas and volumes in both Cartesian and Polar coordinates.
CLOBJ 2	Utilize differential equations to model and solve practical scenarios, demonstrating proficiency in various solution techniques.
CLOBJ 3	Analyse the convergence and divergence of sequences and series, employing tests such as the Alternating Series Test and Ratio Test
CLOBJ 4	Analyse matrix operations and determinants, exploring their properties and applications in solving systems of linear equations.
CLOBJ 5	Apply Fourier series for representing periodic functions, verifying Dirichlet's conditions.
CLOBJ 6	Solve optimization problems using multivariable calculus concepts, such as Lagrange's multiplier.

f. **Course Learning Outcomes:**

CLO 1	Develop understanding of fundamental mathematical concepts
CLO 2	Formulate and solve mathematical models for real-world engineering problems,
CLO 3	Integrate knowledge from different mathematical topics to Analyse and solve complex engineering problems
CLO 4	Critically Analyse mathematical results, interpret their engineering significance, and make informed decisions based on mathematical outcomes, fostering a deeper understanding of the subject.
CLO 5	Clearly and effectively communicate mathematical ideas, solutions, and reasoning, both in written and oral formats, demonstrating effective communication skills.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Improper Integral & Application of Definite Integral** Evaluation of definite and improper integrals, Beta and Gamma functions and their properties Area bounded by curves in Cartesian and Polar form, Area of a region bounded by function, Area of a region bounded by curves in Parametric form, Volume by slicing, Volume of solid by revolution.	8%	5
2	**First order Ordinary Differential equation** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications	15%	9
3	**Matrices** Matrices & Determinants with Properties, Linear Independence, Rank of Matrix, System of Linear Equations, Consistency of System, Solution of system of Linear Equations by Gauss Jordan and Gauss-Elimination Method, Eigen values, Eigenvectors, Symmetric, Skew-symmetric, and orthogonal Matrices, Eigen bases, Diagonalization, Cayley Hamilton Theorem and its Applications, Diagonalization, Orthogonal Transformation, Quadratic form.	25%	15
4	**Sequences and Series** Basic of Sequences, Bounded and Monotonic Sequences, Series, Convergence of sequence and series, Geometric series, P- series, Cauchy's Integral Test, Comparison Test, Alternating Series, Absolute and Conditional convergence, Ratio test, Cauchy's Root Test, Power series, Taylor's and Maclaurin's series.	17%	10
5	**Fourier Series** Fourier Series of 2 periodic functions, Dirichlet's conditions for representation by a Fourier series, Fourier Series of a function of period 2 , Fourier Series of even and odd functions, Half range series.	10%	6
6	**Multivariable Calculus (Differentiation)** Functions of Several Variables, Limit, Continuity, Partial Derivatives, Homogeneous function, Euler's Theorem for homogeneous function, Modified Euler's Theorem, Chain Rule, Implicit function, Jacobian, Tangent plane and Normal line, Maximum and Minimum Values, Lagrange 's Multiplier, Taylor's and Maclaurin's Series for functions of two variables.	25%	15

i. Text Book and Reference Book:

1. Calculus and Analytic Geometry (TextBook), By G.B. Thomas and R.L. Finney | Addison Wesley
2. Calculus with early transcendental functions, By James Stewart | Cengage Learning
3. Higher Engineering Mathematics, By B. S. Grewal | Khanna Publications
4. Elementary Linear Algebra (TextBook), By Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
5. Advanced Engineering Mathematics (TextBook), By Erwin Kreyszig | Willey India Education
6. A text book of Engineering Mathematics, By N.P. Bali and Manish Goyal | Laxmi Publications

(6)

a. **Course Name:** Communication Skills
b. **Course Code:** 303193103
c. **Prerequisite:** Knowledge of English Language studied till 12th standard.
d. **Rationale:** Basic Communication Skills are essential for all Engineers.
e. **Course Learning Objective:**

CLOBJ 1	Demonstrate the ability to communicate ideas clearly and effectively.
CLOBJ 2	Develop strategies for building positive interpersonal relationships, fostering effective collaboration and teamwork.
CLOBJ 3	Develop active reading skills, including the ability to comprehend, interpret, and respond appropriately to written messages.
CLOBJ 4	Exhibit proficiency in written communication, crafting clear, concise, and well-organized messages across various formats (Ex: Book review, Picture Description, Picture Connectors).
CLOBJ 5	Deliver professional presentations, incorporating effective visual aids, engaging content, and confident delivery.
CLOBJ 6	Understand and Analyse the common grammatical errors.

f. **Course Learning Outcomes:**

CLO 1	Understanding the importance of creative and critical thinking.
CLO 2	Expand vocabulary with proper pronunciation.
CLO 3	Comprehend the basics of English grammar.
CLO 4	Read & write effectively for a variety of contexts.
CLO 5	Develop confidence in speaking skills.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
-	2	-	2	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Crazy Scientist** The students will be taught the importance of invention and innovation using some examples that changed the world the way it worked.	**5%**	**2**
2	**Phonetics** IPA Introduction (listening tracks) Phonic Sounds Pronunciation Practice including transcription	**10%**	**4**
3	**Vocabulary Building & Word Formation Process** Compounding, clipping, blending, derivation, creative respelling, coining and borrowing Prefixes & suffixes, synonyms & antonyms, standard abbreviations (related activities will be provided)	**10%**	**2**
4	**Speaking Activity: Role play on Critical Thinking (Life boat)** This activity topic gears towards making students do role play based on various scenarios. It involves giving them a scenario and asking them to further develop the idea in a very interesting manner, then going on to enact it. It aims to improve students' convincing skills.	**10%**	**4**
5	**Picture Description & Picture Connector** Enable students to use vocabulary and useful expression to describe the picture. In this class the students will be trained to form logical connections between a set of pictures which will be shared with them. This geared towards building creativity and presentation skills.	**15%**	**4**
6	**Mine Activity: Usage of Preposition** Students will learn to use proper propositions by active participation in the activity.	**8%**	**2**
7	**Worksheets on Identifying Common Errors in Writing** Sentence structure Punctuations Subject-Verb Agreement Noun-Pronoun Agreement	**12%**	**2**
8	**Reading Skills** The art of effective reading and its various strategies to be taught to the learners and practice exercises be given on reading comprehension.	**10%**	**2**
9	**Speech and spoken Exchanges; Extempore** Students will learn the correct usage of spoken language as different from the written form. It will help the students in extempore speech. This will be done by making the students give variety of impromptu speeches in front of the class: 1 minute talk on simple topics. To change the average speakers in the class to some of	**10%**	**4**

	the best Orator.		
10	**Book Review** The learners will identify the central idea of the book, author's style and approach towards the book. This will enable the learners to express their point of view and hone their creativity and writing skills	**10%**	**4**

i. Text Book and Reference Book:

1. Understanding and Using English Grammar, By Betty Azar & Stacy Hagen | Pearson Education
2. Business Correspondence and Report Writing, By SHARMA, R. AND MOHAN, K.
3. Communication Skills, By Kumar S and Lata P | New Delhi Oxford University Press
4. Technical Communication: Principles And Practice, By Sangeetha Sharma, Meenakshi Raman | Oxford University Press
5. Practical English Usage, By MICHAEL SWAN
6. A Remedial English Grammar for Foreign Student, By F.T. WOOD
7. Oxford Practice Grammar, By John Eastwood | Oxford University Press
8. Oxford Practice Grammar, John Eastwood; Oxford University Press

Semester 2

(1)

a. **Course Name:** Computational Thinking for Structured Design-2
b. **Course Code:** 303105151
c. **Prerequisite:** Basic knowledge of Programming
d. **Rationale:** To write programs in C to solve the problems and To provide required knowledge to implement linear data structures such as arrays. To understand the various steps involved in programming development. To understand the Basic concepts of linear and non-linear Data Structures. To learn how to learn and write modular and readable c programming.

e. **Course Learning Objective:**

CLOBJ 1	To Write programs in C to solve the problems
CLOBJ 2	To understand the various steps involved in programming development.
CLOBJ 3	To understand the Basic concepts of linear and non-linear Data Structures.
CLOBJ 4	To learn how to learn and write modular and readable c programming.
CLOBJ 5	To provide required knowledge to implement linear data structures such as arrays.

f. **Course Learning Outcomes:**

CLO 1	Learn to use data structures concepts for realistic Problems
CLO 2	Ability to identify appropriate data structures for Solving computing problems in respective language
CLO 3	Ability to solve problems independently and think critically.
CLO 4	Understand the concept of File Management

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Dynamic Memory Allocation** malloc, calloc, realloc and free, Array of pointers, Programing Applications, Dangling Pointer	10%	6
2	**Preprocessor Directives** File Inclusion, Macros, Conditional Compilation and Pragmas	10%	6
3	**Enumerators, Structures, Unions** **Enumerators** Enumerator Types **Structures** Declaration Initialization Accessing Structures, Complex Structures, Structure and Functions Array of structures Arrays within structures Anonymous structures Nested structures pointers in structures Self-referential structures Structure Padding **Unions** Bit fields **Typedef**	15%	15
4	**Searching and Sorting** Selection sort, Bubble Sort, Insertion sort, Quick sort and Merge Sort Linear and Binary Searching Techniques	30%	3
5	**Data Structures** **List- Linear List** Singly Linked List - CRUD operations Double Linked List -CRUD operations Circular Linked List- CRUD operations	35%	15

i. Text Book and Reference Book:

1. Fundamentals of Data Structures in C, 2ND EDITION, E.Horowitz, S,.Sahni and Susan Anderson- Freed, Universities Press (TextBook)
2. Computer Programming & Data Structures - E. Balaguruswamy,4th Edition TMH
3. C & Data Structures - P. Padmanabham, Third Edition,B.S Publications
4. Classic Data Structures - D. samanta

j. List of Experiments:

Sr. No.	List of Experiment
1.	1.Write a c program to increase or decrease the existing size of an 1D array. 2.Write a c program on 2D array to Increase & Decrease i) No of subarrays ii) elements in the subarrays
2.	1.Write a to display present date and time using c language. 2.Write a c program to demonstrate pre-processor directives i) Macros ii) Conditional Compilation
3.	1. Write a C program that uses functions to perform the following Operations. i) Reading a complex number ii) Writing a complex number

	iii) Addition of two complex numbers iv) Multiplication of two complex numbers 2. Write a c program to store records of n students based on roll_no, name, gender and 5 subject marks i) Calculate percentage each student using 5 subjects. ii) Display the student list according to their percentages.
4.	Write a C program to store n employee records based on EMP_ID, EMP_NAME, EMP_DEPTID, EMP_PHNO, EMP_SALARY and display all the details of employees using EMP_NAME in sorted order.
5.	1. Write a c program to implement selection Sort & Bubble sort 2. Write a C program to reverse the elements within a given range in a sorted list. Example: input : 10 9 1 2 4 3 4 6 7 8 10 3 8 output: 1 2 8 7 6 4 4 3 9 10 the sorted list of given array elements is 1 2 3 4 4 6 7 8 9 10, after reversing the elements within the range 3 and 8 is 1 2 8 7 6 4 4 3 9 10
6.	1. Write a c program to implement Insertion sort & Quick sort 2. Write a c program to sort the given n integers and perform following operations i) Find the products of every two odd position elements ii) Find the sum of every two even position elements Explanation: **Input:** 9 1 9 8 3 5 4 7 2 6 **Output:** 3 15 35 63 6 10 14 The sorted list of given input is 1 2 3 4 5 6 7 8 9, the product of alternative odd position elements is 1*3 = 3,3*5=15,5*7=35… and the sum of two even position elements 2+4 =6,4+6=10.
7.	Write a C Program to implement Merge Sort.
8.	1. Write a c program to sort in ascending order and reverse the individual row elements of an mxn matrix input: 3 4 1 4 2 3 7 8 10 9 6 3 5 2 output: 4 3 2 1 10 9 8 7 6 5 3 2 2. Write a c program to sort elements in row wise and print the elements of matrix in Column major order Input: 3 4 1 4 2 3 7 8 10 9 6 3 5 2 Output: 1 7 2 2 8 3 3 9 5 4 10 6

	Explanation: The sorted matrix according to the conditions is 1 2 3 4 7 8 9 10 2 3 5 6 after sorting matrix the elements as to be printed in column major order 1 7 2 2 8 3 3 9 5 4 10 6
9.	1.Write a c program to perform linear Search. 2.Write a c program to perform binary search.
10.	Write a c program to Create a single Linked list and perform Following Operations A. Insertion At Beginning B. Insertion At End C. Insertion After a particular node D. Insertion Before a particular node E. Insertion at specific position F. Search a particular node G. Return a particular node H. Deletion at the beginning I. Deletion at the end J. Deletion after a particular node K. Deletion before a particular node L. Delete a particular node M. Deletion at a specific position
11.	1.Write a program to Reverse a singly Linked list. 2.Write a c program to check whether the created linked list is palindrome or not.
12.	Write a c program to Create a Circular Linked list and perform Following Operations A. Insertion At Beginning B. Insertion At End C. Insertion After a particular node D. Insertion Before a particular node E. Insertion at specific position F. Search a particular node G. Return a particular node H. Deletion at the beginning I. Deletion at the end J. Deletion after a particular node K. Deletion before a particular node L. Delete a particular node M. Deletion at a specific position
13.	Write a c program to Create a Circular single Linked list and perform Following Operations A. Insertion After a particular node B. Insertion Before a particular node C. Search a particular node D. Return a particular node E. Deletion before a particular node F. Delete a particular node
14.	Write a c program to Create a Circular Double Linked list and perform Following Operations A. Insertion After a particular node B. Insertion Before a particular node C. Search a particular node D. Return a particular node E. Deletion before a particular node F. Delete a particular node

(2)

a. **Course Name:** Design Thinking
b. **Course Code:** 303105152
c. **Prerequisite:** Open mindedness, curiosity, empathy, collaboration, iteration, creative thinking
d. **Rationale:** Design thinking is a human-centered approach to problem-solving that emphasizes empathy, experimentation, and creativity. It is a framework for innovation and problem-solving that was originally developed in the context of product design but has since been applied to a wide range of fields and industries.

e. **Course Learning Objective:**

CLOBJ 1	Expose students to the design process as a tool for innovation.
CLOBJ 2	Develop students' professional skills in client management and communication.
CLOBJ 3	Demonstrate the value of developing a local network and assist students in making lasting connections with the business community.
CLOBJ 4	To come up with solutions, products, or services that are desirable for the user
CLOBJ 5	To develop in the context of product design

f. **Course Learning Outcomes:**

CLO 1	Understand the basics of design thinking and its implications in product or service development
CLO 2	Understand and Analyse the requirements of a typical problem
CLO 3	Plan the necessary activities towards solving the problem through ideation and prototyping
CLO 4	Evaluate the solution and refine them based on the customer feedback

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	**-**	**2**	**3**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Overview of Design Thinking** Define Design Thinking, Differentiate Design Thinking from Design, Get an Overview of the Design Thinking Process. **Empathize and Understand** Explain how empathy influences the outcomes of Design Thinking, List Different Empathy Research Techniques, Define the Guidelines for an Empathetic Research.	20%	2
2	**Defining Needs, Ideation for solutions, Prototyping** **Defining Needs** Explain how PoV can be used in defining the design problem, Use a structured approach to arrive ata PoV. **Ideation for Solutions** List the best practices for conducting a successful ideating session, Describe the techniques for evaluating and prioritizing ideas **Prototyping** Define prototyping, Explain how prototyping aids in communicating ideas effectively, List various tools for prototyping	20%	2
3	**Testing the Solution, Problem Solving Mindset** **Testing the Solution** Define the steps of a successful testing approach, Demonstrate the process of gathering and responding to user feedback. **Problem Solving Mindset** Understanding Problem Statements, Recapping Design Principles, Design Thinking Toolsets, Formulating approaches to Solutions, Applications of Design Thinking: Case Study.	20%	8
4	**Human Centered Design, Design for the Environment** **Human Centered Design** Services Development process and lifecycle, Product Vs Services, Innovation in Services, Service Experience Lifecycle, Human Computer Interaction, Usability Engineering - Heuristic Evaluation. **Design for the Environment** Design Considerations, Environmental Issues, Sustainable Development, Green Design – Design for Process, Design for Product, Qualitative and Quantitative Methods for DFE, Design for Disassembly, Design for Recyclability, Design for Energy Efficiency. The relevance of 4Rs - reduction, reuse, recycling and recovery in Environmental friendly design. Sustainable Development.	20%	8
5	**Design Thinking and Innovation Management** **Culture** Project Management - Project Planning, Business Plan, Planning the resources, Effective Communication, Team Management, Benchmarking the Development, Cost	20%	8

	Estimation, Interpreting the Feedback and Troubleshooting, Pitching the idea, Revenue Model.		

i. Text Book and Reference Book:

1. The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems (TextBook)

j. Mapping of List of Experiment with Course Learning Outcomes:

Sr. No.	List of Experiment
1.	Introduction to design thinking: Introduce the concept of design thinking, its benefits, and the overall process.
2.	Empathy mapping exercise: Have participants conduct interviews with potential users and create empath maps to gain a deeper understanding of their needs, wants, and pain points.
3.	Define the problem statement: Based on the empathy mapping exercise, have participants synthesize their findings and define a problem statement.
4.	Ideation session: Have participants generate as many ideas as possible to solve the problem statement. Encourage wild, unconventional, and innovative ideas.
5.	Prototyping session: Have participants select one or more ideas and create a low-fidelity prototype to test their assumptions and validate their ideas.
6.	Testing and feedback session: Have participants test their prototypes with potential users and gather feedback on what works, what doesn't, and what could be improved.
7.	Refine and iterate on prototype: Based on the feedback, have participants refine and iterate on their prototype to improve its usability, functionality, and appeal.
8.	Presentation of final prototype: Have participants present their final prototype to the rest of the group, explaining their design decisions, insights, and learnings.

