BTECH MATHEMATICS & COMPUTING

COURSE STRUCTURE

EFFECTIVE: 2024-25 ADMISSION BATCH

Approved in Academic Council held on

B.TECH. MATHEMATICS & COMPUTING

PROGRAM OBJECTIVES

Program Educational Outcomes (PEOs):

Upon completion of the *B.Tech. degree in Mathematics and Computing*, the expected accomplishments of the program's graduates in their professional and personal lives are outlined in the following.

PEO No.	Description
PEO-1	Graduates will develop a strong foundational knowledge in mathematics and computing, enabling them to apply mathematical reasoning, computational techniques, and algorithmic processes to design and solve problems across a broad range of applications.
PEO-2	Graduates will demonstrate the ability to think critically and creatively to innovate and solve complex problems in mathematics and computing, including the capability to conduct research and integrate emerging technologies into their solutions.
PEO-3	Graduates will become effective professionals with a commitment to ethical practices, societal contributions, and lifelong learning. They will possess the skills necessary to lead projects and teams in multidisciplinary environments, both domestically and internationally.
PEO-4	Graduates will maintain an understanding of evolving technologies, adapting their skills accordingly to remain effective and relevant in the rapidly changing fields of mathematics and computing.
PEO-5	Graduates will excel in communicating complex mathematical and technical content clearly and effectively to a variety of audiences. They will also demonstrate the ability to work collaboratively in diverse teams, contributing effectively to the achievement of common goals.

Program Specific Outcomes (PSOs):

The program specifies the following outcomes that define the core competencies students will develop during their studies, preparing them for successful careers and meaningful contributions in their respective fields.

PSO No.	Description
PSO-1	Graduates will be able to apply advanced mathematical techniques and tools, including statistical and numerical methods, to model and solve complex real-world problems across various domains such as finance, technology, and engineering.
PSO-2	Graduates will possess strong programming skills and the ability to develop, test, and maintain software applications that utilize mathematical models and algorithms to address industry needs.
PSO-3	Graduates will be proficient in employing modern data analytics tools and machine learning algorithms to interpret and extract meaningful information from large datasets, enabling them to make data-driven decisions.

PSO-4	Graduates will demonstrate the ability to work effectively in interdisciplinary teams, integrating their mathematical and computing expertise to contribute to innovative solutions in scientific research and industry projects.
PSO-5	Graduates will continuously adapt to emerging technologies and methodologies in mathematics, computing, and their intersections, maintaining relevancy and proficiency in their professional practice.

Program Objectives (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

B. Tech. [Mathematics & Computing] - Curriculum 2024-2025 Batch								
B.Tech. (Maths & Computing) I SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	BSC	24B11MA111	ENGINEERING MATHEMATICS-I	3	1	0	4	4
2	BSC	18B11PH111	ENGINEERING PHYSICS-I	3	1	0	4	4
3	BSCL	18B17PH171	ENGINEERING PHYSICS LAB-I	0	0	2	1	2
4	ESC	24B11CI111	PROBLEM SOLVING AND PROGRAMMING	3	0	0	3	3
5	ESCL	24B17CI171	PROBLEM SOLVING AND PROGRAMMING LAB	0	0	2	1	2
6	ESCL	18B17GE171	WORKSHOP PRACTICES	0	0	3	1.5	3
7	HSMC	21B11HS111	ENGLISH	2	0	0	2	2
8	HSMCL	21B17HS171	ENGLISH LAB	0	0	2	1	2
9	PR	24B19CI191	PROJECT-I	0	0	2	1	2
10	MNC	18B17GE172	MANDATORY INDUCTION PROGRAM	2 Weeks			0	
				Total			**18.5**	**24**
B.Tech. (Maths & Computing) II SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	BSC	24B11MA211	ENGINEERING MATHEMATICS-II	3	1	0	4	4
2	BSC	18B11PH211	ENGINEERING PHYSICS-II	3	0	0	3	3
3	BSCL	18B17PH271	ENGINEERING PHYSICS LAB-II	0	0	2	1	2
4	ESC	24B11CI211	DATA STRUCTURES AND ALGORITHMS	3	0	0	3	3
5	ESCL	18B17CI271	DATA STRUCTURES AND ALGORITHMS LAB	0	0	4	2	4
6	ESC	24B11EC211	BASIC ELECTRICAL ENGINEERING	3	1	0	4	4
7	ESCL	24B17EC271	BASIC ELECTRICAL ENGINEERING LAB	0	0	2	1	2
8	ESCL	18B17GE173	ENGINEERING GRAPHICS	0	0	3	1.5	3
9	HSMC	23B11HS211	UNIVERSAL HUMAN VALUES II-UNDERSTANDING HARMONY	2	1	0	3	3
10	HSMC	23B11HS212	PROFESSIONAL COMMUNICATION PRACTICES	0	1	0	Audit	1
11	PRC	24B19CI291	PROJECT-II	0	0	2	1	2
				Total			**23.5**	**31**
SUMMER TRAINING - I (4 Weeks)								

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B.Tech. (Maths & Computing) III SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PCC	18B11CI311	OBJECT ORIENTED SYSTEMS AND PROGRAMMING	3	0	0	3	3
2	PCCL	18B17CI371	OBJECT ORIENTED SYSTEMS AND PROGRAMMING LAB	0	0	4	2	4
3	PCC	25B11CI313	DATABASE MANAGEMENT SYSTEMS	3	0	0	3	3
4	PCCL	25B17CI373	DATABASE MANAGEMENT SYSTEMS LAB	0	0	2	1	2
5	BSC	25B11MA311	PROBABILITY AND RANDOM PROCESSES	3	1	0	4	4
6	PCC	25B11CI314	DIGITAL SYSTEM AND COMPUTER ORGANIZATION	3	0	0	3	3
7	PCCL	25B17CI374	DIGITAL SYSTEM AND COMPUTER ORGANIZATION LAB	0	0	2	1	2
8	SEC	XXXCIXXXX	COMPETITIVE PROGRAMMING-I	0	0	2	1	2
9	HSMC	25B11HS311	ECONOMICS	2	1	0	3	3
10	MNC	25B11GE311	ENVIRONMENTAL STUDIES	3	0	0	Audit	3
11	PR	25B19MA391	SUMMER TRAINING-I	4 Weeks			2	0
				Total			**23**	**29**

B.Tech. (Maths & Computing) IV SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PCC	25BS1MA411	NUMERICAL ANALYSIS FOR MATHEMATICAL COMPUTING	3	0	0	3	3
2	PCCL	25BS7MA471	NUMERICAL ANALYSIS FOR MATHEMATICAL COMPUTING LAB	0	0	2	1	2
3	PCC	25B11MA213	DISCRETE COMPUTATIONAL MATHEMATICS	3	1	0	4	4
4	PCC	25B11CI412	DESIGN AND ANALYSIS OF ALGORITHMS	3	1	0	4	4
5	PCCL	25B17CI472	DESIGN AND ANALYSIS OF ALGORITHMS LAB	0	0	2	1	2
6	PCC	25B11CI413	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3	0	0	3	3
7	PCCL	25B17CI473	ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB	0	0	2	1	2
8	PCCL	25B17MA471	R - SOFTWARE LAB	0	0	2	1	2
9	HSMC	XXXHSXXX	HSS ELECTIVE	2	1	0	3	3
10	SEC	XXXCIXXXX	COMPETITIVE PROGRAMMING-II	0	0	2	1	2
				Total			**22**	**27**
SUMMER TRAINING - II (6 Weeks)								

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B.Tech. (Maths & Computing) V SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PCC	XXXMAXXX	REAL ANALYSIS AND DIFFERENTIAL EQUATIONS	3	1	0	4	4
2	PCC	XXXCIXXXX	THEORY OF COMPUTATION	3	0	0	3	3
3	PCC	XXXCIXXXX	OPERATING SYSTEMS	3	0	0	3	3
4	PCCL	XXXCIXXXX	OPERATING SYSTEMS LAB	0	0	2	1	2
5	BSC	XXXXXXXX	SCIENCE ELECTIVE	3	0	0	3	3
6	PEC	XXXCIXXXX	DISCIPLINE ELECTIVE - 1	2	0	0	2	2
7	PECL	XXXCIXXXX	DISCIPLINE ELECTIVE - 1Lab	0	0	2	1	2
8	PEC	XXXCIXXXX	DISCIPLINE ELECTIVE –2	2	0	0	2	2
9	PECL	XXXCIXXXX	DISCIPLINE ELECTIVE –2 Lab	0	0	2	1	2
10	HSMC	XXXHSXXX	LOGICAL AND QUANTITATIVE TECHNIQUES-I	2	0	0	2	2
11	MNC	XXXHSXXX	INDIAN CONSTITUTION & TRADITIONAL KNOWLEDGE	2	0	0	Audit	2
12	SEC	XXXCIXXXX	COMPETITIVE PROGRAMMING - III	0	0	2	1	2
13	PR	25B19MA591	SUMMER TRAINING-II	6 Weeks			2	0
				Total			**25**	**29**

B.Tech. (Maths & Computing) VI SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PCC	XXXECXXXX	COMPUTER NETWORKS AND IoT	3	0	0	3	3
2	PCCL	XXXECXXXX	COMPUTER NETWORKS AND IoT LAB	0	0	2	1	2
3	PCC	XXXMAXXXX	STATISTICAL METHODS AND APPLICATIONS	3	0	0	3	3
4	PCCL	XXXMAXXXX	STATISTICAL METHODS AND APPLICATIONS LAB	0	0	2	1	2
5	PEC	XXXXXXX	DISCIPLINE ELECTIVE – 3	3	0	0	3	3
6	PEC	XXXXXX	DISCIPLINE ELECTIVE – 4	3/2	0	0/2	3	3/4
7	OEC	XXXXXX	OPEN ELECTIVE –1	3	0	0	3	3
8	HSMC	XXXHSXXX	LOGICAL AND QUANTITATIVE TECHNIQUES-II	2	0	0	2	2
9	VAC	XXXXXXX	SELECTED VALUE-ADDED COURSE	2	0	0	Audit	2
10	HSMC	XXXHSXXX	SOFT SKILLS FOR EMPLOYABILITY	0	0	2	1	2
11	PR	25B19MAXXX	MINOR PROJECT	0	0	4	2	4
				Total			**22**	**29/30**

SUMMER TRAINING - III (6 Weeks)

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B.Tech. (Maths & Computing) VII SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PEC	XXXXXX	DISCIPLINE ELECTIVE – 5	3	0	0	3	3
2	PEC	XXXXXX	DISCIPLINE ELECTIVE – 6	3	0	0	3	3
3	OEC	XXXXXX	OPEN ELECTIVE –2	3	0	0	3	3
4	PR	XXXXXX	SUMMER TRAINING-III	6 Weeks			4	0
5	PR	XXXXXX	MAJOR PROJECT – I	0	0	8	4	8
				Total			**17**	**17**
B.Tech. (Maths & Computing) VIII SEMESTER								
S. No.	**Category Code**	**Subject Code**	**Name of the Subjects**	**Course Hours**			**Credits**	**Total Hours**
				L	**T**	**P**		
1	PEC	XXXXXX	DISCIPLINE ELECTIVE – 7	3	0	0	3	3
2	OEC	XXXXXX	OPEN ELECTIVE –3	3	0	0	3	3
3	PR	XXXXXX	MAJOR PROJECT – II	0	0	16	8	16
				Total			**14**	**22**

Total Credits 165

		Credits	
1	Basic Science	BSC	22
2	Basic Science Lab	BSCL	2
3	Engineering Science	ESC	10
4	Engineering Science Lab	ESCL	7
5	Humanities & Social Sciences	HSMC	16
6	Humanities & Social Sciences Lab	HSMCL	1
7	Professional Core	PCC	39
8	Professional Core Lab	PCCL	11
9	Professional Elective	PEC	19
10	Professional Elective Lab	PECL	2
11	Open Elective	OEC	9
12	Mandatory Course	MNC	Audit
13	Project/Seminar	PR	24
14	Skill Enhancement Course	SEC	3
15	Value Added Courses	VAC	Audit

Total 165

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Elective Baskets - B.Tech. (M&C) 2024-2025 Admitted Batch

Department of CSE & Mathematics
Bucket Wise Tentative List of Elective Courses
(2024-2025 Admitted Batch) (To be updated)

HSS ELECTIVE (4th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	25B1WHS431	Introduction to Finance and Accounting	2	1	0	3	3
2		India in a Globalized World: Democracy, Development and Contemporary Challenges	2	1	0	3	3
3		Career Readiness Blueprint: From Campus to Corporate	2	1	0	3	3
4		AI and Society	2	1	0	3	3

Discipline Elective – 1 and Discipline Elective – 1 Lab (offered in 5th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Fundamentals of Soft Computing	2	0	0	2	2
2	XXXXXX	Fundamentals of Computer and Cyber Security	2	0	0	2	2
3	XXXXXX	Data Mining and Data Warehousing	2	0	0	2	2
4	XXXXXX	Agile Software Development Process	2	0	0	2	2
5	XXXXXX	IoT Analytics	2	0	0	2	2
6	XXXXXX	Fundamentals of Soft Computing Lab	0	0	2	2	1
7	XXXXXX	Fundamentals of Computer and Cyber Security Lab	0	0	2	2	1
8	XXXXXX	Data Mining and Data Warehousing Lab	0	0	2	2	1
9	XXXXXX	Agile Software Development Process Lab	0	0	2	2	1
10	XXXXXX	IoT Analytics Lab	0	0	2	2	1
11	XXXXXXX	Big Data Analytics	2	0	0	2	2
12	XXXXXXX	Big Data Analytics Lab	0	0	2	2	1
13	XXXXXXX	Search in AI	2	0	0	2	2
14	XXXXXXX	Search in AI Lab	0	0	2	2	1

Discipline Elective – 2 and Discipline Elective – 2 Lab (offered in 5th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Image Processing and Computer Vision	2	0	0	2	2
2	XXXXXX	Introduction to Blockchain Technology	2	0	0	2	2
3	XXXXXX	Computing for Data Science	2	0	0	2	2
4	XXXXXX	Sensor Technology & Android Programming	2	0	0	2	2
5	XXXXXX	Concept of Graph Theory	2	0	0	2	2
6	XXXXXX	Image Processing and Computer Vision Lab	0	0	2	2	1
7	XXXXXX	Introduction to Blockchain Technology Lab	0	0	2	2	1
8	XXXXXX	Computing for Data Science Lab	0	0	2	2	1
9	XXXXXX	Sensor Technology & Android Programming Lab	0	0	2	2	1
10	XXXXXX	Concept of Graph Theory Lab	0	0	2	2	1
11	XXXXXXX	Computational Data Analysis	2	0	0	2	2
12	XXXXXXX	Computational Data Analysis Lab	0	0	2	2	1

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Discipline Elective – 3 (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Introduction to Deep Learning	3	0	0	3	3
2	XXXXXX	Cryptocurrency Technologies	3	0	0	3	3
3	XXXXXX	Information Retrieval and Semantic Web	3	0	0	3	3
4	XXXXXX	Cloud Computing Essentials: Azure and AWS	3	0	0	3	3
5	XXXXXX	Operations Research	3	0	0	3	3
6	XXXXXX	Number Theory	3	0	0	3	3
7	XXXXXXX	Reinforcement Learning	3	0	0	3	3
8	XXXXXXX	Responsible AI and AI Ethics	3	0	0	3	3

Discipline Elective – 4 and Discipline Elective – 4 Lab (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Linear Algebra and its Applications	3	0	0	3	3
2	XXXXXX	Data Analytics using R and Python	2	0	0	2	2
3	XXXXXX	Mobile Application Development	2	0	0	2	2
4	XXXXXX	Fundamentals of Smart Systems and IoT	2	0	0	2	2
5	XXXXXX	Introduction to Compiler Design	2	0	0	2	2
6	XXXXXX	Data Analytics using R and Python Lab	0	0	2	2	1
7	XXXXXX	Mobile Application Development Lab	0	0	2	2	1
8	XXXXXX	Fundamentals of Smart Systems and IoT Lab	0	0	2	2	1
9	XXXXXX	Introduction to Compiler Design Lab	0	0	2	2	1
10	XXXXXXX	Data Engineering	2	0	0	2	2
11	XXXXXXX	Data Engineering Lab	0	0	2	2	1
12	XXXXXXX	Foundation of Data Science and Visualization	2	0	0	2	2
13	XXXXXXX	Foundation of Data Science and Visualization Lab	0	0	2	2	1
14	XXXXXXX	Computational Fundamentals for Optimization	2	0	0	2	2
15	XXXXXXX	Computational Fundamentals for Optimization Lab	0	0	2	2	1
16	XXXXXXX	Artificial and Computational Intelligence	2	0	0	2	2
17	XXXXXXX	Artificial and Computational Intelligence Lab	0	0	2	2	1

Discipline Elective – 5 (offered in 7th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Optimization Techniques	3	0	0	3	3
2	XXXXXX	Mathematical Modelling and Simulation	3	0	0	3	3
3	XXXXXXX	Statistical Analysis and Computing	3	0	0	3	3
4	XXXXXXX	Time Series Analysis and Forecasting	3	0	0	3	3
8	XXXX	Soft Computing and Optimization Algorithms	3	0	0	3	3

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Discipline Elective – 6 (offered in 7th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXX	Machine Learning and Natural Language Processing	3	0	0	3	3
2	XXXX	Ethical Hacking & Prevention	3	0	0	3	3
3	XXXX	Introduction to Large Scale Database Systems	3	0	0	3	3
4	XXXX	Introduction to DevOps	3	0	0	3	3
5	XXXX	Industrial Automation and IOT	3	0	0	3	3
6	XXXX	Fuzzy Sets, Logic and Applications	3	0	0	3	3
8	XXXXXXX	Probabilistic Graphical Models	3	0	0	3	3
9	XXXXXXX	AI for IoT	3	0	0	3	3
10	XXXXXXX	Explainable AI	3	0	0	3	3
11	XXXXXXX	Sentiment Analysis and Opinion Mining	3	0	0	3	3

Discipline Elective – 7 (offered in 8th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	AI for Healthcare & Smart Systems	3	0	0	3	3
2	XXXXXX	Digital Forensics and Cyber Laws	3	0	0	3	3
3	XXXXXX	Social Network Analysis	3	0	0	3	3
4	XXXXXX	Software Construction using Kubernetes and Micro-services	3	0	0	3	3
5	XXXXXX	Algebraic Coding and Cryptography	3	0	0	3	3
6	XXXXXX	Linear Algebra for Data Science and Machine Learning	3	0	0	3	3
7	XXXXXXX	AI for Finance	3	0	0	3	3
8	XXXXXXX	Agentic AI	3	0	0	3	3

Science Elective (offered in 5th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Physics of Renewable Energy Systems	3	0	0	3	3
2	XXXXXX	Optoelectronic Materials and Devices	3	0	0	3	3
3	XXXXXX	Physics of Functional Materials & Devices	3	0	0	3	3
4	XXXXXX	Physics of Medical Imaging Techniques	3	0	0	3	3
5	XXXXXX	Science and Technology of Materials	3	0	0	3	3
6	XXXXXX	Applied Materials Science	3	0	0	3	3

Open Elective – 1 (offered in 6th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Waste to Energy Conversion	3	0	0	3	3
2	XXXXXX	Solid State Electronic Devices	3	0	0	3	3

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3	XXXXXX	Photovoltaic Techniques	3	0	0	3	3
4	XXXXXX	Applied Statistical Mechanics	3	0	0	3	3
5	XXXXXX	Medical and Industrial Applications of Nuclear Radiations	3	0	0	3	3
6	XXXXXX	Cyber Security	3	0	0	3	3
7	XXXXXX	Introduction to Information Theory	3	0	0	3	3
8	XXXXXX	Sociology of Youth	3	0	0	3	3

Open Elective – 2 (offered in 7th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Healthcare Marketplace	3	0	0	3	3
2	XXXXXX	Stress: Biology, Behaviour and Management	3	0	0	3	3
3	XXXXXX	HUMAN RESOURCE ANALYTICS	3	0	0	3	3
4	XXXXXX	Superconducting Materials, Magnets and Devices	3	0	0	3	3
5	XXXXXX	Introduction to Quantum Information Processing	3	0	0	3	3
6	XXXXXX	Nanoscience and Technology	3	0	0	3	3
7	XXXXXX	Algorithm and Analysis and AI	3	0	0	3	3

Open Elective – 3 (offered in 8th Semester)

S. No.	Course Code	Course Title	L	T	P	Total	Credits
1	XXXXXX	Photonics and Applications	3	0	0	3	3
2	XXXXXX	Astrophysics	3	0	0	3	3
3	XXXXXX	Biophysics	3	0	0	3	3
4	XXXXXX	Plasma Physics	3	0	0	3	3

Engineering Mathematics-I

COURSE CODE: 24B11MA111

COURSE CREDITS: 4
CORE/ELECTIVE: CORE
L-T-P: 3-1-0

Pre-requisites: Basic concepts of calculus and algebra.

