Shree Rahul Education Society's (Regd.)

SHREE L. R. TIWARI COLLEGE OF ENGINEERING

An Autonomous Institute Affiliated to University of Mumbai,

Approved by AICTE & DTE, Maharashtra State | NAAC Accredited, NBA Accredited Program | ISO 9001:2015 Certified |
DTE Code No: 3423 | Recognized under Section 2(f) of the UGC Act 1956 | Minority Status (Hindi Linguistic)

Shree Rahul Education Society's (Regd.)

Shree L.R. Tiwari College of Engineering

Shree L.R. Tiwari Educational Campus,

Mira Road–East, Thane-401107.

Maharashtra, India

www.slrtce.in

An Autonomous Institute Affiliated to the University of Mumbai

Department of Electronics and Computer Science

Curriculum FY A.Y 2026-27

First Year Syllabus

Revision: R-2026

PREAMBLE

"Think. Design. Innovate. – Learning that Leads the Future."

SLRTCE is proud to be among the youngest institutions to attain academic autonomy—an achievement that strengthens our commitment to becoming a world-class centre for socio- economic development and quality education. It is with great pride and purpose that we introduce the restructured curriculum under academic autonomy at SLRTCE. This initiative marks a significant step toward transforming engineering education by equipping our graduates with strong technical foundations, research acumen, interdisciplinary perspective, and an innovation-driven mindset essential for success in today's evolving professional landscape.

1. **Curriculum Design:** Theme-Based, Experiential, and Outcome-Oriented The autonomous curriculum adopts a bottom-up, learner-centric approach aligned with all 12 Program Outcomes. Each semester is driven by a central societal or technological theme, with problem statements rooted in local needs, socio-economic priorities, and the UN Sustainable Development Goals (UNSDGs). Students engage with these challenges through individual projects in the IDEA Lab, integrating social science methodologies with engineering solutions to foster innovation, contextual learning, and socially responsible problem-solving.

2**. Purpose of Autonomy:** Empowering Innovation and Real-World Learning Our pursuit of autonomy is rooted in bridging the gap between academic learning and industry relevance. By integrating undergraduate research through the IDEA Lab—our dedicated innovation and problem-solving hub—students engage with real-world challenges, apply interdisciplinary knowledge, and develop socially impactful solutions. This approach nurtures engineers who are not only technically sound but also responsible and creative thinkers.

3. **Alignment with National Education Policy-2020:** Aligned with NEP 2020, the curriculum emphasizes multidisciplinary, hands-on learning. Through theme-based projects, electives, value-added courses, and flexible assessments, SLRTCE ensures holistic student development driven by real-world application and academic rigor. SLRTCE, as a part of Rahul Education, benefits from being in a network of HEIs. All Higher Education Institutions under Rahul Education can collectively contribute to curriculum development, promoting multidisciplinary studies.

4. **Innovative Pedagogy Initiative by IQAC As part of its transformation strategy**, IQAC has introduced an innovative pedagogy model centred on interdisciplinary research and contextual problem-solving. The IDEA Lab enables students to apply subject knowledge through socially relevant projects, supported by design thinking and faculty mentorship. A two-tier assessment framework—covering both project execution and subject-wise application—ensures academic depth, continuous mentoring, and quality assurance.

5. **Empowering Faculty as Mentors and** Innovators: SLRTCE believes that the success of academic autonomy lies in the hands of its faculty. By empowering educators to think beyond conventional boundaries, we enable them to instil Knowledge, Skills, and Attitudes (KSA) in students while enriching their own professional growth. Faculty serve as research mentors and project guides, supported through structured training in innovation pedagogy and assessment**.**

Sincerely,

IQAC Chairperson
SLRTCE

COO
Rahul Education

PREFACE(BOS)

Dear Colleagues and Esteemed Members of the Board,

It is my pleasure to present the newly revised Electronics and Computer Science curriculum— crafted under our recently granted Autonomous status and in compliance with NEP 2020 Building upon the strong foundational framework of SLRTCE's legacy—where industryoriented, tools-based learning complements core computing principles—this syllabus ushers in a truly student-centric, flexible, and future-ready program. The Electronics and Computer Science (ECS) program at our autonomous institute under Mumbai University is a forward-looking, interdisciplinary course that combines the robust foundations of electronics with the transformative capabilities of computer science. The program equips students with the knowledge and skills needed to design, develop, and optimize intelligent systems, enabling innovation at the intersection of hardware and software. As an autonomous institution, we utilize academic independence to continuously update and enrich the curriculum to reflect emerging technologies and industry demands, including areas such as Internet of Things (IoT), artificial intelligence, embedded systems, robotics, and cyberphysical systems. A key feature of the program is the integration of the Idea Lab, a dynamic innovation ecosystem where students engage in hands-on, project-based learning. This lab nurtures creativity, design thinking, and entrepreneurial mindsets, enabling students to take ideas from concept to prototype, often in collaboration with industry, faculty, and the community. The ECS program strongly emphasizes societal impact. Students are encouraged to develop technology-driven solutions to address real-world challenges, particularly in alignment with the United Nations Sustainable Development Goals (UN SDGs). Whether it is promoting quality education (SDG 4) through ed-tech innovations, enhancing good health and well-being (SDG 3) with biomedical devices, contributing to sustainable cities and communities (SDG 11) through smart systems, or driving climate action (SDG 13) using intelligent environmental monitoring, the curriculum instills a deep sense of purpose and responsibility. Through a balance of theoretical grounding, practical application, ethical awareness, and social commitment, the ECSE program prepares graduates to become technological leaders, responsible citizens, and agents of sustainable development in a rapidly evolving global landscape.

Mrs. Samita Bhandari
Chairperson, Board of Studies (ECS), SLRTCE

Abbreviations

AEC	Ability Enhancement Course
AECL	Ability Enhancement Course Laboratory
AU	Audit Course
BSC	Basic Science Course
BSCL	Basic Science Course Laboratory
CC	Co-Curricular Courses
CEP	Community Engagement Project
ELC	Experiential Learning Course
ESC	Engineering Science Course
ESCL	Engineering Science Course Laboratory
EMC	Entrepreneurship/economics/management courses
HSSM	Humanities Social Sciences and Management
IKS	Indian Knowledge System
INTR	Internship
L	Lecture
LC	Laboratory Course
LLC	Liberal Learning Course
MDM	Multidisciplinary Minor
MDML	Multidisciplinary Minor Laboratory
OE	Open Elective
OJT	On Job Training
P	Practical
PROJ	Project
PCC	Program Core Course
PCCL	Program Core Course Lab
PEC	Program Elective Course
RM	Research Methodology
SL	Self-Learning
T	Tutorial
VEC	Value Education Course
VSEC	Vocational and Skill Enhancement Course

Curriculum Structure and Examination Scheme for B.Tech. in Electronics and Computer Science
(FY with Effect from AY 2026-2027) Curriculum Structure – FY Semester-I Group B

Course Code	Course Type	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)	Examination Scheme				Exam Duration for Theory (in Hrs.)	Term Work	Practical / Oral	Total
												In-Semester Assessment			End Semester Exam (ESE)				
			L	T	P	L	T	P	SL	Notional Learning		IAT-I	IAT-II	Total					
2613111101	BSC	Engineering Mathematics-I	3	1	--	45	15	--	60	120	4	20	20	40	60	2.5	25	–	125
2613111102	BSC	Engineering Chemistry	2	--	--	30	--	--	30	60	2	20	20	40	60	2.5	–	–	100
2613121103	ESC	Basic Electrical & Electronics Engineering	3	--	--	45	--	--	45	90	3	20	20	40	60	2.5	–	–	100
2613121104	ESC	Engineering Graphics	2	--	--	30	--	--	30	60	2	20	20	40	60	2.5	–	–	100
2613211105	PCC	C-Programming	2	--	--	30	--	--	30	60	2	20	20	40	60	2.5	–	–	100
2613112106	BSC Lab	Engineering Chemistry Lab	--	--	1	--	--	15	--	15	0.5	–	–	–	–	–	25	–	25
2613122107	ESC Lab	Basic Electrical & Electronics Engineering Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	–	25
2613122108	ESC Lab	Engineering Graphics Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	–	25
2613212109	PCC Lab	Electronics and web Simulation Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	–	25	25
2613122110	ESC Lab	IDEA Lab-I	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	50	75
2613412111	VSEC	C Programming Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	–	25	25
2698462112	CC	Universal Human Values	1	--	1	15	--	15	15	45	1.5	–	–	–	–	–	25	–	25
Total			**13**	**1**	**12**	**195**	**15**	**180**	**210**	**600**	**20**	**100**	**100**	**200**	**300**	**12.5**	**150**	**100**	**750**

Curriculum Structure and Examination Scheme for B.Tech. in Electronics and Computer Science
(FY with Effect from AY 2026-2027) Curriculum Structure – FY Semester-II Group B

Course Code	Course Type	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)	Examination Scheme				Exam Duration for Theory (in Hrs.)	Term Work	Practical / Oral	Total
												In-Semester Assessment			End Semester Exam (ESE)				
			L	T	P	L	T	P	SL	Notional Learning		IAT-I	IAT-II	Total					
2613111201	BSC	Engineering Mathematics-II	3	1	--	45	15	--	60	120	4	20	20	40	60	2.5	25	–	125
2613111202	BSC	Engineering Physics	2	--	--	30	--	--	30	60	2	20	20	40	60	2.5	–	–	100
2613121203	ESC	Engineering Mechanics	3	--	--	45	--	--	45	90	3	20	20	40	60	2.5	–	–	100
2613211204	PCC	Digital Electronics	3	--	--	45	--	--	45	90	3	20	20	40	60	2.5	–	–	100
2698421205	AEC	Professional Communication & Ethics -I	2	--	--	30	--	--	30	60	2	20	20	40	60	2.5	–	–	100
2613112206	BSC Lab	Engineering Physics Lab	--	--	1	--	--	15	--	15	0.5	–	–	–	–	–	25	–	25
2613122207	ESC Lab	Engineering Mechanics Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	–	25
2613212208	PCC LAB	Digital Electronics Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	–	25	25
2698422209	AECL	Professional Communication & Ethics -I Lab	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	–	25
2613122210	ESC Lab	IDEA Lab-II	--	--	2	--	--	30	--	30	1	–	–	–	–	–	25	50	75
2613412211	VSEC	Python Programming	--	--	2	--	--	30	--	30	1	–	–	–	–	–	–	25	25
2698442212	IKS	Indian Knowledge System	1	--	1	15	--	15	15	45	1.5	–	–	–	–	–	25	–	25
Total			**14**	**1**	**12**	**210**	**15**	**180**	**225**	**630**	**21**	**100**	**100**	**200**	**300**	**12.5**	**150**	**100**	**750**

1. Questions based on self-learning must not be asked in internal assessment and End semester Exam

2. IDEA Lab: The IDEA Lab fosters individual interdisciplinary projects through theme-based, subject-integrated, experiential learning, assessed via standardized rubrics for innovation, application, and documentation.

3. Notional Learning Hours: In higher education, Notional Learning Hours (NLH) indicates the estimated time that a typical learner, at a specific academic level, is expected to invest in order to achieve the set learning outcomes of a course or module. This time includes a range of structured and independent learning activities, each contributing to the development of knowledge and competencies within a module

4. Self-Learning (SL): Self-learning is integrated into both theory and practical subjects, particularly where practical sessions have only one contact hour per week. It emphasizes student-driven efforts in preparing for assignments, practicals, and examinations. Additionally, self-learning includes topics that go beyond the prescribed syllabus to align with current industry trends and requirements. Assessment of self-learning will follow a formative approach. For theory subjects that include term work, 30% of the assignment questions and student presentations/discussions should be based on self-learning topics. In subjects without term work, the corresponding laboratory sessions will incorporate self-learning, carrying a weightage of 30%. The subject with no term work and practical will have no assessment on self-learning topics. This may involve laboratory work using the latest tools or preparing technical write-ups/research papers on advanced topics.

Semester – I

Theme: Environment

Aligned with UNSDG: SDG 3- Good Health and Well-being, SDG 4: Quality Education, SDG 6: Clean Water and Sanitation, SDG 11- Sustainable Cities and Communities, SDG 12-Responsible Consumption and Production. SDG 13- Climate Action, SDG 14- Life below water, SDG 15- Life on Land. SDG 16: Peace, Justice and Strong Institutions

Problem Statement 1:

To study environmental practices and challenges in everyday surroundings.

Problem Statement 2:

To observe and analyze environmental issues in local and institutional contexts.

Problem Statement 3:

To study the impact of human activities on local ecosystems and identify opportunities for environmental improvement.

Problem Statement 4:

To examine waste generation and disposal practices and develop approaches that encourage responsible environmental behaviour.

Problem Statement 5:

To investigate factors affecting environmental quality and propose solutions that support ecological balance

Problem Statement 6:

To study community-level environmental challenges and explore ways to promote sustainable living practices.

Problem Statement 7:

To study how human activities impact the environment in daily life.

Problem Statement 8:

To assess awareness and practices related to environmental sustainability.

Problem Statement 9:

To observe existing systems and behaviours related to environmental conservation**.**

Problem Statement 10:

To study environmental conditions and related concerns in nearby communities.

Semester – II

Theme: Energy

Aligned with UNSDG: SDG 4: Quality Education, SDG 7-Affordable and Clean Energy, SDG 10: Reduced Inequalities,SDG 11: Sustainable Cities and Communities, SDG 12-Responsible Consumption and Production. SDG 13- Climate Action.

Problem Statement 1:

To study energy usage patterns and challenges in everyday life.

Problem Statement 2:

To observe and analyze energy consumption practices in households and institutions**.**

Problem Statement 3:

To analyze patterns of energy consumption in daily life and identify opportunities for improving efficiency.

Problem Statement 4:

To study factors contributing to energy wastage and develop approaches for responsible energy utilization.

Problem Statement 5:

To investigate the relationship between energy use and sustainability in institutional and community settings**.**

Problem Statement 6

To examine challenges associated with energy accessibility and explore solutions that support reliable utilization**.**

Problem Statement 7

To assess awareness and practices related to energy conservation**.**

Problem Statement 8

To study sources, usage, and wastage of energy in daily environments.

Problem Statement 9

To observe existing energy practices and identify opportunities for efficient use.

Problem Statement 10:

To study energy-related issues affecting sustainability and daily living.

SEM-I

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613111101	Engineering Mathematics-I	3	1	--	45	15	--	60	120	4

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613111101	Engineering Mathematics-I	20	20	40	60	2.5	25	--	125

Rationale:

This course builds a strong foundation in essential mathematical tools required for analyzing and solving engineering and scientific problems. It begins with matrices, enabling students to perform algebraic operations and represent complex systems in a structured form. The module on systems of linear equations develops methods to solve multiple simultaneous equations arising in real-world modeling and computations. The study of eigenvalues and eigenvectors helps in understanding the behavior of linear transformations, system stability, and simplifying complex matrix operations. Through similarity and diagonalization, students learn techniques to transform matrices into simpler forms, making computations more efficient and insightful. The topic of partial differentiation introduces multivariable calculus, allowing analysis of functions with several variables and their applications in optimization and rate of change problems. Finally, complex variables and differentiation provide the basis for analyzing complex functions, including conditions for analyticity using the Cauchy-Riemann Equations, which is fundamental in many applied mathematical and engineering contexts. Overall, the course enhances analytical thinking, mathematical reasoning, and problem-solving ability, preparing students for advanced technical studies and interdisciplinary applications.

Course Objectives:

1. To develop understanding of matrix algebra and its applications in solving engineering problems.

2. To enable students to formulate and solve systems of linear equations using analytical and matrix methods.

3. To introduce eigenvalues and eigenvectors and their role in engineering and computational applications..

4. To impart knowledge of similarity transformations and diagonalization for simplifying matrix computations.

5. To build proficiency in partial differentiation for analyzing multivariable functions in engineering contexts.

6. To develop understanding of differentiation of complex functions and their applications in engineering.

Course Outcomes:

1. Apply matrix operations to solve problems in areas such as structural analysis, circuit theory, and data processing across engineering disciplines.

2. Solve systems of linear equations arising in engineering applications such as equilibrium analysis, network circuits, and computational models.

3. Compute and apply eigenvalues and eigenvectors in applications like vibration analysis, signal processing, and data science techniques.

4. Use similarity transformations and diagonalization to simplify and analyze engineering systems and computational problems.