(3)

a. **Course Name:** Global Certifications - Fundamentals (Azure, AWS, GCP)
b. **Course Code:** 303105153
c. **Prerequisite:** Basic understanding of computer concepts and basic programming.
d. **Rationale:** This course provides a broad introduction to Azure cloud, infrastructure, services, security and compliance, also billing, pricing and support plans.

e. **Course Learning Objective:**

CLOBJ 1	To validate that they have the skills necessary to cover all aspects of digital transformation.
CLOBJ 2	To become a cloud architect, a developer, or a solution architect.
CLOBJ 3	To work in various industries at different locations.
CLOBJ 4	To build online experiences, including web apps, cloud services, mobile apps, and AI services.
CLOBJ 5	To work with data in the cloud

f. **Course Learning Outcomes:**

CLO 1	Understand the principles Cloud computing. 2 Familiarity with the various Azure services
CLO 2	Understanding the Azure security features,
CLO 3	Understanding Azure Service Level Agreements (SLAs) and the Azure service lifecycle

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Cloud Concepts** Understanding cloud computing principles, such as the different types of cloud models (public, private, hybrid), infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and software-as-a-service (SaaS).	15%	4
2	**Azure Services** Familiarity with the various Azure services and their common use cases. This includes services like Azure Virtual Machines, Azure App Services, Azure Storage, Azure Functions, Azure SQL Database, and more.	20%	6
3	**Security, Privacy, Compliance, and Trust** Knowledge of Azure security features, identity and access management, Azure Active Directory, data protection, compliance frameworks, and Azure governance methodologies.	25%	6
4	**Azure Pricing and Support** Understanding Azure subscription options, cost management, pricing models, and the different support options available to Azure customers	15%	4
5	**Azure SLA and Service Lifecycles** Familiarity with Azure Service Level Agreements (SLAs) and the Azure service lifecycle, including planned maintenance, updates, and deprecation policies.	25%	10

i. Text Book and Reference Book:

1. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl
2. Azure AI Services at Scale for Cloud, Mobile, and Edge: Building Intelligent Apps with Azure Cognitive Services and Machine Learning by Simon Bisson and Mary Branscombe
3. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) by Michael J. Kavis
4. Cloud Computing Bible by Barrie Sosinsky

(4)

a. **Course Name:** ICT workshop
b. **Course Code:** 303107152
c. **Prerequisite:** Basic Computer Knowledge and Physics.
d. **Rationale:** This course is design to provide basic knowledge of Electronics components and computer components. This course helps in learning problem solving process of Electronics circuits and Computer.

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with identifying the Basic Electronic Components.
CLOBJ 2	Solve problems related to testing instruments such as Digital Multi meter, CRO, and function generator, etc.
CLOBJ 3	Acquire knowledge of Different sensors.
CLOBJ 4	Understand and develop group projects using electronic components and sensors.

f. **Course Learning Outcomes:**

CLO 1	Gain ability to understand eh working of Electronics Components
CLO 2	Ability to understand the operating of various testing and measurement instrumentation. CO3: Ability to learn working and use of different IoT sensors
CLO 3	Ability to design electronic circuit for the specific applications.
CLO 4	Gain ability to understand eh working of Electronics Components

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	Internal Evaluation			ESE		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiments:**

Sr. NO.	Experiment List
1	Identification and symbolic representation of electronics basic components. (diode, zener diode, LED, transistor)

2	Verify the circuit analysis (voltage and current) using Digital Multimeter
3	Understanding of working and specifications of CRO and Function generator.
4	Design 5V power supply using 7805.
5	Understanding soldering techniques and practicing proper soldering and de-soldering.
6	Demonstrate the working of Temperature Sensor
7	Verify the functionality of water flow sensor
8	Verify the functionality of distance measurement sensor
9	Demonstrate the working of Rain detector Sensor
10	Group Project based on electronics components and sensors

(5)

   a. **Course Name:** Mathematics-II
   b. **Course Code:** 303191151
   c. **Prerequisite:** Knowledge of Mathematics up to 12th science level
   d. **Rationale:** The Mathematics I syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.
   e. **Course Learning Objective:**

CLOBJ 1	Define and identify ordinary differential equations of higher order. Classify ODEs based on homogeneity and linearity. Solve homogeneous linear ODEs of higher order with constant coefficients, and variable coefficients.
CLOBJ 2	Solve homogeneous linear ODEs of higher order with constant coefficients, variable coefficients
CLOBJ 3	Apply the Method of Undetermined Coefficients to solve nonhomogeneous ODEs. Utilize the Solution by Variation of Parameters for solving nonhomogeneous ODEs. Explore applications of ODEs in real-world scenarios.
CLOBJ 4	Understand power series solutions for ordinary points and regular Singular points. Explore properties and applications of Legendre polynomials and Bessel functions.
CLOBJ 5	Define Laplace transform and its inverse. Understand the linearity property of Laplace transforms. Solve ordinary differential equations using Laplace transforms.
CLOBJ 6	Define Fourier Integral and its applications. Explore Fourier Cosine and Sine Integrals.

   f. **Course Learning Outcomes:**

CLO 1	Demonstrate the ability to translate physical or engineering problems into mathematical equations and solve them.
CLO 2	Develop analytical and critical thinking skills through the process of solving complex mathematical problems.
CLO 3	Understand and interpret mathematical solutions in the context of the given problems.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms.
CLO 5	Present mathematical arguments and solutions in a logical and organized manner.
CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

   g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme		
L	T	P	C	**Internal Evaluation**	**ESE**	**Total**

				MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Higher order ordinary differential equations** Ordinary differential equations of higher orders, Homogeneous Linear ODEs of Higher Order, Homogeneous Linear ODEs with Constant Coefficients, Euler–Cauchy Equations, Nonhomogeneous ODEs, Method of Undetermined Coefficients, Solution by Variation of Parameters, Applications.	8%	5
2	**Power Series** Power series solutions at ordinary point and regular singular point; Legendre polynomials, Bessel functions of the first kind and their properties.	15%	9
3	**Laplace Transform** Laplace Transform and inverse Laplace transform, Linearity, First Shifting Theorem (s- Shifting), Transforms of Derivatives and Integrals, ODEs, Unit Step Function (Heaviside Function), Second Shifting Theorem (t-Shifting), Laplace transform of periodic functions, Short Impulses, Dirac's Delta Function, Convolution, Integral Equations, Differentiation and Integration of Transforms, Solution of ordinary differential equation by Laplace transform	25%	15
4	**Fourier Integral** Fourier Integral, Fourier Cosine Integral and Fourier Sine Integral.	17%	10
5	**Vector Calculus** Gradient of scalar field, Directional Derivative, Divergence and curl of Vector field, Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	10%	6
6	**Multivariable Calculus (Integration)** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Triple integrals (Cartesian)	25%	15

i. Text Book and Reference Book:

1. Calculus and Analytic Geometry (Text Book), By G.B. Thomas and R.L. Finney | Addison Wesley

2. Calculus with early transcendental functions, By James Stewart | Cengage Learning
3. Higher Engineering Mathematics, By B. S. Grewal | Khanna Publications
4. Elementary Linear Algebra (TextBook), By Howard Anton, Chris Rorres | Willy India Edition | 9th Edition
5. Advanced Engineering Mathematics (TextBook), By Erwin Kreyszig | Willey India Education
6. A text book of Engineering Mathematics, By N.P. Bali and Manish Goyal | Laxmi Publications

(6)
a. **Course Name:** Engineering Physics-II
b. **Course Code:** 303192102
c. **Prerequisite:** Knowledge of Physics and some basic concepts in Mathematics like differentiation, integration, limit, differential equation, vector calculus up to 12thscience level.
d. **Rationale:** Knowledge of physics is essential for all Engineering branch because physics is the foundation subject of all the branches of engineering and it develops scientific temperament and analytical capability of engineering students. Comprehension of basic physics concepts enables the students to solve engineering problem logically and develop scientific approach.

e. **Course Learning Objective:**

CLOBJ 1	Understand the basics of quantum mechanics, including Schrödinger's equations and the physical significance of wave functions..
CLOBJ 2	Apply the Schrödinger equation to Analyse particles in one-dimensional potential boxes, emphasizing practical implications and tunneling effects.
CLOBJ 3	Master concepts of energy bands, semiconductor classification, E-k diagrams, and semiconductor device analysis including P-N junction diodes.
CLOBJ 4	Comprehensively understand material classification, focusing on magnetic materials, nanomaterials, and analyzing physical, thermal, electrical, optical, and magnetic properties.
CLOBJ 5	Gain expertise in laser principles, types, and applications, as well as fiber optics principles and applications. Understand optoelectronic devices, their functionalities, and practical applications.

f. **Course Learning Outcomes:**

CLO 1	Formulate and conceptualize various theoretical aspects and the physical phenomena at atomic level
CLO 2	Analyse the optical transition processes in semiconductors and identify the materials useful in optoelectronic devices.
CLO 3	Understand the fabrication and applications of low dimensional semiconductor devices.
CLO 4	Acquire proficiency in experimental techniques used for studying nanoscale systems, including microscopy and spectroscopy.
CLO 5	Master the principles of quantum mechanics and their application to nanoscale systems.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme		
L	T	P	C	Internal Evaluation	ESE	Total

				MSE	CE	P	Theory	P	
3	**-**	**2**	**4**	**20**	**20**	**20**	**60**	**30**	**150**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Modern Physics** Introduction about quantum Mechanics, Schrodinger's equations, Time dependent and Time Independent Wave Equation, Physical Significance of the wave Function, Application of Schrodinger equation in particle in One Dimensional Potential Box and Tunneling effects.	**20%**	**9**
2	**Band theory & Semiconductors** Energy bands in solids, Classification of Materials into Conductors, Semiconductors & Insulators, Density of state, E-k diagram, Kronig-Penny model (to introduce origin of band gap), Effective mass. Direct and indirect band gap. Carrier Concentration in semiconductors, Fermi Level in Intrinsic and Extrinsic Semiconductors, P-N junction diode,Ohmic and Schottky Junction.	**20%**	**9**
3	**Materials** Classification of materials: Magnetic materials, Nanomaterials based on semiconductors and metal oxides, Basic characteristic properties of nanomaterials, Novel Materials. Physical, Thermal, Electrical, Optical and Magnetic properties of materials.	**20%**	**9**
4	**Laser and Fiber Optics** Lasers: Interaction of radiation with Matter, Absorption, Spontaneous and Stimulated emission, Characteristics of Lasers, Types of Lasers: Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers. Fiber Optics: Principle and Structure of Optical Fiber, Numerical Aperture of fiber, Types of Optical Fibers, Attenuation in Optical Fibers, Applications of Optical Fibers.	**20%**	**9**
5	**Devices** Optoelectronic Devices: Photoconductive cell, photovoltaic cell, Photodiode, Phototransistor, LED, IR emitters, Opto coupler, X-ray diffractometer, Quantum devices and their applications.	**20%**	**9**

i. **Text Book and Reference Book:**

1. Semiconductor Optoelectronics (TextBook), By J. Singh | McGraw-Hill Inc, Pub. Year 1995
2. Fundamentals of Photonics (TextBook), By B. E. A. Saleh and M. C. Teich | John Wiley & Sons, Pub. Year 2007
3. Semiconductor Devices: Physics and Technology (TextBook), By S. M. Sze | Wiley, Pub. Year 2008
4. Semiconductor Optoelectronic Devices (TextBook), By P. Bhattacharya | Prentice Hall of India, Pub. Year 1997
5. Fundamentals of Physics (Text Book), By D. Halliday, R Resnick and J. Walker | Asian Books Pvt. Ltd

j. **List of Experiment:**

Sr. NO.	Experiment List
1	Determination of Velocity of ultrasonic waves in water.
2	Determination of Dielectric constants of Dielectric samples.
3	Measurement of Band gap of semiconductor material.
4	Measurement of Planck's constant using LED.
5	Measurement of wavelength of laser light using diffraction grating.
6	Measurement of Numerical aperture of an optical Fiber.
7	Determine Moment of Inertia of a flywheel.
8	Measurement of power loss in an optical fibre.
9	Measurement of a size of a Lycopodium powder.

(7)

a. **Course Name:** Advanced Communication & Technical Writing
b. **Course Code:** 303193152
c. **Prerequisite:** Knowledge of English language studied till 12th standard.
d. **Rationale:** Communication confidence laced with knowledge of English grammar is essential for all engineers.
e. **Course Learning Objective:**

CLOBJ 1	Demonstrate the ability to adapt writing style to different audiences and purposes.
CLOBJ 2	Create comprehensive technical documents such as reports, essay, review and project proposals.
CLOBJ 3	Deliver professional presentations, incorporating effective visual aids, engaging content and confident delivery.
CLOBJ 4	Apply technical communication through various mediums (video, web content, multimedia)
CLOBJ 5	Incorporate advanced document design principles for clarity and readability.
CLOBJ 6	Deliver different types of speeches.

f. **Course Learning Outcomes:**

CLO 1	Develop four basic communication skills.
CLO 2	Construct grammatically correct sentences.
CLO 3	Develop and deliver professional presentation skills.
CLO 4	Develop the skills of critical thinking.
CLO 5	Compare different types of written communication.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
-	2	-	2	-	100	-	-	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Developing Effective Listening Skills** To help students understand the meaning and	10%	2

	importance of good listening skills, learning the traits of being a good listener through activity and listening audio tracks.		
2	**Error Analysis** To provide insights into the complicated processes of language development as well as a systematic way for identifying, describing and explaining errors. (Tenses, Voices, Reported speech).	**10%**	**4**
3	**Delivering Different Types of Speeches** Students will understand and use the different patterns for structuring speeches Welcome / Introductory speech Vote of Thanks speeches Farwell speeches	**10%**	**2**
4	**Professional Presentations** Students will learn, Combating stage fright, Preparing power point presentation Delivering PPT	**10%**	**5**
5	**Essay Writing** Students will overcome the common pitfalls in the task of essay writing by understanding Basics of Paragraph development and paragraph jumble Types of essays Characteristic features of essays Guiding Principles	**10%**	**4**
6	**Reading Comprehension** Employing Different Reading SkillsActivity Practice	**10%**	**2**
7	**Project Proposal** To equip students with the various elements required to prepare a winning proposal.	**5%**	**2**
8	**Misplaced Modifiers** Students will understand how to place the improperly separated word, phrase or clause from the word it describes.	**5%**	**1**
9	**Movie Review** A movie show followed by writing a review. To provide an exposure to students how to express their opinions about some film or documentary with unbiased and objective approach.	**10%**	**2**
10	**Narrative Writing** Narrative writing helps them explore different characters and settings. To help students clarify their thinking, and teach them to express that in writing in an organized way.	**5%**	**2**
11	**Writing Reports** Process of writingOrder of writing, Final draft & checklist for reports, Sample reports: Memorandum Letter report	**10%**	**2**
12	**Critical Thinking** Need, relevance and Significance of Critical Thinking Logic in problem solving and decision making(activities) Moral Reasoning (Case Studies)	**5%**	**1**
13	**Activity Session (Presentation)** An activity where the scene of a press conference is created in the class. Students are encouraged to ask sharp questions and in turn are invited to assume roles of famous personalities, thus answering the questions posed.	**0%**	**1**

*Continuous Evaluation:

It consists of Assignments/Seminars/Presentations/Quizzes/Surprise Tests (Summative/MCQ) etc.

i. **Text Book and Reference Book:**

1. Business Correspondence and Report Writing, By SHARMA, R. AND MOHAN, K.
2. Communication Skills, By Kumar S and Lata P | New Delhi Oxford University Press
3. Practical English Usage, By MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student, By F.T. WOOD
5. On Writing Well, By William Zinsser | Harper Paperbacks,2006 | 30th anniversary edition
6. Oxford Practice Grammar, By John Eastwood | Oxford University Press
7. Technical Communication: Principles And Practice, Sangeetha Sharma, Meenakshi Raman; Oxford University Press

Semester 3

(1)

a. **Course Name:** Design of Data Structures
b. **Course Code:** 303105201
c. **Prerequisite:** Computer Programming and Basic Syntaxes
d. **Rationale:** Data structure is a subject of primary importance in Information and Communication Technology. Organizing or structuring data is important for implementation of efficient algorithms and program development. Efficient problem solving needs the application of appropriate data structure during program development.
e. **Course Learning Objective:**

CLOBJ 1	The hands on experience in design, develop, implementation and evaluation by using Asymptotic notation.
CLOBJ 2	The demonstration knowledge of basic abstract data types (ADT) and associated algorithms for organizing programs into modules using criteria that are based on the data structures of the program
CLOBJ 3	The practical implementation and usage of non-linear data structures for solving problems of different domains.
CLOBJ 4	The knowledge of more sophisticated data structures to solve problems involving balanced binary search trees, AVL Trees, B-trees and B+ trees, hashing.
CLOBJ 5	The graph traversals algorithms to solve real-world challenges such as finding shortest paths on huge maps and assembling genomes from millions of pieces.

f. **Course Learning Outcomes:**

CLO 1	Understand the concept of Dynamic memory management, data types, algorithms, Big O notation
CLO 2	Understand basic data structures such as arrays, linked lists, stacks and queues
CLO 3	Describe the hash function and concepts of collision and its resolution methods
CLO 4	Solve problem involving graphs, trees and heaps
CLO5	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	

3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays. Performance analysis of an algorithm and space and time complexities	10%	6
2	**Stacks, Recursion and Queue** **Stacks** Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. **Recursion** Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, **Queues** Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Deque, Priority Queues and its problems	15%	8
3	**Linked Lists** Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists	10%	5
4	**Searching and Sorting** Interpolation Search **Sorts** Selection Sort Insertion Sort Bubble Sort Quick Sort Merge Sort, Radix Sort	10%	5
5	**Trees** Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - In Order, Post Order, Pre Order; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression	10%	4
6	**Red Black Trees and AVL Trees** Introduction-Operations on Red Black Trees AVL tree Construction Operations on AVL Trees	15%	8

7	**Hashing** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing	**15%**	**3**
8	**Graphs** Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search.	**15%**	**5**

i. Text Book and Reference Book:

1. Fundamentals of Data Structures in C, 2ND eDITION, E.Horowitz, S,.Sahni and Susan Anderson- Freed, Universities Press (TextBook)
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.