Course Objectives:

- To develop the essential tool of matrices and linear algebra in a comprehensive manner.
- To study various techniques of multivariate calculus and integral calculus.
- To understand fundamental concepts of vector calculus.
- To study the fundamentals of Laplace transforms and their applications.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the role of matrices and their properties, solve linear systems of equations and perform Diagonalization of matrices, finding eigenvalues and eigenvectors of matrices.	Familiarity
CO-2	Evaluate partial derivatives with its physical significance and expand functions of several variables, find maxima and minima of functions of several variables with / without constraints, find areas and volumes of solids using multiple integration.	Assessment & Usage
CO-3	Understand the calculus of vectors and vector valued functions with their physical significance.	Assessment & Usage
CO-4	Use Laplace transforms and inverse Laplace transforms to solve initial value problems.	Assessment & Usage
CO-5	Numerical solutions to nonlinear equations, interpolation and quadrature.	Assessment & Usage

Course Contents:

Unit	Contents	Lectures required
1	**Linear Algebra:** Matrices, row echelon form, linear independence and dependence of vectors, rank of a matrix, solution of systems of linear equations, Vector spaces, subspaces, linear span, basis and dimension, eigenvalues and eigenvectors, Cayley Hamilton theorem and its application.	**10**
2	**Multivariate Calculus:** Limits and continuity of function, partial differentiation, chain rule, total derivative, maxima & minima, double integrals, change of order and change of variables, applications to areas and volumes.	**8**

3	**Vector Calculus:** Equations to a line and a plane, tangent plane and normal line, gradient, scalar and vector point function, curl and divergence and their physical significance, directional derivatives, line integrals.	8
4	**Laplace Transform:** Properties of Laplace transform, Linearity, First shifting theorem, multiplication and division by t, transforms of derivatives and integrals, Heaviside unit step function, Dirac's delta function, second shifting theorem, inverse Laplace transform using partial fraction and convolution theorem.	8
5	**Numerical Methods:** Numerical solution of algebraic & transcendental equations – bisection & Newton-Raphson method, interpolation, integrations by trapezoidal and Simpson's rule.	8
	Total Lectures	42

Suggested Text Book(s):

- Jain and Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House, 2023.
- Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2023.

Reference Book(s):

- B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.
- Maurice D. Weir, Joel Hass, Christopher Heil, Przemyslaw Bogacki; Thomas Calculus, 15th Edition, Pearson Education, 2024.
- D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage/ ScopeofExamination
1	T-1	15	1 Hour	Syllabus covered uptoT-1
2	T-2	25	1.5 Hours	Syllabus covered uptoT-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2)-08 Quizzes (3)-12 Attendance - 05

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Engineering Mathematics I)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.8**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.8**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.1**
CO-5	2	2	2	2	2	1	1	1	2	2	1	2	**1.7**
Average	**2**	**2.4**	**2.4**	**2.4**	**2.4**	**1**	**1**	**1**	**2**	**2.2**	**1.4**	**2**	

Engineering Physics-I

COURSE CODE: 18B11PH111

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

: 3-1-0

Pre-requisite: None

Course Objectives:

1. To enable the students to get better understanding about physical optics and its applications in engineering.
2. To familiarize students about modern physics and its applications in engineering.
3. To enable the students to get better understanding about thermal physics and its applications in engineering.
4. To familiarize students with relativistic mechanics.
5. At the conclusion of the course, the ability of students should have enhanced to think logically about the problems of science and technology and obtain their solutions

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the fundamental of physical optics	Familiarity
CO-2	To implement the concepts and theory for solving the application related problems of physical optics	Assessment
CO-3	To learn the basic and mathematical methods for relativity and related fields	Familiarity and Assessment
CO-4	To learn the basic concepts of modern , laser and thermal physics	Familiarity
CO-5	To implement the concept of modern and thermal physics ; analyzing and solving the related problems	Assessment and Implementation

Course Contents:

Unit	Contents	Lectures required
1	**Interference:** Introduction, Young's double slit experiment, Phase difference and Path Difference, Coherence, Analytical treatment of interference, Methods of interference (division of wave front & division of amplitude) Applications of interference in the field of engineering, Scientific applications of interference.	**8**
2	**Diffrection:** Introduction, Difference between interference and diffraction, Fresnel and Fraunhoffer class of diffraction, Diffraction grating, Applications of diffraction grating, Resolving and dispersive power of an optical instrument.	**6**
3	**Polarization:** Introduction, Difference between unpolarized and polarized light, Means of production of polarized light, Optical activity, specific rotation, Lorentz half shade and biquartz polarimeter.	**4**
4	**Atomic Physics:** Introduction, Quantum numbers, spin and orbital angular momentum, Atoms in magnetic field, Zeeman effect, Atoms in electric field,	**4**

	Stark effect.	
5	**Quantum Physics:** Wave particle duality, uncertainty principle and its applications, wave function, Schrodinger equation and its solutions, Particle in a box, Harmonic Oscillator	**6**
6	**Lasers:** Principle and working of laser, Different types of lasers (Three level and four level lasers).	**2**
7	**Thermal Physics:** Introduction, Zeroth law of Thermodynamics. First law of thermodynamics, Specific heat relation, Work done during an isothermal and adiabatic process. Second law of thermodynamics, concept of entropy, entropy for an ideal gas, Third law of thermodynamics, Principle of increase of entropy or degradation of energy, Reversible and irreversible processes. Carnot cycle and Carnot engine, Refrigerator, Clausius-Cleyperon equation, Thermodynamic Potentials, Maxwell's equations.	**8**
8	**Relativistic Mechanics**: Inertial & non-inertial frames, Michelson- Morley experiment, Einstein's postulates. Lorentz transformation, equations. Length contraction & Time dilation, Addition of velocities; Variation of mass with velocity Mass energy equivalence.	**4**
Total lectures		**42**

Suggested Text Book(s):

1. Engineering Physics, Shatendra Sharma & Jyotsna Sharma, Pearson Pub. 2018.
2. N. Subrahmanayam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand (2012).
3. Brij Lal, N Subrahmanyam and P.S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand, 3rd edition 2012.
4. Arthur Beiser, Concepts of Modern Physics, McGraw Hill, 6th edition (1994).

Suggested Reference Book(s):

1. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill (1981).
2. R. Eisberg and R. Resnick, Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles, John Wiley & Sons, 2nd edition (1985).
3. Ajoy Ghatak, Optics, Tata McGraw Hill, 5th addition, (2012)

Other useful resource(s):

1. Link to topics related to course:

i. https://nptel.ac.in/courses/122107035/
ii. https://nptel.ac.in/courses/122103011/
iii. https://nptel.ac.in/courses/122101002/28
iv. https://nptel.ac.in/courses/122105023/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus

Approved in Academic Council held on 25.10.2021

4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Parallel and Distributed Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2				2				2		2	**1.25**
CO-2	2	2	2	2	2	2				2		2	**2**
CO-3	3	2				2				2		2	**1.4**
CO-4	3	3				2				2		2	**1.5**
CO-5	3	3	3	3	3	3				3		3	**3**
Average	**2.6**	**2.4**	**2.5**	**2.5**	**2.5**	**2.2**				**2.2**		**2.2**	

Engineering Physics Lab-I

COURSE CODE: 18B17PH171

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

List of Experiments:

S.No	Description	Hours
1	To determine the wavelength of sodium light by measuring the diameters of Newton's Rings	4
2	To find the wavelength of sodium light using Fresnel's biprism.	2
3	To determine the distance between two virtual source using biprism.	2
4	To measure the wavelengths of certain lines in the spectrum of the mercury lamp using plane transmission grating.	2
5	To determine the dispersive power of the material of prism with the help of a spectrometer.	2
6	To measure the angle of prism with the help of a spectrometer.	2
7	To determine the magnetic susceptibility of a given paramagnetic liquid using Quinck's method.	4
8	To find the specific rotation of sugar solution by using a half shade polarimeter.	4
9	To find the specific rotation of sugar solution by using a biquartz polarimeter.	4
10	To verify the Malus's law for a given light using polarizer and analyzer.	2
Total Lab hours		**28**

Suggested/Resources:

1. S. P. Singh, Advanced Practical Physics,Pragati Prakashan, Vol. 1 (2013).
2. C. L. Arora, Practical Physics, S. Chand Company Limited, 20th edition (2004).
3. N. Subrahmanayam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand (2012)
4. Ajoy Ghatak, Optics, Tata McGraw Hill, 5th addition, (2012)
5. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill (1981).
6. Dabir S. Viswanath, Tushar Ghosh, Dasika H.L. Prasad, Nidamarty V.K. Dutt, Kalipatnapu Y. Rani , Viscosity of Liquids: Theory, Estimation, Experiment, and Data , Springer (2007).

Engineering Physics-II

COURSE CODE: 18B11PH211

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To offer a broad aspect of those areas of Physics which are specifically required as an essential background to engineering students for their studies in higher semesters.
2. To enable the students to get better understanding about solid state physics and its applications in engineering.
3. To familiarize students about electromagnetism and its applications in engineering.
4. To enable the students to get better understanding about statistical physics and its applications in engineering.
5. To familiarize students with optical fibers communication.
6. At the conclusion of the course, the ability of students should have enhanced to think logically about the problems of science and technology and obtain their solutions.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the fundamentals of vector calculus and its applications in electrostatics	Familiarity
CO-2	Knowledge of, physical interpretation, and ability to apply Maxwell's equations to determine field waves, potential waves, energy ,charge conservation conditions and other diverse engineering problems.	Familiarity/Assesment
CO-3	Able to distinguish Step Index, Graded index fibers and compute mode volume and Implementation of numerical methods for calculating the design parameters of optical fiber.	Familiarity/Problem Solving
CO-4	To understand the basics of statistical distributions and use Maxwell-Boltzmann distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems	Familiarity/Problem Solving
CO-5	To analyze atomic structure, Crystal structure, Crystal axes and planes, X-ray diffraction data and effect of energy bands on electronic behavior of solids.	Analytical Skills/ Familiarity
CO-6	To understand the concepts of modern solid state physics ,various properties of semiconductors and apply Hall effect to calculate allied parameters of semiconductors	Familiarity/ Usage

Course Contents:

Unit	Contents	Lectures required
1	**Electromagnetism:** Basic knowledge of fields, gradient, divergence and curl, Coulomb's law and related numerical, electric flux, Gauss's law for the charge inside and outside the Gaussian surface, applications of Gauss law: spherical and cylindrical symmetries, electric field due to charged conductor, force per unit area on the surface of the charged conductor, treatment of electrostatic problems by solution of Laplace and Poisson's equations. Biot Savart law,	**12**

	Ampere's law, Maxwell's equations in free space and dielectric media, energy in electromagnetic waves (Poynting vector and Poynting theorem), plane electromagnetic waves in free space, transverse nature, wave impedance and energy flow, energy density and energy flux (Poynting vector) in an electromagnetic field, radiation pressure.	
2	**Statistical Physics & Applications:** Introduction, macrostates, microstates, thermodynamic probability, distribution of n-particles in k-cells, phase space, minimum volume, classical and quantum statistics: common approach to three statistics, Maxwell-Boltzmann (ideal gas), Bose-Einstein (photon gas), Fermi-Dirac distributions (electron gas), Compton effect.	**10**
3	**Optical Fiber Communication:** Light propagation in fibers, Step index and Graded Index fibers, Numerical Aperture and Attenuation, Single and Multimode fibers and their propagation characteristics, Fiber losses and optical fiber applications.	**4**
4	**Solid State Physics:** Basic ideas of bonding, ionic bonding, covalent bonding (hybridization), metallic bonding, dispersion bonds, dipole bonds, hydrogen bonds, Lattice points and space lattice, basis and crystal structure, unit cell and primitive cell, seven crystal systems and fourteen Bravais space lattice, coordination number, nearest neighbour distance, atomic radius, atomic packing factor in crystal structure, calculation of lattice constant, lattice planes and Miller indices, separation between lattice planes. X-ray diffraction, Bragg's law of X-ray diffraction, Bragg's x-ray spectrometer, powder crystal method, rotating crystal method. Electronic conduction in metals, classical free electron theory, quantum theory of free electrons, band theory of solids, distinction between metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, carrier concentration in thermal equilibrium in intrinsic semiconductor, Fermi level and energy band diagram in intrinsic semiconductor, energy band diagram and Fermi level in extrinsic semiconductors, effect of temperature on extrinsic semiconductor, electrical conductivity of intrinsic semiconductor and extrinsic semiconductor, Hall effect, allied parameters and its applications.	**16**
Total lectures		**42**

Suggested Text Book(s):

1. David J Griffiths, Introduction to Electrodynamics, Eastern Economy Editions, PHI, 4th edition (2012).
2. Brij Lal, N Subrahmanyam and P.S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand, 3rd edition (2012).
3. Gerd Keiser, Optical Fiber Communication, Tata McGraw-Hill Education Pvt. Ltd., 5th edition (2013).
4. S. O. Pillai, Solid State Physics, New age international publishers, 7th edition (2016).

Suggested Reference Book(s):

1. Charles Kittel, Introduction to Solid State Physics. John Wiley & Sons, 8th edition (2005).
2. Ghatak Ajoy, Thyagarajan, Introduction to Fiber Optics, Cambridge University Press (2006).
3. Silvio R A, Salinass, Introduction to Statistical Physics, Springer Verlag (2004).
4. Lakhanpal R C, Modern Approach to Statistical Physics and Thermodynamics, Modern Publishers (2003).

Other useful resource(s):

1. Link to topics related to course:
   i. https://nptel.ac.in/courses/115101004/
   ii. https://nptel.ac.in/courses/115101005/
   iii. https://nptel.ac.in/courses/115105099/
   iv. https://nptel.ac.in/courses/122101002/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Engineering Physics-II)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2				2		2	**2**
CO-2	2	3	3	3	3	2				2		2	**2.5**
CO-3	3	3	3	2	3	2				2		2	**2.5**
CO-4	2	3	3	3	2	2				3		3	**2.6**
CO-5	3	3	3	3	2	1				3		3	**2.6**
CO-6	3	3	3	3	2	1				3		3	**2.6**
Average	**2.5**	**2.8**	**2.8**	**2.7**	**2.3**	**1.7**				**2.5**		**2.5**	

Engineering Physics Lab-II

COURSE CODE: 18B17PH271

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

Pre-requisite: None

Course Objectives:

1. The Art of Experimentation: The introductory laboratory engages each student in significant experiences with experimental processes, including some experience in investigation.
2. Experimental and Analytical Skills: The laboratory help the student develop a broad array of basic skills and tools of experimental physics and data analysis.
3. Conceptual Learning: The laboratory help student's to understand basic physics concepts.
4. Understanding the Basis of Knowledge in Physics: The laboratory help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments.
5. Developing Collaborative Learning Skills: The laboratory helps students to develop collaborative learning skills that are vital to success in many lifelong endeavors.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To Understand different aspects of magnetism and semi conductive properties of materials and their use in design of various devices.	Familiarity
CO2	To helps the students to understand the concepts of light propagation in optical fiber and introduce them to various losses in optical fiber communication.	Familiarity and Assessment
CO3	To demonstrate the scientific results based on observation.	Assessment and usage
CO4	Scientific discussion for clear and concise conclusion on particular scientific results.	Assessment and usage
CO5	To develop collaborative learning skills	Assessment and usage

List of Experiments:

S.No	Description	Hours
1	To determine the numerical aperture, of an optical fibre using LED as a light source.	**2**
2	To determine the attenuation coefficient, losses of an optical fiber	**2**
3	To measure resistivity of semiconductor using four probe methods.	**2**

4	To measure energy band gap of the Ge crystal using four probe methods and compare with optical band gap.	**2**
5	To study Hall effect in semiconductor and determination of its allied parameters.	**2**
6	To determine the carrier concentration and type of doping using hall coefficient.	**2**
7	To calculate the e/m ratio for an electron using Thomson method/Bar magnet method	**4**
8	To study magnetostriction in magnetic materials using He-Ne laser.	**4**
9	To study the coercivity, saturation magnetization, retentivity of given materials.	**4**
10	Experimental Determination of Planck's constant using Light Emitting Diodes (LEDs) and Photoelectric Effect.	**4**
Total Lab hours		**28**

Suggested/Resources:

1. S. P. Singh, Advanced Practical Physics,Pragati Prakashan, Vol. 1 (2013).
2. C. L. Arora, Practical Physics, S. Chand Company Limited, 20th edition (2004).
3. N. Subrahmanayam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand (2012)
4. Ajoy Ghatak, Optics, Tata McGraw Hill, 5th addition, (2012)
5. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill (1981).
6. Dabir S. Viswanath, Tushar Ghosh, Dasika H.L. Prasad, Nidamarty V.K. Dutt, Kalipatnapu Y. Rani , Viscosity of Liquids: Theory, Estimation, Experiment, and Data , Springer (2007).

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO2	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO3	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO4	2	2	2	2	2	2	1	1	1	1	1	1	**1.5**
CO5	2	2	2	2	2	2	1	1	1	1	1	1	**1.5**
Average	**2.6**	**2.6**	**2.6**	**2.6**	**2.0**	**2.0**	**1.0**	**1.00**	**2.2**	**1.00**	**1.0**	**1.0**	

Engineering Physics Lab-I

COURSE CODE: 18B17PH171

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

List of Experiments:

S.No	Description	Hours
1	To determine the wavelength of sodium light by measuring the diameters of Newton's Rings	4
2	To find the wavelength of sodium light using Fresnel's biprism.	2
3	To determine the distance between two virtual source using biprism.	2
4	To measure the wavelengths of certain lines in the spectrum of the mercury lamp using plane transmission grating.	2
5	To determine the dispersive power of the material of prism with the help of a spectrometer.	2
6	To measure the angle of prism with the help of a spectrometer.	2
7	To determine the magnetic susceptibility of a given paramagnetic liquid using Quinck's method.	4
8	To find the specific rotation of sugar solution by using a half shade polarimeter.	4
9	To find the specific rotation of sugar solution by using a biquartz polarimeter.	4
10	To verify the Malus's law for a given light using polarizer and analyzer.	2
Total Lab hours		**28**

Suggested/Resources:

1. S. P. Singh, Advanced Practical Physics,Pragati Prakashan, Vol. 1 (2013).
2. C. L. Arora, Practical Physics, S. Chand Company Limited, 20th edition (2004).
3. N. Subrahmanayam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand (2012)
4. Ajoy Ghatak, Optics, Tata McGraw Hill, 5th addition, (2012)
5. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill (1981).
6. Dabir S. Viswanath, Tushar Ghosh, Dasika H.L. Prasad, Nidamarty V.K. Dutt, Kalipatnapu Y. Rani , Viscosity of Liquids: Theory, Estimation, Experiment, and Data , Springer (2007).