5. Apply partial derivatives to solve problems in optimization, heat transfer, fluid mechanics, and machine learning.

6. Analyze complex functions and apply differentiation concepts, including the Cauchy-Riemann Equations, in fields such as signal processing, fluid flow, and electrical engineering.

Prerequisite:

1. Addition, multiplication, transpose, and inverse of a matrix**.**

2. Review of Complex Numbers-Algebra of Complex Numbers, Cartesian, polar and exponential form of complex number.

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Matrices	Types of Matrices (Symmetric, Skew- symmetric, Hermitian, Skew-Hermitian, unitary, orthogonal matrices and properties of matrices).	07	CO1
		Rank of a matrix using Echelon form, reduction to normal form and PAQ form.		
		Application of matrices to Coding and De-coding.		
		Self-learning Topics: 1. Theorems on sum of symmetric and skew symmetric matrices and similar theorems. 2. Properties of transpose, conjugate of matrices. 3. Idempotent matrix and its properties 4. Nilpotent matrix and its properties 5. Involutory matrix and its properties.	13	
II	System of Linear Equations	System of Linear homogeneous and non–homogeneous equations, their consistency and solutions using rank.	08	CO2
		Linear dependence and independence of vectors. Linear combination of vectors.		
		Solution of a system of linear algebraic equations, by (i) Gauss Jacobi Iteration Method, (ii) Gauss Seidel Iteration Method.		
		Self-learning Topics: 1. Vector Spaces 2. Basis and Dimension 3. Linear Transformations. 4. Rank -Nullity theorem. 5. Inner Product Spaces. 6. Gram Schmidt's Orthogonalization.	12	
III	Eigen values and Eigen vectors	Eigenvalues & eigenvectors of all types of matrices (symmetric, skew symmetric, orthogonal, triangular) and its properties (without proof).	08	CO3

		Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials.		
		Quadratic Forms and its classification(Definiteness using eigen values).		
		Self-learning Topics: 1. Reduction to quadratic forms. 2. Congruent transformation. 3. Rank, signature and index of a quadratic forms. 4. Sylvester's law of inertia.	12	
IV	Similarity and diagonalization of matrix	Similar matrices, diagonalizable matrices, orthogonally diagonalizable matrices.	07	CO4
		Functions of square matrix.		
		Minimal polynomial, Derogatory and non-derogatory matrices.		
		Singular value decomposition (SVD).		
		Self-learning Topics: 1. Orthogonally diagonalization. 2. Triangularization of a matrix 3. Jordan canonical form 4. Rational canonical form.	13	
V	Partial Differentiation	Function of two and three variables, Partial derivatives of first and higher order. Differentiation of composite function.	07	CO5
		Maxima and Minima of a function of two independent variables.		
		Lagrange's Multiplier method with one condition.		
		Self-learning Topics: 1. Euler's Theorem on Homogeneous functions with two independent variables. 2. Euler's Theorem on Homogeneous functions with three independent variables. 3. Deductions from Euler's Theorem.	13	

		4. Total differentials 5. Implicit Functions 6. Lagrange's Multiplier method with two conditions. 7. Maxima and Minima of a function with three independent variables.		
VI	Complex Variables – Differentiation	Circular functions of complex number and Hyperbolic functions. Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof),	08	
		Cauchy-Riemann equations in Cartesian coordinates (without proof, Polar form not included)		CO6
		Milne-Thomson method to determine analytic function f(z) when real (u)or imaginary part (v) is given.		
		Harmonic function, Harmonic conjugate, and orthogonal trajectories.		
		Self-learning Topics: 1. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ. 2. Powers and Roots of a complex number. 3. Logarithm of Complex Number 4. Inverse Hyperbolic Functions. 5. Separation of real and imaginary parts of all types of Functions.	12	

Text Books:

1. Grewal B. S.: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.

2. Kreyszig E.: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

3. Dass H. K.: "Higher Engineering Mathematics", S Chand & Company Ltd, 12th Ed., 2004.

4. Narayan S.: "Differential Calculus", S.Chand Publications, 30th Ed., 2005.

References:

1. Strang G.: "Linear Algebra and its Applications", Cengage Publications, 4th Ed. 2022.

2. Stewart J.: "Multivariable Calculus" Cengage Publications, 7th Ed., 2019.

3. Jain M.K., Iyengar SRK, Jain R K,: "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th Ed., 2007.

4. Bali N.P and Goyal M.: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.

5. Williams G.: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.

6. Wylie C. R, Barrett L.C..: "Advanced Engineering Mathematics" McGraw Hill Book Co., New York, 6th Ed., 2017.

7. Ramana B.V.: "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 1st Ed., 2006.

8. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education, 2015.

9. Lay D. C: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.

10. Pal S. & Bhunia S. C.: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016

Online References:

Sr. No.	Website Name
1.	https://www.math.ucdavis.edu/~daddel/linear_algebra_appl/Applications/applications.html
2.	https://onlinelibrary.wiley.com/doi/10.1155/2016/4854759
3.	https://archive.nptel.ac.in/courses/111/108/111108066/
4.	https://archive.nptel.ac.in/courses/111/104/111104092/

Summary of Internal Assessment (IA) and End Semester Examination (ESE):

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour.**
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions, 10 marks each.**
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613111102	**Engineering Chemistry**	2	--	--	30	--	–	30	60	2

Course Code	Course Name	Examination Scheme					Term work	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)		
		IAT-I	IAT-II	Total				
2613111102	**Engineering Chemistry**	**20**	**20**	**40**	**60**	**2.5**	**--**	**100**

Rationale:

1. Chemical science has contributed in many ways to most of the Engineering branches where "Applied Chemistry" is the modern approach to learn impact of Technology on habitat and can be common to all Core Groups,
2. "Engineering Materials" can be prerequisites to impact of corrosion on metals as many civil engineering materials is the important area of concern.
3. "Advanced polymers and ceramics" are the matter of general approach to all but especially to electronics group as an emerging development in this sector
4. Chemical science has contributed in many ways to most of the Engineering branches where "Applied Chemistry" such as water, polymers, corrosion, electro chemistry, fuels, alloys and ceramics, can be prerequisites to many subjects of all core groups from the perspective of applications as a build material for structural as well as maintenance component in electronics.

Course Objectives:

1. To study effect of hardness of water on various materials used in electronics.
2. To introduce important properties of polymers as Engineering material.
3. To study the effect of corrosion by different mechanisms on metals and methods of corrosion control

4. To recognize importance of alloys and lubricants with their properties and engineering applications.
5. To provide fundamental knowledge of fuels and their energy characteristics and the role of green fuels for sustainable development.
6. To introduce students to the fundamentals of nanomaterials, cement chemistry, and composite materials.

Course Outcomes: Student will be able to –

1. Determine the hardness of water and various method of water hardness removal.
2. Use the polymers for specific engineering applications on the basis of the properties.
3. Understand the causes of corrosion and apply different methods to minimize corrosion.
4. Understand the various alloys and lubricants with their properties and engineering applications.
5. Explain the knowledge of determining the quality of fuel and quantify the oxygen required for combustion of fuel.
6. Explain the knowledge of nanomaterials, Portland cement and composite materials used in engineering applications.

Prerequisite: Knowledge about basic concept of hardness of water.

1. Knowledge of basic properties of polymers.
2. Knowledge of basic mechanism of corrosion.
3. Knowledge of basic difference of ferrous and nonferrous alloys.
4. Knowledge of basic information about fuels.
5. Knowledge of basic information about ceramics.

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Should have basic knowledge of water hardness, polymer properties, and the mechanisms of corrosion. Students should also be familiar with the fundamental differences between ferrous and non-ferrous alloys, as well as basic concepts regarding fuels and ceramics.		
I	Water	Impurities in water, Hardness of water, Types of hardness, Determination of hardness of water by EDTA method and numerical problems based on hardness and EDTA method, softening method of water: -Ion exchange process.	05	CO1

		Desalination of blackish water: electro dialysis, reverse osmosis and ultrafiltration. Definition, significance and numerical problems based on BOD and COD. **Self-learning Topics:** 1. Industrial water treatment in semiconductor manufacturing. 2. Environmental impact of electronic industry wastewater. 3. Water purification technologies in PCB fabrication. 4. BOD & COD monitoring in electronics waste management. 5. Innovations in reverse osmosis and nano-filtration systems.	05	
II	polymers.	**A) Introduction:** i)Definition of polymers, ii) functionality of monomer, iii) degree of polymerization, iv) Classification of Polymers- i) Thermoplastic, ii) Thermosetting. **B) Properties of Polymers: -** i) Molecular weight - Number average molecular weight, Weight average molecular weight, Numerical, ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature, **C) Advanced polymers: -** Conducting polymers: ICP, DCP, ECP, Biomedical polymers, LCP Application of conducting polymers **Self-learning Topics:** 1. Conducting polymers in flexible electronics 2. Application of intrinsically conductive polymers (ICPs) in sensors and OLEDs. 3. Biodegradable polymers in electronic packaging 4. Glass transition temperature and its role in 3D printing of electronic devices 5. Polymer nanocomposites in EMI shielding.	05 05	CO2

III	Corrosion	**A) Introduction:** Definition, Types of Corrosion – i) Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium) **B) Factors affecting rate of corrosion:** i) Position of metal in galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) concentration of medium, vii) moisture, viii) Relative Cathodic and Anodic area, ix) overvoltage **C) Methods to control corrosion:** i) Selection of metal, ii) Proper Designing, iii) Cathodic protection, iv) Use of Corrosion Inhibitors, v) Metallic Coating: galvanization, tinning. **Self-learning Topics:** 1. Corrosion issues in microelectronics and circuit boards. 2.Superalloys used in aerospace industries 3.Nano-coatings for corrosion protection 4.The "magic" of Chromium—how it forms an invisible, self-healing shield over steel. 5. Corrosion in lithium-ion batteries.	05 05	CO3
IV	Alloys & Lubricants	**ALLOYS**: 1) Definition 2) The purpose of making alloy. 3)Types -**A) Ferrous alloys** – Plain-carbon steels, Heat and Shock resisting steels, Stainless steels. Effect of the alloying element- Ni, Cr, Co, Mn, Mo, W and V. **B) Non-Ferrous alloys: A) Aluminum alloys** – Composition, properties and uses of i) Duralumin, ii) Magnalium. **B) Copper alloys –** Composition, properties and uses of i) Brass – Dutch Metal and German Silver and ii) Bronze – Gun metal and Nickel bronze. **C) Alloys of Pb –** Composition, properties and Uses of i) Wood's metal ii) Tinman's solder 4) Lubricants: Definition, Functions of lubrication, Liquid lubricant with its characteristics, Properties of liquid lubricants (Viscosity and viscosity index, Flash point, Fire point, Cloud point, pour point, oiliness, acid value,	05	CO4

		saponification value) Numerical based on acid value and saponification value. **Self-learning Topics:** 1. Smart alloys in actuators and MEMS devices. 2. Ferrous vs. non-ferrous alloys in electronics heat sinks. 3.Bio-lubricants and green lubrication technology. 4. Effect of alloying elements on electrical conductivity. 5. Shape memory alloys in micro positioning systems.	05	
V	Fuels	A**) Fuel:** - Definition, Characteristics of good fuel. B) Calorific value (Definition, Types, Determination, Dulong's formula, Numerical) C) solid fuel: Coal: - Analysis of coal – Proximate analysis, Ultimate analysis, Numerical, Combustion of coal – Numerical **D) petroleum products:** knocking in petroleum products, antiknocking agents, octane number of petrol, Diesel: cetane number. E) Green fuel for sustainable development: Synthesis and Advantages of i) Biodiesel, ii) Ethanol (Power alcohol) **Self-learning Topics:** 1. Biofuel usage in Indian Railways or airlines. 2. Life cycle assessment of fossil vs. alternative fuels. 3. Energy policies promoting ethanol and biodiesel. 4. Innovations in fuel cell technology. 5. Environmental impacts of coal combustion.	05 05	CO5

VI	Chemistry of Engineering materials:	A) Nano materials: fullerene – properties and uses, carbon nano tubes- properties, method preparation and applications of CNT B) Portland cement, chemical composition and constituent of Portland cement, setting and hardening of Portland cement, Use of gypsum, concrete, RCC and decay process of cement. C)Definition, Characteristics of Composites, Constituents of Composites – Matrix Phase and Dispersed Phase (Definition and Functions) Classification of Composites **Self-learning topics:** 1.Graphene and its advanced applications 2.Smart materials (piezoelectric, magnetostrictive materials) 3.Aerogels – ultra-light materials 4.Advanced ceramic materials in electronics 5.Fiber reinforced composites in aerospace (FRP, CFRP)	05 05	CO6

References:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Textbook of Polymer science: F.W. Billmeyer
5. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
6. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
7. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition. 5. J. D. Lee Concise Inorganic Chemistry, Oxford University Press, 5 th edition

Online References:

Sr. No.	**Website Name**
1.	https://archive.nptel.ac.in/courses/103/106/105106205/
2.	https://courses.nptel.ac.in/noc20ch41/preview
3.	https://www.researchgate.net/

4.	https://www.sciencedirect.com/topics/engineering/polymer-material
5..	https://www.sciencedirect.com/topics/chemistry/nanomaterial

Summary of Internal Assessment (IA) and End Semester Examination (ESE):

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour.**
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions, 10 marks each.**
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613121103	Basic Electrical and Electronics Engineering	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613121103	Basic Electrical and Electronics Engineering	20	20	40	60	2.5	--	--	100

Rationale: This course provides foundational knowledge of electrical and electronic principles essential for all engineering disciplines. It covers basic circuit theory, electrical machines, and electronic components like diodes, transistors. Understanding these fundamentals enables students to analyze and troubleshoot simple electrical systems and prepares them for advanced topics in automation, communication, and embedded systems. The course supports interdisciplinary learning and develops essential problem-solving skills for real-world engineering applications.

Course Objectives:

1. To develop a clear understanding of fundamental concepts of DC circuits, including Ohm's Law, Kirchhoff's Laws, and basic circuit components, and to apply them in analyzing simple electrical networks.
2. To introduce the principles of AC circuits (single-phase and three-phase), including RMS values, power factor, and methods of power measurement.
3. To explain the construction, working, performance, and applications of single-phase transformers, including efficiency considerations.
4. To relate the principles of electromagnetic induction to the operation and applications of electrical machines such as DC machines and induction motors.
5. To provide an understanding of semiconductor devices, including diodes and transistors,

and their applications in basic amplifier circuits.

6. To build a foundational understanding of digital systems, including number systems and logic gates, for introductory digital electronics.