(2)

a. **Course Name:** Design of Data Structures Laboratory
b. **Course Code:** 303105202
c. **Prerequisite:** Basic knowledge of Data Structures
d. **Rationale:** This course provides a broad introduction to Data Structures. The various Data structures and its analysis of working design and development.
e. **Course Learning Objective:**

CLOBJ 1	The hands on experience in design, develop, implementation and evaluation by using Asymptotic notation.
CLOBJ 2	The demonstration knowledge of basic abstract data types (ADT) and associated algorithms for organizing programs into modules using criteria that are based on the data structures of the program
CLOBJ 3	The practical implementation and usage of non-linear data structures for solving problems of different domains.
CLOBJ 4	The knowledge of more sophisticated data structures to solve problems involving balanced binary search trees, AVL Trees, B-trees and B+ trees, hashing.
CLOBJ 5	The graph traversals algorithms to solve real-world challenges such as finding shortest paths on huge maps and assembling genomes from millions of pieces.

f. **Course Learning Outcomes:**

CLO 1	Use different types of data structures, operations and algorithms
CLO 2	Apply searching and sorting operations on files
CLO 3	Use stack, Queue, Lists, Trees and Graphs in problem solving
CLO 4	Implement all data structures in a high-level language for problem solving

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
-	-	4	2	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiments:**

Sr. NO.	Experiment List

1	Implement Stack and its operations like (creation push pop traverse peek search) using linear data structure
2	Implement Infix to Postfix Expression Conversion using Stack
3	Implement Postfix evaluation using Stack.
4	Implement Towers of Hanoi using Stack.
5	Implement queue and its operations like enqueue, dequeue, traverse, search.
6	Implement Single Linked lists and its operations (creation insertion deletion traversal search reverse)
7	Implement Double Linked lists and its operations (creation insertion deletion traversal search reverse)
8	Implement binary search and interpolation search.
9	Implement Bubble sort, selection sort, Insertion sort, quick sort, merge sort.
10	Implement Binary search Tree and its operations (creation, insertion, deletion)
11	Implement Traversals Preorder Inorder Postorder on BST
12	Implement Graphs and represent using adjaceny list and adjacency matrix and implement basic operations with traversals (BFS and DFS)

(3)

a. **Course Name:** Database Management System
b. **Course Code:** 303105203
c. **Prerequisite:** Basic Computer Knowledge
d. **Rationale:** The course will enable students to understand the different issues involved in the design and implementation of a database system as well execute various database queries using SQL.
e. **Course Learning Objective:**

CLOBJ 1	Understand DBMS and FPS
CLOBJ 2	Study the use of DBMS language, SQL
CLOBJ 3	Acquire knowledge of the Different type of Model and E-R Diagram.
CLOBJ 4	Understand Different Data Model, Constraints and keys and relational algebra Model
CLOBJ 5	Study the use of transaction, database recovery, concurrency control and deadlock

f. **Course Learning Outcomes:**

CLO 1	Understand basic concepts of Database.
CLO 2	Understand Relational Models and its importance.
CLO 3	Build proper structured database for a given problem or application.
CLO 4	Learn how various transactions are managed in real-time scenarios.
CLO 5	Understand the evaluation parameters of a query as well as security parameters of database.
CLO 6	Implement SQL concepts to build dynamic database applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme						
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**	
				MSE	**CE**	**P**	**Theory**	**P**		

3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Introduction and applications of DBMS, File Processing System and its limitations, ANSI/SPARC Model, Data Independence, Client-Server Architecture, Users & DBA, Database Architecture.	10%	3
2	**SQL** Data Definition Language (DDL) commands, Data Manipulation Language (DML) commands, Data Control Language (DCL) commands, Transaction Control Language (TCL) commands. **Predicates & Clauses** Logical Operators (AND / OR), Relational Operators, BETWEEN Predicate, IN & NOT IN Predicate, LIKE Predicate. **Functions in SQL** Aggregate Functions, Character Functions, Arithmetic Functions, Date Functions, Conversion Functions.	10%	4
3	**Data Models** Hierarchical Model, Network Model, Relational Model, Object Oriented Model. **E-R Diagram** Introduction to E-R Diagram, Entities, Attributes & its types, Relationships, Mapping Cardinalities, Participation Constraints, Weak Entity Sets, Specialization, Generalization, Aggregation.	10%	5
4	**Relational Data Model** Introduction, Degree, Cardinality. **Constraints & Keys** Primary Key, Foreign Key, Super Key, Candidate Key, Not Null Constraint, Check Constraint. **Relational Algebra Operations** Selection, Projection, Cross-Product, Rename, Joins (Natural & Outer Join), Set Operators (Union, Intersection, Set Difference), Aggregate Functions.	10%	4
5	**Relational Database Design** Functional Dependency – definition, trivial and non-trivial FD, Armstrong's Axioms/Inference Rules, Closure of FD, Closure of Attributes, Candidate Key, Finding a	20%	6

	Candidate Key, Decomposition (Lossy & Lossless), Database Anomalies, Normalization – 1Nf, 2NF, 3NF, BCNF, 4NF, 5NF		
6	**Transaction** Introduction, ACID Properties, Transaction Life Cycle, Scheduling, Serial Schedule, Interleaved Schedule, Transaction Operations, Serializability (View & Conflict), Two-Phase Commit Protocol. **Database Recovery** Introduction, Log Based Recovery, Shadow Paging, Checkpoints. **Concurrency Control** Introduction, Lock Based Protocol, Two Phase Lock Protocol, Intention Locking, Multiple Granularity, Time-based Protocol. **Deadlock** Introduction, Deadlock Detection, Deadlock Recovery, Deadlock Prevention (Wait-Die, Wound-Wait & Timeout-Based Approach).	20%	12
7	**Query Processing** Introduction, Layers of Query Processing, Measures of Query Cost, File Scans (Linear & Binary Search), Materialized View, Pipelining. **Query Optimization** Introduction, Equivalence Rules, Cost-Based Query Optimization.	10%	3
8	**Security** Data Security, Data Integrity, Authentication, Authorization, Encryption, Decryption, Access Control (DAC, RBAC, MAC), Intrusion Detection, SQL Injection	5%	2
9	**PL/SQL Concepts** Views, PL/SQL Block, Cursors, Triggers, Stored Procedures, Store Functions	5%	3

i. Text Book and Reference Book:

1. Database System Concepts (TextBook), By Abraham Silberschatz, Henry Korth, S. Sudarshan | McGraw Hill International | 6th Edition
2. An Introduction to Database Systems, By C. J. Date, A. Kannan, S. Swamynathan | Pearson Education | 8th Edition
3. SQL, PL/SQL – The Programming Language, By Ivan Bayross | BPB Publications

(4)

a. **Course Name:** Database Management System Laboratory
b. **Course Code:** 303105204
c. **Prerequisite:** Basic Computer Knowledge
d. **Rationale:** The course will enable students to understand the different issues involved in the design and implementation of a database system as well execute various database queries using SQL.
e. **Course Learning Objective:**

CLOBJ 1	Understand DBMS and FPS
CLOBJ 2	Study the use of dbms language, sql
CLOBJ 3	Acquire knowledge of the Different type of Model and E-R Diagram.
CLOBJ 4	Understand Different Data Model, Constraints and keys and relational algebra Model
CLOBJ 5	Study the use of transaction, database recovery, concurrency control and deadlock

f. **Course Learning Outcomes:**

CLO 1	Understand basic concepts of Database.
CLO 2	Understand Relational Models and its importance.
CLO 3	Build proper structured database for a given problem or application.
CLO 4	Learn how various transactions are managed in real-time scenarios.
CLO 5	Understand the evaluation parameters of a query as well as security parameters of database.
CLO 6	Implement SQL concepts to build dynamic database applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiment:**

Sr. NO.	Experiment List
1	1. What is DBMS? Explain advantages of DBMS over FPS. 2. List 15 applications of Database. Explain any 2 how Database can be helpful in managing that application? 3. Create the Database for the following: 1. Student Details using Excel. 2. Employees Details using MS Access 3. Facebook using Excel
2	Create following Tables: Important Instructions: • Use varchar2(30) datatype for Alphanumeric Characters and Special Symbols, number datatype for Numbers, date datatype for Date. ·Use same table and column name (Capital and Small Case) as mentioned in this file. • Insert proper data (Capital and Small Case) as mentioned in this file. • Employee • Emp_name Street City Adam Spring Pittsfield Brooks Senator Brooklyn Curry North Rye Demalo SunShine San Deago
3	Simple Queries: 1. Describe deposit, branch. 2. Describe borrow, customers. 3. List all data from table DEPOSIT. 4. List all data from table BORROW. 5. List all data from table CUSTOMERS. 6. List all data from table BRANCH. 7. Give account no and amount of depositors. 8. List all data from SAILORS. 9. List Boat Name and its color. 10. List Employee name and its city. 11. List all the details of Clients. 12. Describe various products and its price. 13. Describe sailor's name, age and its rating. 14. Describe the managers of various employees 15. Describe the details of Loan for customers. 16. Describe the date of travel of various sailors.
4	Simple Queries: (1) Give name of depositors having amount greater than 4000. (2) List the employees having salary less than 22000. (3) List the sailors having age more than 25. (4) List the boats travelling on 10-oct-98 (5) List the details of boat "Interlake". (6) List the details of the red colored boat. (7) List the details of clients whose city is Mumbai (8) List Client Name, due balance and city of the clients having balance greater than 1500. (9) Describe the details of products having selling price less than 500. (10) List the products for which quantity ordered is less than 120 and cost price is greater than 250. (11) Display account details having amount greater 2200. (12) Display all the customers staying in Nagpur (13) Display the names of sailors having rating greater than 7 (14) Display the orders made in the month of June (15) List all the accounts created in the month of March.
5	"Like" Queries: 1. Display all customers whose name start with 'M'. 2. Display all the customers whose name ends with 'L'. 3. Display all loan details whose branch starts with 'A'. 4. Display the details of sailors whose name is minimum 6 characters long. 5. Display the details of Employees whose address starts with 'S'. 6. List the details of the boat ending with 'e'. 7. List the details of clients having 'h' as a 3rd character in his/her name. 8. List Client Name, due balance and city whose pin code starts with 4. 9. List all customers whose city contains 'a' as second character. 10. List client names and city whose state has 'a' as fourth or fifth character.
6	"Aggregate Functions & DML" Queries: 1. List total deposit from deposit.. 2. Give Maximum loan given to a customer. 3. Describe the average age of all the sailors. 4. Count total number of customers 5. Count total number of customer's cities. 6. Display total target for the salesman. 7. Update the salary of the employee having 10000 to 11500 8. Update the city of client from Bangalore to Bengaluru. 9. Give the 15% hike in the salary of all the Employees. Rename that column to "New Salary". 10. Increase the sell price of all products by 20% and label new column

	as "New Sell Price". (Do not update the table) 11. Provide the count of customers staying in "Bombay"
7	Join" Queries: 1. Find the salary of Adam. 2. Find the city where Brooks work. 3. Display the sailor's details whose boat is booked for 9th May, 98. 4. Display the day of ride and sailor name for boat 103. 5. Display the sailor name and its age for Red colored and 101 boat. 6. Display the sailor details whose boat is never booked. 7. Display the sailor name that has Red or Green Boat. 8. Display all sailor details and boat details and who has Interlake boat. 9. Display sailor's rating with boat details or the trip on 10th October, 98. 10. Display the sailor id and name whose age is more than 42 or who has Blue colored boat. 11. Display name and rating of sailor whose boat name is Clipper. 12. List products whose selling price is more than 500 and less than equal to 750. 13. Describe the second highest salary of an employee. 14. Display the date of travel and sailor's name whose age is between 35 and 65. 15. List all the employees working for "FBC".
8	"Join" Queries: 1. Display all the employee name and the city where they work. 2. Display the employee name and company's name having salary more than 15000. 3. Find the average rating and age of all sailors. 4. List various products available. 5. Display the names of salesman who have salary more than 2850. 6. Change the cost price of Trousers to 950 7. List all the clients having "a" as a second character in their names. 8. List all the products whose QtyonHand is less than Reorderlvl. 9. Print the description and total qty sold for each product. 10. Find out all the products which have been sold to "Ivan Bayross". 11. Find the names of all clients who have purchased Trousers. 12. Find the products and their quantities for the orders placed by client C00001 and C00002. 13. List the client details who place order no. O19001. 14. List the name of clients who have placed orders worth Rs. 10000 or more. 15. Find the total of Qty ordered for each Order.
9	"Miscellaneous" Queries: 1. Find the average rate for each Order. 2. Give the loan details of all the customers. 3. List the customer name having loan account in the same branch city they live in. 4. Provide the loan details of all the customers who have opened their accounts after August'95. 5. List the order information for client C00001 and C00002. 6. List all the information for the order placed in the month of june 7. List the details of clients who do not stay in Maharashtra. 8. Determine the maximum and minimum product price. Rename the output as "Max_Price" and "Min_Price". 9. Count the number of products having price less than or equal to 500. 10. List the order number and the day on which client placed an order. 11. List the month and the date on which an order is to be delivered. 12. List the date, 25 days after today's date. 13. Find the total of all the billed orders in the month of June. 14. List the products and orders from customers who have ordered less than 5 units of "Pull Overs". 15. Find the list of products and orders placed by "Ivan Bayrosss" and "Mamta Muzumdar". 16. List the clients who placed order before June'04. 17. List all the clients who stays in "Bengaluru" or "Mangalore".
10	PL/SQL Block: 1. Write a PL/SQL Block to Add 2 Numbers 2. Write a PL/SQL Block to find Area of Rectangle, Triangle and Square. 3. Write a PL/SQL Block to find Maximum of 3 numbers 4. Write a PL/SQL Block to print sum of N Numbers using For Loop. 5. Write a PL/SQL Block to generate Fibonacci series of N numbers

(5)
a. **Course Name:** Object Oriented Programming with JAVA
b. **Course Code:** 303105205
c. **Prerequisite:** Basic knowledge of software applications
d. **Rationale:** This course provides a broad introduction to software engineering. The various process models required to develop software is also being described. Moreover the functional and non-functional requirements are also described.
e. **Course Learning Objective:**

CLOBJ 1	Gain the Knowledge of the concept with the Object-oriented programming, oops principles.
CLOBJ 2	Understand Data types, variable, operators
CLOBJ 3	Understand the concept of Control statements.
CLOBJ 4	Demonstrate the use of Array, Array values and memory storage Structure,
CLOBJ 5	Demonstrate the use of various OOPs concepts with the help of programs.

f. **Course Learning Outcomes:**

CLO 1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
CLO 2	Understand dynamic memory management techniques using pointers, constructors, destructors, etc
CLO 3	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CLO 4	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CLO 5	Demonstrate the use of various OOPs concepts with the help of programs

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	

2	-	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Design introduction** Object-oriented programming, oops principles, encapsulation, inheritance and polymorphism java as a oops &internet enabled language, importance of java, java usage in industry, the byte code, compiling, and running of simple java program, jvm, jdk, jre	8%	4
2	**Data types, variable, operators** Data types, variables, dynamic initialization, scope and lifetime of variables, type conversion and casting, operators	10%	4
3	**Control statements** Conditional Statements, Looping Statements, Jump Statements	10%	5
4	**Arrays** Array, Array values and memory storage Structure, Types of Arrays.	8%	4
5	**Object oriented programming** Classes and objects: concepts of classes and objects, declaring objects, assigning object reference variables, methods, constructors, access control, garbage collection, usage of static with data and methods, usage of final with data, overloading methods and constructors, parameter passing - call by value, recursion, nested classes.	18%	9
6	**Inheritance** Inheritance Basics, member access rules, Usage of super key word, forms of inheritance, Method Overriding, Abstract classes, Dynamic method dispatch, Using final with inheritance	8%	2
7	**Strings, Packages and Interfaces** String handling functions, Packages, Class path, importing packages, differences between classes and interfaces, Implementing & Applying interface, enumerations in java.	12%	5
8	**Exception Handling** Exceptions, Types of Exceptions, Handling of Exceptions	8%	3
9	**Multi-Threading** Thread, Usage of threads, Types of threads, Handling Threads	10%	4
10	**Collections Framework** Functional Programming, Collections, Hierarchy of collections	5%	8

Text Book and Reference Book:

1. Introduction to Java Programming (Comprehensive Version) Daniel Liang; Pearson (TextBook)
2. Core Java Volume-II Fundamentals Horstmann & Cornell; Pearson
3. Complete Reference Java 2 Herbert Schildt; TMH

(6)
a. **Course Name:** Object Oriented Programming with JAVA Laboratory
b. **Course Code:** 303105206
c. **Prerequisite:** Basic knowledge of software applications
d. **Rationale:** This course provides a broad introduction to software engineering. The various process models required to develop software is also being described. Moreover the functional and non-functional requirements are also described.
e. **Course Learning Objective:**

CLOBJ 1	Gain the Knowledge of the concept with the Object-oriented programming, oops principles.
CLOBJ 2	Understand Data types, variable, operators
CLOBJ 3	Understand the concept of Control statements.
CLOBJ 4	Demonstrate the use of Array, Array values and memory storage Structure,
CLOBJ 5	Demonstrate the use of various OOPs concepts with the help of programs.

f. **Course Learning Outcomes:**

CLO 1	Understand the principles and practice of object oriented programming.
CLO 2	Write, compile and debug programs with Java compiler.
CLO 3	Create a robust application using exception handling.
CLO 4	Understand the principles of synchronization and design application using multi-threading.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiment:**

Sr. NO.	Experiment List

1	Write a program to display Hello World message in console window.
2	Write a program to perform arithmetic and bitwise operations in a single source program without object creation.
3	Write a program to perform arithmetic and bitwise operations by creating individual methods and classes than create an object to execute the individual methods of each operation.
4	Write a java program to display the employee details using Scanner class.
5	Write a Java program that prints all real solutions to the quadratic equation ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions?
6	The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and non- recursive functions to print the nth value of the Fibonacci sequence?
7	Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer?
8	Write a Java program to multiply two given matrices?
9	Write a Java program for sorting a given list of names in ascending order?.
10	Write a java program for Method overloading and Constructor overloading
11	Write a java program to represent Abstract class with example.
12	Write a program to implement multiple Inheritances.
13	Write program to demonstrate method overriding and super keyword.
14	Write a java program to implement Interface using extends keyword.
15	Write a java program to create inner classes.
16	Write a java program to create user defined package.
17	Write a Java program that displays the number of characters, lines and words in a text?
18	Write a Java program that checks whether a given string is a palindrome or not. Ex: MADAM is a palindrome?
19	Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (Use String Tokenizer class)?
20	Write a java program for creating single try block with multiple catch blocks.
21	Write a program for multiple try blocks and multiple catch blocks including finally.
22	Write a program to create user defined exception.

23	Write a java program for producer and consumer problem using Threads.
24	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
25	Write a program to create dynamic array using Array List class and the print the contents of the array object.
26	Write programs to implement add, search and remove operation on Array List object.