Problem Solving and Programming

COURSE CODE: 24B11CI111

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Prerequisite: None

Course Objectives:

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in C language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To understand various number systems associated with C.
6. To decompose a problem into functions and synthesize a complete program using divide and conquer
7. approach.
8. 6. To use arrays, pointers and structures to formulate algorithms and programs.
9. 7. To apply programming to solve matrix addition and multiplication problems and searching and sorting
10. problems.
11. 8. To apply programming to solve simple numerical method problems, namely rot finding of function,
12. differentiation of function and simple integration

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	To formulate simple algorithms for arithmetic and logical problems.	Familiarity
CO-2	To translate the algorithms to programs (in C language).	Assessment
CO-3	To understand various number systems associated with C	Usage
CO-4	To test and execute the programs and correct syntax and logical errors.	Usage
CO-5	To implement conditional branching, iteration and recursion.	Usage
CO-6	To use arrays, pointers and structures to formulate algorithms and programs.	Usage

CO-7	To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.	Usage

Course Contents:

Unit	Contents	Lectures required
1	Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable	**4**
2	Number System: Decimal, Binary, Octal, Hexadecimal and interconversion.	**3**
3	Arithmetic expressions and precedence	**3**
4	Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching	**6**
5	Arrays (1-D, 2-D), Character arrays and Strings	**4**
6	Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs	**4**
7	Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort and Merge sort. Tracking Recursion	**8**
8	Idea of pointers, Defining pointers, Use of Pointers in self-referential structures.	**4**
9	Structures, Defining structures and Array of Structures, notion of linked list (Basic Idea of Implementation).	**2**
10	File Handling	**4**
Total lectures		**42**

Suggested Text Book(s):

1. Mittal, Ajay. Programming in C: A Practical Approach. Pearson Education India, 2010.
2. Kernighan, Brian W., and Dennis M. Ritchie. "The C programming language." (2002).

Suggested Reference Book(s):

1. Deitel, H., and PJ C+ Deitel. How to program. Pearson, 2021.

Other useful resource(s):

1. Link to NPTEL course contents: https://www.youtube.com/watch?v=t9WKOcRB63Q&list=PLJ5C_6qdAvBFzL9su5J-FX8x80BMhkPy1

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Parallel and Distributed Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2.00**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.08**
CO-5	2	3	3	3	3	1	1	1	2	2	1	2	**2.00**
CO-6	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-7	2	3	3	3	3	1	1	1	2	2	1	2	**2.00**
Average	**2.00**	**2.57**	**2.57**	**2.57**	**2.57**	**1.00**	**1.00**	**1.00**	**2.00**	**2.14**	**1.43**	**2.00**	**1.90**

Problem Solving and Programming Lab

COURSE CODE: 24B17CI171
COURSE CREDITS: 1
CORE/ELECTIVE:
L-T-P: 0-0-2

Pre-requisite: Fundamentals of C Programming and Algorithms

Course Objectives:

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understanding C program development, Compilation, debunking, running, etc.	Familiarity
CO-2	Introduction to C Programming using Control Statements and Repetition Statement	Usage
CO-3	Apply and practice logical formulations to solve some simple problems leading to specific problems.	Assessment
CO-4	Design effectively the required programming components that efficiently solve computing problems in the real world.	Usage

List of Experiments

S. No	Description	Hours
1	Getting acquainted with the C program Structure and basic Functions, Getting acquainted with the various data types and arithmetic operators in C	**2**
2	Write a program to obtain the reversed number and to determine whether the original and reversed numbers are equal or not.	**2**
3	Write a program to check whether a triangle is valid or not, when the three angles of triangle are entered through the keyboard. A triangle is valid if the sum of all three angles is equal to 180 degrees.	**2**
4	Check a given I/P is character, number or special symbol.	**2**
5	WAP to check if a given number is Armstrong or not. Calculate factorial of a number, Given number is prime or not.	**2**
6	(a) Write a program to add the first seven terms of the following series using any loop: 1/1! + 2/2! + 3/3! +..... (b) Develop start patterns using loops	**4**

7	Swap two numbers via various methods.	**2**
8	Functions and Recursion Applications: Factorial, sum, etc.	**2**
9	Programs on Arrays: searching and sorting	**3**
10	Dynamic Memory Allocation and Structures	**2**
11	File Handling	**2**
Total Lab hours		**25**

Suggested/Resources:

1. Deitel and Deitel, C How to Program, 7° Edition, 2013.
2. Venugopal Prasad, Mastering C, Tata McGraw Hill.
3. Complete Reference with C, Tata McGraw Hill.
4. Drmey, How to solve it by Computer, PHI.
5. Kerninghan and Ritchie, The C Programming Language.
6. http://www.acm.uiuc.edu/webmonkeys/book/c_guide/
7. http://msdn.microsoft.com/en-us/library/25db87se.aspx

Evaluation Scheme:

S. No	Exam	Marks
1	Mid Sem. Evalution	20
2	End Sem. Evalution	20
3.	Attendance	15
4.	Lab Assessment	45
	Total	**100**

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Parallel and Distributed Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO-2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO-3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO-4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO-5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
CO-6	2	3	3	3	2	2	2	2	2	2	2	2	**2.25**
Average	**2.67**	**2.83**	**2.83**	**2.83**	**2.50**	**2.17**	**1.33**	**1.17**	**1.17**	**1.17**	**1.33**	**1.50**	**1.96**

Workshop Practices

COURSE CODE:18B17GE171

COURSE CREDITS: 1.5

CORE/ELECTIVE: CORE

: 0-0-3

Pre-requisite: Concrete Technology

Course Objectives:

1. To learn the basics of different workshop practices by understanding and implementing used in different shops of workshop.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Study of various carpentry processes and its applications in carpentry	Familiarity
CO2	Study and practice the use of various carpentry tools for different carpentry processes	Familiarity
CO3	Study and manufacturing of different wood working joints	Assessment
CO4	Study the principles, classification and application of different welding processes	Usage
CO5	Study and Manufacturing of various welding joints using electric arc welding and gas welding	Usage

List of Experiments

S.NO.	Subtitle	Topics
1.	Carpentry	To Study the carpentry processes
		To study and identify carpentry tools
		To prepare a T-Lap Joint
		To prepare Motise-tenon joint
		To prepare corner joint
2.	Welding	To study the different welding processes with mechanism
		To prepare lap welding joint
		To prepare butt welding joint
3.	Sheet Metal work	To cut and prepare V joint from metal using hexablade
4.	Turning	To study the lathe machine and its operation with one turning job

Suggested/Resources:

1. Workshop Practices by S.K. Hajra and Chaudhary

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
CO2	3	3	3	3	3	1	1	1	1	1	1	3	**2.00**
CO3	3	3	2	3	2	3	2	1	1	1	2	1	**2.00**
CO4	3	3	3	2	3	2	1	1	1	1	1	1	**1.83**
CO5	2	2	3	3	3	3	1	1	1	1	1	1	**1.83**
Average	**2.80**	**2.80**	**2.80**	**2.80**	**2.60**	**2.20**	**1.20**	**1.00**	**1.00**	**1.00**	**1.20**	**1.40**	

English

COURSE CODE: 21B11HS111

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

: 2-0-0

Pre-requisite: None

Course Goal

This course is aimed to equip students of engineering with effective oral and written communication. The course develops the verbal skills of the students with emphasis on learning grammatical concepts and syntactical strategies. The course emphasis is on grooming the students and their personality by focusing on written and spoken English and Communication.

Course Objectives

- The Student will be able to analyze communication situations and audiences to make choices about the most effective and efficient way to communicate and deliver messages
- The student will learn to deliver effective presentations in contexts that may require power point, extemporaneous or impromptu oral presentations
- The student will learn to write grammatically correct business documents using appropriate business style.
- The student will learn to speak and write grammatically correct sentences with the ability to express thoughts with clarity and accuracy.
- Students will develop command over their language and synchronize their thoughts into written form

Detailed Syllabi

Lecture-wise Breakup

Subject Code	**21B11HS111**	**Semester**	1
Subject Name	English		
Credits	02	**Contact Hours**	28

Faculty (Names)	**Coordinator(s)**	Dr. Papiya Lahiri
	Teacher(s) (Alphabetically)	Dr. Papiya Lahiri Dr. Tanu Sharma

Module No.	Subtitle of the Module	Topics	No. of Lectures
1	Concept and Nature of Communication	What is communication? Stages of communication Ideation, encoding, transmission, decoding & response Channels of communication Communication in organizational settings Etiquettes in social and Office settings Work culture in Jobs Barriers to effective communication Guidelines to overcome communication barriers	4
2	Self Development and Assessment	Self Assessment, Awareness,. Personal goal Setting **Self study**	2
3	Effective presentation	Pre- presentation jitters Preparation and practice Delivering the presentation Qualities of a skilful presenter Capturing and maintaining attention Handling questions Power point presentations	4
4	Nature and Mechanics of Writing(Basic Writing Skills)	Techniques for writing precisely: Defining Describing Classifying Use of Phrases and Clauses in sentences Importance of Proper Punctuation Organizing Principles of Paragraphs in documents	5

5	Technical Writing	Importance, structure and drafting and revising of Technical Reports Technical writing style and Language Business writing: Letters, Preparing resume, notices, agenda and minutes of meeting , Daily Dairy entry	6
6	Vocabulary Development	Word Formation Derivatives: Prefixes & Suffixes Root words Synonyms, Antonyms Homophones and Homonyms One word substitution	2
7	Grammar and Usage	Subject-Verb Agreement Noun-Pronoun Agreement Prepositions, Articles	3
8	Identifying Common errors in writing	Redundancies, Clichés , Misplace modifiers, words often confused and misused	2
Total number of Lectures			28

Methodology

The course will follow an interactive teaching-learning method with classroom discussions and activities on fundamental concepts of grammar with a strong emphasis on skill development of students with regard to speaking, writing, logically interpreting ideas into words and reasoning in the classroom. Both lab and tutorial activities are run on student –teacher individual and group interactions.

Evaluation

Sr. No.	Components	Total Marks
1	**Mid Term**	30
2	**End term**	45
4	**Internal Assessment**** **(**Class assignments **)**	25
	Total	100

Internal assessment

5 Marks	Etiquettes in Social and Office Settings
8 Marks	Self-Development and Assessment
12 Marks	Report Writing

Recommended Reading (Books/Journals/Reports/Websites etc.: Author(s), Title, Edition, Publisher, Year of Publication etc. in IEEE format)	
1.	*Practical English Usage. Michael Swan. OUP.1995.*
2.	*Remedial English Grammar. F.T. Wood. Macmillan. 2007*
3.	*On Writing Well. William Zinsser. Harper Resource Book. 2001.*
5.	*Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006*
6.	*Communication Skills. Sanjay Kumar and Pushp Lata. OUP. 2011.*
7.	*Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. OUP*
8.	*A Communicative Grammar of English. 3rd Edn. G. Leech and J. Svartvik. 2012*
9.	*Williams, K., Krizan, A. C., Logan, J. & Merrier, P. (2011) Business Communicating in Business 8th Ed. New Delhi: Cengage Learning.*
10.	*Murphy, Herta A., Herbert Hildebrandt, Jane Thomas (2008) Effective Business Communication 7th Ed. New Delhi:Tata Mcgraw Hill Education Private Limited.*
11.	*Guffey, M. A. (2000) Business Communication: Product & Process South-Western College Publishing.*
12.	*Lesikar, R. V., Flatley, M.E., Rentz, K. & Pande, N. (2009) Business communication 11th Ed. New Delhi: Mc Graw Hill.*
13.	*Nesfield, J.C. English Grammar Series: Book IV: Idiom, Grammar and Synthesis. Macmillan, 1956.*

English Lab

COURSE CODE: 21B17HS171
COURSE CREDITS: 2
CORE/ELECTIVE: CORE
: 0-0-2
Pre-requisite: None

Course Objectives:

1. The students will learn to speak and write grammatically correct sentences with the ability to express thoughts with clarity and accuracy.

2. The students will learn the rules of grammar in writing. It will enhance their ability to use logical sequencing while writing any business letter or document.

3. The students will learn using new words and build their vocabulary steadily and systematically by following the exercises.

4. Students will develop command over their language and synchronize their thoughts while writing different types and kinds of Business letters.

5. Students will be groomed to develop the art of speaking logically, confidently and pragmatically which involves understanding work ethics and manners and the correct use of body language.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Understand and sharpen writing skills using correct grammar in Emails, Business letters and Report writing.	Usage and Assessment
CO2	Learn the basics of successful job applications.	Usage and Assessment
CO3	Help make communication stronger by learning Non verbal cues and correct Body Language.	Familiarity and Assessment
CO4	Enable students to prepare better Power Point Presentations with clarity of expression and appropriate language.	Familiarity and Assessment

CO5	Develop advanced vocabulary by learning to use different ways of word construction and strategies of learning new words.	Usage and Assessment
CO6	Learn about the ethics of writing and different types of formats in documents with command over language.	Usage and Assessment

List of Exercises

Subject Code	21B17HS171	**Semester**	1
Subject Name	English Lab		
Credits	01	**Contact Hours**	14

Faculty (Names)	**Coordinator(s)**	1. Dr. Papiya Lahiri
	Teacher(s) (Alphabetically)	1. Dr. Papiya Lahiri 2. Dr. Neena Jindal

Lab Exercise No.	Subtitle of the Module	Topics	Hours
1.	**Essays: For and Against** **Software: Practical Writing**	What will I learn? Stages of writing Brainstorming (1) Brainstorming (2) Planning your essay (1) Choosing a style Quick quiz: the Writing Process	1
2.	**Job Applications: Your Online Profile** **Software: Practical**	What will I learn? Your online profile: overview	1

	Writing	What does a profile look like The structure of a profile Proofreading: grammar Spell checking Writing focus: punctuation marks Practise proofreading Quick quiz: your personal profile	
3.	**Official Letters** **Software: Practical Writing**	What will I learn in this unit? Official letters: layout Official letters: vocabulary Build up an official letter Letters: style The cover letter: job applications Letters: proofreading Present perfect or simple past? Quick quiz: letters	1
4.	**Emails: Asking for Information (I)** **Software: Practical Writing**	What will I learn? Emails: an overview Emails: structure Finding functional language (study sheet) Asking people to do things Enquiries and Responses	1
5.	**Emails: Asking for Information (II)** **Software: Practical Writing**	Functional language for emails Emails: Correcting mistakes Write two emails (on PC note pad) Vocab Focus Quick quiz: Email basics	1
6.	**Use of Body Language**	This exercise will include showing a couple of videos to the students on the use of Body Language in communication and also how to interpret other people's body language when they communicate. This will include studying facial expressions, gestures, non- verbal cues and eye contact.	1

7.	**A Short Report: Graphs (I)**	What will I learn in this unit? A report on graph	1

	Software: Practical Writing	Choosing tenses (1) Choosing tenses (2) Write a report (1) [on PC note pad] Prepositions of time (1) Describing differences (1) Quick quiz: A report on graphs	
8.	**A Short Report: Hotel and restaurants (II)** **Software: Practical Writing**	What will I learn? Restaurant reviews: structure Vocab: Hotels and restaurants Topic sentences (1) Mixing sentences (1) Mixing sentences (2) Past or Present? Write two reviews (Any one of the two on PC note pad) Quick quiz: a short report	1
9.	**Use of Power point presentation**	This exercise will comprise of two videos on the specifics of preparing power- point presentations; the Do's and don'ts; examples from successful business entrepreneurs' presentations.	1
10.	**Vocabulary Development**	Synonyms, Antonyms, Standard Abbreviations One word Substitution Homophones, Homonyms, Paronyms, Words often confused and misused Word Functioning Idiomatically Foreign Words Prefixes Suffixes (5 each on PC note pad)	1
11.	**Reported Speech** **Software :Tense Buster**	Introduction The Rule	1

		Practice: Pronouns Practice: Verbal Actions Pronunciation: Stress and Rhythm Do you understand? Vocab: Reporting verb Your test	
12.	**Essays: Descriptive** **Software: Practical Writing**	What will I learn? Planning your essay (1) Planning your essay (2) Words and senses (1) Vocab focus: choosing precise words Linking ideas (1) Linking ideas (2) Quick quiz: descriptive essays	1
13.	**Avoiding Plagiarism Ist part** **Software: Practical Writing** **Taking Notes IInd part** **Software: Practical Writing**	What will I learn? Plagiarism: an overview Identify plagiarism Past or present? Quick quiz: plagiarism <u>Taking notes</u> What will I learn? Taking notes: the main points Taking notes: the layout Taking notes: abbreviations Quick quiz: taking notes	1

14.	**Text speak** **Software: Practical Writing**	What will I learn? Text speak: an overview Text terms (1)	1

		Text terms (2) Inviting people to do things Responding appropriately Text speak and speaking Quick quiz: text speak	
		Total	14

Methodology

The course follows a lab based teaching-learning method with classroom discussions and activities on fundamental concepts of grammar with a strong emphasis on skill development of students with regard to speaking, writing, logically interpreting ideas into words and reasoning in the classroom. The exercises are solved by the students on the software's and the marking is automatically shown. Additionally, they are asked to draft letters and memos in their Lab files/registers after reading specimens on the software's and improve their English with choice of specific and technical words.

Evaluation

Sr. No.	Components	Total Marks
1	Proforma/Assignments	10
2	Mid Term	20
3	End term	20
4	Tutorial Activities	50
	Total	100

SOFTWARE DETAIL

There are presently three softwares running in the Language Lab. These are as follows:

1. Software Clarity S. Net 7

This software supports Wireless LAN and wired LAN.

Main Functions

1. Screen Broadcast: Teacher PC can broadcast the screen, video file, flash smoothly without delay to student PC.
2. Voice Broadcast: Teacher can broadcast his voice without delay to student PC.
3. Screen Recorder: Teacher and student can record their own operations and then save in video file, which can be broadcast in any PC which has installed media player
4. Monitor: Teacher can monitor any student PC in the classroom.
5. Media Player. Teacher can broadcast all kinds media file formats, such as MPEG, DAT, MVI and so on, to student PC without delay.
6. Control Website and application: Teacher can restrict student to visit any website or application freely.
7. Teacher can remote open website on student PC.
8. Group Teaching: Teacher can divide the students into several groups, and set leader for each group to run group teaching.
9. Exam: It has strong exam functions. Teacher can know student study progress from students

by using this function easily.

10. Remote Command: Teacher can remote run the program in student PC; teacher can remote start-up, turn off and restart student computer.
11. File transfer and collect the file: Teacher can transfer the file to student PC easily, and also teacher can collect the file from student PC.
12. Restrict USB: Teacher can restrict student to use USB flash memory freely. 13. Digital Recorder: It can record teacher and student voice, which can be used in language lab.

Requirements

Teacher side Requirements: CPU Core 2 E6300, 2Gbytes Memory, 256Mbytes Display Card
Student side Requirements: CPU Core 2 E4300, 1Gbytes Memory, 128Mbytes Display Card
Operating System: Support all Windows, includes Windows 8.1,8, 7, Vista, XP and so on. Network: Wired Network 10MB/100MB/1000MB. Wireless Network 802.11n.