Course Outcomes:

1. To apply Ohm's Law, Kirchhoff's Laws, and network theorems such as Thevenin's, Norton's, and Superposition for the analysis of DC circuits in electronic systems.
2. To analyze single-phase and three-phase AC circuits using phasor representation, impedance concepts, and power factor for evaluating voltage, current, and power in different configurations.
3. To explain the construction, working principle, equivalent circuit, and performance parameters (including efficiency) of a single-phase transformer.
4. To illustrate the construction, operating principles, and applications of basic electrical machines such as DC machines and AC motors.
5. To evaluate the characteristics and applications of semiconductor devices, including PN junction diodes, Zener diodes, and BJTs, in electronic circuits.
6. To demonstrate the operation and analysis of basic digital circuits using logic gates and Boolean algebra.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
	Prerequisite	Resistance, inductance, capacitance, series and parallel connection of resistance, concept of voltage, current, power and energy and its units, magnetic circuit, mmf, magnetic field strength, reluctance.		
1	DC Circuits	D.C. circuits and network simplification: series and parallel circuits, Kirchhoff's laws, mesh and nodal analysis. star-delta transformation, Mesh and Nodal Analysis, Source transformation Superposition theorem, Thevenin's theorem, Norton's theorem, maximum power transfer theorem	08	CO1
		Self-Learning: Basic electrical quantities: voltage, current, resistance, and power. Ohm's Law, Kirchhoff's laws, and sign conventions	08	

		Algebra and solving linear equations, basic network terms (node, branch, loop)		
2	AC circuits (Single phase and Three Phase system)	Generation of alternating voltage & current (AC), fundamentals of AC - waveforms, Phasor representation of AC quantities, definitions of time period, amplitude, frequency, phase, RMS value and average value, Peak factor and Form Factor. R, L, C in AC circuits, Series RL, RC and RLC circuits- phase difference and power factor, phasor diagram, series-parallel circuits, active, reactive, apparent power, series resonance. Generation of three-phase voltages, voltage & current relationships in star and delta connections.	08	CO2
		Self Learning: **AC Waveforms & Parameters** – Sine wave, frequency, time period, amplitude **Phasor Representation** – Vector form of AC quantities **RMS & Average Values** – Definitions, formulas, practical significance **Peak Factor & Form Factor** – Understanding waveform shapes	08	
3	Single Phase Transformers	Working principle of single-phase transformer, emf equation of a transformer, transformer losses, actual (practical) and ideal transformer, overview of efficiency	07	CO3
		Self Learning: Working principle and EMF equation of a transformer Transformer losses: core and copper losses Ideal vs. practical transformer. Transformer efficiency and load conditions. Role of transformers in power systems.	07	

4	Electrical Machines	Construction, principle of operation, classification of DC machines, applications of DC generator, DC motor, equation of generated emf/back emf Fundamental principles of rotating machines, construction, working principle and applications of stepper and servo motor	07	CO4
		Self-Learning: Construction, operation, and classification of DC machines EMF and back emf equations in DC machines Basics of rotating machines Stepper and servo motors: construction, working, applications	07	
5	Semiconductor Devices	Semiconductor Basics, Construction, operation and characteristics of PN junction diode, zener diode and bipolar junction transistor.	07	CO5
		Self-Learning: Semiconductor fundamentals: types and properties PN junction diode: construction, operation, and I-V characteristics Zener diode: construction, operation, and voltage regulation Bipolar Junction Transistor (BJT): structure, working, and characteristics.	07	
6	Fundamentals of digital circuits	Number System: Binary, octal, decimal, hexadecimal, their conversion, and arithmetic (binary addition, subtraction using 1's & 2's complement) Logic Gates: AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR universal gates. Boolean algebra, DE Morgan's theorem	08	CO6
		Self Learning: Number systems and conversions Binary addition and subtraction (1's & 2's complement) Boolean algebra basics	08	
	Total		90	

Text Books:

1. B. L. Theraja – Textbook of Electrical Technology, Prentice Hall of India (PHI)
2. B.R Patil – Basic Electrical Engineering, Oxford Higher Education
3. V. N. Mittal and Arvind Mittal – Basic Electrical Engineering, Tata McGraw Hill
4. V. K. Mehta – Principles of Electronics, S. Chand Publishing, New Delhi 7
5. R. S. Sedha – A Textbook of Applied Electronics, S. Chand Publishing, New Delhi
6. Digital Fundamental, 8th edition, Floyd and Jain, Pearson Education India, 2005
7. Electric Motors and Drives Fundamentals, Types and Applications, 3 rd Edition, Austin Hughes, Newnes Publisher.

References:

1. Introduction to Electrical Engineering, M. Naidu, S. Kamakshaiah, McGraw-Hill Education, 2004
2. S. N. Singh, "Basic Electrical Engineering" PHI, 2011
3. Electrical and Electronic Technology, 10th edition Edward Hughes, Pearson Education.

Online References:

Sr. No.	Website Name
1.	https://nptel.ac.in/courses/108108076
2.	https://www.nesoacademy.org/ec/04-analog-electronics/02-semiconductor-diode/01-pn-junction-diode-no-applied-bias
3.	https://onlinecourses.nptel.ac.in/noc21_ee55/preview
4.	https://onlinecourses.nptel.ac.in/noc20_ee60/preview
5.	https://archive.nptel.ac.in/courses/108/105/108105113/

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour**.
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions**, **10 marks each**.
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613121104	Engineering Graphics	2	--	--	30	--	--	30	60	2

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613121104	Engineering Graphics	20	20	40	60	2.5	--	--	100

Rationale:

Engineering Graphics develops spatial visualization and technical drawing skills essential for modern computing applications. It bridges the gap between digital systems and the physical world, supporting areas like embedded systems, IoT, and robotics. The course enhances understanding of 3D modeling, essential for AR/VR, digital twins, and simulation-based tools. It prepares students to work effectively in interdisciplinary teams involving hardware-software integration. Concepts like projections and solid modeling are foundational for CAD software, PCB design, and interface development. It supports UI/UX development for 3D applications, gaming, and visualization platforms. Engineering graphics aids in documenting and communicating design ideas clearly and accurately. Overall, it fosters analytical thinking and design communication, crucial for innovation in intelligent computing systems.

Course Objectives

1. To impart and develop a sound understanding of the principles and conventions of engineering drawing and projection techniques.
2. To enable students to read, interpret, and communicate engineering information through technical drawings.
3. To develop visualization and spatial reasoning skills required for understanding and creating engineering graphics.
4. To enable students to represent three-dimensional objects accurately on two-dimensional drawing planes using standard projection methods.

5. To acquaint students with the preparation and interpretation of sectional views for representing the internal features of engineering components.
6. To develop proficiency in creating neat, accurate, and standardized engineering drawings using graphical and drafting techniques.

Course Outcomes

1. Apply basic concepts of geometrical constructions to create engineering curves.
2. Apply the basic principles of projections in Projection of Lines and Planes
3. Apply the basic principles of projections in Projection of Solids.
4. Apply the basic principles of sectional views in Section of solids.
5. Apply the basic principles of projections in converting pictorial views into orthographic Views.
6. Apply the basic principles of projections in converting orthographic Views into isometric drawing.

Detailed Syllabus

Module no.	Module Name	Detailed content	Teaching hours	CO
	Pre-requisite	To draw basic geometric shapes like circle, pentagon, hexagon, and square with different orientation. Divide a line, circle, etc. into equal numbers of parts.		
1	**Introduction to Engineering Drawing and Engineering curves**	**1.1** Introduction to Engineering Graphics and its significance in the Engineering domain. **1.2** Types of Lines, Dimensioning Systems as per IS conventions. **1.3 Engineering Curves**: Basic construction of Conics - Ellipse, Cycloid, Involutes (of a circle and polygons only) and Helix (cylinder only). **Self-Learning topics -** Other conics such as parabola, hyperbola, Epi-cycloid, Hypo-cycloid, etc. Various methods of constructing ellipse and parabola Helix of a cone	05 05	CO1
2	**Projections of Points, Lines and Planes**	**2.1 Projections of points** in all four quadrants as well as lying on the planes. **2.2 Projections of lines** inclined to both the reference planes (Excluding Traces of lines). **2.3 Projection of planes** only standard geometrical shapes like square, triangle, pentagon, circle, etc. inclined to one of the reference planes. **Self-Learning topics -** Traces of lines on HP and VP, Simple application-based problems on projection of	05 05	CO2

		lines. Projection of planes inclined to both the reference planes		
3	**Projections of Solids**	**3.1** Projections of solids with the axis inclined to one reference plane include prism and cylinder **3.2** Projections of solids with the axis inclined to both reference planes include pyramid, and cone (excluding Cube and Tetrahedron) (Use change of position or Auxiliary plane method) **Self-Learning topics -** Prism and Cylinders inclined to both the reference planes Cube and Tetrahedron inclined to one or both the reference planes	05 05	CO3
4	**Sections of Solids and Development of Lateral Surfaces**	**Sections of Solids** Sections of Prism, Pyramid, Cylinder, & Cone cut by plane inclined to only one reference plane. (Only for object resting on base surface on HP or VP) **Development of Surfaces** Development of lateral surface only for regular solids - Prism, and Pyramid **Self-Learning topics -** Sections of Prism, Pyramid, Cylinder, & Cone cut by plane inclined to one or both reference planes along with triangular surface or slant edge resting on HP or VP. Development of lateral surface for regular solids - Cylinder, & Cone	05 05	CO4
5	**Orthographic and Sectional Orthographic Projections**	Fundamental concepts of orthographic and sectional orthographic projections (Full section only) Different orthographic views with First angle method of projection. Orthographic and sectional orthographic views of simple machine parts as per the first angle projection method **Self-Learning topics -** Orthographic projections using Third angle method of projection Half sectional orthographic projections	05 05	CO5

6	**Isometric Views**	Fundamental concepts of Isometric projections - isometric and non-isometric lines, axes, and planes Conversion of orthographic views to isometric views (holes on isometric planes only). Concept of isometric scale. **Self-Learning topics -** Difference between isometric projection and isometric views. Isometric projection with holes on inclined surfaces	05 05	CO6
	Total		60	

Text Books:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).
3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi.
4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online References:

Sr. No.	**Website Name**
1	https://archive.nptel.ac.in/courses/112/105/112105294/
2	https://nptel.ac.in/courses/112103019
3	https://archive.nptel.ac.in/courses/112/102/112102304/

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour**.
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions**, **10 marks each**.

- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613211105	C Programming	2	--	--	30	--	--	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613211105	C Programming	20	20	40	60	2.5	--	--	100

Rationale:

C Programming is a foundational subject for first-year EXTC students, providing essential problem-solving and programming skills. It enables students to understand core concepts like algorithms, data structures, and low-level memory management, which are crucial for advanced subjects in electronics, communication, and embedded systems.

Course Objectives:

1. Understand and use basic terminology in computer programming.
2. Use various data types in C programs effectively.
3. Design and implement programs involving decision structures, loops, and functions.
4. Design Implement Arrays, String, and Structure
5. Describe and utilize memory dynamics through the use of pointers.
6. Use different data structures and create/update basic data files in C.

Course Outcomes:

After successful completion of the course student will be able to

1. Formulate simple algorithms for arithmetic, logical problems and translate them to programs in C language
2. Implement, test and execute programs consisting of control structures.
3. Decompose a problem into functions and synthesize a complete program.
4. Demonstrate the use of arrays, strings and structures in C language.

5. Understand the concept of pointers
6. Use different data structures and create/update basic data files.

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Fundamentals of C Programming**	● Introduction to Programming, Algorithm and Flowchart ● Structure of a C Program, Compilation, Execution ● Keywords, Identifiers, Constants and Variables ● Data types in C ● Operators in C ● Basic Input and Output Operations ● Expressions and Precedence of Operators ● In-built Functions	06	CO1
		Self-learning Topics: History and features of the C programming language, Comparison of algorithms and flowcharts with pseudocode, Different C compilers and IDEs (e.g., Turbo C, GCC, Code::Blocks),Type casting and type conversion in C, Bitwise operators and their applications, Use of standard library functions from math.h, ctype.h, and string.h.	06	
II	**Control Structures**	● Introduction to Control Structures ● If statement, If-else statement, ● Nested if-else, else-if Ladder ● Switch statement ● For loop, while loop, Do while loop ● break and continue	05	CO2
		Self-learning Topics: Difference between decision-making statements and looping statements, Use of conditional (ternary) operator as an alternative to if-else, Infinite loops and their practical applications, Differences between while and do-while with real-life use cases, Use of break and continue in complex loop control scenarios.	05	
III	**Functions and Parameter**	● Introduction to functions ● Function prototype, ● Function definition, ● Accessing a function and parameter passing.	05	CO3

		● Recursion.		
		Self-learning Topics: Advantages of modular programming using functions, Types of functions (library functions vs user-defined functions). Call by value vs call by reference (conceptual understanding), Scope and lifetime of variables (local, global, static), Inline functions and their significance (conceptual),Recursive vs iterative approaches – comparison and use cases.	05	
IV	**Arrays , String Structure**	● Array-Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. ● String- Basic of String, Array of String, Functions in String.h ● Structure- Declaration, Initialization, structure within structure, Operation on structures, Array of Structure.	05	CO4
		Self-learning Topics: Memory representation of arrays (row-major order for multidimensional arrays).Dynamic vs static arrays (conceptual understanding),Passing arrays and strings to functions, Common string manipulation without using string.h functions, Nested structures and their real-world applications, Use of structures with functions and pointers (basic concept).	05	
V	**Pointer**	● Fundamentals of pointers ● Declaration, initialization and dereferencing of pointers ● Operations on Pointers ● Concept of dynamic memory allocation	05	CO5
		Self-learning Topics: Relationship between pointers and arrays, Pointer arithmetic with examples. Null pointers and void pointers, Dynamic memory allocation functions (malloc, calloc, realloc, free), Memory leaks and best practices in memory management.	05	
VI	**Files**	Files: File operation- Opening, Closing, Creating, Reading, Processing File.	04	CO6

		Self-learning Topics: Types of files in C: Text files vs Binary files, File opening modes (r, w, a, r+, w+, a+),File handling functions (fgetc, fputc, fgets, fputs, fprintf, fscanf),Error handling in file operations (EOF, feof, ferror).	04	

Text Books:

1. “Basics of Computer Science”, by Behrouz Forouzan, Cengage Learning.

2. “Programming Techniques through C”, by M. G. Venkateshmurthy, Pearson Publication.

3. “Programming in ANSI C”, by E. Balaguruswamy, Tata McGraw-Hill Education.

4. “Programming in C”, by Pradeep Day and Manas Gosh, Oxford University Press.

5. “Let Us C”, by Yashwant Kanetkar, BPB Publication.

Reference Books:

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie, Publisher: Prentice Hall Publication Date: February 22, 1988, ISBN-13: 978-0131103627,

2. "C Programming: A Modern Approach" by K. N. King, Publisher: W. W. Norton & Company Publication Date: April 26, 2008 (2nd Edition), ISBN-13: 978-0393979503

3. "C Primer Plus" by Stephen Prata, Publisher: Addison-Wesley Professional Publication Date: December 27, 2013 (6th Edition) ISBN-13: 978-0321928429

4. "Programming in C" by Stephen G. Kochan Publisher: Addison-Wesley Professional Publication Date: August 18, 2014 (4th Edition) ISBN-13: 978-0321776419

Online References:

Sr. No.	Website Name
1.	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2.	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3.	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4.	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

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- Duration of each test: **1 hour**.

- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions**, **10 marks each**.
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613112106	Engineering Chemistry Lab	--	--	1	--	--	15	--	15	0.5

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613112106	Engineering Chemistry Lab	--	--	--	--	--	25	--	25

Lab Objectives:

1. To develop practical skills in chemical analysis and interpretation of experimental results.
2. To understand the properties, composition, and quality assessment of water, fuels, lubricants, and engineering materials.
3. To acquire hands-on experience in the synthesis and characterization of industrially important chemical products.
4. To study the behaviour of materials under different chemical environments and evaluate their performance.
5. To familiarize students with quantitative, volumetric, and instrumental analytical techniques used in engineering applications.
6. To enhance scientific observation, experimental skills, data analysis, and safe laboratory practices for solving engineering problems.

Lab Outcomes: After completion of experiment, the learners will be able to

1. Estimate the type of water hardness and calculate it and also study PH of water samples to interpret their chemical nature.
2. Synthesize UF/PF resin at laboratory level.
3. Learn the effect of various factors on the rate of corrosion.
4. Understand the significance of proximate analysis of coal and determine quality of coal

sample.

5. 5.Learn various instrumental and quantitative analytical techniques to determine % of elements from alloy samples.
6. To understand properties of liquid lubricants used for lubrication & properties of engineering materials.

Prerequisite: 1. Knowledge of basic safety practices in the Chemistry Laboratory
2. Knowledge of Proximate analysis of coal
3. Knowledge of volumetric analysis

List of Experiments:

Sr No	List of Experiments	Hours	LO
01	Determination of Total, Temporary and Permanent hardness of water by EDTA method	**01**	**LO1**
02	Determination of moisture content in coal .	**01**	**LO4**
03	Synthesis of Urea formaldehyde / Phenol formaldehyde Resin.	**01**	**LO2**
04	To compare the rate of corrosion of various metals in acidic medium.	**01**	**LO3**
05	Determination of % purity of iron.	**01**	**LO5**
06	Determination of Sn from solders volumetrically.	**01**	**LO5**
07	Determination of Zn in brass volumetrically.	**01**	**LO5**
08	Determination of unknown concentration of Cu/Mn in the given sample by colorimetry	**01**	**LO5**
09	Determine the unknown PH of water sample by PH meter	**01**	**LO1**
10	Determination of acid value of lubricating oil.	**01**	**LO6**
11	Determination of saponification value of lubricating oil.	**01**	**LO6**
12	Study of effect of Gypsum on setting and hardening time of Portland cement.	**01**	**LO6**
13	Determination of Cu in brass iodometrically.	**01**	**LO5**
14	Synthesis of Phenol formaldehyde Resin.	**01**	**LO2**
15	Determination of ash content in coal.	**01**	**LO4**

List of Assignments:

Sr No	List of Assignments	Hours	Mapping
01	Numerical on determination of hardness of water and on determination of BOD and COD. Short note on sewage water treatment.	**01**	**LO1**

02	Short note on advanced polymers used in various engineering fields.	**01**	**LO2**
03	Short note on various corrosion control techniques	**01**	**LO3**
04	Short note on i) Green fuels. ii) Catalytic convertor iii) Power alcohol.	**01**	**LO4**
05	Short note on smart alloys: some examples of smart polymers with their properties and uses.	**01**	**LO5, LO6**
06	Short note on i) Applications of composites ii) setting and hardening of cement	**01**	**LO6**

References:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Eastern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia
5. Textbook of Polymer science: F.W. Billmeyer
6. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
7. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
8. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
9. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition.
   5. J. D. Lee Concise Inorganic Chemistry, Oxford University Press, 5 th edition.