(7)
a. **Course Name:** Digital Electronics
b. **Course Code:** 303105220
c. **Prerequisite:** Basic Electronics
d. **Rationale:** This course is design to provide basic ideas of computer architecture. This course also makes help to understand organization and architecture of computer. It will help to develop their logical abilities.

e. **Course Learning Objective:**

CLOBJ 1	Understand Fundamentals of Digital Systems and logic families
CLOBJ 2	Study different Minimization Techniques:
CLOBJ 3	Demonstrate types of Combinational Digital Circuits
CLOBJ 4	Learn different SEQUENTIAL CIRCUITS.
CLOBJ 5	Understand A/D and D/A Converters:
CLOBJ 6	Use different Semiconductor Memories And Programmable Logic Devices.

f. **Course Learning Outcomes:**

CLO 1	Identify and Explain the digital number system and also able to justify the practical application of number system.
CLO 2	Understand and Explain different logic gates and codes and also how to use them in real word application.
CLO 3	Realize the minimization techniques of digital Circuits.
CLO 4	Design different Adders, Subtracters, Multiplexers, decoders and many more circuits
CLO 5	Apply the theoretical knowledge to design flip-flops, counters and many more sequential circuits.
CLO 6	Identify and illustrate specifications of different logic families and memories and Analyse them in critical way.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Fundamentals of Digital Systems and logic families** Digital signals, digital circuits, Number Systems: binary, signed binary, octal, hexadecimal number, binary arithmetic, oneṡ and twoṡ complements arithmetic, codes, BCD arithmetic, error detecting and correcting codes, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, examples of IC gates, characteristics of digital lCs, Digital Logic families: TTL and CMOS logic, interfacing CMOS and TTL.	15%	7
2	**Minimization Techniques** Boolean Algebra, Boolean postulates and laws, De-Morgaṅs Theorem, Principle of Duality, Boolean expression, Minterm, Maxterm, Sum of Products (SOP), Product of Sums (POS), K-map representation, simplification and minimization of logic functions using K-map. Doṅt care conditions and Quine-McCluskey Method of minimization. Variable Entered Maps, Realizing Logic Function with Gates.	20%	8
3	**Combinational Digital Circuits** Binary Adders and Subtractors, Parallel binary adder & subtractor, Serial adder, BCD adder, Carry look ahead adder, Multiplexer/De Multiplexer, Encoder/Decoders, Popular MSI chips, Magnitude comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices.	20%	9
4	**SEQUENTIAL CIRCUITS** A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, Applications of shift registers, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, special counter IĊs, asynchronous sequential counters, applications of counters.	20%	9
5	**A/D and D/A Converters** Digital to analog converters: weighted resistor/converter, R-2R Ladder, examples of D to A converters IĊs, Analog to Digital converters: successive approximation, A/D converter, dual slope A/D Converter, Example of A/D Converter ICs.	10%	5
6	**Semiconductor Memories And Programmable Logic Devices**	15%	7

	Classification and characteristics of memories, Content addressable memory (CAM), commonly used memory chips, Introduction of PLD, ROM as a PLD, Programmable logic array, Programmable array logic, Complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA)		

i. **Text Book and Reference Book:**

1. Modern Digital Electronics (TextBook), By R. P. Jain | Tata McGraw-Hill Education
2. Digital Logic and Computer Design, By Morris Mano | PHI
3. Fundamentals of Digital Circuits, By Anand Kumar | Prentice-Hall of India Private Limited, New Delhi (2006)

(8)
a. **Course Name:** Digital Electronics Laboratory
b. **Course Code:** 303105221
c. **Prerequisite:** Basic Electronics
d. **Rationale:** This course is design to provide basic ideas of computer architecture. This course also makes help to understand organization and architecture of computer. It will help to develop their logical abilities.

e. **Course Learning Objective:**

CLOBJ 1	Understand Fundamentals of Digital Systems and logic families
CLOBJ 2	Study different Minimization Techniques:
CLOBJ 3	Demonstrate types of Combinational Digital Circuits
CLOBJ 4	Learn different SEQUENTIAL CIRCUITS.
CLOBJ 5	Understand A/D and D/A Converters:
CLOBJ 6	Use different Semiconductor Memories And Programmable Logic Devices.

f. **Course Learning Outcomes:**

CLO 1	Identify and Explain the digital number system and also able to justify the practical application of number system.
CLO 2	Understand and Explain different logic gates and codes and also how to use them in real word application.
CLO 3	Realize the minimization techniques of digital Circuits.
CLO 4	Design different Adders, Subtracters, Multiplexers, decoders and many more circuits
CLO 5	Apply the theoretical knowledge to design flip-flops, counters and many more sequential circuits.
CLO 6	Identify and illustrate specifications of different logic families and memories and Analyse them in critical way.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. NO.	Experiment List
1	To Study and Testing of various Logic Gates ICs.
2	Configuring NAND and NOR logic gates as universal gates.
3	Design Logic Gates using TTL Logic Gamily.
4	Study and Implementation of Boolean Logic Functions and combinational circuits like Adder/ Subtractor, Code Converters, using Logic Gates.
5	Study and Implementation of Boolean Logic Functions and combinational circuits like Multiplexers/De-Multiplexres using Logic Gates.
6	Study and Implementation of Boolean Logic Functions and combinational circuits like Encoders/ Decoders, using Logic Gates.
7	Study and configure of flip-flop using digital ICs. Design digital system using these circuits.
8	Study and configure of registers and counters using digital ICs. Design digital system using these circuits.
9	Study and Design A to D / D to A converters.
10	Introduction to FPGA / CPLD. Implementation of digital circuits studied in previous sessions using PLD/ CPLD / FPGA

(9)

a. **Course Name:** Discrete Mathematics
b. **Course Code:** 303191202
c. **Prerequisite:** Knowledge of Mathematics up to 12th science level
d. **Rationale:** The Mathematics I, Mathematics-II syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.

e. **Course Learning Objective:**

CLOBJ 1	Apply mathematical techniques to solve diverse real-world problems across different topics in Discrete Mathematics.
CLOBJ 2	Develop and apply analytical and critical thinking skills to understand, Analyse, and evaluate mathematical structures and proofs.
CLOBJ 3	Recognize and interpret mathematical solutions within the context of specific problems, demonstrating practical applications in various fields.
CLOBJ 4	Clearly and effectively communicate mathematical concepts and solutions in both written and verbal forms, adapting to diverse topics.
CLOBJ 5	Present mathematical arguments and solutions in a unified, logical, and organized manner, emphasizing clarity, coherence, and precision.
CLOBJ 6	Establish a comprehensive foundation for more advanced courses in mathematics and related disciplines by demonstrating a thorough understanding of fundamental concepts.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficient problem-solving skills, translating real-world problems into mathematical formulations and applying appropriate techniques for solutions.
CLO 2	Develop integrated analytical and critical thinking skills by engaging with a wide range of mathematical structures, proofs, and problem-solving techniques presented throughout the entire syllabus.
CLO 3	Understand and interpret mathematical solutions within the context of specific problems, recognizing the practical applications of discrete mathematics in diverse fields covered in all units.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms, adapting communication styles to the diverse topics covered in each unit.
CLO 5	Present mathematical arguments and solutions in a unified, logical, and organized manner, emphasizing clarity, coherence, and precision across all units.

	CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Sets, Relation and Function** Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem	8%	5
2	**Principles of Mathematical Induction** The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. Basic counting techniques- inclusion and exclusion, pigeon-hole principle, permutation and combination	15%	9
3	**Propositional Logic** Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers **Proof Techniques** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency	25%	15
4	**Algebraic Structures and Morphism** Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	17%	10

5	**Graphs and Trees** Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.	10%	6

i. Text Book and Reference Book:

1. Discrete Mathematics and its Applications (TextBook), By Kenneth H. Rosen | Tata McGraw – Hill
2. Discrete Mathematics, By Norman L. Biggs | Oxford University Press | 2nd Edition
3. Discrete Mathematical Structures with Applications to Computer Science (TextBook), By J.P.Tremblay and R. Manohar | Tata McGraw-Hill
4. Discrete Mathematics with Applications (TextBook), By Susanna S. Epp | Wadsworth Publishing Co. Inc. | 4
5. Elements of Discrete Mathematics A Computer Oriented Approach (TextBook), By C. L. Liu and D P Mohapatra | Tata McGraw – Hill | 3

(10)

    a. **Course Name:** Professional Communication Skills
    b. **Course Code:** 303193203
    c. **Prerequisite:** Knowledge of English language in practical life
    d. **Rationale:** Knowledge and application of English, Aptitude and Management Skills are crucial for better employability as well as professionalism
    e. **Course Learning Objective:**

CLOBJ 1	Demonstrate the ability to communicate clearly and persuasively in oral presentations.
CLOBJ 2	Practice active listening techniques to enhance understanding in professional interactions.
CLOBJ 3	Write professional emails, memos, and reports with clarity and conciseness.
CLOBJ 4	Understand and practice time management strategies effectively.
CLOBJ 5	Demonstrate skills in resolving conflicts and negotiating effectively.
CLOBJ 6	Use digital communication tools and platforms effectively.

    f. **Course Learning Outcomes:**

CLO 1	To develop advanced communication skills
CLO 2	To become more proficient in formal writing
CLO 3	To apply interpersonal communication skills to be more productive at the workplace
CLO 4	To identity set and achieve the goals with the help of time management
CLO 5	To use with range of vocabulary to communicate effectively

    g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	2	0	2	-	100	-	-	-	100

    L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

    h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours

1	**Technical Writing** Email etiquette & Email writing Letter Writing (Types of Letters & Layout):Trains students on detailed email and letter writing. Students will be able to write formal letters following certain stipulated formats. They will learn different types of letters for different official purposes.	**10%**	**4**
2	**Interpersonal Communication at Workplace: Dynamics of communication** To develop the confidence to handle a wide range of demanding situation more effectively at the workplace To enable the students to analyse their own interpersonal communication style.	**10%**	**2**
3	**Debate: The three minute debate planner** To enable the students to generate effective critical thinking into primary issues in the given topic. Students will be able to resolve controversies and recognize strengths and weaknesses of arguments.	**10%**	**4**
4	**Goal setting & Tracking** To enable the students to define strategies or implementation steps to attain the identified goals and make progress every day.	**10%**	**2**
5	**Time Management & Task Planning (Case –study)** To enable the students to identify their own time wasters and adopt strategies to reduce them. To enable students to clarify and priorities their objective and goals by creating more planning time	**5%**	**2**
6	**Reading Comprehension: Intermediate level** To enable the students develop the knowledge, skills, and strategies they must possess to become proficient and independent readers	**5%**	**2**
7	**Listening Skills: Small everyday conversation & comprehension:** Provides practice on understanding accents and day to day Listening to English conversations in different context.	**10%**	**2**
8	**Information design and writing for print and online media: Blog Writing** To enable students to design information that is targeted to specific audiences in specific situation to meet defined objectives. To create blogs and share their own knowledge and experience to the world.	**5%**	**2**
9	**Advanced vocabulary Building** The students will expand their vocabulary so as to enhance their proficiency in reading and listening to academic texts, writing, and The students will attain vocabulary to comprehend academic and social reading and listening The students will develop adequate speaking skills to communicate effectively.	**10%**	**4**
10	**Picture Perception**	**5%**	**1**

	To prepare the students for a test for basic intelligence and IQ, generally done on the first day ofSSB (Sashastra Seema Bal is one of India's Central Armed Police Forces)		
11	**Appreciation, Apology and Acknowledgement letters** To enable the students to maintain productive business relationship through different types of letters. To enable the students to express their feelings without speaking out loud.	**10%**	**2**
12	**The Art of Negotiation** To enable the students to reach an agreement for mutual benefits through negotiation. To enable the students to learn a process by which compromise or agreement is reached while avoiding argument and dispute	**5%**	**2**
13	**Activity Session (Game of Truth)** To make the students think of significance of certain things in their life. To make them share their thoughts and perception of matters in life, with others.	**5%**	**1**

i. Text Book and Reference Book:

1. Business Correspondence and Report Writing, By SHARMA, R. AND MOHAN, K.
2. Communication Skills 2011
3. By Kumar S and Lata P | Oxford University Press, Practical English Usage
4. By MICHAEL SWAN
5. A Remedial English Grammar for Foreign Student, By F.T. WOOD
6. On Writing Well, By William Zinsser | Harper Paperbacks,2006 | 30th anniversary edition
7. Oxford Practice Grammar, By John Eastwood | Oxford University Press
8. Quantitative Aptitude for Competitive Examinations, By Dr. R.S. Aggarwal

Semester 4

(1)

a. **Course Name:** Operating System
b. **Course Code:** 303105251
c. **Prerequisite:** Data Structures and Algorithms, Good working knowledge of C, and Fundamentals of Computer Systems.
d. **Rationale:** This course is an introduction to the theory and practice behind modern computer operating systems. Topics will include what an operating system does (and doesn't) do, system calls and interfaces, processes, concurrent programming, resource scheduling and management, virtual memory, deadlocks, and algorithms, programming, and security. We will approach the subject from both a theoretical perspective as well as a practical one.

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with generation of Operating System, types of operating System and concept of virtual machine.
CLOBJ 2	Solve problems related to Scheduling Algorithm and concept of threading, multi-threading etc.
CLOBJ 3	Acquire knowledge of Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, and Strict Alternation, Petersoṅ s Solution, Semaphores, Event Counters, Monitors, Message Passing, and Classical IPC Problems.
CLOBJ 4	Understand about Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker᾿ s algorithm, Deadlock detection and Recovery..
CLOBJ 5	Demonstrate a clear understanding of Memory Management, Memory allocation and Paging.
CLOBJ 6	Study about Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software etc.

f. **Course Learning Outcomes:**

CLO 1	Distinguish different styles of operating system design.
CLO 2	Understand device and I/O management functions in operating systems as part of a uniform device abstraction.
CLO 3	Have an understanding of disk organisation and file system structure.
CLO 4	Give the rationale for virtual memory abstractions in operating systems.

CLO 5	Understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
CLO 6	Understand the main mechanisms used for inter-process communication also the main problems related to concurrency and the different synchronization mechanisms available.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					Total
				Internal Evaluation			ESE		
L	T	P	C	MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine.	5%	3
2	**Processes, Thread & Process Scheduling** 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. 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 preemptive, FCFS, SJF, RR.	20%	9
3	**Inter-Process Communication** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc	15%	6
4	**Deadlocks** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	10%	5
5	**Memory Management & Virtual Memory**	30%	13

	Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation ʹ? Fixed and variable partitionʹ Internal and External fragmentation and Compaction; Paging: Principle of operation Page allocation. Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory ʹ? Hardware and control structuresʹ ?Locality of reference, Page fault , Working Set , Dirty page/Dirty bit ʹ ?Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).		
6	**I/O Systems, File & Disk Management** I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software. 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 algorithms - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	**20%**	**9**

i. Text Book and Reference Book:

1. Operating System Concepts Essentials (Text Book), By Avi Silberschatz, Peter Galvin, Greg Gagne | 9th Edition Wiley Asia Student Edition.
2. Operating Systems Internals and Design Principles, By William Stallings | PHI | 5th Edition
3. Operating System: A Design-oriented Approach, By Charles Crowley, | 1st Edition - Irwin Publishing
4. Operating Systems: A Modern Perspective, By by Gary J. Nutt | Addison-Wesley; 2nd Edition | 2nd Edition
5. Design of the Unix Operating Systems, By Maurice Bach, | Prentice-Hall of India | 8th Edition
6. Understanding the Linux Kernel, By Daniel P. Bovet, Marco Cesati, | O'Reilly and Associates | 3rd Edition

(2)
a. **Course Name:** Operating System Laboratory
b. **Course Code:** 303105252
c. **Prerequisite:** Data Structures and Algorithms, Good working knowledge of C, and Fundamentals of Computer Systems.
d. **Rationale:** This course is an introduction to the theory and practice behind modern computer operating systems. Topics will include what an operating system does (and doesn't) do, system calls and interfaces, processes, concurrent programming, resource scheduling and management, virtual memory, deadlocks, and algorithms, programming, and security. We will approach the subject from both a theoretical perspective as well as a practical one

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with generation of Operating System, types of operating System and concept of virtual machine.
CLOBJ 2	Solve problems related to Scheduling Algorithm and concept of threading, multi-threading etc.
CLOBJ 3	Acquire knowledge of Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, and Strict Alternation, Peterson̓s Solution, Semaphores, Event Counters, Monitors, Message Passing, and Classical IPC Problems.
CLOBJ 4	Understand about Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker̓s algorithm, Deadlock detection and Recovery..
CLOBJ 5	Demonstrate a clear understanding of Memory Management, Memory allocation and Paging.
CLOBJ 6	Study about Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software etc.

f. **Course Learning Outcomes:**

CLO 1	Experiment with Linux commands and shell programming.
CLO 2	Able to build shell program for process and file system management with system calls.
CLO 3	Able to implement and analyse the performance of CPU scheduling algorithm.
CLO 4	Able to implement and analyse the performance of page replacement algorithms.

CLO 5	Able to implement and analyse the performance of deadlock avoidance and detection algorithm.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. NO.	Experiment List
1	Study of Basic commands of Linux.
2	Study the basics of shell programming.
3	Write a Shell script to print given numbers sum of all digits.
4	Write a shell script to validate the entered date. (eg. Date format is: dd-mm-yyyy).
5	Write a shell script to check entered string is palindrome or not.
6	Write a Shell script to say Good morning/Afternoon/Evening as you log in to system.
7	Write a C program to create a child process.
8	Finding out biggest number from given three numbers supplied as command line arguments.
9	Printing the patterns using for loop.
10	Shell script to determine whether given file exist or not.
11	Write a program for process creation using C. (Use of gcc compiler.)
12	Implementation of FCFS &Round Robin Algorithm.
13	Implementation of Banker's Algorithm.