Overview:

Clarity English publishes programs, aimed at specific language areas in English like Grammar, Reading, Study Skills & Results Tracking. Under 'Clarity English', there are three softwares in our language lab which are Tense Buster, Practical Writing and Clear Pronunciation. The Program named Tense Buster focuses on 33 areas of Grammar through reading, listening, speaking & writing. It is one of a kind which is accepted by British Council in all its 226 teaching centres.

2. Software: Tense Buster 9.0 (3 years)

Licence Details

Tense Buster V11
Licence type: Anonymous Access

Version: International English Number of concurrent users: 33 Start date: 2021-08-09
Expiry date: 2025-08-08

Tense Buster is an ESL (English as a second language) program which focuses on helping students improve their reading, writing, listening, speaking, vocabulary and grammar skills in 5 levels (beginner, upper intermediate, intermediate, lower intermediate, advanced).

Tense Buster covers 33 aspects of the English language through presentations, practice exercises, rules, tests and learner training tips. Students learn how to ask questions, make comparisons, and report on what they've heard, in addition to learning how to describe past, present and future events.

Each unit begins with a presentation of a grammar topic based on a dialogue, a newspaper article, a radio broadcast or an extract from a story, where learners are encouraged to form theories about how the grammar works. Next comes checking questions focusing on key areas of difficulty, and a grammar rule. Students move on to practice and testing activities in which the language is contextualized and key aspects of form and function are highlighted. Each unit includes a video-based pronunciation activity relating to an aspect of the grammar. Finally, each unit includes a vocabulary session and ends by suggesting extension activities. All activities include detailed feedback.

Multimedia Authoring Kit

This kit enables the teacher to create effective exercises tailored to students' specific needs. The Tense Buster multimedia Authoring Kit comprises a wide range of exercise types. It lets you add your own material and adapt the courses to the needs of your students. Use any one of
these formats to create your own activities: drag and drop, proof reading and free practice as well as target spotting,

multiple choice questions, true/false, text and gap fill.

3. Software: Practical Writing

Licence Details (3 years)

Practical Writing V11
Licence type: Anonymous Access

Version: International English Number of
concurrent users: 33 Start date: 2021-08-09
Expiry date: 2025-08-08

This cloud based software helps in developing the writing skills of the students. It has 10 core skill development areas:

1. Essays: For and Against
2. Job Applications: your online profile
3. Emails: Asking for Information
4. A Short Report: Graphs
5. A Short Report: Hotels and Restaurants
6. Avoiding Plagiarism
7. Taking Notes
8. Essays: Descriptive
9. Textspeak
10. Official Letters

Each area deals with a separate set of exercises that are designed to master the skill set of LSRW. It entails learning about reports, cover letters, resumes, drafting business letters, textspeak, spell check etc. It covers a wide range of topics on grammar, functional language, formal and communicative language. The Lab exercises will be covered from Tense Buster and Practical Writing software.
Every week the students perform the exercises and enter their auto-system-generated scores on the printed pro forma.

4. Software: Clear Pronunciation 2 V11

License Details (1 year)

Clear Pronunciation 2 V11 Licence type:
Anonymous Access

Version: British English Number of concurrent
users: 33 Start date: 2021-08-09
Expiry date: 2022-08-08

This software is particularly for learning and practicing phonetics or the study of the sounds of human speech. It deals with five distinct areas:

- Consonant Clusters
- Word Stress
- Connected Speech
- Sentence stress
- Intonation

All these areas will make the students practice correct pronunciation and listen to their own recorded voices and make improvement.

Engineering Mathematics - II

COURSE CODE: 24B11MA211

COURSE CREDITS:4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: Engineering Mathematics - I

Course Objectives:

- To study various methods of solving the second order differential equations with variable coefficients,
- To study the basic properties of Bessel functions, Legendre polynomials and their applications.
- To learn finding the solutions of heat and wave equations.
- To study calculus of complex variables.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Solve problems related to convergence of series & Fourier series	Familiarity & Usage
CO-2	Understand basics of ordinary differential equation, comprehend series solution with certain special functions e.g. Bessel, Legendre Equation.	Assessment & Usage
CO-3	Understand partial differential equations and solve heat and wave equations	Usage
CO-4	Understand functions of a complex variable, analytic functions and harmonic functions.	Usage
CO-5	Solve contour integration and find Taylor's and Laurent's series, evaluate certain real definite and improper integrals.	Familiarity & Usage

CourseContents:

Unit	Contents	Lectures required
1	**Infinite series and Fourier series:** Convergence of sequence and series, tests for convergence; Power series. Definition of Fourier series, orthogonal and orthonormal functions, Fourier series with arbitrary period, half range Fourier sine and cosine series.	8
2	**Ordinary differential equations:** Introduction to first order differential equations, second and higher order differential equations with constant coefficients. Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Power series solutions, Legendre polynomials, Bessel functions of the first kind and their properties, solving IVPs using Laplace Transformation.	12

3	**Partial Differential Equations:** Introduction to partial differential equations, second order PDEs - one dimensional wave, heat equations with applications in science and technology, solution by separation of variables method using Fourier series.	**6**
4	**Complex Variables (Differentiation):** Limit, continuity and differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, elementary analytic functions (exponential, trigonometric, logarithm) and their properties.	**8**
5	**Complex Variables (Integration):** Contour integrals, Cauchy theorem, Cauchy integral formula, zeros of analytic functions, singularities, Taylor's & Laurent's series, residues, Cauchy residue theorem, evaluation of definite integral involving sine and cosine, improper integrals.	**8**
	Total Lectures	**42**

Suggested Text Book(s):

- Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2023.
- R K Jain and SRK Iyengar, Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House, 2016.

Reference Book(s):

- Brown, J. W., Churchill, R.V., Complex Variables and Applications, 9th Edition. McGraw Hill 2023.

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage/ ScopeofExamination
1	T-1	15	1 Hour	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2)-8 Quizzes (3) -12 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Engineering Mathematics- II)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	2	**1.75**
CO-2	2	3	3	3	3	1	1	1	2	2	1	2	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	2	**1.75**
CO-4	2	3	3	3	2	1	1	1	2	3	2	2	**2.0**
CO-5	2	3	3	3	2	1	1	1	2	3	2	2	**2.0**
Average	**2**	**2.6**	**2.6**	**2.6**	**2.4**	**1**	**1**	**1**	**2**	**2.4**	**1.6**	**2**	

Engineering Physics-II

COURSE CODE: 18B11PH211

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

: 3-0-0

Pre-requisite: None

Course Objectives:

1. To offer a broad aspect of those areas of Physics which are specifically required as an essential background to engineering students for their studies in higher semesters.
2. To enable the students to get better understanding about solid state physics and its applications in engineering.
3. To familiarize students about electromagnetism and its applications in engineering.
4. To enable the students to get better understanding about statistical physics and its applications in engineering.
5. To familiarize students with optical fibers communication.
6. At the conclusion of the course, the ability of students should have enhanced to think logically about the problems of science and technology and obtain their solutions.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the fundamentals of vector calculus and its applications in electrostatics	Familiarity
CO-2	Knowledge of, physical interpretation, and ability to apply Maxwell's equations to determine field waves, potential waves, energy ,charge conservation conditions and other diverse engineering problems.	Familiarity/Assesment
CO-3	Able to distinguish Step Index, Graded index fibers and compute mode volume and Implementation of numerical methods for calculating the design parameters of optical fiber.	Familiarity/Problem Solving
CO-4	To understand the basics of statistical distributions and use Maxwell-Boltzmann distribution, Fermi-Dirac and Bose-Einstein distributions to solve problems in some physical systems	Familiarity/Problem Solving
CO-5	To analyze atomic structure, Crystal structure, Crystal axes and planes, X-ray diffraction data and effect of energy bands on electronic behavior of solids.	Analytical Skills/ Familiarity
CO-6	To understand the concepts of modern solid state physics ,various properties of semiconductors and apply Hall effect to calculate allied parameters of semiconductors	Familiarity/ Usage

Course Contents:

Unit	Contents	Lectures required
1	**Electromagnetism:** Basic knowledge of fields, gradient, divergence and curl, Coulomb's law and related numerical, electric flux, Gauss's law for the charge inside and outside the Gaussian surface, applications of Gauss law: spherical and cylindrical symmetries, electric field due to charged conductor, force per unit area on the surface of the charged conductor, treatment of electrostatic problems by solution of Laplace and Poisson's equations. Biot Savart law,	**12**

	Ampere's law, Maxwell's equations in free space and dielectric media, energy in electromagnetic waves (Poynting vector and Poynting theorem), plane electromagnetic waves in free space, transverse nature, wave impedance and energy flow, energy density and energy flux (Poynting vector) in an electromagnetic field, radiation pressure.	
2	**Statistical Physics & Applications:** Introduction, macrostates, microstates, thermodynamic probability, distribution of n-particles in k-cells, phase space, minimum volume, classical and quantum statistics: common approach to three statistics, Maxwell-Boltzmann (ideal gas), Bose-Einstein (photon gas), Fermi-Dirac distributions (electron gas), Compton effect.	**10**
3	**Optical Fiber Communication:** Light propagation in fibers, Step index and Graded Index fibers, Numerical Aperture and Attenuation, Single and Multimode fibers and their propagation characteristics, Fiber losses and optical fiber applications.	**4**
4	**Solid State Physics:** Basic ideas of bonding, ionic bonding, covalent bonding (hybridization), metallic bonding, dispersion bonds, dipole bonds, hydrogen bonds, Lattice points and space lattice, basis and crystal structure, unit cell and primitive cell, seven crystal systems and fourteen Bravais space lattice, coordination number, nearest neighbour distance, atomic radius, atomic packing factor in crystal structure, calculation of lattice constant, lattice planes and Miller indices, separation between lattice planes. X-ray diffraction, Bragg's law of X-ray diffraction, Bragg's x-ray spectrometer, powder crystal method, rotating crystal method. Electronic conduction in metals, classical free electron theory, quantum theory of free electrons, band theory of solids, distinction between metals, semiconductors and insulators, intrinsic and extrinsic semiconductors, carrier concentration in thermal equilibrium in intrinsic semiconductor, Fermi level and energy band diagram in intrinsic semiconductor, energy band diagram and Fermi level in extrinsic semiconductors, effect of temperature on extrinsic semiconductor, electrical conductivity of intrinsic semiconductor and extrinsic semiconductor, Hall effect, allied parameters and its applications.	**16**
Total lectures		**42**

Suggested Text Book(s):

1. David J Griffiths, Introduction to Electrodynamics, Eastern Economy Editions, PHI, 4th edition (2012).
2. Brij Lal, N Subrahmanyam and P.S. Hemne, Heat Thermodynamics and Statistical Physics, S. Chand, 3rd edition (2012).
3. Gerd Keiser, Optical Fiber Communication, Tata McGraw-Hill Education Pvt. Ltd., 5th edition (2013).
4. S. O. Pillai, Solid State Physics, New age international publishers, 7th edition (2016).

Suggested Reference Book(s):

1. Charles Kittel, Introduction to Solid State Physics. John Wiley & Sons, 8th edition (2005).
2. Ghatak Ajoy, Thyagarajan, Introduction to Fiber Optics, Cambridge University Press (2006).
3. Silvio R A, Salinass, Introduction to Statistical Physics, Springer Verlag (2004).
4. Lakhanpal R C, Modern Approach to Statistical Physics and Thermodynamics, Modern Publishers (2003).

Other useful resource(s):

1. Link to topics related to course:
   i. https://nptel.ac.in/courses/115101004/
   ii. https://nptel.ac.in/courses/115101005/
   iii. https://nptel.ac.in/courses/115105099/
   iv. https://nptel.ac.in/courses/122101002/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Engineering Physics-II)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2				2		2	**2**
CO-2	2	3	3	3	3	2				2		2	**2.5**
CO-3	3	3	3	2	3	2				2		2	**2.5**
CO-4	2	3	3	3	2	2				3		3	**2.6**
CO-5	3	3	3	3	2	1				3		3	**2.6**
CO-6	3	3	3	3	2	1				3		3	**2.6**
Average	**2.5**	**2.8**	**2.8**	**2.7**	**2.3**	**1.7**				**2.5**		**2.5**	

Engineering Physics Lab-II

COURSE CODE: 18B17PH271

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

: 0-0-2

Pre-requisite: None

Course Objectives:

1. The Art of Experimentation: The introductory laboratory engages each student in significant experiences with experimental processes, including some experience in investigation.
2. Experimental and Analytical Skills: The laboratory help the student develop a broad array of basic skills and tools of experimental physics and data analysis.
3. Conceptual Learning: The laboratory help student's to understand basic physics concepts.
4. Understanding the Basis of Knowledge in Physics: The laboratory help students understand the role of direct observation in physics and to distinguish between inferences based on theory and the outcomes of experiments.
5. Developing Collaborative Learning Skills: The laboratory helps students to develop collaborative learning skills that are vital to success in many lifelong endeavors.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To Understand different aspects of magnetism and semi conductive properties of materials and their use in design of various devices.	Familiarity
CO2	To helps the students to understand the concepts of light propagation in optical fiber and introduce them to various losses in optical fiber communication.	Familiarity and Assessment
CO3	To demonstrate the scientific results based on observation.	Assessment and usage
CO4	Scientific discussion for clear and concise conclusion on particular scientific results.	Assessment and usage
CO5	To develop collaborative learning skills	Assessment and usage

List of Experiments:

S.No	Description	Hours
1	To determine the numerical aperture, of an optical fibre using LED as a light source.	**2**
2	To determine the attenuation coefficient, losses of an optical fiber	**2**
3	To measure resistivity of semiconductor using four probe methods.	**2**

4	To measure energy band gap of the Ge crystal using four probe methods and compare with optical band gap.	**2**
5	To study Hall effect in semiconductor and determination of its allied parameters.	**2**
6	To determine the carrier concentration and type of doping using hall coefficient.	**2**
7	To calculate the e/m ratio for an electron using Thomson method/Bar magnet method	**4**
8	To study magnetostriction in magnetic materials using He-Ne laser.	**4**
9	To study the coercivity, saturation magnetization, retentivity of given materials.	**4**
10	Experimental Determination of Planck's constant using Light Emitting Diodes (LEDs) and Photoelectric Effect.	**4**
Total Lab hours		**28**

Suggested/Resources:

1. S. P. Singh, Advanced Practical Physics,Pragati Prakashan, Vol. 1 (2013).
2. C. L. Arora, Practical Physics, S. Chand Company Limited, 20th edition (2004).
3. N. Subrahmanayam, Brij Lal and M.N. Avadhanulu, A Text Book of Optics, S. Chand (2012)
4. Ajoy Ghatak, Optics, Tata McGraw Hill, 5th addition, (2012)
5. F.A. Jenkins and H.E. White, Fundamentals of Optics, McGraw-Hill (1981).
6. Dabir S. Viswanath, Tushar Ghosh, Dasika H.L. Prasad, Nidamarty V.K. Dutt, Kalipatnapu Y. Rani , Viscosity of Liquids: Theory, Estimation, Experiment, and Data , Springer (2007).

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO2	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO3	3	3	3	3	2	2	1	1	3	1	1	1	**2.00**
CO4	2	2	2	2	2	2	1	1	1	1	1	1	**1.5**
CO5	2	2	2	2	2	2	1	1	1	1	1	1	**1.5**
Average	**2.6**	**2.6**	**2.6**	**2.6**	**2.0**	**2.0**	**1.0**	**1.00**	**2.2**	**1.00**	**1.0**	**1.0**	

Data Structure and Algorithms

COURSE CODE: 18B11CI211

COURSE CREDIT: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisites: C/C++

Course Objectives:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures
5. Introduce students to data abstraction and fundamental data structures.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To gain knowledge on the notions of data structure, Abstract Data Type.	Familiarity
CO-2	For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.	Assessment
CO-3	For a given Search problem (Linear Search and Binary Search) student will able to implement it.	Assessment
CO-4	For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.	Assessment
CO-5	Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.	Assessment
CO-6	Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Introduction:** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	7
2	**Stacks:** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis.	5
3	**Queues:** ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	5

4	**Linked Lists:** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.	**8**
5	**Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.	**6**
6	**Sorting and Hashing:** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.	**6**
7	**Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	**5**
Total lectures		**42**

Suggested Text Book(s):

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press

Suggested Reference Book(s):

1. "Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
3. "Data structures and Algorithms Made Easy" 5th edition by Narasimha Karumanchi, Career monk publications
4. "Data Stru**c**ture and Algorithms in C" 2nd edition by Mark Allen Weiss (2002), Pearson Education

Other useful resource(s):

1. Link to NPTEL course contents: https://nptel.ac.in/courses/106102064/
2. Link to topics related to course:
   - **a.** https://onlinecourses.nptel.ac.in/noc18_cs25/preview
   - **b.** https://nptel.ac.in/courses/106103069/
   - **c.** http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10

				Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course Outcomes (Data Structure and Algorithms)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	2	2	3	2	2	2	3	1	3	**2.4**
CO-2	3	3	3	2	3	2	3	2	2	3	1	3	**2.5**
CO-3	3	3	3	2	2	3	1	2	3	3	1	3	**2.4**
CO-4	3	3	3	2	3	3	2	2	3	3	1	3	**2.6**
CO-5	3	3	3	2	3	3	2	2	3	3	1	3	**2.6**
CO-6	3	3	3	2	3	3	2	2	2	3	1	3	**2.5**
Average	**3**	**3**	**3**	**2**	**2.7**	**2.8**	**2**	**2**	**2.5**	**3**	**1**	**3**	

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Bioinstrumentation Techniques)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	2	3	1	1	1	1	1	1	1	3	**1.75**
CO-2	3	3	3	3	2	1	1	1	2	1	1	3	**2.00**
CO-3	3	3	3	3	3	1	1	2	2	1	1	3	**2.16**
CO-4	3	3	3	3	3	2	2	2	2	1	2	3	**2.42**
CO-5	3	3	3	3	2	2	1	1	1	1	1	1	**1.83**
Average	**3.00**	**3.00**	**2.80**	**3.00**	**2.20**	**1.40**	**1.20**	**1.40**	**1.60**	**1.00**	**1.20**	**2.60**	

Data Structure and Algorithms Lab

COURSE CODE: 18B17CI271

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

: 0-0-4

Pre-requisites: None

Course Objectives:

1. Develop problem solving ability using Programming
2. Develop ability to design and analyze algorithms
3. Introduce students to data abstraction and fundamental data structures
4. Develop ability to design and evaluate Abstract Data Types and data structures
5. Apply data structure concepts to various examples and real life applications

Course outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To gain knowledge on the notions of data structure, Abstract Data Type	Familiarity
CO-2	To have hands on skills to evaluate different kinds of linked lists and their applications in day to day problem solving.	Usage
CO-3	To have hands on skills to evaluate different kinds stacks and their applications and implementations in day to day problem solving	Assessment
CO-4	To have hands on skills to evaluate different kinds queues and their applications and implementations in simulations.	Assessment
CO-5	To acquire knowledge of various sorting algorithms	Usage
CO-6	To learn Searching: Balanced tree, red-black tree, lower bounds for searching	Usage
CO-7	To learn to code for operations on Tree or BST (Creation; Traversing like pre-order,post-order and in-order; Searching element; finding height etc.)	Usage
CO-8	Introduction to Heaps	Usage
CO-9	To learn to code for operations on Graphs (Creation; entering info, printing output and deleting; traversal of BFS and DFS algorithm)	Assessment

List of Experiments:

S.No	Description	Hours
1	**Getting acquainted with** a) Arrays and Strings, Structures, b) Recursion, Pointers c) Dynamic memory allocation	 2 4 4
2	**Operations on: (Creation, insertion, deletion, sorting, traversing, reversing etc)** a) Linear Linked List, b) Doubly and c) Circular Linked List	 4 4 2

3	**Operations on Stacks:** a) Creation; pushing; popping; b) testing underflow, overflow; c) prefix and postfix	 4 2 2
4	**Operations on Queues:** a) Creation; b) enqueue; dequeue; c) testing underflow, overflow	 4 2 2
5	**Operations on Tree or BST:** Creation; a) Traversing like preorder, post-order and in-order; b) Searching element; finding height etc.	 4 2
6	**Implementation of sorting algorithms 1:** Insertion Sort and Selection Sort Algorithm with arrays using dynamic memory allocation.	2
7	**Implementation of sorting algorithms 2:** Bubble Sort and Merge Sort Algorithm with arrays using dynamic memory allocation.	2
8	**Implementation of sorting algorithms 3:** Implementation of Radix Sort and Quick Sort Algorithm with arrays using dynamic memory allocation.	2
9	**Operation on Heaps:** a) Heaps, b) Heap Sort	 2 2
10	**Implementation of Searching algorithms:** Linear Search Algorithm and Binary Search Algorithm using dynamic memory allocation.	2
11	**Operations on Graphs :** (Creation; entering info; printing Output and deleting; traversal of BFS and DFS algorithm etc.)	2
Total Lab hours		**56**

Minor Project(s) – (*Only for 2 credit lab)*

- Design GUI based program to solve any binary equation.
- Design GUI based program to find the roots of quadratic equation.