Online Resources:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/103/106/105106205/
2.	https://courses.nptel.ac.in/noc20ch41/preview
3.	https://www.researchgate.net/
4.	https://www.sciencedirect.com/topics/engineering/polymer-material
5.	https://www.sciencedirect.com/topics/chemistry/nanomaterial

Assessment:

Term Work: Term Work shall consist of at least 07 practical's based on the above list. Also, Term work Journal must include at least 6 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613122107	Basic Electrical and Electronics Engineering Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Laboratory					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122107	Basic Electrical and Electronics Engineering Lab	--	--	--	--	--	25	--	25

Lab Objectives:

Lab course aims to

1. To develop an understanding of network analysis concepts and their practical applications in electrical circuits.
2. To apply fundamental principles of AC circuit analysis for evaluating circuit parameters in practical setups.
3. To demonstrate the operation and characteristics of transformers and electrical machines through experiments.
4. To analyze the behavior and applications of special-purpose diodes and transistors in electronic circuits.
5. To implement and evaluate different transistor configurations through experimental analysis.
6. To build and verify basic digital circuits using logic gates.

Lab Outcomes:

1. To apply and experimentally verify network theorems in DC circuits for the analysis and simplification of electrical networks.
2. To perform experiments on AC circuits to evaluate power factor and analyze phase relationships between voltage and current.

3. To demonstrate the operation of transformers and identify their practical applications.
4. To illustrate the performance characteristics and applications of electrical motors in automation and peripheral systems.
5. To implement and analyze the behavior of diodes in electronic circuits.
6. To demonstrate the functioning of basic logic gates and implement them using universal gates.

DETAILED SYLLABUS

Sr. No.	List of Experiments	Hours	LO Mapping
Pre-requisite	**Fundamental Mathematics and Physics**		
1	Introduction to Laboratory Safety and Usage of Electrical Measuring Instruments	2	LO1
2	Verification of Mesh and Nodal analysis.	2	LO1
3	Verification of DC network Theorems (Superposition. Norton's and Thevenin's)	2	LO1
4	Measurement of electrical parameters for alternating sinusoidal voltage (AC)	2	LO2
5	Observe three-phase voltage relationships in star and delta connections using simulation tools.	2	LO2
6	To simulate and analyze the performance of single-phase transformer	2	LO3
7	Study of DC machines	2	LO4
8	Forward & reverse bias characteristics of PN junction diode	2	LO5
8	Observe LED behavior and test various LED configurations for digital indicators.	2	LO5
9	Construct a BJT-based switch circuit	2	LO5
10	To simulate the implementation of basic logic gates using universal gates.	2	LO6

Sr No	List of Assignments / Tutorials	Hrs
1	Application and Analysis of DC Network Theorems: A Study through Theoretical Concepts and Numerical Problems	2
2	Comparative Analysis of DC Network Theorems and Their Extension to Single and Three-Phase AC Circuits: A Theoretical and Numerical Approach	2
3	Theoretical Understanding of Single-Phase Transformers: Principles, Construction, and Role in Modern Power Systems	2
4	Theoretical Insights into Electrical Machines: Working Principles, Construction, and Applications in Modern Industry	2
5	Industrial Applications of Semiconductor Devices: A Study on Diodes and Transistors in Power and Communication Systems	2
6	Design and Application of Basic Digital Circuits: A Study on Logic Gates, Boolean Algebra, and Real-World Implementations	2
7	Case Study 1: Integrated Power System Design: Analysis of DC and AC Circuits with Single-Phase Transformers and Electrical Machines for Smart Residential Applications	2
8	Case study 2: Application of Semiconductor Devices and Digital Electronics in Industrial Automation and Control of Electrical Machines	2

Online Resources:

Sr. No.	Website Name
1.	https://www.allaboutcircuits.com/
2.	https://www.tinkercad.com/
3.	https://www.circuitlab.com/

Assessment:

Term Work: Term Work shall consist of at least 8 to 10 practicals based on the above list. Also, the term work journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613122108	Engineering Graphics Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122108	Engineering Graphics Lab	--	--	--	--	--	25	--	25

Lab Objectives:

1	To impart and inculcate proper understanding of the theory of projection.
2	To impart the knowledge to read and interpret a drawing.
3	To improve the visualization skill.
4	To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5	To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
6	To impart basic AutoCAD skills.

Lab Outcomes:

1	Apply the concepts of Draw, Modify and basic concepts of ACAD to draw basic geometries and diagrams of simple engineering parts.
2	Apply the concepts of layers, and dimensions to create engineering drawing for a part drawing.
3	Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.

4	Apply the basic principles of projections in 2D drawings using a CAD software.
5	Apply basic AutoCAD skills to draw different views of a 3D object.
6	Apply basic AutoCAD skills to draw the isometric view from the given two views.

List of Experiments:

Component: 01 – ACAD Print outs (activities to be completed in the CAD Laboratory - All printouts to be the part of Term Work.)

Sr. No.	**List of Experiments**	**Hrs**	**CO mapping**
1	Redrawing simple machine parts as given (05 problems)	04	CO1, CO2, and CO3
2	Orthographic projections (with and without section) (05 problems)	12	CO4 and CO5
3	Isometric Drawing – 3 problems.	08	CO6

Component: 02 – Drawing Sheets

01	Two problems on Engineering Curves (Ellipse and Parabola)	02	CO1
02	Two problems each on Projection of Lines and Planes	02	CO2
03	Two problems on Projection of Solids	02	CO3
04	Two problems on Section of Solids with DLS	02	CO4
05	Four problems on Sectional Orthographic projection (ACAD printouts only)	02	CO5
06	Four problems on Isometric projection (ACAD printouts only)	02	CO6

Component: 03 – A3 size Sketch book

Sr No	**List of Assignments**	**Hrs**	**CO mapping**
01	Engineering Curves. (4 problems - Cycloid, Helix, Ellipse and Involute)	02	CO1
02	Projection of Lines and Planes (2 problems each)	02	CO2
03	Projection of solids. (2 problems)	02	CO3
04	Section of solids and DLS (2 problems)	02	CO4

05	Orthographic Projections (2 problems each)	04	CO5
06	Isometric Drawing. (2 problems)	03	CO6

Assessment:

Term Work: Term Work shall include all the drawings, assignments, and printouts listed above.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Drawing sheets and ACAD printouts) + 10
Marks (Assignments) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613212109	Electronics & Web Simulation Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613212109	Electronics & Web Simulation Lab	--	--	--	--	--	--	25	25

Lab Objectives:

Lab course aims to

1. To understand the fundamentals of HTML, XHTML, and HTML5 for designing web pages.
2. To develop skills in creating structured web content using tags, tables, forms, and multimedia elements.
3. To implement client-side web applications such as forms and simple calculators using HTML.
4. To learn data representation using XML and apply basic web development concepts in practical scenarios.
5. Understand and analyze basic electronic components such as resistors, capacitors, inductors, diodes, LEDs, and transistors through theory and practical circuit implementation.
6. Develop skills in using electronic measurement and debugging tools including breadboard, digital multimeter (DMM), oscilloscope, function generator, logic analyzer, and soldering/desoldering equipment.
7. Design, simulate, and implement electronic circuits and PCBs using software tools like KiCad, ngspice, and eSim, followed by fabrication and testing.

8. Introduce digital fabrication techniques by creating 3D models and producing physical objects using tools like FreeCAD and Ultimaker Cura, along with understanding basic electrical wiring systems.

Lab Outcomes:

After the successful completion students should be able to

1. Students will be able to design and develop basic web pages using HTML, XHTML, and HTML5 features.

2. Students will be able to create forms, tables, and simple web applications like a calculator.

3. Students will be able to structure and display data using XML and apply web development techniques effectively.

4. Design, simulate, and troubleshoot electronic circuits and PCBs, and validate their performance using appropriate testing instruments.

5. Handle modern engineering tools for circuit development, PCB design, soldering, and 3D printing to build functional prototypes.

6. Understand the practical implementation and safety practices in electronics and basic electrical wiring applications.

DETAILED SYLLABUS

Sr. No.	List of Experiment	Hrs	LO Mapping
1.	Introduction to different HTML tags with syntax and examples (Basic HTML Document structure, Formatting and fonts, Commenting code, Color, Hyperlink, Lists, Tables, Images)	2	LO1
2.	Design the HTML page for your Class Time Table using Table tag and its attribute.	2	LO2
3.	Design the Registration form with User Id, Name, Email, Mobile no., Address, Country, Gender, CV, and buttons (submit, reset) using HTML.	2	LO2
4.	Write an XML file to display the Book information which includes the following: 1) Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price	2	LO3
5.	XHTML: XHTML document structure, frames and framesets (rows and cols attributes).	2	LO1
6.	HTML5: Introduction to HTML5 New Elements, Use HTML5 input types, HTML Video and Audio Element.	2	LO2
7.	Develop a simple calculator using HTML	2	LO3

8.	Introduction to basic Electronics components (Resistor, Capacitor, inductor, diode, LED and transistor)	2	LO4
9.	Introduction to basic tools for measuring and debugging electronics circuits. (Breadboard, DMM, Oscilloscope, DSO, Function generator, Logic analyzer, DC Power Supply, Soldering and Desoldering iron and its usage Practices.)	2	LO5
10.	Simulation of electronics circuit using open-source software's like, LTspice, Tinkercad eSim etc.	2	LO4
11	To design PCB using basic components using open-source software's like Kicad, Altium, Autodesk eagle etc	2	LO4
12	To fabricate, test and troubleshoot the designed PCB.	2	LO4
13	To design your first object (Introduction and basics, 3d modelling, Slicing.)	2	LO5
14	To print your first object using 3d printer. (Preparing the print, Printing and reviewing.)	2	LO5
15	Introduction to wiring and its types like House Wiring, Staircase wiring, Go-down wiring etc.	2	LO6

Text Books:

1. Paulraj Ponniah, *"Data Warehousing: Fundamentals for IT Professionals"*, Wiley India.
2. Jiawei Han, Micheline Kamber, Jian Pei, *"Data Mining: Concepts and Techniques"*, Morgan Kaufmann.
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, *"Introduction to Data Mining"*, Pearson Education.
4. Roger S Pressman "Software Engineering: A Practitioner's Approach" 8th Edition McGraw-Hill, ISBN:978-0-07-802212-8.
5. 3D Printing and Design, Sabrie Soloman, Khanna Publishing House
6. Getting Started with 3D Printing: A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution, Liza Wallach Kloski, Nick Kloski, Make Community, LLC; 2nd edition, 2021
7. Basic Electricity & Practical Wiring by Thomas Hoerner

References Book:

1. William H. Inmon, *"Building the Data Warehouse"*, Wiley India.
2. Ralph Kimball, *"The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling"*, Wiley India.
3. Max Bramer, *"Principles of Data Mining"*, Springer.
4. Manaranjan Pradhan, U. Dinesh Kumar, *"Machine Learning Using Python"*, Wiley.

5. Joel Grus, *"Data Science from Scratch: First Principles with Python"*, O'Reilly Media.
6. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India.
7. PCB Design for Beginners by Albert Kelly.
8. Complete PCB Design Using OrCAD Capture and Layout, K. Mitzner, 2nd Edition, Academic Press.
9. Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing, Andreas Gebhardt, Hanser Publisher, 2011
10. Electrical Wiring and Installation by S.K. Bhattacharya (McGraw-Hill Education India)
11. Electrical Wiring Residential by Ray C. Mullin and Phil Simmons

Online Resources:

Sr. No.	Website Name
1.	WEKA Tool and Documentation – https://www.cs.waikato.ac.nz/ml/weka/
2.	Scikit-learn (sklearn) Library – https://scikit-learn.org/stable/
3.	DataCamp – Interactive Python and R Coding – https://www.datacamp.com
4.	https://onlinecourses.swayam2.ac.in/aic20_sp59/preview -ESim - EDA tool for circuit design, simulation, analysis and PCB design, By Prof Kannan Moudgalya
5.	https://onlinecourses.nptel.ac.in/noc25_ee163/preview -Electronic Systems Design: Hands-on Circuits and PCB Design with CAD, By Prof. Ankur Gupta
6.	3D Printing and Design for Educators - https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr24_ed17
7.	https://spoken-tutorial.org/tutorial-search/?search_foss=eSim&search_language=English
8.	Electricity and Electrical Wiring- https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_ee04

Laboratory Assessment:

Assessment:

Practical/ Oral Exam: An Oral and practical examination will be held based on the above syllabus and job work.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613122110	IDEA LAB - I (Innovation Design Engineering and Apply)	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122110	IDEA LAB - I (Innovation Design Engineering and Apply)	--	--	--	--	--	25	50	75

Rationale:

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a structured assessment framework is implemented.

1. Project assessment is carried out using standardized IDEA Lab rubrics with multiple evaluation parameters.
2. One of the key parameters is **Engineering Subject-Based Assessment**, which focuses on the effective application of same-semester subject knowledge in project work, ensuring integration of theoretical learning with practical implementation.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Students must ensure that their IDEA Lab project meaningfully incorporates concepts from all core subjects of the current semester and maintain a project logbook as evidence of subject-wise application.
- Faculty in-charge must guide students to apply concepts from subjects studied in the same semester to their IDEA Lab projects.
- The term work evaluation will partially reflect the effective application of subject-specific knowledge.
- Faculty should regularly review the integration of academic content within the project work.

2) Implementation Strategy – IDEA Lab Learning Model

- A theme-based learning structure shall be implemented where each semester is anchored to a broad contextual domain such as Healthcare, Smart Cities, Energy, Agriculture, or Governance, providing the overall learning direction.
- From the identified theme, a system-level, open-ended problem statement shall be defined, serving as a solution-neutral framework that enables interdisciplinary thinking and innovation.
- The learning sequence shall follow a structured flow:
  Theme → Problem Statement → Same Semester Subject Application → Design–Implementation Experience, ensuring progressive transformation from context to solution.

- Themes shall provide the context (defining the domain of work), while problem statements shall provide the purpose, enabling students to identify meaningful real-world challenges.
- Subjects shall be treated as engineering tools, where each subject contributes specific knowledge components to solve different aspects of the problem.
- Students shall be encouraged to take ownership of their learning and projects, fostering curiosity, exploration, social relevance, and a mindset of creative risk-taking.
- Structured brainstorming and ideation sessions shall be conducted at the beginning of the semester to guide students in problem identification and development of solution pathways through collaborative and interdisciplinary thinking.
- Guest lectures and expert talks shall be organized by inviting industry experts, researchers, and innovators aligned with the semester theme and subject areas to provide exposure to real-world challenges, trends, and opportunities.
- A mechanism shall be implemented to ensure uniqueness and originality of projects by systematically reviewing ideas to avoid duplication and encouraging novel, technology-driven solutions.
- Platforms shall be created for collaborative learning and discussion, enabling students to present ideas, receive peer and mentor feedback, and refine solutions through iterative engagement.
- Content beyond syllabus for as subject shall be integrated with IDEA Lab themes and problem statements to ensure deeper interdisciplinary application and enhanced conceptual understanding.
- Preference shall be given to ensuring same-semester academic alignment, where subject faculty contribute to effective contextual integration of project-based learning.
- Continuous monitoring and documentation shall be ensured through logbooks, milestone tracking, and periodic progress reviews to maintain academic rigor and outcome alignment.
- Coordination with subject faculty shall be ensured for effective mapping of theoretical concepts into project execution and for evidence-based term work assessment.
- The IDEA Lab shall function as an institutional mechanism for implementing the CDIO (Conceive–Design–Implement–Operate) framework, promoting experiential and outcome-based learning through structured mini-projects.