(3)
a. **Course Name:** Computer Network
b. **Course Code:** 303105255
c. **Prerequisite:** knowledge of Computer and Information system
d. **Rationale:** This course is design to provide the basic knowledge about the data & signals. It also provides basic concepts of computer network and firm foundation for understanding how data communication occurs in the Transmission Medium. It will help to develop logical abilities and practically setup the network

e. **Course Learning Objective:**

CLOBJ 1	Student will be able to understand about network.
CLOBJ 2	Student will be able to create some network connection
CLOBJ 3	Student will be able to create some design about some WAN or LAN
CLOBJ 4	Understand different types of switching, router, and it's table.
CLOBJ 5	Demonstrate a addressing mapping with the network.
CLOBJ 6	Study the use of TCP/IP protocol etc

f. **Course Learning Outcomes:**

CLO 1	Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
CLO 2	Understand the functions of the different layers of the OSI Protocol
CLO 3	Understand and Design For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component
CLO 4	Learn on the given problem-related TCP/IP protocol developed for the network programming.
CLO 5	Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

g. **Teaching & Examination Scheme:**

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**DATA COMMUNICATION COMPONENTS** Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum	25%	11
2	**DATA LINK LAYER AND MEDIUM ACCESS SUB LAYER:** Error Detection and Error Correction -Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Goback 'N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA	25%	11
3	**Network Layer** Switching, Logical addressing 'IPV4, IPV6; Address mapping 'ARP, RARP, BOOTP and DHCP'Delivery, Forwarding andUnicast Routing protocols	20%	8
4	**Transport Layer** Process to Process Communication, User Datagram Protocol(UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality ofService, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	15%	6
5	**Application Layer** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography	15%	6

i. Text Book and Reference Book:

1. Computer Networks (Text Book), By Andrew S. Tanenbaum and David J. Wetherall | PEARSON Edition
2. Internetworking with TCP/IP Principles, Protocols and Architecture, By Douglas E Comer
3. TCP/IP Illustrated, By Richard Stevens
4. Data Communication and Networking, By Behrouz A. Forouzan
5. Data and computer communications, By William Stallings | Prentice Hall

(4)

a. **Course Name:** Computer Network Laboratory
b. **Course Code:** 303105256
c. **Prerequisite:** knowledge of Computer and Information system
d. **Rationale:** This course is design to provide the basic knowledge about the data & signals. It also provides basic concepts of computer network and firm foundation for understanding how data communication occurs in the Transmission Medium. It will help to develop logical abilities and practically setup the network

e. **Course Learning Objective:**

CLOBJ 1	Student will be able to understand about network.
CLOBJ 2	Student will be able to create some network connection
CLOBJ 3	Student will be able to create some design about some WAN or LAN
CLOBJ 4	Understand different types of switching, router, and it's table.
CLOBJ 5	Demonstrate a addressing mapping with the network.
CLOBJ 6	Study the use of TCP/IP protocol etc

f. **Course Learning Outcomes:**

CLO 1	Configure and set up different types of networks, including local area networks (LANs) and wide area networks (WANs).
CLO 2	Configure routers and switches, and implement routing protocols to understand how data is directed through a network.
CLO 3	Use network monitoring tools to analyse network.
CLO 4	Apply security measures, such as firewalls, encryption, and intrusion detection systems, to secure network communication.
CLO 5	Implement and analyse various network protocols, such as TCP/IP, UDP, and ICMP, through practical exercises.

g. **Teaching & Examination Scheme:**

Teaching Scheme	Evaluation Scheme

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiment with Course Learning Outcomes:

Sr. NO.	Experiment List
1	Experiments on Simulation Tools: (CISCO PACKET TRACER)..
2	Experiments of Packet capture tool: Wireshark.
3	To study behaviour of generic devices used for networking: (CISCO PACKET TRACER).
4	Data Link Layer (Error Correction)..
5	Virtual LAN.
6	Wireless LAN
7	Inter-networking with routers: 1: Experiment on same subnet 2: Perform Experiment across the subnet and observe Functioning of Router via selecting suitable pair of Source and destination.
8	Implementation of SUBNETTING
9	Routing at Network Layer.
10	Experiment on Transport Layer.

(5)
a. **Course Name:** Programming in Python with Full Stack Development
b. **Course Code:** 303105257
c. **Prerequisite:** Basic knowledge of Programming and web applications
d. **Rationale:** This course provides a broad introduction to Python programming and development of web applications. Developing and using Python as a scripting language for automating tasks and data processing. Moreover Building and deploying web applications using popular Python frameworks such as Django and Flask.

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with the fundamental concepts of web development and basic of python programming concepts.
CLOBJ 2	Gain knowledge of hoe to define functions in python. Acquire knowledge of OOPS concepts.
CLOBJ 3	Acquire knowledge of how to work with modules and packages in Python.
CLOBJ 4	Understand and use the flask framework.
CLOBJ 5	Understand and use the Django framework.
CLOBJ 6	Study the use of RESTful APIs.

f. **Course Learning Outcomes:**

CLO 1	Understand the fundamental concepts of web development.
CLO 2	Create and manipulate data using a variety of databases, including SQL and NoSQL
CLO 3	Build and deploy web applications using a popular Python web framework, such as Django or Flask.
CLO 4	Design and implement APIs (application programming interfaces) that enable different applications to communicate with each other.
CLO 5	Test and debug web applications, and to deploy them to production environments.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**-**	**-**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**- Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to python programming** Introduction to Python and basic programming concepts, variables, data types, conditionals statements and loops Lists, Sets, Tuples, Dictionaries: Working with strings, lists, sets, tuples and dictionaries, including common operations and built-in functions	15%	6
2	**Functions** Defining and using functions, including the use of arguments and return values OOPS Concepts: Object, class, abstraction, encapsulation, polymorphism, Inheritance. Exceptions and File handling: Handling exceptions and working with files	20%	5
3	**Modules and Packages** Working with modules and packages in Python Introduction to popular Python libraries for specific tasks, such as data analysis, web development, or game development. **PyCharm IDE** GIT- Git Integration with PyCharm IDE, PyTests. Python connectivity with Databases MYSQL, MongoDB CRUD operations.	15%	5
4	**Flask Framework** Introduction to Flask and web development with Python, Installation in Virtual Environment. Creation Routing App Settings. URL Building HTTP methods Templates Working with Static, Media Files. Sending Form Data to Template. Flask App with Database connectivity Sqlite3, MySQL. Handling Exceptions and Errors Flash Message Working with Mails. Authenticating and authorizing users with Flask-Login, Deploying a Flask application to a web server.	20%	10
5	**Django Framework** Introduction to Django framework, Django Project Installation in Virtual Environment. Phases in Django Project Creation Create a Project. Creation of Apps and their Structure. Working with ADMIN Console. Creating Views URL Mapping. Template System Working with	20%	10

	Models. Form Processing static, media files, Django App Deployment.		
6	**Restful APIs** Introduction to RESTful APIs and the REST architectural style Understanding the HTTP protocol and its role in RESTful APIs Designing and implementing RESTful APIs using common HTTP methods, such as GET, POST, PUT, and DELETE Using URLs and resource representations to identify and transfer data in RESTful APIs Implementing best practices for designing and implementing RESTful APIs, such as using HTTP status codes, versioning, and error handling Consuming RESTful APIs using common tools and libraries, such as cURL, Postman, and the requests library in Python Building scalable and secure RESTful APIs using common frameworks and libraries Flask or FastAPI.	**10%**	**6**

i. Text Book and Reference Book:

1. Fluent Python, 2nd Edition by Luciano Ramalho (TextBook)
2. Learn Python3 the Hard Way By Zed Shaw
3. "Django for Beginners: Build websites with Python and Django" by William S. Vincent.
4. "Learning Django Web Development" by Samuli Natri.
5. "Flask Web Development with Python" by Miguel Grinberg.
6. "Mastering Flask" by Jack Stouffer.
7. "Building RESTful Python Web Services" by Gastón C. Hillar.
8. Building Web APIs with FastAPI" by Samuel Colvin.

(6)

a. **Course Name:** Programming in Python with Full Stack Development Laboratory
b. **Course Code:** 303105258
c. **Prerequisite:** Basic knowledge of Programming and web applications
d. **Rationale:** This course provides a broad introduction to Python programming and development of web applications. Developing and using Python as a scripting language for automating tasks and data processing. Moreover Building and deploying web applications using popular Python frameworks such as Django and Flask

e. **Course Learning Objective:**

CLOBJ 1	Gain familiarity with the fundamental concepts of web development and basic of python programming concepts.
CLOBJ 2	Gain knowledge of how to define functions in python. Acquire knowledge of OOPS concepts.
CLOBJ 3	Acquire knowledge of how to work with modules and packages in Python.
CLOBJ 4	Understand and use the flask framework.
CLOBJ 5	Understand and use the Django framework.
CLOBJ 6	Study the use of RESTful APIs.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate a strong understanding of Python programming language fundamentals, including syntax, data types, control structures, and functions.
CLO 2	Understand the basics of web development, including HTML, CSS, and JavaScript, and demonstrate the ability to create static web pages.
CLO 3	Design and implement RESTful APIs using Python for communication between the front-end and back-end components.
CLO 4	Identify and resolve issues in both front-end and back-end code, and optimize the performance of web applications.

CLO 5	Integrate AJAX techniques into Django applications to enable dynamic updates and improve interactivity without full page reloads.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. NO.	Experiment List
1	1. A program that converts temperatures from Fahrenheit to Celsius and vice versa. 2. A program that calculates the area and perimeter of a rectangle. 3. A program that generates a random password of a specified length. 4. A program that calculates the average of a list of numbers. 5. A program that checks if a given year is a leap year. 6. A program that calculates the factorial of a number. 7. A program that checks if a given string, is a palindrome. 8. A program that sorts a list of numbers in ascending or descending order. 9. A program that generates a multiplication table for a given number. 10. A program that converts a given number from one base to another.
2	1. A program that models a bank account, with classes for the account, the customer, and the bank. 2. A program that simulates a school management system, with classes for the students, the teachers, and the courses. 3. A program that reads a text file and counts the number of words in it. 4. A program that reads a CSV file and calculates the average of the values in a specified column. 5. A program that reads an Excel file and prints the data in a tabular format.
3	1. A program that creates a simple web server and serves a static HTML page. 2. A program that creates a web application that allows users to register and login. 3. A program that creates a web application that allows users to upload and download files. 4. A program that creates a web application that displays data from a database in a tabular format. 5. A program that creates a web application that accepts user input and sends it to a server-side script for processing.
4	1. A program that creates a web application that uses a template engine to generate dynamic HTML pages. 2. A program that creates a web application that supports AJAX requests and updates the page without reloading.

	3. A program that creates a web application that uses Django's built-in debugging features to troubleshoot errors and exceptions.
	4. A program that creates a web application that implements user authentication and authorization.
	5. A program that creates a web application that integrates with third-party APIs to provide additional functionality.
5	1. A program that creates a simple RESTful API that returns a list of users in JSON format.
	2. A program that creates a RESTful API that allows users to create, read, update, and delete resources.
	3. A program that creates a RESTful API that authenticates users using a JSON Web Token.
	4. A program that creates a RESTful API that paginates the results of a query to improve performance.
	5. A program that creates a RESTful API that supports data validation and error handling.

(7)

a. **Course Name:** Competitive Coding
b. **Course Code:** 303105259
c. **Prerequisite:** proficiency in a programming language (e.g., C++, Python) and a strong grasp of data structures and algorithms, with a focus on problem-solving skills and efficient code implementation. Familiarity with common coding platforms (e.g., Codeforces, LeetCode) is also beneficial.

d. **Rationale:** Competitive coding sharpens problem-solving skills, enhances algorithmic thinking, and fosters quick and efficient coding practices. It provides a platform for continuous learning, challenges individuals to tackle diverse problems, and fosters a competitive spirit that's valuable in technical interviews and real-world software development.

e. **Course Learning Objective:**

CLOBJ 1	To develop skills that are necessary for student participations in programming contests
CLOBJ 2	To solve very complex programming problems
CLOBJ 3	To write source code of computer programs which are able to solve given problems.
CLOBJ 4	To develop skills such as problem-solving, critical thinking, and efficient coding.
CLOBJ 5	To provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.

f. **Course Learning Outcomes:**

CLO 1	Develop strong problem-solving skills, improve algorithmic thinking, and enhance proficiency in coding by tackling a variety of challenging problems.
CLO 2	Cultivate the ability to write efficient and optimized code under time constraints, honing the skill of quickly translating algorithmic insights into practical solutions.

CLO 3	Gain a competitive advantage in technical interviews and coding assessments, showcasing the ability to tackle diverse coding challenges commonly encountered in job placements and coding competitions.
CLO 4	Foster a mindset of continuous learning by regularly engaging with new problems, staying updated on emerging algorithms, and adapting to evolving coding paradigms.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. No.	List of Experiment
1.	Write a program for implementing a MINSTACK which should support operations like push, pop, overflow, underflow,display 1. Construct a stack of N-capacity 2. Push elements 3. Pop elements 4. Top element 5. Retrieve the min element from the stack
2.	Write a program to deal with real-world situations where Stack data structure is widely used Evaluation of expression: Stacks are used to evaluate expressions, especially in languages that use postfix or prefix notation. Operators and operands are pushed onto the stack, and operations are performed based on the LIFO principle.
3.	Write a program for finding NGE NEXT GREATER ELEMENT from an array.
4.	Write a program to design a circular queue(k) which Should implement the below functions a. Enqueue b. Dequeue c. Front d. Rear
5.	Write a Program for an infix expression, and convert it to postfix notation. Use a queue to implement the Shunting Yard Algorithm for expression conversion.
6.	Write a Program for finding the Product of the three largest Distinct Elements. Use a

	Priority Queue to efficiently find and remove the largest elements.
7.	Write a Program to Merge two linked lists (sorted).
8.	Write a Program to find the Merge point of two linked lists (sorted).
9.	Write a Program to Swap Nodes pairwise.
10.	Write a Program for Building a Function ISVALID to VALIDATE BST.
11.	Write a Program to Build BST.
12.	Write a Program to determine the depth of a given Tree by Implementing MAXDEPTH.
13.	Write a Program to Understand and implement Tree traversals i.e. Pre-Order Post-Order, In-Order.
14.	Write a Program to perform Boundary Traversal on BST.
15.	Write a program for Lowest Common Ancestors.
16.	Write a Program to verify and validate mirrored trees or not.
17.	Write a Program for a basic hash function in a programming language of your choice. Demonstrate its usage to store and retrieve key-value pairs.
18.	Implement a hash table using separate chaining for collision handling. Perform operations like insertion, deletion, and search on the hash table.
19.	Write a Program to Implement Two sums using HASHMAP.
20.	Write a Program to Implement Search, insert, and Remove in Trie.
21.	Write a Program to Implement Huffman coding.
22.	Write a Program to find Distinct substrings in a string.
23.	Write a Program to find The No of Words in a Trie.
24.	Write a Program to view a tree from left View.
25.	Write a Program to Traverse a Tree using Level Order Traversal.

(8)
a. **Course Name:** Computer Organization and Architecture
b. **Course Code:** 303108253
c. **Prerequisite:** Digital Electronics, Basic Understanding of Computer System.
d. **Rationale:** This course is concerned with the structure and behaviour of the various functional modules of Computer and how they interact to provide the processing needs of the user. This course also helps to understand basic instruction formats and parallel processing. It will help to develop their understanding about the organization of computer parts.

e. **Course Learning Objective:**

CLOBJ 1	Understand the organization and architecture of computer systems and electronic computers.
CLOBJ 2	Study the assembly language program execution, instruction format and instruction cycle.
CLOBJ 3	Design a simple computer using hardwired and micro-programmed control methods.
CLOBJ 4	Study the basic components of computer systems besides the computer arithmetic.
CLOBJ 5	Understand input-output organization, memory organization and management, and pipelining.

f. **Course Learning Outcomes:**

CLO 1	Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

CLO 2	Write assembly language program for specified microprocessor for computing 16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
CLO 3	Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
CLO 4	Given a CPU organization and instruction, design a memory module and analyse its operation by inter facing with the CPU.
CLO 5	Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	-	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Functional Blocks Of A Computer** CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU registers, instruction execution cycle, RTL Interpretation of instructions, addressing modes, instruction set. Case study instruction set of some common CPUs	15%	7
2	**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.	20%	9
3	**Introduction To X86 Architecture** CPU CONTROL UNIT DESIGN: hardwired and micro-programmed design approaches, Case study design of a simple hypothetical CPU. MEMORY SYSTEM DESIGN: Semiconductor memory technologies, memory organization.	15%	7

4	**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 -SCII, USB	**15%**	**7**
5	**Pipelining** Basic concepts of pipelining, throughput and speedup, pipeline hazards. **Parallel Processors** Introduction to parallel processors, Concurrent access to memory andcache coherency.	**15%**	**7**
6	**Memory Organization** Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies	**20%**	**9**

i. **Text Book and Reference Book:**

1. Computer Organization and Design: The Hardware/Software Interface, By David A. Patterson and John L. Hennessy, Elsevier | 5th Edition
2. Computer Organization and Embedded Systems, By Carl Hamacher | McGraw Hill Higher Education. | 6th Edition
3. Computer Architecture and Organization, By John Hayes | McGraw-Hill
4. Computer Organization and Architecture: Designing for Performance, By William Stallings | Pearson Education | 10th Edition
5. Computer System Design and Architecture, By Vincent P. Heuring and Harry F. Jordan | Pearson Education | 2nd Edition

(9)

a. **Course Name:** Computer Organization and Architecture Laboratory
b. **Course Code:** 303108254
c. **Prerequisite:** Digital Electronics, Basic Understanding of Computer System
d. **Rationale:** This course is concerned with the structure and behaviour of the various functional modules of Computer and how they interact to provide the processing needs of the user. This course also helps to understand basic instruction formats and parallel processing. It will help to develop their understanding about the organization of computer parts.

e. **Course Learning Objective:**

CLOBJ 1	Understand the organization and architecture of computer systems and electronic computers.
CLOBJ 2	Study the assembly language program execution, instruction format and instruction cycle.
CLOBJ 3	Design a simple computer using hardwired and micro-programmed control methods.
CLOBJ 4	Study the basic components of computer systems besides the computer arithmetic.
CLOBJ 5	Understand input-output organization, memory organization and management, and pipelining.

f. **Course Learning Outcomes:**

CLO 1	Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
CLO 2	Write assembly language program for specified microprocessor for computing16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
CLO 3	Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

CLO 4	Given a CPU organization and instruction, design a memory module and Analyse its operation by inter facing with the CPU.
CLO 5	Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. No.	List of Experiment
1.	Write the working of 8085 simulator GNUsim8085 and basic architecture of 8085 along with small introduction.
2.	Study the complete instruction set of 8085 and write the instructions in the instruction set of 8085 along with examples.
3.	Write an assembly language code in GNUsim8085 to implement data transfer instruction.
4.	Write an assembly language code in GNUsim8085 to store numbers in reverse order in memory location.
5.	Write an assembly language code in GNUsim8085 to implement arithmetic instruction.
6.	Write an assembly language code in GNUsim8085 to add two numbers using lxi instruction.
7.	Write an assembly language code in GNUsim8085 to add two 8 bit numbers stored in memory and also storing the carry.
8.	Write an assembly language code in GNUsim8085 to find the factorial of a number.
9.	Write an assembly language code in GNUsim8085 to implement logical instructions.
10.	Write an assembly language code in GNUsim8085 to implement stack and branch instructions.

(10)
a. **Course Name:** Probability, Statistics and Numerical Methods
b. **Course Code:** 303191251
c. **Prerequisite:** Knowledge of Mathematics up to 12th science level
d. **Rationale:** The Mathematics I, Mathematics-II syllabus integrates fundamental calculus concepts, advanced mathematical techniques, and vector calculus, preparing students for engineering challenges with optimized problem-solving skills.

e. **Course Learning Objective:**

CLOBJ 1	Understand fundamental concepts of probability, probability spaces, conditional probability, and Bayes' Rule for making informed statistical decisions.
CLOBJ 2	Analyse discrete and continuous random variables, compute expectations and variances, and explore key distributions such as Binomial, Poisson, and Normal.
CLOBJ 3	Develop skills in hypothesis testing, including large sample tests for proportions, means, standard deviations, and chi-square tests for goodness of fit and independence.
CLOBJ 4	Demonstrate proficiency in numerical methods for solving linear equations, finding roots of algebraic and transcendental equations using techniques like Gauss-Jacobi, Gauss-Seidel, Bisection, Newton-Raphson, and Regula-Falsi.
CLOBJ 5	Master the concepts of finite differences, interpolation using Newton's Forward and Backward Difference Formula, Newton's Divided, and Lagrange's Formula for Unequal Intervals.
CLOBJ 6	Gain expertise in numerical integration techniques such as the Trapezoidal rule, Simpson's 1/3rd and 3/8th Rules, Gaussian Quadrature, and solve ordinary differential equations using methods like Taylor's series, Euler, Modified Euler, and Runge-Kutta of the fourth order for first and second-order equations.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate proficient problem-solving skills, translating real-world problems into mathematical formulations and applying appropriate techniques for solutions.