- Design a program that picks the characters at equal interval from the given text/paragraph and generate a new paragraph in which each set of word can't have more than 4 characters. Last word of the paragraph can have <=4 characters.
- Program to input following data into disk file. Code, name, department and salary of employee in a firm. After creating file read the file and find following-
  Methodology
  algorithms
  Code execution
  Future scope
  Count number of employees as per department
  Search record of employee
  Display record of employee
  Display list of employee in alphabetical order as per department

Read record from file

Suggested Books/Resources:

1. Langsam, Augestein, Tenenbaum : Data Structures using C and C++, 2nd Edn, 2000, Horowitz and Sahani : Fundamental of Data Structures in C, 2nd Edn, 2008
2. Weiss : Data Structures and Algorithm Analysis in C/C++, 3rd Edn, 2006
3. Sahani : Data Structures, Algorithms and applications in C++, 1997.
4. Corman et al : Introduction to Algorithms, 3rd Edn., 2009
5. http://www.nptel.iitm.ac.in/video.php?subjectId=106102064, last accessed Mar 13, 2014.
6. http://www.cs.auckland.ac.nz/~jmor159/PLDS210/ds_ToC.html, last accessed Mar 13, 2014.
7. http://courses.cs.vt.edu/csonline/DataStructures/Lessons/index.html, last accessed Mar 13, 2014.
8. Link to topics related to course:
    a. http://cse.iitkgp.ac.in/~pallab/pds16/pds16.htm
    b. https://onlinecourses.nptel.ac.in/programming101/preview

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO-1	3	2	3	2	2	3	3	3	2	3	2	2	**2.5**
CO-2	3	3	3	2	3	3	3	3	2	3	2	3	**2.8**
CO-3	3	3	3	2	2	3	3	3	3	3	2	2	**2.7**
CO-4	3	3	3	3	3	3	3	2	2	3	3	3	**2.8**
CO-5	3	3	3	2	2	2	3	3	3	3	2	2	**2.6**
CO-6	3	3	3	3	3	3	3	2	2	3	3	3	**2.8**
CO-7	3	3	3	3	3	3	2	2	3	3	3	3	**2.8**
CO-8	3	3	3	2	3	3	3	3	3	3	2	3	**2.8**
CO-9	3	3	2	3	3	3	3	3	3	2	3	3	**2.8**
Average	**3**	**2.9**	**2.9**	**2.4**	**2.7**	**2.9**	**2.9**	**2.7**	**2.6**	**2.9**	**2.4**	**2.7**	

Basic Electrical Engineering

COURSE CODE:

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: None

Course Objectives:

To have a good understanding and application of a broad set of analytical tools to analyze Electrical Circuits.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	Understand the three simple scientific laws, Ohm's law, Kirchhoff's Voltage and Current Laws	Familiarity
CO-2	Application of Ohm's law, KCL and KVL to analyze circuits by different techniques.	Usage
CO-3	Analysis of time varying responses of circuits consisting of capacitors and inductors	Familiarity
CO-4	Understanding sinusoidal steady state analysis of various AC circuits.	Usage
CO-5	Understand the principle of mutual coupling and its significance in the power system.	Assessment

Course Contents:

Unit	Contents	Lectures required
1	**DC Analysis:** Basic Components and Electric circuits, Voltage and Current laws, Basic Nodal and Mesh Analysis including supernode and supermesh, Comparison of Nodal and Mesh Analysis.	10
2	**Circuit Analysis Techniques:** Superposition, Source Transformation, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer Theorem, Delta-Wye Conversion	6
3	**Time-domain analysis of RL, RC and RLC circuits:** Capacitors and Inductors, Basic RL and RC circuits (The source free RL and RC circuits, Driven RL and RC circuits, Natural and forced response). Second order RLC circuits: critically damped, under damped, over damped and un-damped responses: Complete response	7 3
4	**AC Analysis:** Characteristics of Sinusoids, Forced response to Sinusoidal Functions, Complex Forcing function, Phasor, Impedance and Admittance, Nodal and Mesh Analyis, Superposition, Source Transformation and Thevenins Theorem,	8

	Phasor Diagrams	
5	**AC Circuit Power Analysis:** Instantaneous Power, Average Power, Effective Values of Current and Voltage, Apparent Power and Power Factor, Complex Power. Power Factor Correction	**3**
6	**Magnetically Coupled Circuits:** Mutual Inductance, The linear transformer and the ideal transformer. Electric Motor and Electric Generator principle.	**5**
Total lectures		**42**

Suggested Text Book(s):

1. W.H. Hayt, J. E. Kemerlay & S.M. Durbin: Engineering Circuit Analysis, 6th Ed., TATA McGraw Hill, 2006.
2. J. Hiley, K. Brown, & I.M. Smith: Electrical and Electronic Technology, 10th Ed., Pearson, 2019.
3. D.C. Kulshreshtha: Basic Electrical Engineering, 1stEd., McGraw Hill Education, 2011.

Suggested Reference Book(s):

1. Ozgur Ergul: Introduction to Electrical Circuit Analysis, 1st Ed., Wiley , 2017.
2. V.N. Mittle and Arvind Mittal: Basic Electrical Engineering, 2nd Ed., Tata McGraw Hill, 2015.

Other useful resource(s):

Link to NPTEL course contents:https://nptel.ac.in/courses/108102097/3 (Prof. S.C. Dutta Roy, IIT Delhi)

EvaluationScheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes(2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes(POs)

Course outcomes (Basic Electrical Engineering)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	2	2	1	1	1	1	1	3	**2**
CO-2	3	2	2	2	3	2	1	1	1	1	2	3	**1.92**
CO-3	3	3	3	3	2	2	1	1	1	1	1	3	**2**
CO-4	3	3	3	3	2	2	1	1	1	1	1	3	**2**
CO-5	3	3	3	3	3	2	1	1	1	1	2	3	**2.17**
Average	**3**	**2.8**	**2.8**	**2.8**	**2.4**	**2**	**1**	**1**	**1**	**1**	**1.4**	**3**	

Basic Electrical Engineering Lab

COURSE CODE:

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: None

Course Objectives:

1. The primary objective of this course is to provide a thorough understanding of circuit analysis and measurement of various electrical parameters.
2. Analysis of a given circuit depending on types of elements - DC analysis, Transient analysis and Frequency analysis.
3. To acquire hands on experience of conducting various experiments on electrical machines.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Understanding basic electrical sources and measuring devices: Power supply, Multimeter, CRO/DSO and Function Generator.	Familiarity
CO2	Understand the basic working principle of a transformer and the operation of electrical machines.	Usages
CO3	Practical implementation of the fundamental electrical theorems and modeling of simple electrical systems.	Usages
CO4	Accurate measurement of voltage, current, power and impedance of any circuit.	Usages
CO5	DC analysis, Transient analysis and Frequency analysis of a given circuit depending on types of elements.	Assessment
CO6	Teamwork skills for working effectively in groups and develop analytical skills to compare experimental results with theoretical concepts.	Assessment

List of Experiments

S.No	Description	Hours
1	Introduction to Power supply & Multimeter.	2
2	To determine the equivalent resistance of a circuit using color code and to verify it using a multimeter. To verify Voltage divider and Current divider.	2
3	To verify Delta to Star and Star to Delta conversion.	2
4	Introduction to CRO & Function Generator	2
5	To verify Kirchoff's voltage law (KVL) and Kirchoff's Current Law (KCL)	2
6	To verify Superposition Theorem	2
7	To verify Norton's Theorem	2
8	To verify Thevenin's Theorem and Maximum Power Transfer Theorem	2

9	To study the transient response of series RC circuits using different values and R and C	2
10	Determination of frequency response of current in RLC circuit with sinusoidal ac input	2
11	To determine the turns ratio and polarities of transformer windings.	2
12	To obtain the equivalent circuit parameters from OC and SC tests, and to estimate efficiency & regulation at various loads.	2
Total Lab hours		24

Suggested Resources:

1. W.H. Hayt, J. E. Kemerlay & S.M. Durbin, "Engineering Circuit Analysis", Eighth Edition, McGraw Hill, 2012.
2. Van Valkenburg, "Network Analysis", Prentice-Hall India, 2001.
3. D.C. Kulshreshtha, "Basic Electrical Engineering", First Edition, McGraw Hill, 2011.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Program Outcomes (POs)

CO /PO	PO1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	Aver age
CO1	3	3	3	2	2	2	3	1	1	1	1	1	1.92
CO2	3	3	3	2	3	2	1	1	1	1	1	1	1.83
CO3	3	3	2	3	2	3	2	1	1	1	2	1	2.00
CO4	3	3	3	2	3	2	1	1	1	1	1	1	1.83
CO5	3	2	3	3	3	2	1	1	1	1	1	1	1.83
C06	3	3	3	3	2	2	2	3	2	2	2	2	2.42
Aver age	3.00	2.8 3	2.83	2.5 0	2.5 0	2.1 7	1.6 7	1.3 3	1.1 7	1.17	1.33	1.17	

Engineering Graphics

COURSE CODE: 18B17GE173

COURSE CREDITS: 1.5

CORE/ELECTIVE: CORE

: 0-0-3

Pre-requisite: None

Course Objectives:

1. To introduce the students to the "universal language of Engineers" for effective communication through drafting exercises of geometrical solids.
2. To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions.
3. To impart knowledge to students about creating a sheet and software aided layout of required dimensions in 2-D and 3-D view.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To impart and inculcate proper understanding of the theory of projection.	Familiarity
CO2	To improve the visualization skills	Assessment
CO3	To enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient	Usage
CO4	To impart the knowledge on understanding and drawing of simple residential/office buildings.	Usage

List of Experiments

S.No	Description	Hours
1	Introduction to Lettering	**3**
2	Scales and their types	**2**
3	Construction of Polygons	**4**
4	Projection of points	**2**
5	Projection of lines	**4**
6	Projection of planes	**3**
7	Drawing of building plan	**6**

8	Introduction to Basic Commands in Auto-CAD	**3**
9	Orthographic projections in Auto-CAD	**3**
10	Isometric Projection in Auto-CAD	**4**
11	Projections of solids in Auto-CAD	**1**
12	Section of solids in Auto-CAD	**1**
Total Lab hours		**36**

Suggested/Resources:

1. Engineering Drawing & Graphics with AutoCAD by K.Venugopal, New Age International Pvt. Ltd., New Delhi (India)
2. Engineering Drawing by N.D.Bhatt, V.M.Panchal and Pramod R. Ingle, Charotar Publishing House, Anand, Gujarat (India)
3. Engineering Drawing [With Introduction to Auto-CAD] by Roop Lal and Ramakant Rana, IK International Publishing House Pvt. Ltd.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	10 Marks
4	Lab Assessment	50 Marks
	Total	**100 marks**

UNIVERSAL HUMAN VALUES II-Understanding Harmony

COURSE CODE: 23B11HS211

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 2-1-0

Pre-requisite: None

Course Objectives:

1. Development of a holistic perspective based on self-exploration about themselves (human being), Family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/ existence
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Self Awareness, Social awareness (family, society, nature).Sustainability in relationships and Critical thinking	Familiarity
CO-2	. Introspection and self reflection	Assessment
CO-3	Sensitive to commitment towards human values, human relationship and human society	Usage
CO-4	Developing commitment and courage	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education** 1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.	6
2	**Understanding Harmony in the Human Being - Harmony in Myself!** 7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Health.	6
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 14. Understanding the meaning of Trust; Difference between intention and competence 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals	5

	17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.	
4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence** 18. Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self regulation in nature 20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space 21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	**5**
5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics** 22. Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 26. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations	**6**
Total lectures		**28**

Suggested Text Book(s):

1. Text Book 1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999. 2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004

Suggested Reference Book(s):

1. The Story of Stuff (Book).
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
4. Small is Beautiful - E. F Schumacher.
5. Slow is Beautiful - Cecile Andrews
6. Economy of Permanence - J C Kumarappa

7. Bharat Mein Angreji Raj - PanditSunderlal
8. Rediscovering India - by Dharampal
9. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
10. India Wins Freedom - Maulana Abdul Kalam Azad
11. Vivekananda - Romain Rolland (English)
12. Gandhi - Romain Rolland (English)

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Average
CO-1	3	3	3	3	3	3	3	3	**3**
CO-2	3	3	3	3	3	3	3	3	**3**
CO-3	3	3	3	3	3	3	3	3	**3**
CO-4	3	3	3	3	3	3	3	3	**3**
Average	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	3

PROFESSIONAL COMMUNICATION PRACTICE

COURSE CODE:

COURSE CREDITS: 0 (AUDIT)

CORE/ELECTIVE: CORE

L-T-P: 0-1-0

Pre-requisite: None

Course Objectives:

1. Improve spoken and written communication in English.
2. Develop students' interpersonal communication ability in the professional settings.
3. Learn to design effective resume and cover letter
4. Understand how to make effective and impressive presentations using digital media.
5. Develop the confidence to perform well in interviews.

Course Outcomes:

SNo	Course Outcomes	Level of Attainment
CO-1	Improved spoken and written communication in English.	Familiarity
CO-2	Develop the ability to interact effectively in the professionalsetting.	Familiarity
CO-3	Design a good resume and be able to update it from time totime.	Assessment and Usage
CO-4	Make effective and impressive presentations using digital media	Usage
CO-5	Develop the confidence to perform well in interviews.	Usage

Course Contents:

Unit	Contents	Lectures required
1	**Professional Communication and CV/Resume Writing (W)** An introduction to professional communication' Introduction to CV writing, difference between a CV and a Resume, samples of good CVs/Resumes and cover letters, Drafting Resumes	3
2	**Personal (L&S)Interview** Interviewing for employment, Types of interviews, Preparing for the personal interview. Practice session for interviews	3
3	**Text speak: (Language Lab)** Writing: What will I learn?, Text speak: an overview, Text terms (1), Text terms (2), Inviting people to do things, Responding appropriately, Text speak and speaking, Quick quiz: text speak	1
4	**Presentation skills(L,S&W)** Making professional presentations, using effective body language, usingvisuals effectively.	3
5	**Essays: Descriptive: Software: Practical Writing (Language Lab)** What will I learn?, Planning your essay (1), Planning your essay (2), Words and senses (1), Vocab focus: choosing precise words, Linking ideas (1), Linking ideas (2), Quick quiz: descriptive essays	1
6	**Technical Report Writing (R&W)/Technology and communication (Language Lab)** A Short Report: Hotel and restaurants (II), Software: Practical Writing: What will I learn? Restaurant reviews: structure, Vocab: Hotels and restaurants, Topic sentences (1), Mixing sentences (1), Mixing sentences (2), Past or Present?, Write two reviews, Quick quiz: a short report Lab work: Write any one review	2
7	**Job Applications: Your Online Profile**, S**oftware: Practical Writing (Language Lab)** What will I learn? Your online profile: overview, What does a profile look like The structure of a profile Proofreading: grammar Spell checking, Writing focus: punctuation marks Practice proofreading Quick quiz: your personal profile Lab work: Write your personal profile	1
Note:	Report writing and Creating a LinedIn Profile will be a part of continuous evaluation and hence should be discussed throughout thesemester.	
Total lectures		**14**

Evaluation Scheme:

S. No	Exam	Marks
1	Resume and Cover Letter	20
2	LinkedIn Profile	10
3.	PI	20
4.	PPT	20
5	Lab work (Software)	10
6	Lab File	10
7	Attendance (5)	10

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	1	2	2	2	1	3	1	1	1	3	2	3	1.83
CO-2	1	2	2	2	1	3	1	1	3	3	2	3	2
CO-3	0	0	0	1	1	3	0	1	1	3	0	2	1
CO-4	1	2	1	2	2	3	1	0	3	3	2	2	1.83
CO-5	0	0	1	2	1	3	0	0	2	3	1	3	1.33
Average	0.6	1.2	1.2	1.8	1.2	3	0.6	0.6	2	3	1.4	2.6	1.6

Object-Oriented Systems and Programming

COURSE CODE: 18B11CI311

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: None

Course Objectives:

1. To use object modelling technique to analyze problem requirements, design a solution to the problem and then implement the solution in Object-Oriented Programming Language(s) or database.
2. To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
3. To strengthen ability to design and represent solutions to problems using UML notations
4. To introduce object oriented concepts in C++ and Java.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO-1	To learn the concepts of Objects, Classes, Methods, Constructors and Destructors	Usage
CO-2	To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.	Usage
CO-3	To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-levelInheritance, Hierarchical Inheritance and Hybrid Inheritance.	Usage
CO-4	To learn the concept of Abstract classes and interfaces	Usage
CO-5	To learn the concepts of Operator overloading and conversion function	Usage
CO-6	To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.	Usage
CO-7	To learn the Exception Handling: try --catch and finally block, making user-defined exceptions.	Usage
CO-8	To learn the Unified Modeling Language (UML): Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams.	Familiarity

Course Contents:

Unit	Contents	Lectures required
1	Structured versus Object-Oriented programming, Object-Oriented paradigm. Defining Objects, Classes, Data members, Member functions, Constructors and Destructors in C++. Inline Functions, Friend Functions, Constant member functions, and Static members (static data and static member functions). Function overloading, Operator overloading and Conversion functions. Using the concepts of File handling	**12**
2	Polymorphism and Inheritance in C++. Abstract classes, virtual function, pure virtual functions, and virtual base classes in C++.	**6**
3	Function templates and Class templates	**3**
4	Introduction to Java and its features. Defining Classes in Java, Wrapper classes, Packages and Exception handling in Java	**7**
5	Inheritance and Interfaces in Java. Abstract class, abstract methods,	**5**

	final class and final method in Java	
6	Basic principles of Software engineering. System analysis, design, testing and debugging. Unified Modeling Language (Class Diagram, Use Case Diagram, State Diagram, Sequenced Diagram, Communication Diagram, Activity Diagram)	**9**
Total lectures		**42**

Suggested Text Book(s):

1. Lafore R., Object oriented programming in C++, Waite Group
2. Java 2: The Complete Reference, Fifth Edition -- by Herbert Schildt
3. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design

Suggested Reference Book(s):

1. Stroustrap B., The C++ Programming Language, Addison Wesley
2. Bruce Eckel, Thinking in C++
3. Bruce Eckel, Thinking in Java

Other useful resource(s):

1. Link to NPTEL course contents:

    a. https://onlinecourses.nptel.ac.in/noc16_cs17/preview
    b. http://www.nptelvideos.com/java/java_video_lectures_tutorials.php
    c. https://onlinecourses.nptel.ac.in/noc17_cs25/announcements

2. Link to topics related to course:

    a. https://www.tutorialspoint.com/cplusplus/
    b. http://www.cplusplus.com/doc/tutorial

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Internal Assessment	25	Entire Semester	Assignment Quizzes Attendance

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes (Object-Oriented Systems and Programming)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**

CO-2	3	3	3	2	1	1	2	3	2	3	3	3	**2.4**
CO-3	3	3	2	2	2	1	2	2	2	3	3	3	**2.3**
CO-4	3	3	3	2	2	1	2	3	2	3	3	3	**2.5**
CO-5	3	3	3	3	2	1	2	3	2	1	3	3	**2.4**
CO-6	3	3	3	3	2	3	2	3	2	2	3	3	**2.7**
CO-7	3	3	2	2	2	3	3	2	2	3	3	3	**2.6**
CO-8	3	3	3	3	3	2	3	3	2	1	3	1	**2.5**
Average	**3**	**3**	**2.8**	**2.5**	**2**	**1.8**	**2.4**	**2.8**	**2**	**2.4**	**3**	**2.8**	

Object-Oriented Systems and Programming Lab

COURSE CODE: 18B17CI371

COURSE CREDITS: 2

CORE/ELECTIVE: CORE

: 0-0-4

Pre-requisite: None

Course Objectives:

1. To use object modelling technique to analyze problem requirements, design a solution to the problem and then implement the solution in Object-Oriented Programming Language(s) or database.
2. To strengthen their problem solving ability by applying the characteristics of an object-oriented approach.
3. To strengthen ability to design and represent solutions to problems using UML notations.
4. To introduce object-oriented concepts in C++ and Java.