Implementation Notes:

- Guide will assess subject's contribution using specific evidence such as:
    - Logbooks
    - Subject-specific outputs (e.g., simulations, designs)
    - Paper publications or review presentations

3) Guidelines for Assessment

Assessment Month	**Marks**
Month 1 (Formative 1)	50 marks
Month 2 (Formative 2)	50 marks
Month 3 (Formative 3)	50 marks

Total Assessment Structure

Component	Marks	Assessed By
Term work – Project Execution	50 Marks	Project Guide – Average of all innovation
Viva Voce (Final Evaluation)	50 Marks	External Examiner

Criteria	**Excellent (10)**	**Good (8)**	**Satisfactory (6)**	**Needs Improvement (4)**
1. Innovation	Highly original and disruptive idea solving a real-world or futuristic problem	Novel idea with a creative approach to a known problem	Moderately innovative; adapts existing solutions	Common or repetitive idea with minimal novelty
2. Design	User-centric, systematic design with professional-level tools, prototyping, or simulations	Logical structure; clearly presented using standard tools	Functional design but limited user perspective or refinement	Poor or confusing design with lack of user consideration
3. Engineering	Applies concepts from all same-semester subjects with clear integration and interdisciplinary depth	Applies knowledge from 4 or more subjects with relevance	Applies 2–3 subjects with moderate clarity	Applies 1 subject with weak or shallow connection

4. Implementation	Complete, fully functional prototype with rigorous testing and real-world validation	Working model with minor errors; partially tested	Prototype is incomplete; basic testing or debug attempt	Poorly implemented; fails to function properly
5. Application	Strong real-world relevance with alignment to SDGs/National Missions; impact clearly identified	Clear practical use-case with user/market relevance	Some practical value but limited clarity on impact	Vague or irrelevant application; weak user connect

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613412111	C Programming Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT -I	IAT-II	Total					
2613412111	C Programming Lab	--	--	--	--	--	--	25	25

Laboratory Objectives:

This subject aims to provide students with an understanding of the role computation can play in solving problems. The Course will be taught using C-Programming Language.

1. Understand and use basic terminology in computer programming.
2. Use various data types in C programs effectively.
3. Design and implement programs involving decision structures, loops, and functions.
4. Design Implement Arrays, String, and Structure
5. Describe and utilize memory dynamics through the use of pointers.
6. Use different data structures and create/update basic data files in C.

Laboratory Outcomes:

Learners will be able to

1. Illustrate the basic terminology used in computer programming.
2. Use different data types in a computer program.
3. Design programs involving decision structures, loops and functions.
4. Implement Arrays, String, and Structure
5. Describe the dynamics of memory by the use of pointers.
6. Use different data structures and create/update basic data files.

Suggested List of Experiments:

Sr. No	Suggested List of Experiments	Hours	LO mapping
01	a) Program to demonstrate Operators Data Input and Output – getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ) b) Program to demonstrate Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators.	02	LO1, LO2
02	a) Program to demonstrate Branching - If statement, If-else Statement, Multiway decision. b) Program to demonstrate Looping – while, do-while	02	LO3
03	a) Program to demonstrate Nested control structure- Switch statement, Continue statement, Break statement, Goto statement	02	LO3
04	a) Program to demonstrate Function, Passing Arguments to a Function (call by value and call by reference)	02	LO3
05	a) Implement an iterative function for factorial/ Fibonacci etc. b) Implement a recursive function for factorial/ Fibonacci etc.	02	LO3
06	a) Program to demonstrate Storage Classes – Auto, Extern, Static, Register	02	LO3
07	a) Program to demonstrate Array 1D, b) Program to demonstrate Array 2D	04	LO4
08	a) Program to demonstrate String b) Program to demonstrate String arrays of string	02	LO4
09	Program to demonstrate Structure Write a program to store and display information of a student/employee etc using structures. a) Define a structure. b) Read and store details. c) Display the stored information.	02	LO4
10	Program to demonstrate pointers a) Define a node structure. b) Implement functions to insert, delete, and display nodes.	02	LO5
11	Program to demonstrate files Write a program to maintain a simple student/employee etc. database using file handling. a) Open a file to store student records. b) Implement functions to add, update, and display records. c) Ensure data persistence by saving changes to the file.	04	LO6

12	Implement one small application using Function, Files, Structure and Pointers concepts you have learnt in C (e.g.: Simple Library Management System 1.Functions: Add, display, and search books. 2. Files: Store and retrieve book data. 3. Structures: Represent a book. 4. Pointers: Manage the list of books dynamically	04	LO6

Text Books

1. "Basics of Computer Science", by Behrouz Forouzan, Cengage Learning.
2. "Programming Techniques through C", by M. G. Venkatesh Murthy, Pearson Publication.
3. "Programming in ANSI C", by E. Balaguruswamy, Tata McGraw-Hill Education.
4. "Programming in C", by Pradeep Day and Manas Gosh, Oxford University Press.
5. "Let Us C", by Yashwant Kanetkar, BPB Publication.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie, Publisher: Prentice Hall Publication Date: February 22, 1988, ISBN-13: 978-0131103627

2. "C Programming: A Modern Approach" by K. N. King, Publisher: W. W. Norton & Company Publication Date: April 26, 2008 (2nd Edition), ISBN-13: 978-0393979503

3. "C Primer Plus" by Stephen Prata, Publisher: Addison-Wesley Professional Publication Date: December 27, 2013 (6th Edition) ISBN-13: 978-0321928429

4. "Programming in C" by Stephen G. Kochan Publisher: Addison-Wesley Professional Publication Date: August 18, 2014 (4th Edition) ISBN-13: 978-0321776419

Online Resources:

Sr. No.	Website Name
1.	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2.	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3.	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4.	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Assessment:

Term Work: Term Work shall consist of at least 10 to 12 practical's based on the above list. Also, Term work Journal must include at least 2 assignments.

Practical / Oral Exam: A Practical exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2698462112	Universal Human Values	1	--	1	15	--	15	15	45	1.5

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2698462112	Universal Human Values	--	--	--	--	--	25	--	25

Rationale: The goal of the education system is to cultivate well-rounded individuals who are capable of rational thinking and action, as well as empathy and compassion. It strives to nurture ethical values and principles, shaping responsible citizens who can contribute to creating an inclusive, equitable, and diverse society, as envisioned by our Constitution. Education should focus not only on intellectual growth but also on developing social, ethical, and emotional intelligence. Ultimately, education is essential for unlocking human potential and fostering a just and fair society. A fair combination of holistic and multidisciplinary education would develop human beings wide intellectual, deep aesthetic, social, physical, emotional, and moral in an integrated manner. UHV courses are intended to help students to develop a holistic, humane world vision for adopting fair technological advancements. The modules structured to be discussed are universal, rational, and verifiable, hence leads to harmony.

Course Objectives:

1. To develop a holistic perspective based on self-exploration about them (human being),
2. To understand the meaning of harmony in relationship family with reverence and compassion
3. To explore a wide range of social networking ensuring mutual happiness and prosperity
4. To identify the urge to establish global peace and harmony to make the world a better place to live.
5. To understand the threats posed by human activities to biodiversity, and provide solutions
6. To develop understanding in implementing technologies to serve mankind.

Course Outcomes:

After successful completion of the course learner will be able:

1. Identify innate humanistic virtues and abilities as fundamentals to work as an individual.

2. Explore solutions to behavioral conflicts through family, a society in miniature with empathy.

3. Develop understanding to maintain human-human relationship for mutual happiness for building great teams.

4. Adapt for global pursuits in a peaceful co-existence with the entire mankind for global society uplift.

5. Acquire awareness of maintenance and conservation of biodiversity to provide sustainable solutions.

6. Evaluate the knowledge of 'Real Self 'augmenting universal human order to develop holistic technologies and creating congenial work environments.

Prerequisite: There is no prerequisite for this course.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	There is no prerequisite for this course.		
I	Holistic Growth of Individual	Understanding the Human Being: Body, mind, and self – their roles and needs, Distinction between the self (conscious entity) and the body, Importance of self-reflection and self-awareness Developing clarity about personal goals and values, Emotional intelligence: managing thoughts and feelings. Lifestyle choices that support well-being Integrating knowledge with ethics and values **Self-Learning Topics**: Analyze yourself thoroughly and discover your personality traits: Behavioral, Habitual and Acquired traits and record the significance of the traits in handling diverse situations in your past and present life.	5 2	CO1

II	Self-Harmony & Family Values	Prosperity - a right identification of needs and fulfillment through right means What is *naturally acceptable* (permanent, universal) vs. what is acquired or conditioned. Family - a space for value cultivation and emotional support, Mutual fulfillment addressing Common Family Issues: Balancing individuality and togetherness, Misunderstandings due to Assumptions, Generational gaps and communication barriers. Trust empathy, and open communication in family relationships. Family as a Basic Unit of Society,	5	CO2
		Joint versus nuclear family structures and their social impact. **Self-learning Topics**: Importance of Respect and. Compassion in families, relations, neighborhood, how family harmony helps to progress and attain a worthy and respectable social and financial status. Togetherness and advancement, Conflict and resolution	2	
III	Social Equilibrium	Human-Human relationship, Respecting others and their perspectives, Understanding the difference between *intention* and *competence*. Vision of a universal human order (Sarvabhauma Vyavastha) based on trust and mutual prosperity. Promotion of dialogue, cooperation, and peaceful coexistence. Individuals and groups work together for common goals and shared well-being. Visualizing a universal harmonious order in society- Undivided Society, Universal Order from self to community Mutual Prosperity. Support and Empower marginalized communities **Self-Learning Topic:** A positive and unbiased Mediation and dialogue, and its importance Different communities' views for creating better communities & societies. Incidents happening around you which urgently require social equilibrium as a vision.	5 2	CO3

IV	Shared Values of Mankind	Values accepted and upheld by all human beings regardless of background, peaceful coexistence and global harmony. Role in addressing global challenges like conflict, inequality, and environmental crises, Philosophical and spiritual traditions worldwide. Human rights frameworks (e.g., Universal Declaration of Human Rights). Sensitizing individual towards Contemporary	5	CO4
		World Issues **Self Learning Topic:** India's relationships with other countries. Promoting peace and harmony hence preventing conflict situations. Conflict situations throughout the world where India as a one who maintained its integrity by following its traditional, philosophical and ethical standard.	3	
V	Human-Nature Relationship	Humans as caretakers of the Earth, not conquerors. Ethical choices like wildlife conservation, habitat preservation, and reducing pollution. Promoting humane treatment in agriculture, research, entertainment, and daily life. Sustainable living: reducing waste, recycling, and using renewable energy. Educating communities about the importance of biodiversity and ecosystem health. **Self-Learning Topics**: Practices adopted in ancient India for preserving the environment, Importance of rivers, trees, water mentioned in Indian scriptures and culture. Modern technologies/practices favoring ecosystem preservation. (Past Practices Vs, Present Practice)	5 3	CO5
VI	Integrating universal human values in the workplace	Meaningful and Purposeful Work: Encouraging dignity in all types of jobs. Human creativity and contribution to society. Equal opportunities without discrimination. Prioritizing human well-being over mere profit. Technical education is enriched with ethics and human-centric values. Ethical behavior includes not exploiting others for personal gain—whether as employers or consumers. Ability to identify and develop appropriate technologies and management patterns for production systems.	5	CO6

		Case studies of typical holistic technologies, management models and production systems. **Self-Learning Topics:** Contemporary workplace scenario Confronting challenges like globalization, technological advancement/disruption cultural diversity, workplace prejudice. unconscious bias. Hampering output and how universal human values helps erasing these complexities.	3	

References:

1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2009). *A Foundation Course in Human Values and Professional Ethics*. New Delhi: Excel Books.
2. Ravindran, P. S. (2007). *Essence of Human Values and Professional Ethics*. Chennai: Sri Ramakrishna Math.
3. Gaur, R. R. (2011). *Human Values and Professional Ethics*. New Delhi: Dhanpat Rai Publishing Company.
4. Chitkara, M. G. (2002). *Education and Human Values*. New Delhi: A.P.H. Publishing Corporation.
5. Martin, M. W., & Schinzinger, R. (2005). *Ethics in Engineering* (4th ed.). New York: McGraw-Hill.
6. Gandhi, M. K. (1927). *The Story of My Experiments with Truth*. Ahmedabad: Navajivan Publishing House.
7. Vivekananda, S. (Compilation). (2001). *I and My Nation*. Kolkata: Advaita Ashrama.
8. AICTE (2020). *Towards a Holistic Development: A Collection of Good Practices in UHV*. New Delhi: All India Council for Technical Education.

Sr. No.	Website Name
1.	https://uhv.org.in/

Term work 25 Marks =

Assignments 20 Marks + Attendance 5 Marks

Conduct Group Speaking Activities to explore and comprehend the basic human and global society issues.

(In group speaking activity, especially, conduct discussions on Contemporary World Issues, Contemporary workplace challenges enabling students to think and suggest solutions on humanitarian ground)

List of Assignments (Answer the questions about in 500 words)

1. Explain the process, content, and natural outcome of self-exploration with a neat diagram and two examples from your life.

2. Analyze the impact of compassion on mental health. Describe the role of family in the development of an individual.

3. Describe the concept of an undivided society and the universal order and explain how both these can help to create a world family.

4. What do we mean by holistic technologies, management models, and production systems? How are these useful for mankind?

5. Explain the concept of co-existence in nature. How can this be understanding help in addressing environmental issues?

6. Design a program to promote respect in the workplace where people treat each other with respect and have equal opportunities for growth.

SEM-II

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613111201	Engineering Mathematics-II	3	1	--	45	15	--	60	120	4

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613111 201	Engineering Mathematics-II	20	20	40	60	2.5	25	--	125

Rationale

This course is designed to strengthen the mathematical foundation of first-year engineering students by introducing essential concepts such as differential equations of first and higher order, multiple integrals (double and triple), probability distributions (discrete and continuous), regression analysis, and numerical methods. These topics collectively enable students to model and analyze real-world engineering problems involving rates of change, multi-variable systems, uncertainty, and data-driven relationships. Differential equations provide tools to describe dynamic systems, while multiple integrals help in evaluating quantities over complex geometries. Probability distributions build the ability to handle uncertainty in practical situations, and regression techniques support data interpretation and prediction. Numerical methods equip students with computational approaches for solving problems that are difficult to solve analytically. Overall, the course develops analytical thinking, problem-solving skills, and computational proficiency required for advanced engineering applications and interdisciplinary learning.

Course Objectives:

1. To develop understanding of first and higher order differential equations and their role in modeling engineering phenomena.

2. To introduce the concepts and applications of double and triple integrals in evaluating physical quantities over regions and volumes.

3. To provide knowledge of discrete and continuous probability distributions for analyzing uncertainty in real-world problems.

4. To familiarize students with lines of regression and correlation for interpreting relationships between variables.

5. To equip students with numerical techniques for solving equations and engineering problems where analytical methods are not feasible.

6. To integrate mathematical concepts for developing analytical and computational problem solving skills in engineering contexts.

Course Outcomes:

1. Solve first and higher order differential equations and apply them to model engineering systems involving growth, decay, and dynamic processes.

2. Evaluate double and triple integrals and apply them in computing area, volume, mass, and other engineering quantities.

3. Apply discrete and continuous probability distributions to analyze uncertainty and variability in engineering and scientific data.

4. Determine and interpret regression lines and coefficients to analyze relationships and make predictions from experimental data.

5. Apply numerical techniques such as iterative methods and interpolation to solve algebraic and transcendental equations.

6. Develop computational and analytical skills to model, analyze, and solve complex engineering problems using appropriate mathematical tools.