CLO 2	Develop integrated analytical and critical thinking skills by engaging with a wide range of mathematical structures, proofs, and problem-solving techniques presented throughout the entire syllabus.
CLO 3	Understand and interpret mathematical solutions within the context of specific problems, recognizing the practical applications of discrete mathematics in diverse fields covered in all units.
CLO 4	Communicate mathematical concepts and solutions clearly and effectively, both in written and verbal forms, adapting communication styles to the diverse topics covered in each unit.
CLO 5	Present mathematical arguments and solutions in a unified, logical, and organized manner, emphasizing clarity, coherence, and precision across all units.
CLO 6	Lay a solid foundation for more advanced courses in mathematics and related disciplines.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
4	-	-	4	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Correlation, Regression and Curve Fitting** Correlation and Regression – Rank correlation Curve Fitting by The Method of Least Squares- Fitting of Straight Lines, Second Degree Parabolas and More General Curves	18%	8
2	**Probability and Probability Distributions** Probability Spaces, Conditional Probability, Bayes' Rule, Discrete and Continuous Random Variables, Independent Random Variables, Expectation and Variance of Discrete and Continuous Random Variables, Distribution and Their Properties: Binomial Distribution, Poisson Distribution, Normal Distribution	23%	10
3	**Testing of Hypothesis** Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations. Test for single mean, difference of means, Test	25%	15

	for ratio of variances, Chi-square test for goodness of fit and independence of attributes.		
4	**Solution of a System of Linear Equations, Roots of Algebraic and Transcendental Equations** Gauss-Jacobi and Gauss Seidel Methods, Solution of Polynomial and Transcendental Equations – Bisection Method, Newton- Raphson Method and Regula-Falsi Method	17%	10
5	**Finite Differences and Interpolation** Finite Differences, Relation between Operators, Interpolation using Newton's Forward and Backward Difference Formulae. Newton's Divided and Lagrange's Formulae for UnequalIntervals.	10%	6
6	**Numerical Integration** Trapezoidal rule, Simpson's 1/3rd and 3/8th Rules, Gaussian Quadrature Formulae. **Numerical solution of Ordinary Differential Equations** Taylor's Series, Euler and Modified Euler's Methods. Runge- Kutta Method of Fourth Order for Solving First and Second Order Equations.	7%	1

i. Text Book and Reference Book:

Text books:
1. Numerical Methods in Engineering & Science with Programs in C and C++ (Text Book), By Dr. B. S. Grewal | Khanna Publishers
2. Introduction to Numerical Analysis, By C.E. Froberg | Addison Wesley Publishing Company
3. Introduction to Probability (Text Book), By P. G. Hoel, S. C. Port and C. J. Stone, | UBS Publishers
4. Fundamentals of Mathematical Statistics (Text Book), By S.C. Gupta and V. K. Kapoor | Sultan Chand & Sons

Reference Books:
1. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.

(11)
a. **Course Name:** Professional Grooming and Personality Development
b. **Course Code:** 303193252
c. **Prerequisite:** Knowledge of communication theories and basic management skills are essential.
d. **Rationale:** Acquiring soft skills, life skills and aptitude skills are crucial for organisational communication as well as employability respectively.
e. **Course Learning Objective:**

CLOBJ 1	Articulate verbal communication skills.
CLOBJ 2	Enhance non-verbal communication, including body language and facial expressions.
CLOBJ 3	Understand the importance of personal grooming and hygiene in a professional setting.
CLOBJ 4	Apply proper business etiquette in various professional settings.
CLOBJ 5	Develop emotional intelligence to understand and manage one's own emotions and those of others.
CLOBJ 6	Cultivate leadership qualities and skills to inspire and influence others positively.

f. **Course Learning Outcomes:**

CLO 1	Identify and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace
CLO 3	Speak and participate effectively in oral organizational communication
CLO 4	Improve comprehensive skills for reading
CLO 5	Know how to be assertive in professional environment

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
-	1	-	1	-	100	-	-	-	100

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Self -Development and Assessment** Various self-assessments for personal and professional development skills that are relevant to career development: **-** Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Guess, Think, Communicate, Relate, and Dream	25%	4
2	**Corporate Etiquette** Tips and guide to develop personality and gain various etiquettes manners, case studies and activities. Telephone etiquette, Etiquette for foreign business trips, Etiquette for small talks Respecting privacy, Learning to say 'No'	25%	4
3	**Public Speaking** It's process of communicating information to an audience and is helpful in career advancement. Effective Public speaking skills includes: Choosing appropriate pattern Selecting appropriate method Art of persuasion Making speeches effective Delivering different types of speeches	20%	4
4	**Reading Skills Activity & Reading Comprehension** Aims to improve students' Comprehensive Skills in English Language by getting them involved in reading activity and providing practice for reading comprehension.	15%	2
5	**Listening Skills- Inquiry Based Listening Questions** Aims to improve students' listening skills in English Language providing them practice of various types of	15%	1

inquiry based listening tracks. Students will listen and will be able to find out details from the conversations.	

i. Text Book and Reference Book:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Communication Skills Kumar S and Lata P; New Delhi Oxford University Press
3. Practical English Usage MICHAEL SWAN
4. A Remedial English Grammar for Foreign Student F.T. WOOD
5. On Writing Well William Zinsser; Harper Paperbacks,2006; 30th anniversary edition
6. Oxford Practice Grammar, John Eastwood; Oxford University Press

Semester 5

(1)
  a. **Course Name:** Basic Aircraft Science
  b. **Course Code:** 303101331
  c. **Prerequisite:** knowledge of Introduction to Aeronautics, Fluid mechanics, Engineering Thermodynamics
  d. **Rationale:** The subject gives basic principles and understanding of Aircraft Science, Air plane structure & operation of Prime movers used in Aeronautics

e. Course Learning Objective:

CLOBJ 1	Understand the principles of aerodynamics and how they apply to aircraft flight.
CLOBJ 2	Identify and describe the components and systems of an aircraft.
CLOBJ 3	Explain the forces acting on an aircraft during flight, including lift, weight, thrust, and drag.
CLOBJ 4	Analyse the factors affecting aircraft performance, including altitude, speed, and load.

f. Course Learning Outcomes:

CLO 1	Understand the basic principles of flight take off, stability and control.
CLO 2	Know the fundamentals of aerodynamics involved in airplane performance.
CLO 3	Learn the various types of structure used for airplane manufacturing.
CLO 4	Analysis the various components used for the propulsion of airplane.

CLO 5	Calculate the power requirement necessary for flight operation under different condition.
CLO 6	Understand various wireless and navigation system used for airplane

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	0	-	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Flight Principles** Principles of generation of lift, Nomenclature of aerofoil, forces acting upon an aircraft, three axes of manoeuvring, primary control surfaces; elevator, aileron, stabilators and rudder. Secondary control surfaces; trim tabs, flaps, spoilers, air-brakes, slats-slots, condition for straight & level flight, flight path angle. Steady Level Flight and Altitude effects, Ceilings, Steady Climbing Flight, Sustained Level Turn, Range and Endurance, Take-off and Landing.	10%	3
2	**Fundamentals of Basic Aerodynamics** Introduction of Basic Aerodynamics, Different regimes of atmosphere, Critical Mach no. Elementary aerodynamics (lift, drag, thrust, Weight) Moment Force and Airfoil stalling, Flight forces and aircraft loading, Fundamentals of stability, Introduction to Flight stability and dynamics.	25%	7
3	**Fundamentals of Aircraft Structure** Introduction to aircraft structure, Classification of aircraft parts, Basic function & Structural details of landing gear, wing , fuselage and tail planes, Wing Airfoil nomenclature, Airfoils structure ,Lift generation Theories ,Functions of ribs, skin, spars, stringers, longerons, Fuselage Types,	25%	7

	Monocoque and semi-monocoque structures, Constructional features of conventional aircraft.		
4	**Fundamentals of Propulsion Systems** Introduction, Fundamentals of different propulsion systems, Types of cycles, Requirement of power to fly; balance of forces, various means of producing power, Fundamental gas turbine cycles and Propulsion Techniques. Types of Propulsive systems.	15%	5
5	**Basic of Avionics** Airspeed, Altimeter, Vertical speed, Angle of attack indicator, Mach meter, Accelerometer, Heading indicator, Gyroscopic Instrument, Anti and De-icing system, Black box recorder, Turn& bank indicator, Pitot tube, Primary and secondary flight control. Short range navigation and approach aids: Introduction to NDB, VOR, DME, ILS, MLS, RADAR. Introduction to A/c hydrolytes and hydraulic systems, Pneumatic System.	25%	8

i. Text Book and Reference Book:

1. Aircraft Instruments By E H Pallet | Pearson Education
2. Introduction to Flight By John D Anderson | Tata Mc Graw Hill Book Company
3. Flight without Formula By A C Kermode | Pearson Education
4. Fundamentals of Flight By R S Shevell | Pearson Education

(2)

a. **Course Name:** Disaster Preparedness and Planning
b. **Course Code:** 303104305
c. **Prerequisite:** NA
d. **Rationale:** This subject is conceptual applications of principles of management to mitigate various disasters.

e. **Course Learning Objective:**

CLOBJ 1	Understand the concept of disaster preparedness and its importance in mitigating the impact of natural and man-made disasters.
CLOBJ 2	Identify potential hazards and risks specific to different geographical areas and communities.
CLOBJ 3	Develop skills in creating comprehensive disaster preparedness plans for various organizations and communities.
CLOBJ 4	Learn strategies for effectively communicating and disseminating disaster preparedness information to stakeholders.

f. **Course Learning Outcomes:**

CLO 1	The application of Disaster Concepts to Management
CLO 2	Analysing Relationship between Development and Disasters.

CLO 3	Ability to understand Categories of Disasters
CLO 4	Realization of the responsibilities to society

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
2	**0**	**0**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T**- Tutorial; **P-** Practical; **C**- Credit; **MSE-** Mid-Semester Evaluation, **CE**-Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Concepts and definitions: disaster, hazard, vulnerability, risks-severity, frequency and details, capacity, impact, prevention, mitigation	**10%**	**3**
2	**Disasters** Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.	**25%**	**7**
3	**Disaster Impacts** Disaster impacts(environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters	**25%**	**8**
4	**Disaster Management Cycle and Framework** Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk	**25%**	**8**

	analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.		
5	**Disasters, Environment and Development** Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.	**15%**	**4**

i. Text Book and Reference Book:
1. Disaster Risk Reduction in South Asia By Pradeep Sahni
2. Handbook of Disaster Management: Techniques & Guidelines By Singh B.K
3. Disaster Management By Ghosh G.K.
4. Disaster Medical Systems Guidelines By Emergency Medical Services Authority, State of California, Pub. Year 2003
5. Inter-Agency Standing Committee (IASC) By IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

(3)
a. **Course Name:** Cyber Security
b. **Course Code:** 303105326(T)
c. **Prerequisite:** Familiarity with computer networks, operating systems, and basic programming concepts, along with knowledge of fundamental cybersecurity principles and protocols.
d. **Rationale:** The Cyber Security course aims to equip individuals with the knowledge and skills necessary to protect digital assets, mitigate cyber threats, and safeguard information systems, thereby ensuring the confidentiality, integrity, and availability of data in an increasingly interconnected and digital world.
e. **Course Learning Objective:**

CLOBJ 1	Understand the principles and concepts of cybersecurity, including threat landscape, attack vectors, and defence mechanisms.
CLOBJ 2	Identify common cybersecurity threats, such as malware, phishing, and denial of service attacks, and learn how to mitigate them.
CLOBJ 3	Gain proficiency in cybersecurity tools and techniques for monitoring, detecting, and responding to security incidents.
CLOBJ 4	Develop skills in securing computer networks, systems, and applications against unauthorized access and data breaches.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate a comprehensive understanding of cybersecurity principles, threats, and defence mechanisms.
CLO 2	Apply knowledge of cybersecurity tools and techniques to detect, Analyse, and respond to security incidents effectively.
CLO 3	Implement security measures to protect computer networks, systems, and data from unauthorized access and cyber-attacks.
CLO 4	Utilize cryptographic techniques to ensure data confidentiality, integrity, and authenticity.
CLO 5	Evaluate and assess security risks and vulnerabilities in various computing environments.
CLO 6	Develop and implement cybersecurity policies, procedures, and best practices to mitigate risks and enhance security posture.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Information Security** Introduction to information system, Types of information Systems, Development of Information Systems, Introduction to Information Security, Need for Information Security, Threats to Information Systems, Information Assurance, Cyber Security and Security Risk Analysis	15%	6
2	**Systems Vulnerability Scanning** Overview of vulnerability scanning, Open Port/Service Identification, Banner/ Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples. Networks Vulnerability Scanning - Netcat, Understanding Port and Services tools, Network Reconnaissance–Nmap. Network Sniffers and Injection tools–Wireshark.	25%	7
3	**Network Defence tools** Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation(NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System	20%	7
4	**Introduction to Cyber Crime and law** Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics ,Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian ITACT 2000.	20%	4
5	**Introduction to Cyber Crime Investigation** Firewalls and Packet Filters, password Cracking, Key loggers and Spyware, Virus And Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks.	20%	4

i. Text Book and Reference Book:

1. Cryptography and Network Security (Text Book) By William Stallings
2. Anti-Hacker Tool Kit By Mike Shema | McGrawHill
3. Cyber Security understanding Cyber Crimes, Computer forensics and Legal Perspectives By Nina Godbole and Sunit Belapure | WILEY
4. Cryptography and Network Security (Text Book) By V.K. Jain | Khanna Publishing House

5. Information and Cyber Security (Text Book) By Gupta Sarika | Khanna Publishing House
6. Cryptography and Network Security (Text Book) By Atul Kahate | TMH
7. Cryptography and Information Security (Text Book) By V.K. Pachghare | PHI Learning

j. List of Experiments:

Sr. NO.	Experiment List
1	Implementation to gather information from any PC's connected to the LAN using who is, port scanners, network scanning, Angry IP scanners etc.
2	Experiments with open source firewall/proxy packages like iptables, ufw, squid etc.
3	Implementation of Steganography.
4	Implementation of MITM- attack using wireshark/ network sniffers.
5	Implementation of Windows security using firewalls and other tools.
6	Implementation to identify web vulnerabilities, using OWASP project
7	Implementation of IT Audit, malware analysis and Vulnerability assessment and generate the report
8	Implementation of OS hardening and RAM dump analysis to collect the Artifacts and other Information.
9	Implementation of Mobile Audit and generate the report of the existing Artifacts
10	Implementation of Cyber Forensics tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery

(4)
a. **Course Name:** Azure Fundamentals
b. **Course Code:** 303105302
c. **Prerequisite:** Basic understanding of computer concepts and basic programming
d. **Rationale:** This course provides a broad introduction to Azure cloud , infrastructure , services, security and compliance ,also billing ,pricing and support plans
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of cloud computing and the Microsoft Azure platform.
CLOBJ 2	Navigate the Azure portal and manage Azure resources effectively
CLOBJ 3	Learn about Azure services, including compute, storage, networking, and databases.
CLOBJ 4	Gain proficiency in deploying and managing virtual machines, containers, and serverless applications on Azure.

f. **Course Learning Outcomes:**

CLO 1	Understand the principles Cloud computing.
CLO 2	Familiarity with the various Azure services
CLO 3	Understanding the Azure security features
CLO 4	Understanding Azure Service Level Agreements (SLAs) and the Azure service lifecycle

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Cloud Concepts** Understanding cloud computing principles, such as the different types of cloud models (public, private, hybrid), infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS), and software-as-a-service (SaaS).	15%	6

2	**Azure Services** Familiarity with the various Azure services and their common use cases. This includes services like Azure Virtual Machines, Azure App Services, Azure Storage, Azure Functions, Azure SQL Database, and more	**20%**	**7**
3	**Security, Privacy, Compliance, and Trust** Knowledge of Azure security features, identity and access management, Azure Active Directory, data protection, compliance frameworks, and Azure governance methodologies.	**25%**	**5**
4	**Azure Pricing and Support** Understanding Azure subscription options, cost management, pricing models, and the different support options available to Azure customers	**15%**	**5**
5	**Azure SLA and Service Lifecycles** Familiarity with Azure Service Level Agreements (SLAs) and the Azure service lifecycle, including planned maintenance, updates, and deprecation policies.	**25%**	**7**

i. Text Book and Reference Book:

1. Microsoft Azure Fundamentals: Understanding Azure" by Michael Collier and Robin Shahan - 3rd Edition (TextBook)
2. Azure for Architects: Implementing cloud design, DevOps, containers, IoT, and serverless solutions on your public cloud" by Ritesh Modi - 2nd Edition
3. Exam Ref AZ-900 Microsoft Azure Fundamentals" by Jim Cheshire - 2nd Edition

(5)

a. **Course Name:** Fundamentals of Communication Engineering
b. **Course Code:** 303107346
c. **Prerequisite:** Fourier series, Fourier Transforms, Basic Electronics
d. **Rationale:** This course explores the fundamentals of electronic communication systems. The course has two primary focuses: Understanding electronic communications systems in analog form from deterministic approach They can have a broad understanding of satellite, optical, cellular, mobile, wireless.

e. **Course Learning Objective:**

CLOBJ 1	Understand the basic principles and concepts of communication engineering, including modulation, demodulation, and signal processing.
CLOBJ 2	Learn about different communication systems and their components, such as transmitters, receivers, and antennas.
CLOBJ 3	Explore various modulation techniques, including amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM).
CLOBJ 4	Gain proficiency in analyzing the performance of communication systems in terms of signal-to-noise ratio (SNR), bandwidth, and bit error rate (BER).
CLOBJ 5	Understand the principles of digital communication, including pulse amplitude modulation (PAM), pulse code modulation (PCM), and digital modulation techniques.

f. **Course Learning Outcomes:**

CLO 1	Understand the basics of communication system.
CLO 2	Work on various types of modulations.
CLO 3	Should be able to use these communication modules in implementation..
CLO 4	Will have a basic understanding of various wireless and cellular, mobile communication.
CLO 5	Understand the basics of Satellite Communication & Optical Communication