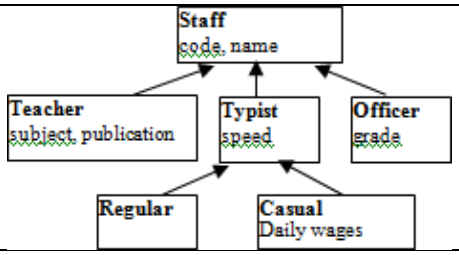
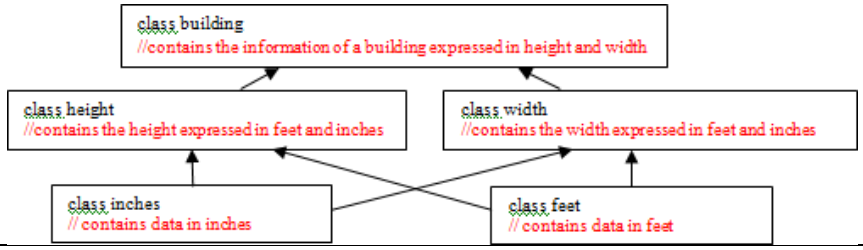
Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	To learn the concepts of Objects, Classes, Methods, Constructors and Destructors	Usage
CO2	To learn the designing of complex classes: Friend Functions and Static member functions, Inline functions, constant functions.	Usage
CO3	To learn Inheritance: Single Inheritance, Multiple Inheritance, Multi-level Inheritance, Hierarchical Inheritance and Hybrid Inheritance.	Usage
CO4	To learn the concept of Abstract classes and interfaces	Usage
CO5	To learn the concepts of Operator overloading and conversion function	Usage
CO6	To learn File Handling. Writing and reading data from the file, reading and writing the objects into the file.	Usage
CO7	To learn the Exception Handling: try --catch and finally block, making user-defined exceptions.	Usage
CO8	To learn the Unified Modeling Language (UML): Use Case Diagrams, State Diagrams, Sequence Diagrams, Communication Diagrams, and Activity Diagrams.	Familiarity

List of Experiments

S.No	Description	Hours
1	Create a class called Complex in C++ for performing arithmetic with complex numbers. Use double variables to represent the private data of the class. Provide public member functions for each of the following: *(Define all the member functions outside the class)* a) Enter the values of real and imaginary part. b) Addition of two Complex numbers: (The real parts are added together and the imaginary parts are added together. c) Subtraction of two Complex numbers. (The real part of the right operand is subtracted from the real part of the left operand and the imaginary part of the right operand is subtracted from the imaginary part of the left operand. ***d)*** Printing Complex numbers in the form: **a + b *i***	**2**
2	Define a class in C++ to represent a bank account. Include the following members:	**2**

	Data members: a) Name of the depositor b) Account number c) Type of account d) Balance amount in the account ***Member functions:*** *(Define all the member functions inside the class)* a) To assign initial values b) To deposit an amount c) To withdraw an amount after checking the balance d) To display name and balance Write a main function to create a database of 10 customers	
3	a) Employees have a number, date of birth (dd-mm-yyyy), rank, and salary. When an employee is first recruited then all these are given values of 0. Upon confirmation, the actual values of these are entered for the employee. Their rank can be incremented by 1 and when this happens an employee gets an increment of 25%. Write a C++ class for Employee. b) Students are registered in a University. When students are created then they are given default values (zeroes or blanks) for roll_number, department, year, and semester of study. At registration time, the values of these attributes of student are updated with the proper values. Students can be promoted and their departments can be changed. Write a C++ class for Student.	**2**
4	Users of the computer have profile which consists of Name, Password, and Access Rights. Access rights take on values X, R, W, and ALL. It is possible to have default values for Password and Access rights which are the first three letters of the Name and ALL respectively. Users can change their password and access rights. Write a class User in C++ and create a user named Rajesh.	**2**
5	Define two classes Distance1 and Distance2 in C++. Distance1 stores distance in miles and Distance2 in kmeters & meters. Write a program that reads values of the class objects and adds one object of Distance1 with the object of Distance2 class. The display should be in the format of miles or kmeters & meters depending on the type of object (Distance1 or Distance2) being used to invoke the function. (Hint: Make use of friend function).	**2**
6	Implement a singleton class in C++. A class whose number of instances that can be instantiated is limited to one is called a singleton class. (Hint: make use of static members).	**2**
7	Imagine a publishing company that markets both books and audio- cassette version of its works. Create a class Publication in C++ that stores the title (a string) and price (type float) of a publication. From this class derive two classes: Book, which adds a page count and Tape, which adds playing time in minutes. These classes should have getdata() function to get its data from the user and the putdata() function to display its data. Write a main() program to test the book and tape classes by creating instances of them, asking the user to fill in their data with getdata() and displaying the data with putdata().	**2**
8	Implement the class hierarchy as shown in the following figure (using C++).	**2**

		
19	The database created in the experiment 8 does not include educational information of the staff. It has been decided to add this information to teacher and officers (not for typists) which will help the management in decision making with regard to training, promotion, etc. Add another data class called Education that holds two pieces of education information, namely, highest qualification in general education and highest professional qualification. The class should be inherited by the class Teacher and Officer. Modify the program of above exercise to incorporate these additions. Include overloaded constructors in all above classes.	**2**
10	Implement the class hierarchy shown in the following figure, using C++. Define appropriate member functions (including constructors and destructors) to convert feet class object into inches class object and vice versa. Also the objects of the feet and inches constructors should construct their objects using the constructors of the height and width constructor which in turn call building constructor.	**2**
		
11	Define a class Directory with members: name and phone number. Use the class object to store each set of data into a text file "phone.txt". The names contain only one word and the names and telephone numbers are separated by white spaces. Write a C++ program to read the file and output the list in two columns, such as: John 23456 Ahmed 9876	**2**
12	Write an interactive, menu-driven program that will access the file created in the experiment 11 and implement the following tasks: Determine the telephone number of the specified person. b) Determine the name if a telephone number is known. Update the telephone number, whenever there is a change	**2**
13	Define a class Queue in C++ that contains elements of type integer. Define two operators on Queue, „+" to insert an element in it and „–„ to remove and element from it. Use the friend function approach first and then the one without friends	**2**
14	A programmer wants to manipulate arrays. Two arrays are equal if (a) they have the same dimension, (b) are of the same size, and (c) contain identical values in their corresponding elements. Comparison is done using the operator „= =" which returns true or false. Also, arrays can be copied to one another using the operator „=". Implement the foregoing using the friend function approach first and then the one without friends. Which one is preferable and why?	**2**
15	An istream class overloads the >> operator for the standard types [int, long, double, float, char]. For example, the statement cin >> x ; calls the appropriate >> operator function for the istream class defined in iostream.h and uses it to direct this input	**2**

	stream into the memory location represented by the variable x. Similarly, the ostream class overloads the << operator, which allows the statement cout << x to send the value of x to ostream cout for output. Overload these operators to enter the object‟s data members through input operator >> and display the values of these members by using the output operator <<.	
16	Define a class Distance in C++ with data members: kmeter and meter. Define conversion function to convert Distance object into distance in miles (float type). Also make use of constructor to convert distance in miles (float type) into object of Distance class.	**2**
17	Define two classes Polar and Rectangle (using C++) to represent points in polar and rectangle systems. Use the conversion routines to convert from one system to the other.	**2**
18	Define a function template in C++ to sort an array of elements of int type, string type, float type and user-defined type Distance with data members: kmeter & meter.	**2**
19	Define a template class LinkedList in C++ with the following member functions: createList(), displayList(), insertElement(), and deleteElement(); In the main() function invoke above functions for the list of integer numbers, floating numbers and complex numbers.	**2**
20	Define a class Employee in Java with members: name, age and salary and methods: enterData() to enter the record of the employee through keyboard: displayData() to display the details of the employee. Define two user defined exceptions that are thrown when) The name entered has numeric character(s).) The age of the person is less than 18 or greater than 60.	**2**
21	Write a program in Java that demonstrates handling of exceptions in inheritance tree. For example, create a base class called “Father” and derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge() where the input age <0. In Son class, implement a constructor that uses both father and son‟s age and throws an exception if son‟s age is >= father‟s age.	**2**
22	Define a class Person in the package MyPackage. The class has data members as: name, age, address and Methods to enter the data through keyboard and display them. Make use of overloaded constructors in the class. Now, import the above class and inherit the class Employee from this. The sub-class should have overloaded functions and also call to the base class constructors. In the main class, define a database of 5 objects and display them.	**2**
23	Define an abstract class Shape in Java, with two abstract functions: enterData() and displayArea(). Define two classes Circle and Rectangle inside a new file that inherit the class Shape and implement the abstract functions in their own way. Illustrate the concept of dynamic binding in this program.	**2**
24	Find the source code for the Vector class in the Java source code library that comes with all Java distributions. Copy this code and make a special version called intVector that holds only integers. Consider what it would take to make a special version of Vector for all the primitive types. Now consider what happens if you want to make a linked list class that works with all the primitive types. If parameterized types are ever implemented in Java, they will provide a way to do this work for you automatically.	**2**

25	Create a class MyString in Java containing a String object so that you initialize in the constructor using the constructor‟s argument. Add a toString() method and a method concatenate() that appends a String object to your internal string. Implement clone() in MyString. Create two static methods that each take a myString x handle as an argument and call x.concatenate(“test”), but in the second method call clone() first. Test the two methods and show the difference effects.	
26	**Design the USE-CASE diagram for the following:** A description of the behavior of an automated telling machine (ATM) is given below: A user begins a transaction at the ATM by entering a bank card. If the card is readable by the machine the user is prompted to enter their personal identification number (PIN). Once this number has been entered, a menu is presented to the user containing the following options: show account balance, withdrawal with receipt and withdrawal without receipt. If the user selects one of the withdrawal options, they are prompted to enter an amount of money to withdraw; the amount entered must be a multiple of 10. The user‟s PIN is validated when the ATM sends the details of the transaction to the bank‟s remote computer. If the PIN is invalid, the user is given the option of re-entering it and the selected transaction is retired. This is repeated if the new PIN is also invalid. Once three invalid PINs have been entered, the transaction processing depends on the transaction type selected. For a show balance transaction, the balance is displayed on the screen and after they have confirmed this, the user is returned to the transaction menu. A withdrawal transaction may fail if the user has executed the amount of money that can be withdrawn from the account; in this case an error message is displayed and, after confirmation, the user is returned to the transaction menu. Otherwise, the user‟s card is returned and the money is issued, followed by the receipt if required. At any point where user input, other than a simple confirmation, is required, a cancel option is provided. If this is selected, the user‟s card is returned and their interaction with the ATM terminates.	**2**
27	**Design the Collaboration and Sequence diagram for the following:** Many word processors, graphical editors and similar tools provide cut, copy and paste operations by means of some kind of a clipboard facility. At run-time suppose that such a system consists of an instance of an Editor class linked to a number of instances of a Element class. Elements are the items manipulated by a tool, such as words or shapes. Some of the elements may have been selected by the user. The editor is also linked to an instance of a Clipboard class, which in turn maintains links to all the elements that have been placed in the clipboard. An element cannot simultaneously be displayed by the editor and on the clipboard. Draw a collaboration showing a configuration where there are several elements displayed by the editor and one element on the clipboard. Assume that the selected elements are identified by an additional link	**2**
	from the editor. Draw a sequence diagram showing what happens when the editor receives a cut message from a client. The effect of this is that all the currently selected elements are moved to the clipboard.	

	Draw a sequence diagram showing what happens when the editor receives a paste message from a client. The effect of this is that all the elements on the clipboard are moved back to the editor. Draw a sequence diagram showing what happens when the editor receives a copy message from a client. The effect of this is that all the currently selected elements are copied to the clipboard. Assume that elements implement a clone operation, which returns a exact copy of the element. Draw equivalent collaboration diagrams for each of your answers.	
28	**Draw a state diagram expressing these facts about the display of windows.** A window in a window management system on a computer can be displayed in one of the three states: maximized, where it takes up the entire screen; normal, where it is displayed as a small icon. When a window is opened, it will be displayed as a normal window, unless minimize on use has been selected, in which case it will be displayed as an icon. A normal window and an icon can be maximized; a maximized window and a normal window can be minimized or reduced to an icon. Maximized windows can be restored to their normal size and icons can be restored to the size they had before they were minimized. Icons and normal windows can be moved as normal windows can also be resized. No matter how it is displayed, a window can always be closed.	**2**
Total Lab hours		**56**

Suggested Books/Resources:

1. Lafore R., Object oriented programming in C++, Waite Group
2. Java 2: The Complete Reference, Fifth Edition -- by Herbert Schildt
3. Satzinger, Jackson, Burd, Object-Oriented Analysis & Design
4. Stroustrap B., The C++ Programming Language, Addison Wesley
5. Bruce Eckel, Thinking in C++
6. Bruce Eckel, Thinking in Java

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Average
CO1	3	3	3	3	2	2	3	3	2	3	3	3	**2.8**
CO2	3	3	3	2	1	1	2	3	2	3	3	3	**2.4**
CO3	3	3	2	2	2	1	2	2	2	3	3	3	**2.3**
CO4	3	3	3	2	2	1	2	3	2	3	3	3	**2.5**
CO5	3	3	3	3	2	1	2	3	2	1	3	3	**2.4**
C06	3	3	3	3	2	1	2	3	2	2	3	3	**2.5**
CO7	3	3	2	2	2	3	3	2	2	3	3	3	**2.6**
CO8	3	3	3	3	3	2	3	3	2	1	3	1	**2.5**
Average	**3**	**3**	**2.8**	**2.5**	**2**	**1.5**	**2.4**	**2.8**	**2**	**2.4**	**3**	**2.8**	

Database Management Systems

COURSE CODE: 25B11CI313

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 3-0-0

Pre-requisite: Introduction to Computer Programming, Discrete Mathematics, Data Structures

Course Objectives:

1. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
2. To understand and use data manipulation language to query, update, and manage a database.
3. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
4. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Explain the characteristics, architecture of database approach, its components, different data models and the examples of their usage.	Remember, Understand
CO-2	For a given specification of the requirement, design the databases using E-R method and normalization.	Apply
CO-3	For a given query write relational algebra expressions for that query and optimize the developed expressions.	Apply
CO-4	Determine the functional dependency between two or more attributes, compute the closure of a set of attributes, evaluate a proposed decomposition	Evaluate
CO-5	Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.	Apply
CO-6	Familiarize with the security in databases and gaining familiarity with other popular databases used in the industry	Remember, Understand

Course Contents:

Unit	Contents	Lectures required
1	Fundamentals of Database and Database Management System, Physical Level of Data Storage, Structure of Relational Database, Table, Attributes, Records	**3**
2	Introduction to SQL, Data Types in SQL, Operations on Single Table like Create, Insert, Delete, Update, Alter, etc., SQL Queries on Single Table using Select Statement with or without Where and Group By Clause, etc., Overview of No SQL Databases	**4**
3	Database Design and ER Model, Entity type, Attributes, Relation types, Notations, Constraints, Extended ER Features	**5**
4	Relational Model and Structured Query Language, Data Definition and Data Manipulation, Relational Algebra	**7**
5	Procedural Language, PL/SQL, Stored Procedures, Functions, Cursors, Triggers	**5**
6	Functional Dependency & Normalization, Data Dependencies, 2NF, 3NF, BCNF, Building Normalized Databases	**8**
7	Transaction Management, ACID properties of Transactions, Need of Concurrency, Concurrency Control Techniques, Deadlocks, Database Recovery System, Database Security and Authorization	**10**
Total lectures		**42**

Suggested Text Book(s):

1. R. Elmasri, S. B. Navathe , "Fundamentals of Database Systems", Pearson Education.
2. H. F. Korth, A. Silberschatz, S. Sudarshan, “Database system concepts”, McGraw-Hill Ellis.
3. C. J. Date, “An Introduction to Database Systems”, Pearson Education.
4. Bayross, “SQL, PL/SQL – The Programming Language of Oracle” BPB Publications.

Suggested Reference Book(s):

1. J. D. Ullman, J Windon, “A First Course in Database Systems”, Pearson, Education.
2. R. T. Watson, “Data Management: Databases and Organization”, Wiley.

Other useful resource(s):

1. Link to NPTEL Course Contents:
   https://archive.nptel.ac.in/courses/106/105/106105175/

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) -10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	Average
CO-1	2	2	2	2	2	1	1	1	2	2	2	**1.73**
CO-2	2	3	3	3	3	1	1	1	2	2	1	**2**
CO-3	2	2	2	2	3	1	1	1	2	2	1	**1.73**
CO-4	2	3	3	3	2	1	1	1	2	3	2	**2.09**
CO-5	1	2	2	1	3	2	1	1	1	1	1	**1.45**
CO-6	1	2	2	1	3	2	1	1	1	1	1	**1.45**
Average	**1.6**	**2.3**	**2.3**	**2.2**	**2.0**	**1.3**	**1**	**1**	**1.6**	**1.8**	**1.3**	

Database Management Systems Lab

COURSE CODE: 25B17CI373

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basics of Programming Language

Course Objectives:

1. To develop the ability to design, implement and manipulate databases.
2. To build database management systems.
3. To apply DBMS concepts in real life applications.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO1	Design and implement a database schema using Structured Query Language	Apply
CO2	Design different views of tables for different users and to apply embedded and nested queries	Apply
CO3	Understand, analyze and apply common SQL statements including DDL, DML, DCL statements to perform different operations	Evaluate, Apply
CO4	Develop application programs using PL/SQL	Apply

List of Experiments

S. No	Description	Hours
1	To implement Data Definition language and Data Manipulation Language commands: Create database/table, alter, drop, truncate, Insert, Select, Update, Delete etc.	**2**
2	To implement Constraints as a part of Data Definition language: Primary key, Foreign Key, Check, Unique, Null, Not null, Default, Enable Constraints, Disable Constraints, Drop Constraints	**2**
3	To practice in Built Functions: Date functions, numerical functions, character functions, conversion functions, group functions, count functions etc.	**2**
4	To practice group by, having clause and special operators such as between, like, in etc.	**2**

5	To practice Set Operators Union, Intersect, Minus, Except	**2**
6	To implement Views from Single and Multiple Tables	**2**
7	To implement the ER Diagram modelled for different problems	**2**
8	To implement and practice PL/SQL control structure if, if then else, else if, nested if, for and while loop	**2**
9	To implement PL/SQL Procedures and Functions	**6**
10	To implement Cursors and Triggers	**2**
11	To implement Transaction Processing Commands: Commit, Rollback, Save Point and Time Stamps	**2**
12	To implement Data Control Language Commands: Grant and Revoke	**2**
Total Lab hours		**28**

Suggested/Resources:

1. I. Bayross, “SQL, PL/SQL – The Programming Language of Oracle” BPB Publications.
2. R. Elmasri, S. B. Navathe," Fundamentals of Database Systems", Pearson Education.
3. H. F. Korth, A. Silberschatz, S. Sudarshan, “Database system concepts”, McGraw-Hill Ellis.