Prerequisite:

1. Basics of integration and it's properties**.**
2**.** Linear differential equations

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Differential Equation	Exact differential Equations, Equations reducible to exact form by using integrating factors.	08	CO1

		Equation reducible to linear form and Bernoulli's equation.		
		Linear differential equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax}, sin(ax + b), cos(ax +b), x^m.		
		Self-learning topics: 1. Method of variation of parameter 2. Particular integrals for $e^{ax}V$ and xV. 3. Cauchy's homogeneous linear differential equation. 4. Legendre's differential equation. 5. Applications of first order and first degree and also Higher order differential equation.	12	
II	Multiple Integral	Beta and Gamma functions and its properties.	08	CO2
		Double integration- definition, Evaluation of Double Integrals. (Cartesian & Polar)		
		Change the order of integration (No Evaluation)		
		Self-learning topics: 1. Rectification of curves. (Cartesian, Polar and Parametric) 2. Application of double integrals to compute Area and Mass of lamina.	12	
III	Multiple Integral-II	Evaluation of double integrals by changing to polar coordinates	07	CO3
		Evaluation of integrals over the given region (Cartesian and polar).		
		Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates).		
		Self-learning topics: 1. Application of triple integrals to compute volume. 2. Triple integrals over a volume bounded by a plane.	13	

		3. Triple integrals over a volume bounded by a paraboloid. 4. Triple integrals over a volume bounded by a cone. 5. Triple integrals over a volume bounded by an ellipsoid.		
IV	Probability Distribution	Poisson and Geometric distributions.	07	CO4
		Uniform, Exponential, Gamma, Beta and Normal distributions.		
		Self-learning Topics: 1. Skewness and Kurtosis of distribution (data). 2. Discrete distribution: Bernoulli, Binomial and Negative binomial distribution. 3. Conditional probability, joint probability, total probability and Bayes' theorem. 4. Chi-Square Distribution.	13	
V	Statistical Techniques	Spearman's Rank correlation coefficient (R) (with repeated and non-repeated ranks).	07	CO5
		Karl Pearson's Coefficient of correlation(r).		
		Lines of regression.		
		Fitting of first- and second-degree curves.		
		Self-learning Topics: 1. Fitting of the exponential curve. 2. Fitting of logarithmic curve. 3. Covariance 4. Sampling theory for quantitative and qualitative samples. 5. Kendall's Correlation Coefficient.	13	
VI	Numerical Methods	Numerical integration‑by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all without proof)	08	CO6
		Interpolation by Newton's and Lagrange polynomials		
		Numerical solutions of transcendental equations by		

		Newton Raphson method and Regula –Falsi method.		
		Self-learning topics: 1. Indeterminate forms, L- Hospital Rule, 2. Gauss Elimination Method, Gauss Jordan Method. 3. Maclaurin Series 4. Numerical solution of ordinary differential equation using (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta fourth order method	12	

Text Books:

1. Operations Research, Hira and Gupta, S. Chand Publication.

2. Fundamentals of Statistics, S. C. Gupta.

3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa.

4. Murray Spiegel, "Schaum's Outline of Probability and Statistics", 4th Edition, Tata McGraw-Hill.

References:

1. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons.

2. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education.

3. Operations Research: An Introduction, Hamdy A Taha, Pearson.

4. Engineering Optimization: Theory and Practice, S.S Rao, Wiley-Blackwell

Online References:

Sr. No.	Website Name
1.	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/
2.	https://www.youtube.com/watch?v=KgItZSst2sU
3.	https://nptel.ac.in/courses/117103017
4.	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/
5.	https://archive.nptel.ac.in/courses/117/103/117103017/

6.	https://archive.nptel.ac.in/courses/111/102/111102111/
7.	https://www.youtube.com/playlist?list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour**.
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions**, **10 marks each**.
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks
2. No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613111202	Engineering Physics	2	--	--	30	--	—	30	60	2

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613111202	Engineering Physics	20	20	40	60	2.5	--	--	100

Rationale:

1. Engineering Physics provides a strong grounding in fundamental concepts like mechanics, electromagnetism, thermodynamics, and optics, which are essential for understanding the scientific basis of all engineering disciplines.
2. The syllabus supports key subjects in all branches—such as strength of materials in civil and mechanical, circuits in electrical and electronics, and semiconductor physics in computer and IT—ensuring a smooth transition to branch-specific learning.
3. Physics fosters logical thinking, mathematical modelling, and problem-solving skills that are crucial for engineering analysis, system design, and innovation in every branch of engineering. Topics like quantum mechanics, nanoscience, and wave phenomena prepare students for future technologies and interdisciplinary fields such as AI, robotics, renewable energy, and smart infrastructure, relevant across all engineering domains.

Course Objectives:

1. To build a foundation of quantum mechanics needed for modern technology.
2. To demonstrate principles of interference in thin film and diffraction.
3. To provide students with a basic understanding of basics of laser and Optical fiber and its use in communication technology.
4. To give exposure to the concept of Fermi level in semiconductors.
5. To introduce the basic principles of sensors and familiarize learners with their role and applications in modern technological systems.
6. To introduce the fundamental concepts of nanoscience and nanotechnology, enabling

students to understand nanoscale phenomena

Course Outcomes:

1. Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology
2. Learners will be able to DEVELOP understanding of interference and diffraction; connect it to few engineering applications.
3. Learners will be able to ILLUSTRATE and APPLY the use of laser and OFC in engineering applications
4. Learners will be able to CLASSIFY semiconductors and EXPLAIN variation of Fermi level with temperature and doping concentration.
5. Learners will be able to IDENTIFY the fundamentals of sensors and their applications in Advanced Technology.
6. Learners will be able to DESCRIBE the significance of nanoscience and nanotechnology, its applications.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
	Prerequisite	Basic knowledge of optics and atomic structure, Wave front and Huygens principle, reflection and refraction, Interference by division of wave front, Refractive index of a material, Snell's law, Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment. Intrinsic and extrinsic semiconductors, electrical resistivity and conductivity concepts, Basic understanding of wave motion, sound waves, oscillations, magnetism, and electric fields is essential to grasp concepts like ultrasonic wave generation and acoustics.	–	–
I	Quantum Physics	Introduction (Matter waves, De Broglie hypothesis, Wave Packet). Concept of Phase velocity and group velocity and relation with particle velocity. Heisenberg Uncertainty Principle. Wave function; Physical interpretation of wave function. Schrodinger's time dependent wave equation; time independent wave equation. Particles trapped in one dimensional infinite potential well. Basics of Quantum Computing. Concept of Qubits, Quantum Superposition Quantum Entanglement.	05	CO 1

		Self-learning Topics: Quantum Tunnelling and real-life examples, Operators in Quantum Mechanics (basic idea) Quantum States and Measurement concept Basic Quantum Gates (NOT, Hadamard, CNOT) Quantum Teleportation (concept only) Quantum Cryptography and secure communication	05	
II	Optics for Engineers	**Thin Film Interference**: Introduction (division of amplitude & Stoke's relation) Interference in thin film of constant thickness in reflected light, Formation of colors in thin film; Interference in Wedge shaped film in reflected light; Formation of Newton's rings; Applications Diffraction: Introduction to Fraunhhofer diffraction at single slit, Amplitude equation of double slit, Diffraction Grating (N slits),	05	CO 2
		Self-learning Topics: Concept of Antireflection coating, highly reflecting films, Uses of Thin films, Measurement of optical flatness. Determination of refractive index of liquids using interference, Determination of wavelength of light using plane transmission grating and numerical,	05	
III	Lasers and fiber Optic system	**Laser:** Characteristics of LASERS, spontaneous emission and Stimulated emission; Metastable state, Resonant cavity, Population inversion, three & four level lasers, types of pumping, Semiconductor Laser, Barcode Reader, Lidar. **Fiber optics**: Structure of an optical fiber, Types: Single mode & Multimode, Step index & Graded index. Modes of OFC, Intermodal Dispersion, Critical Angle, Derivation of Acceptance angle, Numerical aperture.	05	CO3
		Self-learning Topics: Attenuation, Losses in Optical fiber due to Physics structure and Transmission of signal Application: Optical fibre Transmission, Holography, Memory reading and writing applications.	05	
IV	PHYSICS OF SEMICON DUCTOR	Direct and indirect band gap semiconductors, Electrical Conduction: Concept of drift velocity, mobility, conductivity in intrinsic semiconductors, Fermi- Dirac distribution function, position of Fermi level in intrinsic and extrinsic semiconductors, variation of Fermi level in N and P type semiconductors with temperature and concentration, Hall effect and applications. Application: BJT and MOSFET	05	CO 4

		Self-learning Topics: Applications of semiconductor devices in computing hardware, including memory and modern VLSI trends like FETs, Comparison of Various types of FET on performance.	05	
V	PHYSICS OF SENSORS	Resistive sensors- PT100, Humidity measurement, proximity sensors, pressure sensors- Piezoelectric effect, Converse Piezoelectric effect, ultrasonic sensors for distance and velocity measurement in liquid and air, optical sensors- Photo diode, light dependent resistors, Image sensor-CCD and CMOS.	05	CO 5

		Self-learning Topics: basic concepts of sensors and transducers, measurement system characteristics (accuracy, precision, sensitivity, range), signal conditioning basics (amplifiers, filters), analog vs digital signals, noise and interference in measurement systems, basics of data acquisition systems (DAQ), calibration and error analysis, introduction to microcontrollers for sensor interfacing, basics of ADC and DAC, simple applications of sensors in real-world systems	05	
VI	NANOTECHNO LOGY AND NANO - COMPUTING	**Nanotechnology**: Nanoscale, nanomaterial classification, properties, significance of quantum confinement and surface to volume ratio, top down and bottom-up approach, ball milling, sputtering, sol-gel, and CVD methods of synthesis, Techniques-SEM, TEM, AFM. **Nano computing**: Introduction to nano computer, Nano computer Building block, Chemically Assembled Electronic Nanotechnology (CAEN), Single Electron Transfer (SET	05	CO 6
		Self-learning Topics: Methods to synthesize nanomaterials (Ball milling, Sputtering, Vapour deposition, sol gel), properties and applications of nanomaterials. Application: Lithography, Single Electron Transfer (SET), Spin Valves	05	

Text Books:

1. A Text book of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014.
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya, Poonam Tandon, Oxford Higher Education, 1st Edition 2015-16.
4. Engineering Physics -R. K. Gaur, S. L. Gupta, DhanpatRai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017

6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education
Pvt. Ltd., 2012.

References:

1. Concepts of Modern Physics - ArtherBeiser, Shobhit Mahajan, S. Choudhury, McGraw Hill, 7th Edition 2017
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Nanotechnology- Principles & Practices- Sulabha K. Kulkarni

Online References:

Sr. No.	Website Name
1.	1. https://archive.nptel.ac.in/courses/115/102/115102124/
2.	2. https://archive.nptel.ac.in/courses/115/102/115102025/
3.	3. https://archive.nptel.ac.in/courses/115/105/115105132/

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- **Two compulsory Internal Assessment Tests (IATs) of 20 marks each will be conducted.**
- **IAT-I will cover three CO's and IAT-II will cover the remaining three CO's (Course Outcomes).**
- **Duration of each test: 1 hour.**
- **The summation of both tests will be considered for IA marks.**

End Semester Examination (ESE) – 60 Marks

- **Duration: 2 Hours 30 Minutes**
- **Question paper consists of six compulsory questions, 10 marks each.**
- **Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...**
- **Each question may have two alternatives (Option A / Option B) from the same module.**
- **Both options should be of similar difficulty level and assess similar learning outcomes.**
- **Internal choice may be provided within questions.**
- **Questions should cover the entire syllabus, all Course Outcomes, and different levels of learning as per Bloom's Taxonomy.**

Note: -

1. Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks
2. No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)				Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613121203	Engineering Mechanics	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613121203	Engineering Mechanics	20	20	40	60	2.5	--	--	100

Rationale:

Engineering mechanics is a branch of science that deals with the behaviour of solid bodies when subjected to external forces or loads and the effects of these forces on the bodies. Though traditionally software-focused, Computer and IT engineers increasingly interact with physical systems through areas like robotics, virtual reality, gaming, digital twin technology, and simulation. Engineering Mechanics introduces the physical principles of force, motion, and equilibrium, which are essential for the development of realistic simulation engines, AI-based mechanical system models, and integration of software with hardware systems. This subject helps build the foundation of computational models of mechanical phenomena and enhances interdisciplinary competence for modern applications.

Course Objectives

1. To acquaint with basic principles of Centroid and Moment of Inertia and its real-life significance
2. To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3. To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4. To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.
5. To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.

6 To acquaint with the basics of Robot kinematics

Course Outcomes

1 Demonstrate the understanding of Centroid and area Moment of Inertia and locate the same.
2 Determine the resultant and equivalent force-couple system for a given system of forces.
3 Determine the support reactions for coplanar force system in equilibrium & illustrate the concept of loadings such as UDL & UVL, FBD, supports, beams, and conditions of equilibrium along with Friction.
4 Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for two-dimensional curvilinear motion and general plane motion.
5 Apply the principles of force and acceleration, work-energy and impulse-momentum to particles in motion.
6 Establish the relation between robot joints and parameters

Detailed Syllabus

Module no.	Module Name	Detailed content	Hours	CO
	Pre-requisite	Statics, Dynamics, Kinetics, Kinematics, Rigid body, Deformable body, applying trigonometric functions, resolution of a vector (Force vector), Law of triangle, Polygon law of forces, Newton's laws of motion Velocity, acceleration, displacement, Uniform velocity and accelerated motion, Variable acceleration for rectilinear motion, Law of conservation of Energy, Law of conservation of Momentum, work-energy principle, impulse and momentum principle, and Co-efficient of restitution	-	-
1	**Centroid and Moment of Inertia**	i. Characteristics, and real-life significance for Centroid and Moment of Inertia ii. Centroids of primary geometrical shapes and plane laminas (Excluding sector problem) iii. Area Moment of Inertia of basic shapes and areas (I section, T section, Rectangle. Circle, etc.) **Self-Learning topics:** i. Centroid for area with sector and real-life application ii. Exploring Moment of Inertia for composite shapes	07 07	CO1
2	**Force and System of Forces**	i. Principle of transmissibility, Moment of force about a point and concept of couple, Classification of force systems ii. Resultant of coplanar system of forces and Varignon's Theorem	08	CO2

		iii. Resultant of non-coplanar system of forces – Concurrent and General system of forces **Self-Learning topics:** i. Explore real – life problems on resultant of force system such as Street Light Pole with Cable Supports, Crane Hook Carrying Load with Two Cables, Boat Pulled by Two Ropes at Dock, etc.	08	
3	**Equilibrium and Friction**	i. Conditions of equilibrium for system of forces and free body diagrams, Types of beams, loads, and support and its reaction ii. Equilibrium of beams, and rollers (two and three rollers) (Excluding system of combining beam and roller) iii. Laws of friction. Cone of friction. angle of repose, and angle of friction iv. Application of equilibrium with friction on blocks on horizontal and inclined plane and ladders **Self-Learning topics:** i. Equilibrium of connected bodies (beam and sphere), two force and three force members, beams connected using internal hinges ii. Application of equilibrium with friction – Wedge and blocks	08 08	CO3
4	**Kinematics of particles and rigid bodies**	i. Motion along plane curved path, projectile motion ii. Introduction to General plane motion, problem based on Instantaneous centre (ICR) method for general plane motion (up to 2 linkage mechanism and roller) (Excluding 3 linkage mechanism and multiple bodies) **Self-Learning topics:** **i.** Exploring problems of ICR for 3 linkage mechanism and System of bodies ii. Exploring Liner motion with constant and Variable acceleration with Motion graphs	07 07	CO4
5	**Kinetics of particles**	i. Introduction to D'Alembert's Principle (DAP), inertia force, dynamic equilibrium, Work done by active forces, impact and collision ii. Problems on DAP, WEP, and IMP (Direct and Oblique central impact) **Self-Learning topics:**	08	CO5

		i. Application of WEP to the real-life problems such as Electric Scooter Acceleration, Luggage Moving on Airport Conveyor Belt, Car Climbing a Flyover, Spring-Based Door Closing Mechanism, etc. **ii.** Explore the concept of Impulse and Momentum Principle with real life problems such as Airbag Safety in Cars, Cricket Ball Impact on Bat, Landing of a Drone, etc.	08	
6	**Introduction to Robot Kinematics**	i. Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward) ii. Homogeneous transformation (limited to 2 DOF Serial robot) **Self-Learning topics:** i. Derive and Analyze – Manual derivation of forward kinematics using D-H Parameters	07 07	CO6

Text Books:

1. Engineering Mechanics by A K Tayal, Umesh Publication.
2. Engineering Mechanics by Kumar, Tata McGraw Hill
3. Engineering Mechanics by Beer &Johnston, Tata McGraw Hill

References:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
3. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill

Online References:

Sr. No.	**Website Name**
1	https://archive.nptel.ac.in/courses/112/106/112106286/
2	https://archive.nptel.ac.in/courses/112/106/112106180/

Assessment:

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour**.
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**

- Question paper consists of **six compulsory questions**, **10 marks each**.
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. **Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks**
2. **No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.**

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613211204	Digital Electronics	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613211204	Digital Electronics	20	20	40	60	2.5	--	--	100

Rationale: Digital Electronics is a core subject that provides the basic understanding of digital systems used in modern electronic devices. It helps students learn logic design using Boolean algebra, combinational and sequential circuits. The course introduces important components like flip-flops, memory, and programmable devices. It develops skills to analyze and design digital circuits. This knowledge is essential for advanced subjects like microprocessors and embedded systems. Overall, it builds a strong foundation for careers in electronics and computer engineering.