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Need for Modulation, Frequency translation, Electromagnetic spectrum, Gain, Attenuation and decibels.	8%	3
2	**Noise** Introduction, thermal noise, Shot noise, Partition Noise, Low frequency noise, Burst noise, a noise, High frequency noise, BJT and FET noises, Equivalent input noise generators, Signal to noise ratio (SNR), SNR of Tandem connection, Noise factor and noise figure, Amplifier input noise in terms of noise figure, Noise factor in cascaded amplifiers, Noise factor and equivalent input noise generators, noise factor of a lossy network, Noise temperature, Measurement of noise temperature and noise factor, narrow-band band pass noise. Behavior of Analog systems in presence of Noise.	20%	5
3	**Simple description on Modulation** Analog Modulation-AM, FM, Pulse Modulation-PAM, PWM, PCM, Digital Modulation Techniques-ASK, FSK, PSK, QPSK modulation and demodulation schemes.	22%	6
4	**Networking and Local Area Networks** Network fundamentals, LAN hardware, Ethernet LANs, Token Ring LAN.	14%	4
5	**Satellite Communication & Optical Communication** **Satellite Communication** Satellite Orbits, satellite communication systems, satellite subsystems, Ground Stations Satellite Applications, Global Positioning systems. **Optical Communication** Optical Principles, Optical Communication Systems, Fiber –Optic Cables, Optical Transmitters & Receivers, Wavelength Division Multiplexing.	22%	6
6	**Cellular and Mobile Communications & Wireless Technologies** **Cellular and Mobile Communications** Cellular telephone systems, AMPS, GSM, CDMA, and WCDMA. **Wireless Technologies** Wireless LAN, PANs and Bluetooth, WiFi , Zig Bee and Mesh Wireless networks, Wimax and MANs, Infrared wireless, RFID communication, UWB, LTE , 5G.	14%	6

i. Text Book and Reference Book:

1. Electronic Communications By Dennis Roddy & John Coolen | PHI
2. Electronic Communications By Kennedy | McGraw Hill Publication
3. Electronic Communications Systems By Wayne Tomasi | Pearson education India
4. Electronic Communication Systems By Roy Blake | Cengage learning
5. Communication Systems By Simon Haykins | Wiley India
6. Modern Digital and Analog Communication Systems By B. P. Lathi, Zhi Ding | Oxford University Press | 4th Edition
7. Wireless Communications Principles and Practice By T. S. Rappaport | PHI | 2nd edition, Pub. Year 2002
8. Introduction to data communications and networking By Wayne Tomasi | Pearson Education
9. Theory and Problem Of Electronic Communication By Lloyd Temes and Mitchel E.Schulz | McGraw Hill Publication

(6)
a. **Course Name:** Internet of Things
b. **Course Code:** 303105305
c. **Prerequisite:** Basic Electronics
d. **Rationale:** The explosive growth of the "Internet of Things" is changing our world. IoT components are allowing people to innovate new designs and products at home. In this course students will learn the importance of IoT in society, the current components of typical IoT devices and trends for the future. This course will make students understand Hardware and software component of embedded systems. This course is also cover components of the networking and how to connect devices with internet.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of Internet of Things (IoT) technologies, including sensors, actuators, and communication protocols.
CLOBJ 2	Explore the architecture and components of IoT systems, including edge devices, gateways, and cloud platforms.
CLOBJ 3	Learn about IoT data acquisition, processing, and analytics techniques for extracting meaningful insights from sensor data.
CLOBJ 4	Gain proficiency in IoT networking protocols, including Wi-Fi, Bluetooth, Zigbee, and MQTT, for device connectivity and communication.
CLOBJ 5	Understand the security and privacy challenges in IoT systems and learn best practices for securing IoT deployments.

f. **Course Learning Outcomes:**

CLO 1	Define the term "Internet of Things"
CLO 2	State the technological trends which have led to IoT. Describe the impact of IoT on society.
CLO 3	Define what an embedded system is in terms of its interface.
CLO 4	Enumerate and describe the components of an embedded system
CLO 5	Describe the interactions of embedded systems with the physical world.
CLO 6	Describe the interaction between software and hardware in an IoT device.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	0	0	2	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to Embedded Systems** Microprocessor, Microcontroller, GPU, I/O devices, clock, memory, other peripherals: ADC, DAC, Sensors and Actuators, Introduction to operating Systems.	20%	5
2	**Internet of Things (IoT)** Introduction to IOT, Case Study of Refrigerator, IoT Devices, IoT Devices vs. Computers, Societal Benefits of IoT, Risks, Privacy, and Security.	20%	5
3	**IoT Hardware and Software** Arduino Platform, Arduino IDE, Compiling Code, Arduino Shields, Arduino Basic Setup. Setting Up Your Environment, Variables, Basic C Operators, Conditionals, Loops, Functions, And Global Variables.	35%	10
4	**Networking and the Internet** Need of Networking, Networking Components, Internet Structure, Protocols: UART and its Synchronization, Serial on Arduino, Reading from Serial	25%	8

i. **Text Book and Reference Book:**

1. Arduino Cookbook By Michael Margolis | O'Really Publication
2. "Internet of Things(A Hands-on-Approach)", By Vijay Madisetti and Arshdeep Bahga, | VPT
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", By Francis daCosta, | Apress Publications
4. Embedded systems Architecture, Programming and Design By Rajkamal | TMH

(7)

a. **Course Name:** Renewable Energy Sources
b. **Course Code:** 303109346
c. **Prerequisite0:** Basic knowledge of Renewable energy sources such as geothermal, wind, solar, ocean and bio-energy
d. **Rationale:** This course develops fundamental understanding about the need for renewable energy sources and energy scenario of a country. Students will learn the concepts about renewable energy sources like solar energy, wind energy, energy from biomass, geothermal energy, energy from the ocean.

e. **Course Learning Objective:**

CLOBJ 1	Understand the various renewable energy sources available, including solar, wind, hydroelectric, biomass, geothermal, and tidal energy.
CLOBJ 2	Explore the principles of energy conversion from renewable sources and their applications in electricity generation, heating, and transportation.
CLOBJ 3	Learn about the environmental impacts and sustainability considerations associated with different renewable energy technologies
CLOBJ 4	Gain proficiency in the design and analysis of renewable energy systems, including site assessment, system sizing, and integration into the grid.

f. **Course Learning Outcomes:**

CLO 1	List out different renewable energy sources: solar energy, wind energy, bio-energy, tidal energy, ocean thermal energy, geothermal energy, etc
CLO 2	Evaluate different energy production methods: solar energy, wind energy, bio energy etc.
CLO 3	Discuss the key aspects of renewable energy sources: solar energy, wind energy, bio-energy, tidal energy, geothermal energy etc
CLO 4	Describe various applications ofsolar energy, wind energy, bio-energy, tidal energy, ocean thermal energy, geothermal energy, etc
CLO 5	Calculate energy conversion methods used for solar energy, wind energy and bio-energy

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			**ESE**		**Total**
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
2	**0**	**0**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE- Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Thermodynamic laws related to Energy and Power, Energy conversion and unit system. Brief history and need of renewable energy, Global and National scenarios, Prospects of renewable energy sources.	10%	3
2	**Solar Energy** Solar Radiation Geometry, Solar radiation - Outside the earth atmosphere and at earth surface, Instruments for measurement of solar radiation and sunshine, localsolar time, derived solar angles, sunrise, sunset and day length. Non concentrating collectors, Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation and solar still, solar cooker, solar heating & cooling of buildings, photo voltaic - solar cells & its applications.	35%	10
3	**Wind Energy** Introduction, power in wind, power coefficient, wind mills-types, design consideration, performance, site selection, advantages and disadvantages, applications, wind energy development in India.	17%	5
4	**Bio Energy** Introduction, types of biogas plants, biogas generation, factors affecting biogas generation, design consideration, advantages and disadvantages, site selection, applications, scope of biogas energy in India, biomass energy, energy plantation.	13%	4
5	**Ocean Energy** Introduction, OTEC principle, open cycle OTEC system, closed cycle, hybrid cycle, site selection, Energy from tides, estimation of tidal power, tidal power plants, single basin, double basin, site requirements, advantages and limitations, wave energy, wave energy conversion devices, advantages and disadvantages, small scale hydro power.	12%	4
6	**Geothermal Energy** Introduction, Vapor dominated system, Liquid dominated system, Binary Cycle, Hot Dry Rock resources, Magma Resources, Geothermal Energy in India.	13%	4

i. Text Book and Reference Book:
1. Renewable Energy Sources and Emerging Technologies By D.P Kothari , K.C. Singal ,Rakesh Ranjan. | PHI Publication
2. Non-Convectional Resources By G.S. Sawhney | PHI Publication
3. Conventional Energy Sources By G. D. Rai | khanna publishers | fifth, Pub. Year 2012
4. Solar Energy: Principles of Thermal Collections and Storage By S.P. Sukhatme | McGraw Hill Publishing Co.

(8)
a. **Course Name:** Enterprise Programming using Java
b. **Course Code:** 303105309
c. **Prerequisite:** Basic knowledge of software applications
d. **Rationale:** This course provides a broad introduction to software engineering. The various process models required to develop software is also being described. Moreover the functional and non-functional requirements are also described.

e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of enterprise programming, including design patterns, architectural styles, and best practices.
CLOBJ 2	Learn to develop scalable and maintainable enterprise applications using industry-standard programming languages and frameworks.
CLOBJ 3	Gain proficiency in building multi-tiered architectures, including presentation, business logic, and data access layers.
CLOBJ 4	Explore techniques for integrating disparate systems and services using APIs, web services, and message queues.

f. **Course Learning Outcomes:**

CLO 1	Prepare and do Software Requirement Specification and Software Project Management Plan
CLO 2	To ensure the quality of software product, different quality standards and software review techniques
CLO 3	Apply the concept of Functional Oriented and Object Oriented Approach for Software Design
CLO 4	Understand modern Agile Development and Service Oriented Architecture Concept of Industry
CLO 5	Understand modern Agile Development and Service Oriented Architecture Concept of Industry
CLO 6	Execute a Project Management Plan, tabulate Testing Plans and Reproduce effective procedures

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
2	**0**	**0**	**2**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Foundation of Enterprise Programming** XML, JDBC, JDBC architecture, JDBC with Oracle, MySql, Maven: integration with eclipse, POM.xml	10%	3
2	**Servlets** Basics of Web, Servlet Lifecycle, Servlets API, HTTP Servlets, Servlets Configuration, Servlets Context, Servlets Collaboration, Session Tracking, CRUD operations	15%	4
3	**JSP** Java Server Programming: Scripting elements, Directive elements, CRUD operations.	15%	4
4	**Hibernate** Architecture, JPA, Generator class, Dialects, Mapping, Annotations, Transaction Management, HQL, HCQL, CRUD operations.	20%	6
5	**Spring** Architecture, Modules, Dependency Injection, Spring AOP, Application Context, annotation-based configuration, MVC CRUD operations	20%	7
6	**Spring Boot** Dependency Injection, Autowire, Web App using spring boot, Spring boot AOP, spring boot Database, Spring Rest	20%	6

i. Text Book and Reference Book:
1. Software Engineering (Text Book) R. Pressmen; 6th (Text Book)
2. Software Engineering by Sommer ville
3. Fundamentals of Software Engineering Rajib Mall; PHI
4. Software Engineering Pankaj Jalote; Wiley India

(9)

a. **Course Name:** Enterprise Programming using Java Laboratory
b. **Course Code:** 303105310
c. **Prerequisite:** Basic knowledge of software applications
d. **Rationale:** This course provides a broad introduction to software engineering. The various process models required to develop software is also being described. More over the functional and non-functional requirements are also described.

e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of enterprise programming, including design patterns, architectural styles, and best practices.
CLOBJ 2	Learn to develop scalable and maintainable enterprise applications using industry-standard programming languages and frameworks.
CLOBJ 3	Gain proficiency in building multi-tiered architectures, including presentation, business logic, and data access layers.
CLOBJ 4	Explore techniques for integrating disparate systems and services using APIs, web services, and message queues.

f. **Course Learning Outcomes:**

CLO 1	Prepare and do Software Requirement Specification and Software Project Management Plan
CLO 2	To ensure the quality of software product, different quality standards and software review techniques
CLO 3	Apply the concept of Functional Oriented and Object Oriented Approach for Software Design.
CLO 4	Understand modern Agile Development and Service Oriented Architecture Concept of Industry
CLO 5	Analyse, design, verify, validate, implement and maintain software systems.
CLO 6	Execute a Project Management Plan, tabulate Testing Plans and Reproduce effective procedures.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. NO.	Experiment List
1	Write a program to insert and retrieve the data from database using JDBC
2	Write a program to demonstrate the use of Prepared Statement and Result Set interface
3	Servlet Programming Servlet Execution on tomcat A servlet program to print hello world A servlet program to display request details A servlet program to handle user form A servlet program to create a cookie A servlet program to display cookie A servlet program to do session tracking Write a program to implement chat Server using Server Socket and Socket class. Write a Servlet program to send username and password using HTML forms and authenticate the user
4	JSP Programming JSP program to display hello world. JSP program to demonstrate arithmetic operations JSP program to demonstrate jsp: forward action tag JSP program to request implicit object Developing a web application to insert record into Oracle Database using JSP and JDBC.
5	Create application to store the data in database to perform Hibernate CRUD operations
6	Create a application store the data in database to perform Spring CRUD operations
7	Create a web application to store the data in database with spring boot.

(10)
a. **Course Name:** Design and Analysis of Algorithms
b. **Course Code:** 303105218
c. **Prerequisite:** Computer Programming and Basic Syntaxes
d. **Rationale:** To understand the basic idea of the problem and find an approach to solve the problem. Analyse and improve the efficiency of existing techniques. To understand the basic principles of designing the algorithms compare the performance of the algorithm with respect to other techniques. It is the best method of description without describing the implementation detail. The Algorithm gives a clear description of requirements and goal of the problem to the designer. A good design can produce a good solution.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of algorithm design and analysis, including time and space complexity.
CLOBJ 2	Learn various algorithm design paradigms, such as divide and conquer, dynamic programming, and greedy algorithms.
CLOBJ 3	Explore advanced data structures and their applications in algorithm design, including heaps, trees, hash tables, and graphs.
CLOBJ 4	Understand the principles of algorithmic problem-solving, including problem decomposition, abstraction, and optimization.

f. **Course Learning Outcomes:**

CLO 1	Argue the correctness of algorithms using inductive proofs and invariants.
CLO 2	Analyse worst-case of algorithm
CLO 3	Understand Various methods of Algorithm and its implementation.
CLO 4	Apply various algorithm to solve real time problems

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Introduction: Algorithms, Analysing algorithms, Complexity of algorithms, Growth of functions, Performance measurements **Sorting and order Statistics** Shell sort, Quick sort, Merge sort, Heap sort Comparison of sorting algorithms	10%	6
2	**Divide and Conquer** Introduction and Problem statements Binary Search Quick Sort Merge Sort, Convex Hull , Problem Strassen , Matrix Multiplication	15%	8
3	**Greedy Methods** Introduction and Problem statements Selection Sort , Greedy methods with examples such as Optimal Reliability Allocation, Knapsack problem , Minimum Spanning trees – Prim's and Kruskal's algorithms, Single source shortest paths - Dijkstra's and Bellman Ford algorithms.	30%	9
4	**Dynamic programming** Knapsack - All pair shortest paths– Warshall's and Floyd's algorithms Resource allocation problem	10%	5
5	**Backtracking Branch and Bound** Travelling Salesman Problem Graph Coloring, -Queen Problem, Hamiltonian Cycles and Sum of subsets.	10%	4
6	**String Matching Algorithms** Naïve Matching, Robin Karp Algorithm, KMP Algorithm	15%	8
7	**Selected Topics** Algebraic Computation Fast Fourier Transform String Matching, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.	10%	5

i. Text Book and Reference Book:

1. Introduction to Algorithms (Text Book) By Thomas Cormen, Charles Leiserson, Ronald Rivest, Clifford Stein | PHI publication
2. Design and Analysis of Algorithms By E. Horowitz, S. Sahani | Galgotia
3. The Design and Analysis of Computer Algorithms By Aho, Hopcroft, Ullman

(11)

a. **Course Name:** Design and Analysis of Algorithms Laboratory
b. **Course Code:** 303105219
c. **Prerequisite:** Computer Programming and Basic Syntaxes
d. **Rationale:** To understand the basic idea of the problem and find an approach to solve the problem. Analyse and improve the efficiency of existing techniques. To understand the basic principles of designing the algorithms compare the performance of the algorithm with respect to other techniques. It is the best method of description without describing the implementation detail. The Algorithm gives a clear description of requirements and goal of the problem to the designer. A good design can produce a good solution.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamentals of algorithm design and analysis, including time and space complexity.
CLOBJ 2	Learn various algorithm design paradigms, such as divide and conquer, dynamic programming, and greedy algorithms.
CLOBJ 3	Explore advanced data structures and their applications in algorithm design, including heaps, trees, hash tables, and graphs.
CLOBJ 4	Understand the principles of algorithmic problem-solving, including problem decomposition, abstraction, and optimization.

f. **Course Learning Outcomes:**

CLO 1	Argue the correctness of algorithms using inductive proofs and invariants
CLO 2	Analyse worst-case of algorithm
CLO 3	Understand Various methods of Algorithm and its implementation.
CLO 4	Apply various algorithm to solve real time problems

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
-	-	4	2	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. **List of Experiments:**

Sr. NO.	Experiment List
1	Introduce the concept of algorithms, their importance in computing, and how to Analyse their efficiency. Cover time and space complexity, big-O notation, and the

	basics of algorithm analysis.
2	**Sorting algorithms:** Introduce the concept of sorting algorithms, their importance, and their various types. Discuss the implementation and analysis of selection sort, insertion sort, and quicksort algorithms.
3	**Implementation and analysis of selection sort, insertion sort, and quicksort:** Have participants implement these sorting algorithms and Analyse their performance in terms of time and space complexity.
4	**Graph Algorithms Subject Syllabus Design and Analysis of Algorithms Laboratory** Introduce the concept of graph algorithms, their importance, and their various types. Discuss the implementation and analysis of breadth-first search and depth-first search algorithms.
5	**Implementation and analysis of breadth-first search and depth-first search** Have participants implement these graph algorithms and Analyse their performance in terms of time and space complexity.
6	**Project work and lab report preparation:** Have participants work on their project assignment, which involves selecting an algorithm and analysing its performance using appropriate metrics. Encourage them to work collaboratively, share their insights, and discuss their findings.
7	**Divide and conquer algorithms:** Introduce the concept of divide and conquer algorithms, their importance, and their applications. Discuss the implementation and analysis of binary search and merge sort using divide and conquer.
8	**Implementation and analysis of binary search and merge sort:** Have participants implement these divide and conquer algorithms and Analyse their performance in terms of time and space complexity.
9	**Project work and lab report preparation:** Have participants finalize their project assignment, prepare their lab report, and present their findings to the rest of the group. Encourage them to reflect on their learning, share their experiences, and provide constructive feedback to their peers.
10	**Dynamic programming** Introduce the concept of dynamic programming, its importance, and its applications. Discuss the implementation and analysis of the Knapsack problem using dynamic programming.
11	**Implementation and analysis of the Knapsack problem:** Have participants implement the Knapsack problem using dynamic programming and Analyse its performance in terms of time and space complexity.
12	**Project work and lab report preparation** Have participants work on their project assignment, refine their lab report, and prepare their final presentation.