Evaluation Scheme:

S. No	Exam	Marks
1	Mid Sem. Evaluation (P-1)	20
2	End Sem. Evaluation (P-2)	20
3.	Internal Assessment (P-3) (May include attendance, class participation, lab file records, experiment execution, viva voce, quizzes, mini-projects etc.)	60
	Total	**100**

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	Average
CO-1	3	2	2	2	3	1	1	1	1	1	2	**1.73**
CO-2	3	3	3	3	3	2	1	2	2	1	2	**2.27**
CO-3	3	3	2	3	3	2	1	2	2	1	2	**2.18**
CO-4	3	3	3	3	3	2	1	2	2	1	2	**2.27**
Average	**3**	**2.75**	**2.5**	**2.75**	**3**	**1.75**	**1**	**1.75**	**1.75**	**1**	**2**	

Probability and Random Processes

COURSE CODE: 25B11MA311

COURSE CREDITS: 4

CORE/ELECTIVE: CORE

L-T-P: 3-1-0

Pre-requisite: Knowledge of Differential/Integral Calculus from Engineering Mathematics - I & II.

Course Objectives: On successful completion of this course, students will be able to

1. Understand different types of random variables and study probability distributions of practical importance.
2. Equip students with foundational statistical tools for summarizing and interpreting data, and to develop their ability to construct and evaluate statistical models for solving real-world data analysis.
3. Learn and apply stochastic processes as mathematical models for random phenomena evolving in time.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	Understand the basic probability concepts; understand the axiomatic approach of probability theory and compute probabilities; and apply Bayes' theorem to update posterior probabilities by incorporating prior probabilities.	Familiarity & Usage
CO-2	Recognize random variables of random experiments, describe probability distributions using moments; compute probabilities for various events using appropriate probability distributions as models; demonstrate proficiency in generation of random numbers.	Familiarity & Assessment
CO-3	Formulate and interpret basic statistical measures such as central tendency, dispersion, skewness, kurtosis, covariance, and correlation, and apply them to evaluate statistical parameters for discrete distributions including binomial and Poisson models.	Assessment & Usage
CO-4	Construct and evaluate statistical models such as multiple linear regression and logistic regression to solve data classification and prediction problems in data mining contexts.	Assessment & Usage
CO-5	Understand and describe stochastic processes; determine correlation and covariance of stationary random processes; analyze and apply stochastic processes in the context of communication models, demonstrating proficiency in modeling random phenomena over time.	Familiarity & Usage

Course Contents:

Unit	Contents	Lectures
1	**Basic probability:** Random experiments; probability axioms; combinatorial probability; conditional probability; multiplication rule - independence of events and repeated independent trials, Bayes' theorem.	**8**

2	**Random variables and distributions:** Concept of random variables (RVs); probability mass functions, density functions and cumulative distribution functions; expectation, variance and MGF of RVs; joint, marginal, and conditional densities, distribution of sum of two independent RVs; modeling and probability calculations with discrete and continuous distributions: binomial, Poisson, exponential, uniform, and univariate/ multivariate Gaussian distributions; simulation of RVs – generating random numbers.	**12**
3	**Basic Statistics & Statistical Modeling:** Measures of central tendency & dispersion: evaluation of statistical parameters for binomial and Poisson distributions; interpretation of skewness and kurtosis; concept of covariance and correlation; statistical models for data mining: multiple linear regression, and logistic regression in data classification problems.	**12**
4	**Stochastic Processes:** Probabilistic structure of a random process X(t); statistical averages: mean, auto-correlation, auto-covariance functions of X(t); strict-sense stationary & wide-sense stationary processes; Markov chain and *n*-step transition probability matrix; Gaussian process - covariance matrix; random processes in signal processing - modeling noise in communication systems.	**10**
	Total Lectures	**42**

Suggested Text Book(s):

1. Jay L. Devore, "Probability and statistics for engineering and the sciences", Cengage, 9th Edition, 2015.
2. Henry Stark and John W. Woods, "Probability and random processes with applications to signal processing", Pearson Education, 4th Edition, 2011.

Suggested Reference Book(s):

1. Richard A. Johnson, Irwin Miller, and John E. Freund, `` Miller & Freund's Probability and statistics for engineers", Pearson Education, 8th Edition, 2015.
2. Oliver C. Ibe, "Fundamentals of applied probability and random processes", Elsevier, 2nd Edition, 2014.

Evaluation Scheme:

S. No.	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1.0 Hours	Syllabus covered up to T-1
2	T-2	25	1.5 Hours	Syllabus covered up to T-2
3	T-3	35	2.0 Hours	Entire Syllabus
4	Teaching Assessment	25	Entire Semester	Assignment (2) - 08 Quizzes (3) - 12 Attendance - 05

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (PTRP)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	Average
CO-1	3	3	1	1	1	1	1	1	1	1	2	**1.5**
CO-2	3	3	1	2	2	1	1	1	1	1	2	**1.6**
CO-3	3	3	2	3	3	3	1	1	1	1	3	**2.2**
CO-4	3	3	3	3	3	3	1	1	1	2	3	**2.4**
CO-5	3	2	2	2	3	3	2	1	1	1	3	**2.1**
Average	**3.0**	**2.8**	**1.8**	**2.4**	**2.4**	**2.0**	**1.2**	**1.0**	**1.0**	**1.2**	**2.6**	

Detailed Syllabus
Lecture-wise Breakup

Course Code	25B11EC311	**Semester: Odd**	**Semester III Session 2025-26** **Month** from July-Dec
Course Name	DIGITAL SYSTEMS & COMPUTER ORGANIZATION		
Credits	3	**Contact Hours**	3

Faculty (Names)	**Coordinator(s)**	Dr. Nilufar Yasmin
	Teacher(s) (Alphabetically)	Dr. Nilufar Yasmin

	COURSE OUTCOMES		**COGNITIVE LEVELS**
	EBIT217.1	Explain Number systems, Boolean algebra, Basics of Computer Systems, Instruction sets and I/O organizations.	Understand (C2)
	EBIT217.2	Implement digital logic techniques for designing Combinational circuits, and Flip flops.	Apply (C3)
	EBIT217.3	Analyze various Sequential circuits and examine the behavior of Memory hierarchy, Cache mapping techniques, and Virtual memory systems	Analyze (C4)
	EBIT217.4	Evaluate the performance trade-offs of different CPU design approaches, including hardwired vs. microprogrammed Control.	Evaluate (C5)

Module No.	**Title of the Module**	**Topics in the Module**	**No. of Lectures for the module**
1	Number System, Boolean Algebra	Number systems: Binary, Octal, Hexadecimal, Boolean algebra: logic gates, K-maps; SOP/POS.	5
2	Combinational Circuits	Half Adder, Half Subtractor, Full Adder, Full Subtractor, Multiplexer, Demultiplexer, Encoder, Decoder, Comparator and Code Converter	7
3	Sequential Circuits	Flip Flops: SR, JK, Master Slave JK, T And D; Excitation Tables, Conversion of Flip-Flops Synchronous and Asynchronous Counters, Design of Counters Using Flip- Flops Analysis of Sequential Circuits, State Diagram Design, Registers, Shift Registers, Counters Using Shift Registers	10
4	Basics of Computer Systems and Instruction Set Architecture (ISA)	Introduction to Computer Organization, Types of Instructions: Data Movement, Arithmetic, Control Flow, Addressing Modes: Immediate, Direct, Indirect, Register, Indexed, Instruction Formats (RISC vs. CISC Concepts)	7

5	CPU Design and Control Unit	CPU Components: ALU, Registers, Control Unit, Hardwired vs. Microprogrammed Control, Instruction Cycle: Fetch-Decode-Execute, Design of ALU	6
6	Memory & Input-Output Organization	Memory Hierarchy: Cache, Main, Secondary, Cache Memory: Mapping Techniques (Direct, Associative, Set-Associative), Virtual Memory, Paging, TLB, Memory Access Time and Performance, I/O Interfaces and Data Transfer Techniques, Programmed I/O, Interrupt-Driven I/O, DMA.	7
Total number of Lectures			**42**

Evaluation Criteria

Components	**Maximum Marks**
T1	20
T2	20
End Semester Examination	35
TA	25 (Assignment = 10, Quiz = 5, Attendance = 10)
Total	**100**

Program Based Learning: Students will be able to design and simulate digital circuits using multiplexers, decoders, and comparators. Hands-on implementation of flip-flops, counters, and shift registers enhances their practical understanding. Programming ALUs, memory units, and I/O interfaces builds a strong foundation in computer architecture. These skills prepare students for real-world applications in digital and embedded systems.

Recommended Reading material: Author(s), Title, Edition, Publisher, Year of Publication etc.
(Text books, Reference Books, Journals, Reports, Websites etc. in the IEEE format)

1.	M. M. Mano and M. D. Ciletti, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog*, 6th edition, Pearson, 2021
2.	D. A. Patterson and J. L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface (MIPS Edition)*, 5th edition, Morgan Kaufmann, 2013
3.	W. Stallings, *Computer Organization and Architecture: Designing for Performance*, 11th Global edition, Pearson, 2022
4.	Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085," 6th edition, Penram International Publishing, 2013.
5.	Thomas L. Floyd, "Digital Fundamentals, Global Edition," 11th edition, Pearson Education, April 2025.

Digital Systems and Computer Organization Lab

COURSE CODE:25B17CI471

COURSE CREDITS: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Computer Fundamentals

Course Objectives:

1. To understand and implement basic combinational and sequential digital circuits.
2. To analyze and design digital systems using logic gates and flip-flops.
3. To gain hands-on experience with hardware description and simulation tools.
4. To study and implement basic components of computer organization such as ALU, registers, and memory.
5. To develop problem-solving skills for designing and testing digital and computer-based systems.

Course Outcomes:

S.No.	Course Outcomes	Level of Attainment
CO1	Understand and analyze the functionality of basic logic gates and verify their truth tables.	Assessment
CO2	Apply the concepts of logic gates to Design and simulate combinational circuits such as adders, subtractors, decoders, multiplexers, and code converters.	Assessment
CO3	Implement and analyze sequential circuits including SR latch, D flip-flop, and JK flip-flop.	Apply
CO4	Create a 2-bit and 4-bit Arithmetic Logic Unit (ALU) using MATLAB for performing basic operations.	Apply

List of Experiments

S.No	Description	Hours
1	Introduction to MATLAB/ Digital Integrated Circuits.	4
2	To verify the truth tables of basic logic gates(AND,OR and NOT) and their realization using universal logic gates(NAND and NOR) using Digital Integrated Circuits.	2
3	To design a half adder and a full adder circuits using Digital Integrated Circuits and verify their functionality.	2
4	To design a half subtractor and a full subtractor using Digital Integrated Circuits and verify their functionality.	2
5	To design a 2-to-4 decoder and a 3-to-8 decoder using Digital Integrated Circuits and verify their functionality.	2
6	To design a 2-to-1, a 4-to-1, and a 8-to-1 multiplexers using Digital Integrated Circuits and verify their functionality.	2

7	To design a binary-to-gray, and a gray-to-binary code converters using Digital Integrated Circuits and verify their functionality.	2
8	To realize an SR Latch using Digital Integrated Circuits and verify its functionality.	2
9	To realize (i) a D flip flop using Digital Integrated Circuits and verify its functionality. (ii) aJK flip flop using Digital Integrated Circuits and verify its functionality.	4
10	To design a 2-bit and a 4-bit ALUs using Digital Integrated Circuits (or MATLAB) and verify their functionality.	2
11	**Mini Project**: Students will learn about Combinational and Sequential logic circuits and design them using open source software/MATLAB. Additionally, students in group sizes of two-three will realize various applications of Digital Systems employing these circuits.	4
Total Lab hours		28

Suggested/Resources:

1. Salivahanan, S., and S. Arivazhagan. Digital circuits and design.Vikas publishing house PVT Limited. Fifth edition (March 2018)
2. M. Morris Mano, Computer System Architecture, Pearson, 2006.
3. M. M. Mano, "Digital Logic and Computer Design", Pearson Education India.

EvaluationScheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	10 Marks
4	Project	20 Marks
4	Lab Assessment	30 Marks
	Total	100 marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	Average
CO-1	3	3	3	2	2	3	1	1	3	1	2	2.18
CO-2	3	3	3	3	3	3	1	1	1	1	2	2.18
CO-3	3	3	3	3	3	2	1	1	1	1	1	2
CO-4	3	3	3	3	3	3	2	2	1	1	1	2.45
Average	3	3	3	2.75	2.75	2.75	1.25	1.25	1.75	1	1.50	

ECONOMICS

COURSE CODE: 25B11HS311

COURSE CREDITS: 3

CORE/ELECTIVE: CORE

L-T-P: 2-1-0

Pre-requisite: None

Course Objectives:

1. To provide understanding about economics and its applicability to engineering discipline.
2. To apply micro economics concepts and techniques in evaluating business decisions taken by firms.
3. To engage in learning the techniques of economic thinking and decision making.

Course Outcomes:

S. NO.	Course Outcomes	Level of Attainment
CO1	*Understand* the fundamental concepts of micro and macro economics	Familiarity
CO2	*Apply* the concepts of opportunity cost, national income accounting andvarious business forecasting methods.	Assessment
CO3	*Analyze* the concepts of demand, supply, market equilibrium, consumerchoices and production in micro-economic decision making.	Usage
CO4	*Evaluate* the different market structures and their implications on thebehavior of the firm.	Usage

Course Contents:

UNIT	Contents	Lectures Required
1.	**Introduction:** Economics Definition, Basic economic problems, Resource constraints and welfare maximization, Micro and Macroeconomics, Production Possibility Curve, Circular flow of economic activities.	**2**
2.	**Basics of Demand, Supply and Market Equilibrium:** Demand side and supply side of the market, Factors affecting demand & supply, Elasticity of demand & supply–price, income and cross-price elasticity, Market equilibrium price.	**4**

3.	**Theory of Consumer Choice:** Theory of Utility and consumer's equilibrium, Indifference Curve analysis, Budget Constraints, Consumer Equilibrium.	**4**
4.	**Demand Forecasting:** Regression Technique, Time-series, Smoothing Techniques: Exponential, Moving Averages Method	**3**
5.	**Production Theory and Analysis:** Production function. Isoquants, Isocost lines, Optimal combination of inputs. Stages of production, Law of returns, Return to scale.	**3**
6.	**Cost Theory and Analysis:** Nature and types of cost, Cost functions-short run and long run, Economies and diseconomies of scale	**2**
7.	**Market Structure:** Market structure and degree of competition, Perfect competition, Monopoly, Monopolistic competition, Oligopoly	**7**
8.	**National Income Accounting:** Overview of Macroeconomics, Basic concepts of National Income Accounting	**1**
9.	**Macro Economics Issues:** Introduction to Business Cycle, Inflation-causes, consequences and remedies: Monetary and Fiscal policy.	**2**
	Total Lectures	**28**

Suggested Textbooks:

1. H.C. Petersen, W.C. Lewis, *Managerial Economics*, 4th ed., Pearson Education 2001.
2. D. Salvatore, *Managerial Economics in a Global Economy*, 8th ed., Oxford University Press,2015.
3. William A. McEachern, *Micro ECON*, 6th ed., Cengage Learning, 2022.
4. Hal R. Varian. Intermediate Microeconomics, W. W. Norton and Company, 2019.
5. Henderson J., & Quandt, R.E. Microeconomic Theory: A Mathematical Approach. McGrawHill, New Delhi.
6. Mankiw: Principles of Macroeconomics with MindTap, 8thEdition, Cengage Learning, 2022.
7. Olivier Blanchard: Macroeconomics, 7th Edition, Pearson, 2020.
8. Ruder Dutt and Sundaram, Indian Economy, 65th Ed., S. Chand, 2018.
9. D. Salvatore, International Economics, 11th Ed., John Wiley & Sons, 2013.
10. Handa, J. Monetary Economics. Routledge.

Suggested Reference Books:

1. A. Koutsoyiannis. Modern Microeconomics. Macmillan.
2. Sodersten, BO, International Economics. Macmillan Press Ltd. London
3. R Dornbusch, S Fischer and R Startz: Macroeconomics, 12th Edition, TMH, 2018.

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1.	T-1	15	1 Hour.	Syllabus covered upto T-1

2.	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
	Teaching Assessment	25	Entire Semester	Class Performance– 10 MCQ-10 Attendance – 5

Course Outcomes (COs) contribution to the Program Outcomes (POs)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**Average**
CO1	2	2	3	3	2	3	2	3	2	1	3	**2.36**
CO2	3	3	3	3	3	3	2	2	1	1	3	**2.45**
CO3	3	3	3	3	3	3	2	2	2	1	3	**2.54**
CO4	3	3	3	3	3	2	2	2	2	1	2	**2.36**
Average	**2.75**	**2.75**	**3**	**3**	**2.75**	**2.75**	**2**	**2.25**	**1.75**	**1**	**2.75**	**2.43**

Environmental Studies Syllabus

COURSE CODE: 25B11GE411

COURSE CREDITS: 2

CORE/ELECTIVE: Core Course

L-T-P: 2-0-0

Unit	Contents	Lectures required
1	**Humans and the Environment:** Population growth and natural resource exploitation; Global environmental change. The emergence of environmentalism: Anthropocentric and eco-centric perspectives.	2
2	**Natural Resources and Sustainable Development:** Natural resources, their consumption & Protection: Water, Land Energy (Renewable, non-renewable, wind, solar, hydro, Biomass), Mineral, Forest, & Food resources. Concept of sustainable development, its challenges.	3
3	**Environmental Issues: Local, Regional and Global:** Pollution: Impact of sectoral processes on Environment, Types of Pollution-air, noise, water, soil, municipal solid waste, hazardous waste; Transboundary air pollution; Acid rain; Smog. Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. Global change: Ozone layer depletion; Climate change.	3
4	**Conservation of Biodiversity and Ecosystems:** Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches; Major protected areas;	5
5	**Environmental Pollution and Health:** Understanding pollution:	6

	Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. Important air pollutants, Sources of water pollution and adverse health impacts of water pollution on human and aquatic life. Soil pollution and solid waste: Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	
6	**Climate change: Impacts, adaptations and mitigation:** Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. Mitigation of climate change: Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan.	**4**
7	**Environmental Management:** Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. Environmental management system: ISO 14001, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Environmental risk assessment. Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.	**3**
8	**Environmental Treaties and Legislation:** Major International Environmental Agreements. Major Indian Environmental Legislations on wildlife, water, forest, air and biological diversity. The Scheduled Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights); Industry-specific environmental standards; Waste management rules; Major International organizations and initiatives.	**4**
	Total	**30**
9	**Case studies (will be suggestive as part of self study) and fieldwork (part of assignments)**[*]: The students are expected to be engaged in some of the following or similar identified activities and report these activities twice in a week. • Discussion on one national and one international case study related to the environment and sustainable development. • Field visits to identify local/regional environmental issues, make	**20**

	observations including data collection and prepare a brief report. • Documentation of campus biodiversity. • Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.	