Course Objectives:

1. To enable students to understand and simplify logic functions using Boolean algebra, De Morgan's theorems, and Karnaugh maps.
2. To enable students to design and analyze combinational logic circuits using basic building blocks and standard ICs such as adders, multiplexers, encoders, decoders, and comparators.
3. To enable students to understand the operation and timing characteristics of sequential logic elements used in digital systems.
4. To enable students to design sequential circuits using flip-flops, shift registers, counters, and FSM models.
5. To enable students to understand semiconductor memory devices and programmable logic devices used for digital system implementation.

6. To enable students to understand logic family characteristics and basic concepts of analog–digital and digital–analog conversion.

Course Outcomes:

7. Formulate and simplify logic functions using Boolean algebra techniques and Karnaugh map minimization methods.
8. Design and analyze combinational logic circuits using adders, multiplexers, decoders, encoders, comparators, and identify hazards in combinational circuits.
9. Analyze the operation of latches and flip-flops and interpret timing parameters in sequential circuits.
10. Design and analyze sequential circuits such as counters, shift registers, and FSM-based digital systems.
11. Differentiate semiconductor memory technologies and implement digital logic functions using programmable logic devices.
12. Explain logic family parameters and identify basic types of ADC and DAC used in digital systems.

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
	Prerequisite	Basic knowledge of binary number systems, binary arithmetic, and logic gates used in digital circuits.		
1	**Implementation of Logic Functions**	Formulation of logic functions, Sum of Products (SOP), Product of Sums (POS), Simplification using Boolean Algebra, De Morgan's Theorems, Minimization using Karnaugh Map (up to 4 variables)	07	CO1
		Self-Learning: ● Practice writing truth tables ● Convert expressions into SOP and POS forms ● Solve problems using Boolean laws ● Practice K-map simplification	07	

2	**Combinational Circuit Design**	Introduction to combinational circuits, Adder , Use of 7483, Subtractor, Multiplexer (16:1, 8:1, 4:1), De-multiplexer, Decoder (3:8 and 5:12),74138 decoder Encoder (Priority Encoder), Code converters, Comparator (2-bit, 4_bit), Comparator IC 7485, Static and dynamic hazards in combinational circuits.	08	CO2
		Self-Learning: ● Design 4-bit adder using IC 7483 and verify its operation. ● Implement 3:8 decoder using IC 74138 and construct its truth table. ● Design 2-bit and 4-bit comparators using logic gates and verify using IC 7485. ● Implement logic functions using multiplexer (4:1 / 8:1). ● Identify static hazards in given Boolean expressions and suggest methods for removal.	08	
3	**Sequential Logic Elements**	Latches and Flip-flops (S-R, J-K, D, T flip-flop), Master–Slave flip-flop, Edge triggering and level triggering, Propagation delay time, Setup time, Hold time.	06	CO3
		Self-Learning: ● Draw truth tables and timing diagrams for different flip-flops. ● Study edge-triggered vs level-triggered flip-flops.	06	
4	**Sequential Circuit Design**	Shift registers (SISO, SIPO, PISO, PIPO) and their applications, Synchronous and asynchronous counters, Mod-N counter design, Finite State Machines (FSM): Moore and Mealy models, State diagrams and state tables, State reduction techniques, Introduction to asynchronous sequential circuits and essential hazards.	08	CO4
		Self-Learning: ● Design Mod-N counters using flip-flops. ● Draw Moore and Mealy FSM state diagrams.	08	

		● Explore applications of shift registers in communication systems.		
5	**Memory Devices and Programmable Logic Devices**	Memory devices: ROM, RAM, EPROM, EEPROM, Flash memory, Volatile and Non-volatile memory, Static RAM and Dynamic RAM. Programmable Logic Devices: Structure of PLDs, Logic implementation using PAL and PLA, Numerical problems on PAL and PLA. Introduction to CPLD and FPGA and their applications in digital systems.	08	CO5
		Self-Learning ● Compare SRAM and DRAM in terms of speed, cost, and applications. ● Implement logic functions using PLA programming tables. ● Explore basic FPGA architecture and its applications in modern digital systems.	08	
6	**Fundamentals of digital circuits**	Characteristic parameters of logic families: Voltage and current parameters, Fan-in, Fan-out, Noise margin, Power dissipation, Propagation delay. TTL NAND gate and its transfer characteristics, CMOS inverter and transfer characteristics, Comparison of TTL and CMOS logic families. Need of Analog to Digital Converter (ADC), Types of ADC – Counter type, Successive approximation type, Flash type. Digital to Analog Converter (DAC): Binary weighted DAC, R–2R ladder DAC. (No detailed explanation expected)	08	CO6
		Self-Learning: ● Compare TTL and CMOS logic families with respect to speed, power consumption, and noise margin. ● Study applications of ADC and DAC in real-world digital systems such as sensors and communication devices.	08	
	Total		90	

Text Books:

1. John F. Wakerly, “Digital Design Principles and Practice”- Pearson Publications, 4th edition.

2. Morris Mano, Michael D. Ciletti, “Digital Design with introduction to Verilog HDL” Pearson, 5th edition

3. John M. Yarbrough, "Digital Logic Applications and Design" – Thomson Publications.

4. Stephen Brown and ZvonkoVranesic, "Fundamentals of digital logic design with Verilog design", McGraw Hill, 3rd Edition.

5. Roth and Kinney, "Fundamentals of Logic Design", Cengage learning,7th edition

References:

1. J. Bhaskar, A Verilog HDL Primer, Third Edition, Star Galaxy Publishing [8] Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"

2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India

Online References:

Sr. No.	Website Name
1.	https://onlinecourses.nptel.ac.in/noc20_ee32/preview
2.	https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- Two compulsory Internal Assessment Tests (IATs) of **20 marks each** will be conducted.
- **IAT-I** will cover three CO's and **IAT-II** will cover the remaining three CO's (Course Outcomes).
- Duration of each test: **1 hour**.
- The **summation of both tests** will be considered for IA marks.

End Semester Examination (ESE) – 60 Marks

- Duration: **2 Hours 30 Minutes**
- Question paper consists of **six compulsory questions**, **10 marks each**.
- Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...
- Each question may have **two alternatives (Option A / Option B)** from the same module.
- Both options should be of **similar difficulty level** and assess similar learning outcomes.
- Internal choice may be provided within questions.
- Questions should cover the **entire syllabus**, all Course Outcomes, and different levels of learning as per **Bloom's Taxonomy**.

Note: -

1. Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks

2. No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.

Course Code	Course Name	Teaching Scheme (Contact Hours)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2698421205	Professional Communication &Ethics-I	2	--	--	30	--	--	30	60	2

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2698421205	Professional Communication &Ethics-I	20	20	40	60	2.5	--	--	100

Rationale:

The professional communication and ethics -I course has been designed to train students for oral and written proficiency in an increasingly interconnected and digital world. The engineers must be able to analyze intricate concepts & messages, understand communication theories, and develop practical skills in verbal, non-verbal, and digital communication. Effective communication skills are essential to express confidently during interviews to secure placements. It helps to create a confident and presenting image through open and transparent channels of communication by up-skilling LSRW competencies (Listening, Speaking, Reading and Writing) Overall, the course lays a strong foundation for producing competent, ethical, and industry-ready engineers who can thrive in a competitive and interconnected world.

Course Objectives - The learners should be able to:

1. Effectively explore the dynamics of communication and navigate professional arenas
2. Competently acquire active listening skills by comprehending physical and digital content
3. Critically analyze communication barriers, audience and purpose to speak proficiently
4. Minutely comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Efficiently organize and create purposeful technical writing for professional and business transactions
6. Impact fully relates with other agencies with ethical standards to deliver synergistic solutions.

Course Outcomes - The learners will be able to:

1. Explore dynamics of communication for computer-mediated communication using modern digital tools and platforms to facilitate effective workplace communication.
2. Demonstrate active listening skills in face-to-face and computer-mediated communication using modern digital tools and platforms.
3. Apply effective individual and team speaking skills by analyzing audience, communication methods, and barriers in technical and professional problem solving situations.
4. Read, synthesize and analyze complex technical and business documents efficiently.
5. Design purposeful and ethical technical and business content, presentation using ICT enabled media.
6. Apply ethical communication practices to promote environmental and social responsibility in professional and societal contexts.

Prerequisite: Basic knowledge of English language

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic knowledge of English language.		
I	Communication Dynamics	Foundations of Communication Dynamics: Definition, objectives, and importance in corporate settings, Process and components: Sender, message, channel, receiver, feedback Types: Verbal and non-verbal communication Models of Communication: Linear, interactive and transactional models, Workplace communication: Formal and informal communication channels, Barriers to Communication: Physical, semantic, psychological, emotional Cultural and organizational barriers. **Self-Learning Topics** Internal communication (emails, notices, circulars) Regular email updates company-wide newsletters and bulletin boards External Communication: Brand messaging, crisis communication, and stakeholder engagement. (clients, stakeholders, branding)	5 5	CO1

II	Active Listening& Interpersonal Skills	Active Listening& Interpersonal Skills: Meaning and importance of active listening, Components, Types of Listening: Informational Listening – Listening to understand and retain information, Critical Listening – Evaluating ideas and analyzing information Reflective Listening – Understanding emotions and responding empathetically. Note-Taking Techniques for Engineers: Importance in project work and learning Methods: Cornell method Bullet Journaling Digital tools (OneNote, Notion, etc.) Role of Emotional Intelligence in Communication: Self-awareness and self-regulation Empathy in listening, Managing interpersonal relationships effectively	5	CO2

		Self-Learning Topics Listening kryptonite in Corporate Settings Technology overload (hello, constant notifications), Information overwhelm Multitasking Distraction, Tunnel Vision, Neglecting Nonverbal Cues, Technical vs. Human Disconnect Poor Documentation & Follow-Up, Interrupting & Rushing.	5	
III	Professional Speaking Skills	Oral communication in professional settings: Public speaking and presentations, Group discussions and interviews, explaining technical concepts in simple language Grooming and Self Development: Articulatory Speech Sounds, Acoustic Speech Sounds, Pronunciation of Accent Neutralization: Useful for professionals interacting with international clients, Virtual Meetings & online Discussion, Problem-Solving, Poster Presentation and Q&A **Self-Learning Topics:** Practice through mock presentations , Recording and improving speech clarity Technical Terms: Ensuring correct articulation of IT jargon like "cache," "router," or "SQL.", Field Specific terms Record your own speaking, imitating native accent and pronunciation and fluency, Engage in discussion with colleagues and family members to adopt an impressive & open communication style.	5 5	CO3

VI	Reading and Text Summarization Skills	Advanced Reading Strategies in Engineering Context: SQ3R technique Exploratory vs. Analytical reading Reading workflows used in industry (emails, documentation, reports) Intensive reading: (algorithms, system design, manuals) Extensive reading: Exposure to emerging technologies, standards, and innovations scope :Interpretation of Technical Documents. Types of documents: white papers, design documents, case studies Extracting Problem statement methodology, data, conclusions Critical evaluation of sources (credibility, bias, accuracy. Visualization tools: Flowcharts (process logic) Graphs & charts (data trends, comparisons) Mind maps (concept linking) Converting text → visuals (infographics, system diagrams) Interpreting visual data: Trends, correlations, deviations Use in presentations, reports, and product design discussions **Self-Learning Grammar and Vocabulary** Practice Verbal Ability Test (GRE, TOEFL, IELTS) Reading Technical Resources Exploring documentation from platforms like GitHub and official software docs Reading research papers and white papers (basic structure and understanding)	5 5	CO4
V	Technical & Business Writing Skills	Principles of High-Impact Professional Writing: The Seven Cs as design principles of communication quality Cognitive clarity, precision, and reader-centric writing Eliminating ambiguity in technical and business communication. Advanced Business & Formal Communication Structured professional correspondence in corporate ecosystems Decision-oriented writing (inquiry, acceptance, rejection, grievance, appreciation) Tone modulation for hierarchy and stakeholder communication Short and Long Reports: Formatting Guidelines Tips for Text Chat Software Installation Guides Standard Operating Procedures (SOP) Press Releases Legal and compliance writing: Data Privacy Policy, Compliance Reports and License Agreement Digital & Professional Identity Writing (Modern Extension)Engineering resumes as structured technical narratives, LinkedIn and professional branding communication, Technical blogging and knowledge dissemination, AI-assisted writing with ethical validation	5	CO5

V	Technical & Business Writing Skills	**Self-Learning**: Company SOPs, user manuals, API documentation, and product guides. Structure analysis of IEEE papers and technical reports, Digital Content Creation for Social Media and e-Commerce Platforms, Short videos, Blogs, Vlog Keynote speeches Podcast titles Landing pages Social media posts YouTube video description	5	
VI	Ethics in professional and community context	Ethical standards in workplace communication; confidentiality, transparency, professional responsibility, and code of conduct. Ethical Issues and Dilemmas Fake news, misinformation, plagiarism, propaganda, manipulation, and ethical decision-making in communication. Ethical concerns in AI-generated content, automation bias, deep fakes. Role of communication in society; responsible messaging, public communication ethics, and impact on communities. Communicating environmental and social responsibility ethically in organizations and society. **Self-Learning** Ethical use of technology, Sustainable Study Habits: Time Management and Responsibility. Linking with Tech folk (Ethical Hackers, Makers , founders)	5 5	CO6
	Total		60	

References:

1. Communication Skills by Sanjay Kumar & Pushap Lata
2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick & Hemphill
3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo
4. Effective Business Communication by Herta Murphy
5. Technical Communication: Principles and Practice by Raman and Sharma
6.Bhatnagar, Nitin & Bhatnagar, Mamta, *Communicative English for Engineers and Professionals*, Pearson India.
7.Jain, Alok Kumar, *Professional Communication Skills*, S. Chand Publishing.
8.Singh, Priyanka, *Professional Communication*, Atlantic Publishers.
9. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi

10. Oxford Guide to Effective Writing & Speaking by John Seely

Online References:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/
4.	https://venngage.com/blog/white-paper-examples/

Summary of Internal Assessment (IA) and End Semester Examination (ESE)

Internal Assessment (IA) – 40 Marks

- **Two compulsory Internal Assessment Tests (IATs) of 20 marks each will be conducted.**
- **IAT-I will cover three CO's and IAT-II will cover the remaining three CO's (Course Outcomes).**
- **Duration of each test: 1 hour.**
- **The summation of both tests will be considered for IA marks.**

End Semester Examination (ESE) – 60 Marks

- **Duration: 2 Hours 30 Minutes**
- **Question paper consists of six compulsory questions, 10 marks each.**
- **Questions will be set module-wise: Q1 – Module I, Q2 – Module II, Q3 – Module III and so on...**
- **Each question may have two alternatives (Option A / Option B) from the same module.**
- **Both options should be of similar difficulty level and assess similar learning outcomes.**
- **Internal choice may be provided within questions.**
- **Questions should cover the entire syllabus, all Course Outcomes, and different levels of learning as per Bloom's Taxonomy.**

Note: -

1. Internal Assessment (IA) – 40 Marks + End Semester Examination (ESE) – 60 Marks = Total – 100 Marks

2. No questions shall be asked from self-learning modules in either the Internal Assessment or the End Semester Examination.

Course Code	Course Name	Teaching Scheme Contact Hours (Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613112206	Engineering Physics Lab	--	--	1	--	--	15	--	15	0.5

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613112206	Engineering Physics Lab	--	--	--	--	--	25	--	25

Lab Objectives:

1. To BUILD a foundation of quantum mechanics needed for understanding and developing modern technology.
2. To DEMONSTRATE the principles of interference in thin films and relate them to optical phenomena.
3. To INTRODUCE the fundamentals of lasers and optical fibers along with their applications in communication technology.
4. To UNDERSTAND the working principle of an ultrasonic distance meter and to MEASURE distances using ultrasonic wave propagation.
5. To provide students with a basic UNDERSTANDING of Semiconductors in the field of Basic Engineering.
6. To STUDY synthesis methods and characterize nanomaterials, analyzing size-dependent properties due to quantum confinement.

Lab Outcomes:

LO1: Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.

LO2: Learners will be able to DETERMINE the wavelength of light and EXPLAIN the interference phenomenon.

LO3: Learners will be able to ILLUSTRATE the use of lasers in applications and APPLY the fundamentals of fiber optics in modern communication technology.

LO4: Learners will be able to OPERATE an ultrasonic sensor to measure distance accurately and EXPLAIN its working based on the time-of-flight principle of sound waves.

LO5: **:** Learners will be able to have a fundamental UNDERSTANDING of semiconductors, including their properties, types, and applications in basic engineering.