13	**Greedy algorithms** Introduce the concept of greedy algorithms, their importance, and their applications. Discuss the implementation and analysis of Dijkstra's algorithm and the Greedy Knapsack problem using greedy algorithms.
14	**Implementation and analysis of Dijkstra's algorithm and the Greedy Knapsack problem:** Have participants implement these greedy algorithms and Analyse their performance in terms of time and space complexity.
15	**Project work and lab report generation**

(12)
a. **Course Name:** Theory of Computation
b. **Course Code:** 303108301
c. **Prerequisite:** Knowledge of Set Theory, Relations and Functions, Data Structure
d. **Rationale:** Theory of Automata teaches how efficiently problems can be solved using an algorithm. Finite state machines can help in all the computing of emerging area

e. **Course Learning Objective:**

CLOBJ 1	Understand the theoretical foundations of computation, including formal languages, automata theory, and computability.
CLOBJ 2	Learn about different models of computation, such as finite automata, pushdown automata, and Turing machines, and their relationships.
CLOBJ 3	Gain proficiency in converting between different models of computation and understanding their computational power.
CLOBJ 4	Explore the hierarchy of formal languages, including regular, context-free, and recursively enumerable languages, and their corresponding automata.
CLOBJ 5	Understand the concept of computability and the Church-Turing thesis, which states the limits of what can be computed algorithmically.

f. **Course Learning Outcomes:**

CLO 1	Write a formal notation for strings, languages and machines
CLO 2	Design finite automata to accept a set of strings of a language
CLO 3	For a given language determine whether the given language is regular or not
CLO 4	Design context free grammars to generate strings of context free language.
CLO 5	Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
CLO 6	Write the hierarchy of formal languages, grammars and machines.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	**Internal Evaluation**			**ESE**		**Total**
				MSE	**CE**	**P**	**Theory**	**P**	
3	**0**	**0**	**3**	**20**	**20**	**-**	**60**	**-**	**100**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction** Introduction to Formal Languages and Automata, Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	5%	2
2	**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, pumping lemma for regular languages, minimization of finite automata	20%	8
3	**Grammars** Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for contextfree languages, deterministic pushdown automata, closure properties of CFLs. Context-sensitive languages: Context-sensitive grammars(CSG) and languages, linear bounded automata and equivalence with CSG.	30%	8
4	**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.	20%	8
5	**Undecidability** Church Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages	15%	4

i. Text Book and Reference Book:
1. Introduction to Automata theory, languages and Computation (TextBook) By John E. Hopcroft, Rajiv Motwani and Jeffery D. Ullman | Pearson
2. Elements of the Theory of Computation By Harry R.Lewis and Christos H. Papadimitriou | Pearson Education Asia
3. Automata and Computability By Dexter C. Kozen | Undergraduate Texts in Computer Science, Springer
4. Introduction to the Theory of Computation By Michael Sipser | PWS Publishing
5. Introduction to Languages and the Theory of Computation By John C. Martin | McGraw Hill

(13)
a. **Course Name:** Data Mining and Data Visualization
b. **Course Code:** 303108303
c. **Prerequisite:** Database Management System, Linear algebra & Statistics
d. **Rationale:** This course helps the students to understand different data mining models and data visualization techniques.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts and techniques of data mining, including data pre-processing, pattern discovery, and predictive modelling.
CLOBJ 2	Learn how to apply various data mining algorithms and tools to extract valuable insights from large datasets.
CLOBJ 3	Develop skills in data visualization to effectively communicate findings and trends through charts, graphs, and interactive dashboards.
CLOBJ 4	Gain proficiency in using data visualization tools and software to create visually appealing and informative representations of data.
CLOBJ 5	Explore different data visualization techniques to present complex information in a clear and understandable manner

f. **Course Learning Outcomes:**

CLO 1	Have a comprehensive understanding of the technologies and frameworks that make up the MEAN stack, including MongoDB, Expíess.js, AngularJS, and Node.js.
CLO 2	Build full-stack web applications.
CLO 3	Understand web development best practices:
CLO 4	Work on real-world projects using the MEAN stack. This could include developing a portfolio of projects of contributing to open- source projects.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction to data mining (DM)** Importance of Data Mining, Data Mining-Definition and Functionalities, Classification of Data mining systems, Data mining Architecture, KDD, DM task primitives, Major Issues in Data Mining, Data mining Technologies, Applications of Data Mining.	21%	9
2	**Data Pre-processing** Tasks in Data Preprocessing, Reasons of Missing Values & Noisy Data, Cleaning, Integration, Reduction, Transformation and Discretization, Concept Hierarchy Generation.	16%	7
3	**Mining Frequent Patterns** Efficient and scalable frequent itemset mining methods, Association Rules, Multidimensional & Multilevel association rules, Generating Association Rules from Frequent Item sets, Interesting Pattern Evaluation Methods.	16%	7
4	**Classification & Clustering** Classification vs. prediction, Supervised learning, Approach to Classification: Decision Tree Induction, Unsupervised learning, Cluster Analysis: Partitioning Methods, Hierarchical Methods, Density-Based Methods, Evaluation of Clustering, Outlier Detection. Introduction to analytics tools like Power BI.	21%	9
5	**Statistical Representation of Data** Data Quality, Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Histogram Analysis.	10%	6
6	**Fundamental of Data Visualization** Introduction to data visualization & analytics, Info-graphic representation of terminologies, DIKW (Data, Information, Knowledge, wisdom) Pyramid, Difference between Analysis and Analytics, Applications of Data Visualization, Applications of Data Analytics	16%	7

i. Text Book and Reference Book:

1. Data Mining concepts and Techniques By Jiawei Han, Micheline Kamber | Elsevier
2. Data Mining Techniques By Arun K. Pujari | Universities Press
3. Principles of Statistics, By M. G. Bulmer, Dover Publications Inc.
4. Beautiful Visualization. By Noah Iliinsky, Julie Steele Publisher(s): O'Reilly Media, Inc. ISBN: 9781449379865
5. Statistics 101: From Data Analysis and Predictive Modeling to Measuring Distribution and Determining Probability, Your Essential Guide to Statistics By David Borman, Adams Media

(14)
  a. **Course Name:** Data Mining and Data Visualization Laboratory
  b. **Course Code:** 303108304
  c. **Prerequisite:** Database Management System, Linear algebra & Statistics
  d. **Rationale:** This course helps the students to understand different data mining models and data visualization techniques.

  e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts and techniques of data mining, including data preprocessing, pattern discovery, and predictive modeling.
CLOBJ 2	Learn how to apply various data mining algorithms and tools to extract valuable insights from large datasets.
CLOBJ 3	Develop skills in data visualization to effectively communicate findings and trends through charts, graphs, and interactive dashboards.
CLOBJ 4	Gain proficiency in using data visualization tools and software to create visually appealing and informative representations of data.
CLOBJ 5	Explore different data visualization techniques to present complex information in a clear and understandable manner.

  f. **Course Learning Outcomes:**

CLO 1	Extract knowledge using data mining techniques
CLO 2	Adapt to new data mining tools.
CLO 3	Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data
CLO 4	Analyse the dataset and perform Descriptive Statistics.
CLO 5	Analyse the dataset and perform an Inferential Statistics.

  g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
3	0	0	3	20	20	-	60	-	100

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. No.	List of Experiment
1.	Study Weka Tool.
2.	Perform Pre-processing on a dataset using Weka Tool. Apply various Filters and discuss the effect of each filter applied. Handle Missing Values Handle Infrequent Nominal Values Derive an attribute from the existing attribute Sampling
3.	Perform Association rule mining using WEKA tool.
4.	Perform Classification with WEKA tool.
5.	Perform Clustering using WEKA tool
6.	Perform Binning techniques to smooth out the noise in the dataset.
7.	Write a python program for linear regression analysis on the given dataset.
8.	Use python libraries to generate chart from csv data.
9.	Study different Data visualization tools.
10.	Case study: Interactive Data Analytics with Power BI

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a. **Course Name:** Software Engineering and Project management
b. **Course Code:** 303108305
c. **Prerequisite:** Knowledge of structure programming language and Application development
d. **Rationale:** To study Software Development Life Cycle, Development models and Agile Software development. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods. Today's world is a digital world driven by software of varying sizes and complexity. Understandably, the effectiveness and efficiency of the work done nowadays, primarily depends on the quality of the software(s) being employed. The quality of the software relies on the way it is managed during its development as well as maintenance.
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles and concepts of software engineering, including software development life cycle models, methodologies, and best practices.
CLOBJ 2	Learn project management techniques and methodologies applicable to software development projects, including Agile, Scrum, and Waterfall.
CLOBJ 3	Gain proficiency in requirements engineering, including elicitation, analysis, specification, and validation of software requirements.
CLOBJ 4	Develop skills in software design and architecture, including modular design, design patterns, and architectural styles.

f. **Course Learning Outcomes:**

CLO 1	Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.
CLO 2	Apply various testing techniques and test plan in.
CLO 3	Describe and determine the purpose and importance of a software project and project management practices.
CLO 4	Estimate and evaluate project cost and schedules and determine risk management approaches.
CLO 5	Define and evaluate quality assurance measures

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	T	P	C	MSE	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

h. **Course Content:**

Sr. No.	Content	Weightage	Teaching Hours
1	**Introduction Study of Different Models** Software Characteristics, Components, Applications, Layered Technologies, Processes, Methods and Tools, Generic View Of Software Engineering, Process Models- Waterfall model, Incremental, Evolutionary process models- Prototype, Spiral And Concurrent Development Model Agile Development Agility and Agile Process model, Extreme Programming, Other process models of Agile Development and Tools.	20%	6
2	**Requirement Analysis and Specification** Understanding the Requirement, Requirement Modelling, Requirement Specification (SRS), Requirement Analysis and Requirement Elicitation, Requirement Engineering.	10%	4
3	**Software Coding & Testing Coding** Standard and coding Guidelines, Code Review, Software Documentation, Testing Strategies, Testing Techniques and Test Case, Test Suites Design, Testing Conventional Applications, Testing Object Oriented Applications, Testing Web and Mobile Applications, Testing Tools (Win runner, Load runner).	10%	5
4	**Introduction to Software Project Management (SPM)** Rationale, Software Projects Vs other types of Projects, Contract Management and Technical Project Management, Activities Covered by SPM, Plans, Methods and Methodologies, Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, Project Success and Failure, Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices.	15%	6
5	**Project Planning: Tasks in Project Planning** Work Breakdown Structures(WBS), Planning Methods, Selecting Project Approach, SDLC, Software Processes and Process Models, Choice of Process Models, A Generic Project Model, Software Cost Estimation; COCOMO Model; Budgeting	15%	7
6	**Software Project Management Spectrum** People –Product – Process- Project, W5HH Principle, Importance of Team Management Planning a Software Project Scope and Feasibility, Effort Estimation, Schedule and staffing, Quality Planning, Risk management- identification, assessment, control, project monitoring plan, Detailed Scheduling	15%	6
7	**Quality Assurance**	10%	5

	Software Quality Assurance Activities, Software Qualities, Software Quality Standards – ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards.		
8	**Software Re-engineering** Software Maintenance Problems, Redevelopment vs. Reengineering, Business Process Reengineering, Software Reengineering Process Model, Technical Problems of Reengineering. Project closure: Project Closure Analysis	**5%**	**4**

    i.   Text Book and Reference Book:

1. Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.
2. Apply various testing techniques and test plan in.
3. Describe and determine the purpose and importance of a software project and project management practices.
4. Estimate and evaluate project cost and schedules and determine risk management approaches.
5. Define and evaluate quality assurance measures.

(16)

a. **Course Name:** Software Engineering and Project management Laboratory
b. **Course Code:** 303108306
c. **Prerequisite:** Knowledge of structure programming language and Application development.
d. **Rationale:** To study Software Development Life Cycle, Development models and Agile Software development. To study fundamental concepts in software testing, including software testing objectives, process, criteria, strategies, and methods. Today's world is a digital world driven by software of varying sizes and complexity. Understandably, the effectiveness and efficiency of the work done nowadays, primarily depends on the quality of the software(s) being employed. The quality of the software relies on the way it is managed during its development as well as maintenance
e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles and concepts of software engineering, including software development life cycle models, methodologies, and best practices.
CLOBJ 2	Learn project management techniques and methodologies applicable to software development projects, including Agile, Scrum, and Waterfall.
CLOBJ 3	Gain proficiency in requirements engineering, including elicitation, analysis, specification, and validation of software requirements.
CLOBJ 4	Develop skills in software design and architecture, including modular design, design patterns, and architectural styles.

f. **Course Learning Outcomes:**

CLO 1	Prepare SRS (Software Requirement Specification) document and SPMP (Software Project Management Plan) document.
CLO 2	Apply various testing techniques and test plan in.
CLO 3	Describe and determine the purpose and importance of a software project and project management practices
CLO 4	Estimate and evaluate project cost and schedules and determine risk management approaches.
CLO 5	Define and evaluate quality assurance measures

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	**T**	**P**	**C**	Internal Evaluation			ESE		Total
				MSE	**CE**	**P**	**Theory**	**P**	
-	-	2	1	-	-	20	-	30	50

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. List of Experiments:

Sr. NO.	Experiment List
1	Study the complete Software Development Life Cycle (SDLC) and Analyse various activities conducted as a part of various phases. For each SDLC phase, identify the objectives and summaries outcomes.
2	Project Definition and objective of the specified module and Perform Requirement Engineering Process
3	Identify Suitable Design and Implementation model from the different software engineering models.
4	Develop Software project management planning (SPMP) for the specified module
5	Consider any project to be developed in any technology as a Software Architect or Project Manager. Construct Software Requirement Specification (SRS) document for the project. Solve the problem by Applying Basic and intermediate COCOMO o Find Project Type? o Find Project Size? Find Initial Effort Estimation? o Find Adjusted Effort Estimation? o Find schedule? o Find minimum size of the team you would require to develop this system? Assuming that your client would pay Rs. 50,000 per month of development, how much would be the likely billing?
6	Prepare System Analysis and System Design of identified Requirement specification using structure design as DFD with data dictionary and Structure chart for the specific module
7	Designing the module using Object Oriented approach including Use case Diagram with scenarios, Class Diagram and State Diagram, Collaboration Diagram, Sequence Diagram and Activity Diagram.
8	Coding Standards and walk through
9	Project: For below mentioned Systems and other systems assign a mini-project two a group of students to prepare Software documents mentioned as A to E 1. Library Information System 2. Villager Telephone System 3. Waste Management Inspection Tracking System (WMITS) 4. Flight Control System 5. Ambulance Dispatching System A. Development of Software Requirements Specification (SRS) B. Function oriented design using SA/SD C. Object-oriented design using UML D. Test case design E. Implementation using Java and testing

i. Text Book and Reference Book:

1. Ian Sommerville, Software engineering, Pearson education Asia
2. Pankaj Jalote, Software Engineering – A Precise Approach Wiley
3. Behhforoz & Frederick Hudson, Software Engineering Fundamentals, OXFORD
4. Walker Royce, "Software Project Management", Pearson Education, 2005
5. Kieron Conway, "Software Project Management", Dreamtech Press, 2001
6. S. A. Kelkar, "Software Project Management", PHI Publication, 15th edition, 2013

(17)
a. **Course Name:** Professionalism & Corporate Ethics
b. **Course Code:** 303193304
c. **Prerequisite:** Basic knowledge of SWOT analysis and understanding of the fundamentals of communication are essential.
d. **Rationale:** Soft skills and ethics are essential for career growth.
e. **Course Learning Objective:**

CLOBJ 1	Articulate the principles of professionalism in a corporate context.
CLOBJ 2	Analyse ethical dilemmas and make informed decisions.
CLOBJ 3	Apply ethical decision-making models to real-world business scenarios
CLOBJ 4	Evaluate the impact of corporate activities on various stakeholders, including the community and the environment.
CLOBJ 5	Practice proper business etiquette in various communication channels.
CLOBJ 6	Develop skills in resolving conflicts ethically and professionally.

f. **Course Learning Outcomes:**

CLO 1	Identity and develop soft skills required for personal and professional growth.
CLO 2	Develop professional etiquette & desired behaviour at the workplace
CLO 3	Speak and participate effectively in oral organizational communication
CLO 4	Improve comprehensive skills for reading.
CLO 5	Know how to be assertive in professional environment

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
				Internal Evaluation			ESE		Total
L	**T**	**P**	**C**	**MSE**	**CE**	**P**	**Theory**	**P**	
0	**1**	**0**	**1**	-	**100**	-	-	-	**100**

L- Lectures; **T-** Tutorial; **P-** Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continuous Evaluation, **ESE-** End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage	Teaching Hours
1	**Ethics in Engineering** Scope of engineering ethics Accepting & sharing responsibility Responsible professionals and ethical corporations Resolving ethical dilemmas Case studies	20%	5
2	**Group Discussion** Communication core Definition, types, process, guidelines Mock round -1	20%	3
3	**Introduction to B-School Tests** Students will be able to solve verbal questions from the following exams. In these sessions students will learn to distinguish between national & international level of Management exam. GMAT CAT	15%	2
4	**Listening Skills** Advanced Level Demonstrate ability to listen more than two minutes of audio clips & solve questions based on it.	10%	1
5	**Preparing Brochures** Students will learn how to establish the purpose of writing & determine audience they are writing for	15%	2
6	**Agenda & Minutes of Meeting** Students will be able to explain what an agenda & minutes of meeting are and why they are useful.	10%	1
7	**Reading Comprehension** Intermediate level Students will develop their ability to skim for main idea(s). They will able to make use of contextual clues to infer meaning of unfamiliar words from context and will be able to solve questions based on it.	10%	1

i. Text Book and Reference Book:

1. Business Correspondence and Report Writing SHARMA, R. AND MOHAN, K.
2. Ethics in Engineering Practice and Research Caroline Whitbeck, Cambridge University Press
3. Technical Communication : Principles And Practice Sangeetha Sharma, Meenakshi Raman; Oxford University Press
4. How to prepare for verbal ability and reading comprehension for the CAT
5. Arun Sharma, Meenakshi Upadhyay, TATA McGRAW HILL