* 12 to 15 hrs to these activities in correlating with swatch Bharat Abhiyan and Unnat Bharat Abhiyaan

Suggested Text Book(s):

1. Environmental Studies By: M. P. Poonia and S.C. Sharma, Khanna Publishers
2. Textbook of Environmental Studies for UG Courses - Erach Bharucha, University Press
3. Joseph, B., 2005, Environmental Studies, Tata McGraw Hill, India.
4. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press

Suggested Reference Book(s):

1. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA.
2. Chiras D D.(Ed.). 2001. Environmental Science – Creating a sustainable future. 6th ed. Jones & Barlett Publishers.
3. David Laurance. 2003. Environment Impact assessment, Wiley publications.
4. Chhokar KB, Pandya M & Raghunathan M. 2004. Understanding Environment. Sage publications, NewDelhi .

Other useful resource(s):

1. Issues of the journal: Down to Earth, published by Centre for Science and Environment.
2. Audio visuals from: Discovery, National Geographic etc.
3. https://nptel.ac.in/courses/120108002/
4. https://nptel.ac.in/courses/120108005
5. https://www.india.gov.in/official-website-central-pollution-control-board
6. https://unnatbharatabhiyan.gov.in/

Discrete Computational Mathematics

COURSE CODE: 25B11MA213
COURSE CREDITS: 4
CORE/ELECTIVE: CORE
L-T-P: 3-1-0

Pre-requisite: Basic Mathematics Algebra

Course Objectives

1. To simplify and evaluate any logical expression and to express logical statements in terms of logical connectives, predicates and quantifiers.
2. Use of various set operations, relations and functions concept to solve applied problems.
3. To solve counting problems using elementary counting techniques.
4. To learn and perform various graphs and trees terminologies, traversals & their applications.
5. Problem solving using recursion and recurrence relations by analyzing algorithms.

Course Outcomes: The students will be able to

S. No.	Course Outcomes	Level of Attainment
CO-1	explain partial order relations, Hasse diagram, lattices and recursive functions.	Understanding (C2)
CO-2	solve the difference equations using generating function and Z transform.	Applying (C3)
CO-3	explain the propositional and predicate calculus to check the validity of arguments.	Understanding (C2)
CO-4	demonstrate graphs, digraphs, trees and use it to solve the different problems of graph theory.	Applying (C3)
CO-5	illustrate various algebraic structures and their properties.	Understanding (C2)
CO-6	explain the theory of formal languages and solve the related problems of automata.	Applying (C3)

Course Contents:

Unit	Contents	Lectures required
1	**Relations & Lattices:** Relations and their composition. Pictorial representation, matrix and graphical representations. Equivalence relations and partitions. Partial ordered relations and Hasse diagram. Lattices.	5
2	**Functions:** Functions and recursively defined functions, generating functions, solution of recurrence relations by generating function. Z transforms, solution of difference equations by Z transform	8
3	**Propositional Calculus:** Propositions- simple and compound. Basic logical operators. Implication. Truth tables. Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers.	4
4	**Graphs:** Graphs and related definitions, subgraphs, isomorphism, paths and connectivity. Eulerian graph and Konigsberg 7 problem. Hamiltonian graph. Labelled and weighted graphs. Tree Graphs-Minimum spanning Tree (Prim's algorithm). Graph colorings. Four color problem.	7
5	**Trees & Directed Graphs:** Trees, Digraphs and related definitions. Rooted trees. Algebraic expressions and Polish notation. Sequential representation. Adjacency matrix. Path matrix. Shortest path. Linked representation of directed graphs. Binary trees.	5
6	**Algebraic Structures:** Groups- definitions and examples, order of elements, subgroup, condition for subgroups. Quotient groups, Lagrange theorem and applications, Rings, integral domains and Fields- definition and examples.	7

7	**Languages & Grammars:** Strings (words) and languages, grammars, types of grammars, Finite state machines, finite state automata, regular languages and regular expressions.	6
Total Lectures		**42**

Suggested Text Book(s):

1. K. H. Rosen, "*Discrete Mathematics and Its Applications"*, 7th Edition, McGraw-Hill Education, 2012.
2. C. L. Liu and D. P. Mohapatra, "*Elements of Discrete Mathematics: A Computer-Oriented Approach"*, 4th Edition, McGraw-Hill Education, 2013.

Suggested Reference Book(s):

1. B. Kolman, R.C. Busby & S.C. Ross, "Discrete Mathematical Structures", 6th Edition (New International Edition), Pearson Education, 2014.
2. S. Lipschutz & M. Lipson, "Discrete Mathematics", 3rd Edition, TMH.
3. J.P. Tremblay & R. S. Manohar, "Discrete Mathematical Structures with Applications to Computer Science, TMH, New York 1997.
4. Richard Hammack, "Book of Proof", 2nd Edition, VCU Mathematics Text Book Series

Other useful resource(s):

1. Link to NPTEL course contents: https://onlinecourses.nptel.ac.in/noc18_cs53/preview
2. Link to topics related to course:
   i. https://www.youtube.com/watch?v=xlUFkMKSB3Y
   ii. https://www.youtube.com/watch?v=RMLR2JHHeWo
   iii. https://www.youtube.com/watch?v=9AUCdsmBGmA
   iv. https://www.youtube.com/watch?v=7cTWea9Y

Evaluation Scheme:

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1	T-1	15	1 Hour.	Syllabus covered upto T-1
2	T-2	25	1.5 Hours	Syllabus covered upto T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) - 10 Attendance - 5

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course Outcomes (Discrete Computational Mathematics)	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	3	3	2	1	2	2	2	1	2	3	3	2	**2.2**
CO-2	3	3	3	2	2	2	3	2	2	1	2	2	**2.3**
CO-3	3	3	2	1	1	3	3	3	3	3	1	1	**2.3**
CO-4	3	2	2	1	2	2	2	2	1	2	1	2	**1.8**
CO-5	3	2	2	1	2	3	3	2	1	3	2	1	**2.1**
CO-6	3	2	3	1	1	3	2	1	1	3	2	1	**1.9**
Average	**3**	**2.6**	**2.3**	**1.1**	**1.6**	**2.6**	**2.6**	**1.7**	**1.9**	**2.6**	**2**	**1.4**	

Numerical Analysis for Mathematical Computing

COURSE CODE: 25BS1MA411
COURSE CREDITS: 3
CORE/ELECTIVE: Core
L-T-P: 3-0-0

Prerequisite: Basic knowledge of calculus, linear algebra, and programming fundamentals.

Course Objectives

1. To introduce the concepts of approximation and computational errors involved in numerical analysis.
2. To familiarize students with various numerical methods for solving non-linear equations and interpolation.
3. To enable the application of numerical techniques in solving interpolation, integration, systems of linear equations, and differential equations.
4. To develop the ability to analyse and evaluate numerical methods for accuracy, efficiency, and error estimation in solving mathematical problems.

Course Outcomes

S. No.	Course Outcomes	Level of Attainment
CO-1	Students will be able to relate with the concepts of approximation, errors in computation and roots of non-linear equations.	Familiarity
CO-2	Students will be able to apply numerical methods for finding the roots of non-linear equations	Assessment and Usage
CO-3	Students will be able to apply numerical methods for solution of system of linear equations	Assessment
CO-4	Students will be able to perform interpolation of a polynomial using various techniques.	Assessment and Usage
CO-5	Students will be able to perform numerical Differentiation and numerical Integration	Assessment and Usage
CO-6	Students will be able to solve initial value problems and boundary value problems.	Assessment and Usage

Course Contents

Unit	Contents	Lectures required
1.	**Errors in Computation:** Errors, relative error, absolute error, error in series approximation, round-off and truncation errors.	4
2.	**Roots of Non-linear Equations:** Iterative methods for finding the roots of non-linear equations - Bisection method, Regula-Falsi method, Iterative method, Newton-Raphson method, and Secant method - along with their convergence criteria.	8
3.	**Numerical Linear Algebra:** Solution of systems of linear equations: Gauss Elimination, Gauss-Jacobi, and Gauss-Seidel methods. LU Decomposition and its applications. Power Method for computing the dominant eigenvalue. Singular Value Decomposition (SVD) and its significance in numerical computations.	8
4.	**Interpolation:** Finite differences, Newton's forward and backward interpolation, Central difference formulas, Newton's divided difference formula, Lagrange's interpolation formula.	8

5.	**Numerical Differentiation and Integration:** Approximation of derivatives, Newton-Cote's formulae, Trapezoidal, Simpson's, Boole's and Weddle's rules.	6
6.	**Numerical Solution of Differential Equations:** Euler's method, Modified Euler's method, Fourth order Runge-Kutta and predictor corrector methods for IVPs, Finite difference methods for BVPs.	8
	Total Lectures	**42**

Suggested Textbook(s)

1. R. S. Gupta, *Elements of Numerical Analysis*, 2nd ed., Cambridge University Press, 2015.
2. M. Pal, *Numerical Analysis for Scientists and Engineers: Theory of C Programming*, Narosa Publishing House, 2020.
3. R. L. Burden and J. D. Faires, *Numerical Analysis*, 10th ed., Cengage Learning, MA, 2016.

Suggested Reference Book(s)

1. Jain, M.K., Iyengar, S.R.K. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation 5th Ed., New Age International, New Delhi, 2007.
2. Gerald, C. F., Applied Numerical Analysis, 7th Ed., Pearson 2009.

Online Resources

1. https://www.youtube.com/watch?v=pOtnzAXlXvI&list=PLwdnzlV3ogoUY43XoMwVVCWDSImC9mVQB
2. https://www.youtube.com/watch?v=M8HrMF1kh3c&list=PLOzRYVm0a65d0WWST6wvOP6m7VRQyRgSa

Evaluation Scheme

S. No	Exam	Marks	Duration	Coverage / Scope of Examination
1.	T-1	15	1 Hour	Syllabus covered up to T-1
2.	T-2	25	1.5 Hours	Syllabus covered up to T-2
3.	T-3	35	2 Hours	Entire Syllabus
4.	Teaching Assessment	25	Entire Semester	Assignment (2) - 10 Quizzes (2) -10 Attendance – 5

Course Outcomes (COs) Contribution to the Programme Outcomes (POs)

Course Outcomes Numerical Analysis for Mathematical Computing	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	Average
CO-1	3	2	1	1	2	0	0	0	0	1	0	1
CO-2	3	3	1	2	2	0	0	0	0	1	0	1.27
CO-3	3	3	2	2	3	0	0	0	1	1	1	1.55
CO-4	3	3	2	3	3	0	0	0	1	1	1	1.73
CO-5	3	3	2	3	3	0	0	0	1	1	1	1.73
CO-6	3	3	2	3	3	0	0	0	1	1	1	1.73
Average	3	2.75	1.5	2	2.5	0	0	0	0.5	1	0.5	

R-SOFTWARE LAB

COURSE CODE: 25B17MA471

COURSE CREDIT: 1

CORE/ELECTIVE: CORE

L-T-P: 0-0-2

Pre-requisite: Basic understanding of programming concepts such as variables, loops, and conditional statements. Fundamental knowledge of matrices, vectors, linear algebra operations, statistics and probability.

Course Objectives: On successful completion of this course, students will be able to:

1. Write and execute basic R programs for mathematical and statistical computations.
2. Perform data manipulation, cleaning, and visualization using R libraries.
3. Apply statistical and analytical techniques for data-driven problem solving.
4. Develop R-based solutions for mathematical modeling and computational analyses.

Course Outcomes:

S. No.	Course Outcomes	Level of Attainment
CO-1	**Understand the fundamentals of R programming**: Students will gain knowledge of R syntax, data types, operators, and basic control structures, enabling them to write and execute simple R programs confidently.	Familiarity & Usage
CO-2	**Perform data import, manipulation, and visualization**: Students will learn to handle various data formats, clean and transform datasets, and create informative visualizations using R libraries such as *ggplot2*, *dplyr, etc*.	Familiarity & Assessment
CO-3	**Apply statistical analysis and interpret results**: Students will be able to conduct descriptive and inferential statistical analyses, apply hypothesis testing, regression, and correlation techniques, and interpret outcomes effectively using R.	Assessment & Usage
CO-4	**Develop computational solutions using R**: Students will acquire the skills to implement mathematical models and computational algorithms in R to solve real-world data analysis and optimization problems.	Assessment & Usage

Course Contents:

S. No.	Description	Hours
1	**Introduction to R and RStudio:** Installation of R and RStudio, Advantages of R over Other Programming Languages, R Interface, Workspace, Script Editor, and Basic Commands, Different Packages in R	2
2	**Basic Syntax and Data Types in R:** Variable and Assignments, Finding Variable, Deleting Variables, Operators, Data Types (Numeric, Character, Logical), and Data Type Conversions.	2
3	**Vectors and Matrices:** Creation and Manipulation of Vectors and Matrices; Matrix Operations.	2
4	**Lists and Data Frames:** Lists and Data Frames, Indexing, Sub setting, and Basic Data Handling.	2
5	**Control Structures and Functions:** Logic, Conditional Statements, Loops, and Writing User-defined Functions in R.	2

6	**Importing and Exporting Data:** Working Directory, Importing Data from CSV, Excel, and Text Files; Export Results to External Files.	**2**
7	**Data Cleaning:** Data Cleaning and Manipulation, Filtering, Grouping, and Summarization Techniques using *dplyr* Package.	**2**
8	**Data Visualization:** Basic and Advanced Plots (Bar, Histogram, Scatter, Boxplot, etc.) using *ggplot2*, etc., Labeling of Plots, 3D Visualization, Exporting Plots.	**2**
9	**Descriptive Statistics and Data Summarization:** Measures of Central Tendency and Dispersion (Mean, Median, Mode, Variance, etc.), and Visualize Data Distributions.	**2**
10	**Probability Distributions in R:** Discrete and Continuous Probability Distributions (Binomial, Poisson, and Normal .), Random Number Generalization..	**2**
11	**Hypothesis Testing:** Perform t-Test, Chi-square Test, and ANOVA using built-in R Functions.	**2**
12	**Correlation and Regression Analysis:** Correlation, Simple, and Multiple Linear and Non-linear Regression Analysis in R.	**2**
13	**Advanced Statistical Modeling:** Logistic Regression, Poisson Regression, Generalized Linear Models (GLM), Residual Analysis.	**2**
14	**Resampling Techniques:** Bootstrapping, Cross-Validation (CV), Model Accuracy Estimation.	**2**
Total Lab Hours		**28**

Suggested Text Book(s):

1. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, Advanced R Statistical Programming and Data Analysis, CRC Press, 1st Edition, 2019.
2. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, 1st Edition, 2011.
3. Crawley M. J., The R Book, Wiley, 2nd Edition, Reprint, 2017.
4. Baclawski, K., Introduction to Probability with R, 1st Edition, Reprint, Chapman & Hall/CRC, 2011
5. Kabacoff, R. I., R in Action, Dream Tech Press, 2nd Edition, 2015.
6. Ugarte, M. D., Militino, A. F., and Arnholt, A. T., Probability and Statistics with R, CRC press, 2008

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 Marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs):

Course Outcomes (R-Software Lab)	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**Average**
CO-1	3	1	2	3	2	3	3	3	2	3	2	3	**2.50**
CO-2	3	2	1	2	2	2	3	3	2	2	2	3	**2.25**
CO-3	3	2	2	3	2	3	3	3	2	3	3	3	**2.67**
CO-4	3	2	2	3	2	3	3	3	2	3	3	3	**2.67**
CO-5	3	1	3	2	2	3	3	3	2	3	3	3	**2.58**
Average	**3.00**	**1.60**	**2.00**	**2.60**	**2.00**	**2.80**	**3.00**	**3.00**	**2.00**	**2.80**	**2.60**	**3.00**	

Numerical Analysis for Mathematical Computing Lab

COURSE CODE: 25BS7MA471
COURSE CREDIT: 1
CORE/ELECTIVE: CORE
L-T-P: 0-0-2
Pre-requisite: Basic knowledge of Python programming.

Course Objectives: This course introduces student's theoretical and practical aspects of a relatively wide spectrum of numerical techniques and familiarize the student with numerical coding using Python language. On completion of the course, students will be able

1. To exercise the fundamentals of numerical analysis in the Python environment.
2. To develop programs for various numerical methods in Python programming.

S. No.	Course Outcomes	Level of Attainment
CO-1	Getting familiar with Python, learn data input, vector functions and arrays, understand to write Python functions and implementation.	Familiarity
CO-2	Learn to write and execute programs for solving algebraic & transcendental equation, and system of linear equations & eigen value problems.	Assessment& Usage
CO-3	Learn to write and execute programs for polynomial interpolation.	Assessment& Usage
CO-4	Learn to write and execute programs to perform numerical integration.	Assessment& Usage
CO-5	Learn to write and execute programs for finding numerical solution of ordinary differential equations.	

List of Experiments:

S. No.	Description	Hours
1	Getting started with Python, perform basic calculations, variables and basic data structures.	2
2	Python functions, loop and recursion syntax, reading and writing data inputs, visualization and plotting.	2
3	Error types: absolute, relative and percentage error, avoiding errors.	2
4	To write a program and execute it to find roots of algebraic and transcendental equation using bisection method.	2
5	To write a program and execute it to find roots of algebraic and transcendental equation using Newton-Raphson method.	2
6	To write a program and execute it for solving systems of equations using Gauss Seidel method	2
7	To write a program and execute it for calculating the eigenvalues and	2

	eigenvectors.	
8	To write a program and execute it for LU decomposition and Singular Value Decomposition.	2
9	To write a program and execute it for interpolation using Newton-Gregory' s formula.	2
10	To write a program and execute it for polynomial interpolation using Lagrange's formula.	2
11	To write a program and execute it for numerical integration using Trapezoidal rule.	2
12	To write a program and execute it for numerical integration using Simpson's rule.	2
13	To write a program and execute it for finding numerical solutions of ordinary differential equations (IVP) using Euler's method.	2
14	To write a program and execute it for finding numerical solutions of ordinary differential equations using Runge-Kutta's (RK) method.	2
Total Lab Hours		**28**

Suggested Text Book(s):

1. Qingkai Kong, Timmy Siauw, and Alexandre Bayen, "Python Programming And Numerical Methods: Guide For Engineers And Scientists", Academic Press Inc., 1st Edition, 2020.

Suggested Reference Book(s):

1. Robert Johansson, Numerical Python: Scientific Computing and Data Science Applications with Numpy, SciPy and Matplotlib, APRESS, 2nd Edition, 2019.

Evaluation Scheme:

1	Mid Sem. Evaluation	20 Marks
2	End Sem. Evaluation	20 Marks
3	Attendance	15 Marks
4	Lab Assessment	45 Marks
	Total	100 Marks

Course Outcomes (COs) contribution to the Programme Outcomes (POs)

Course outcomes	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	Average
CO-1	2	2	2	2	2	2	1	1	1	1	1	2	**1.58**
CO-2	3	2	2	2	2	2	1	1	1	1	1	2	**1.67**
CO-3	2	3	3	3	3	2	2	2	3	2	3	3	**2.58**
CO-4	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
CO-5	2	3	3	3	3	3	3	2	3	3	3	3	**2.83**
Average	**2.2**	**2.6**	**2.6**	**2.6**	**2.5**	**2.4**	**2**	**1.6**	**2.2**	**2**	**2.2**	**2.6**	**2.29**