LO6 : Learners will able to UNDERSTAND nanoscale concepts, nanomaterial synthesis and characterization, and apply these principles to nano computing concepts like Quantum Confinement and Single Electron Transfer.

List of Experiments. (Minimum five experiments required)

Sr No	List of Experiments	Hours	LO
01	Determination of 'h' using LED/photocell	**01**	**LO1**
02	Determination of Number of Lines / Wavelength in Diffraction Grating using He-Ne Laser	**01**	**LO2**
03	Determination of Radius of Curvature of Lens Using Newton's ring Set Up.	**01**	**LO2**
04	Determination of Divergence of LASER	**01**	**LO3**
05	Determination of Numerical of Aperture of OFC	**01**	**LO3**
06	Input and Output Characteristics of CB and CE Configuration	**01**	**LO4**
07	Study of IV characteristics of Semiconductor PN Junction Diode	**01**	**LO5**
08	Study of IV characteristics of Photodiode	**01**	**LO4**
09	Study of Hall Effect.	**01**	**LO4, LO5**
07	Measurement of Distance using Ultrasonic Distance Meter.	**01**	**LO5**
08	Measurement LVDT for displacement sensing.	**01**	**LO5**
09	Determine RTDs (PT100) for temperature measurement.	**01**	**LO5**
10.	Learning Basic operations of Scanning Electron Microscope and Transmission Electron Microscope.	**01**	**LO6**
11	Feature Size measurement: Porosity, Grain, and Reinforcement	**01**	**LO6**

Text Books and References:

1. **Ajoy Ghatak –** ***Optics***
Excellent explanation of diffraction, laser interference, and grating equations.
2. **C.L. Arora –** ***B.Sc. Practical Physics***
Practical procedure and observation format for the experiment.
3. **Jenkins & White –** *Fundamentals of Optics*
4. **Gerd Keiser** – *Optical Fiber Communications*
5. **R.S. Sedha –** ***Applied Electronics***
6. Digital CMOS Design by Sung-Mo Kang

Online Resources:

Sr. No.	Website Name
1.	IEEE Xplore / Research Gate
2.	https://www.electronics-tutorials.ws/diode/diode_2.html
3.	https://circuitdigest.com.
4.	https://www.vlab.co.in/
5.	https://www.AMRITHA.vlab.co.in/

Assessment:

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks Project + 5 Marks (Attendance)

Project work: The project is to be completed within one semester. Students must execute the project as per the plan submitted at the beginning of the semester. The project outcome can be a working model, a simulation model, or a study report leading to the anticipated conclusion. Evaluation will be based on the quality of work and adherence to the submitted plan. A proper assessment rubric will be used for awarding marks.

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613122207	Engineering Mechanics Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122207	Engineering Mechanics Lab	--	--	--	--	--	25	--	25

Lab Objectives:

1 To acquaint with basic principles of Centroid & Moment of Inertia and its real-life significance
2 To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3 To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4 To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.
5 To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.
6 To acquaint with the basics of Robot kinematics

Lab Outcomes:

1 Demonstrate the understanding of Centroid locate the same.
2 Determine the resultant and equivalent force-couple system for a given system of forces.
3 Illustrate the concept of loads, supports, beams, conditions of equilibrium, and friction and apply the same in two-dimensional systems with the help of FBD.
4 Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for rectilinear, curvilinear, and general plane motion.
5 Apply the principles of force and acceleration, work-energy and impulse- momentum to particles in motion.
6 Establish the relation between robot joints and parameters

List of Experiments:

Minimum six experiments from the following list of which a minimum one should be from dynamics.

Sr. No.	List of Experiments	Hrs	CO mapping
1	Determination of Centroid of plane lamina made up of standard geometrical shapes	02	CO1
2	Moment of Inertia of fly wheel	02	CO1
3	Verification of Polygon law of coplanar forces (Universal force table apparatus)	02	CO2
4	Verification of the Principle of Moments (Bell crank lever)	02	CO2
5	Determination of support reactions of a Simply Supported Beam.	02	CO3
6	Determination of coefficient of friction using inclined plane	02	CO3
7	Verification of the equations of equilibrium for non-concurrent non-parallel (General) force system.	02	CO3
8	Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity)	02	CO4
9	Collision of elastic bodies (Law of conservation of momentum).	02	CO5
10	Kinetics of particles. (collision of bodies)	02	CO5

Sr No	List of Assignments / Tutorials	Hrs	CO mapping
01	Centroid and Moment of Inertia of composite plane laminas (4 Numerical)	01	CO1
02	Resultant of coplanar and non-coplanar system of forces (3 Numerical)	01	CO2
03	Equilibrium of beam, rollers, bodies on inclined plane with friction and ladders with friction (6 Numerical).	03	CO3
04	Kinematics of particles and rigid bodies (8 Numerical)	03	CO4
05	Kinetics of particles (6 Numerical)	02	CO5
06	Homogeneous transformation, and Direct Kinematics of robot (4 Numerical)	02	CO6

Assessment:

Term Work: Term Work shall consist of at least 06 practical based on the above list. Also, Term work Journal must include all the assignments listed above.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks (Assignments) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613212208	Digital Electronics		--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122208	Digital Electronics Lab	--	--	--	--	--	--	25	25

Lab Objectives:

Lab course aims to

1. To enable students to implement basic logic functions using logic gates and verify Boolean expressions.
2. To enable students to design and test combinational circuits such as adders, multiplexers, decoders, and comparators using ICs.
3. To enable students to analyze the operation of flip-flops and verify timing behavior of sequential circuits.
4. To enable students to design counters and shift registers using flip-flops.
5. To enable students to implement simple digital systems using memory and programmable logic concepts.
6. To enable students to study logic family characteristics and basic analog-to-digital and digital-to-analog conversion techniques.

Lab Outcomes:

After successful completion of the laboratory work, students will be able to:

1. Implement Boolean expressions and logic functions using K-map simplification and logic gates.

2. Design and verify combinational circuits such as adders, multiplexers, decoders, code converters, and comparators.
3. Analyze the operation of flip-flops and interpret timing behavior of sequential circuits.
4. Analyze the operation of flip-flops and interpret timing behavior of sequential circuits.
5. Demonstrate the working principles of memory devices and programmable logic implementation techniques.
6. Simulate and analyze digital circuits such as logic families, shift registers, and programmable logic devices (PLA) using appropriate software tools.

DETAILED SYLLABUS

Sr. No.	List of Experiments	Hours	LO Mapping
Prerequisite	**Fundamental Mathematics and Physics**		
1	Implementation of Boolean functions using K-map simplification and logic gates.	2	LO1
2	Implementation and verification of SOP and POS form	2	LO1
3	Design and verification of Full Adder and Full Substarctor circuits**.**	2	LO2
4	Implementation of 4-bit adder using IC 7483**.**	2	LO2
5	Implementation of Multiplexer and De-multiplexer circuits (4:1 / 8:1)**.**	2	LO2
6	Implementation of 3:8 Decoder using IC 74138**.**	2	LO2
7	Design and verification of code converter (Binary to Gray / Gray to Binary)	2	LO2
8	Design and verification of 2-bit and 4-bit comparator using IC 7485**.**	2	LO2
9	Study and verification of SR, JK, D and T flip-flops**.**	2	LO3
10	Design and verification of shift registers (SISO / SIPO)**.**	2	LO5
11	Design of synchronous or asynchronous counters using flip-flops**.**	2	LO4
12	Study of memory devices or simple PLA / FPGA demonstration using simulation tools**.**	2	LO5/LO6

Recommended Books:

1. Morris Mano, Michael D. Ciletti, "Digital Design with introduction to Verilog HDL" Pearson, 5th edition
2. Sameer Palnitkar, "Verilog HDL: A guide to digital design and synthesis"
3. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India

Online Resources:

Sr. No.	Website Name
1.	CircuitVerse - Online Digital Logic Circuit Simulator
2.	Online circuit simulator & schematic editor – Circuit Lab

Assessment:

Term Work shall consist of at least minimum 10 practical based on the above list. Also, the term work journal must include at least 2 assignments.

Oral/Practical: 25 Marks: The practical and oral will be conducted on above experiments and theory syllabus

Course Code	Course Name	Teaching Scheme (Contact Hours)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning) Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2698422209	Professional Communication &Ethics-I Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2698422209	Professional Communication & Ethics-I Lab	--	--	--	--	--	25	--	25

Lab Objectives: The learners should be able to:

1. Effectively explore the dynamics of digital communication in academic and professional arenas.
2. Positively acquire active listening skills through Speech Acts in different modes.
3. Thoroughly analyse communication barriers, audience and purpose to speak effectively at the workplace.
4. Minutely demonstrate technical and non-technical text to comprehend and discern the exact purposes.
5. Efficiently organize and create purposeful technical and business writings using ICT enabled media.
6. Successfully manage teams and individual tasks by applying ethical standards to execute the tasks.

Lab Outcomes: The learners will be able to:

1. Apply computer mediated communication principles for excellence in professional settings.
2. Test listening capabilities for advanced listening strategies using physical and digital modes.
3. Evaluate and present technical and non -technical ideas precisely to the audience in a confident way.
4. Demonstrate reading proficiencies through practicing extensive technical and business texts for developing new ideas.
5. Design digital, technical and business content for professional transactions.
6. Implement interpersonal skills and professional ethics to provide fair and collaborative community solutions

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Basic knowledge of English language and ICT enabled media		
I	Communication Dynamics	Application of Communication Dynamics Communication, Shannon Weaver Model at workplace. Identify sender, receiver, message, channel, feedback, and noise in real-life workplace examples. Study communication practices in selected Indian companies A Case Study, News Letter, Brand messaging: Develop a brand message for a product or company	5	LO1
II	Active Listening& Interpersonal Skills	Types of Listening: Informational Listening – Listening to understand and retain information, Critical Listening – Evaluating ideas and analyzing information Reflective Listening – Understanding emotions and responding empathetically. Skill Components, Pair Activity (Listening Practice) Empathy Practice.	5	LO2
III	Professional Speaking Skills	Conversational Activities -I Self Introduction, Prepared Speech on Technical Topics and Impromptu Speech on General Topics Conversational Activities-II Simulation in communication: Role Play Activity for Conflict Resolution Negotiation, Handling complaints or angry customers through simulated phone or chat interactions. Conversational Activities-III customer Communication, Cross-Cultural communication, Marketing & Brand Communication Handling Q&A in Presentation	5	LO3
IV	Reading and Text Summarization Skills	SQ3R-Based Technical Paper Analysis. Industry Document Workflow Simulation Analyze a given document (white paper / design doc / case study) Compare 2 technical sources on the same topic. Practice Verbal Ability Test (GRE TOEFL and IELTS for grammar and vocabulary)	5	LO4

		Text to Visual Conversion Summarizing text to Graphic Organizers (GO) Infographics, Flow Charts, Mind Maps, SWOT analysis Gantt Charts, Venn Diagram Different Types of Organograms etc. as per the situations in the organizational setting. Summarizing text in point form after reading white paper , Industry reports and articles		
V	Technical & Business Writing Skills	Writing Letters and emails, Inquiry Letter Cover Letter, Offer acceptance / Rejection Letter Grievance Letter Thank you Letter Business communication Technical documentation, (SOPs, policies, reports)Content creation for digital platforms Website/blog publishing using CMS tools like WordPress. Industry-oriented writing Data Privacy Policy, Compliance Report (basic format)'License Agreement, Press Release, landing pages, e-commerce content)	5	LO5
VI	Ethics in professional and community context	Ethical Decision-Making in Communication Dilemmas. Ethical risks in artificial intelligence communication systems. To design ethical communication for sustainability and social good. To develop ethical reasoning at the workplace during conflicts.	5	LO6

Reference Books:

1.Communication Skills by Sanjay Kumar & Pushp Lata

2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick & Hemphill

3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo

4. Effective Business Communication by Herta Murphy

5. Technical Communication: Principles and Practice by Raman and Sharma

6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi

7. Oxford Guide to Effective Writing & Speaking by John Seely

8. English Grammar by Raymond Murphy

9. Word Power Made Easy by Norman Lewis

Online Resources:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/

List of Experiments

Sr. No	Name of Experiment	Hours	LO
1.	Prepare a case study on Corporate level Communication in Select Indian Companies Tata Consultancy Services (TCS), Infosys, Reliance Industries,HCL Technologies, Wipro etc.	02	LO1
2	Listening Skill Activity Sheet containing minimum three types of listening activities from Lab Syllabus.(Using Language Lab & Open Source)	02	LO2
3	A Continuous Evaluation of at least three types of the activities form Lab Syllabus for proficiency in oral communication/presentation	02	LO3
4.	Select a technical article (AI, IoT, Cybersecurity, etc.) and Perform:1.Exploratory Reading: Skim and summarize in 100 words 2.Analytical Reading: Deep analysis using Visualization Task using graphic organizers.	02	LO4
5.	Decision-Oriented Business Writing: Write any three: Inquiry letter/email,Acceptance message, Rejection message Grievance/complaint,Appreciation email. b.Prepare the following: 1. Standard Operating Procedure (SOP) 2. Data Privacy Policy 3. Compliance Report (basic format) 4. License Agreement 5. Press Release create content for **at least 3 of the following categories**: 1. Blog Writing 2. Vlog Script 3. Keynote Speech 4. Podcast Titles 5. Landing Page Content 6. Social Media Posts	02	LO5
6.	Ethical code of Conduct Draft: a simple code of conduct for a company or student group. agencies regarding the future inputs for synergistic solutions, Ethical AI Content Review, generate content using AI and evaluate: Accuracy, Bias, Ethical concerns Interview Report, Interview or research a professional form diverse area such as: Cybersecurity expert, Startup founder etc.	02	LO6

Term Work - 25

Experiments/Practicals

Six to Eight experiments from all six modules will be conducted using a language lab, open source and must be documented well for final submission as a part of term work at term end **20 marks**

Attendance -5 Marks

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)				Total Credits (C) (Notional Learning Hour/30)
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613122210	IDEA LAB -II (Innovation Design Engineering and Apply)	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613122210	IDEA LAB -II (Innovation Design Engineering and Apply)	--	--	--	--	--	25	50	75

Rationale:

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a structured assessment framework is implemented.

1. Project assessment is carried out using standardized IDEA Lab rubrics with multiple evaluation parameters.
2. One of the key parameters is **Engineering Subject-Based Assessment**, which focuses on the effective application of same-semester subject knowledge in project work, ensuring integration of theoretical learning with practical implementation.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and

integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Students must ensure that their IDEA Lab project meaningfully incorporates concepts from all core subjects of the current semester and maintain a project logbook as evidence of subject-wise application.
- Faculty in-charge must guide students to apply concepts from subjects studied in the same semester to their IDEA Lab projects.
- The term work evaluation will partially reflect the effective application of subject-specific knowledge.
- Faculty should regularly review the integration of academic content within the project work.

2) Implementation Strategy – IDEA Lab Learning Model

- A theme-based learning structure shall be implemented where each semester is anchored to a broad contextual domain such as Healthcare, Smart Cities, Energy, Agriculture, or Governance, providing the overall learning direction.
- From the identified theme, a system-level, open-ended problem statement shall be defined, serving as a solution-neutral framework that enables interdisciplinary thinking and innovation.
- The learning sequence shall follow a structured flow:
  Theme → Problem Statement → Same Semester Subject Application →
  Design–Implementation Experience, ensuring progressive transformation from context to solution.
- Themes shall provide the context (defining the domain of work), while problem statements shall provide the purpose, enabling students to identify meaningful real-world challenges.
- Subjects shall be treated as engineering tools, where each subject contributes specific knowledge components to solve different aspects of the problem.

- Students shall be encouraged to take ownership of their learning and projects, fostering curiosity, exploration, social relevance, and a mindset of creative risk-taking.
- Structured brainstorming and ideation sessions shall be conducted at the beginning of the semester to guide students in problem identification and development of solution pathways through collaborative and interdisciplinary thinking.
- Guest lectures and expert talks shall be organized by inviting industry experts, researchers, and innovators aligned with the semester theme and subject areas to provide exposure to real-world challenges, trends, and opportunities.
- A mechanism shall be implemented to ensure uniqueness and originality of projects by systematically reviewing ideas to avoid duplication and encouraging novel, technology-driven solutions.
- Platforms shall be created for collaborative learning and discussion, enabling students to present ideas, receive peer and mentor feedback, and refine solutions through iterative engagement.
- Content beyond syllabus for as subject shall be integrated with IDEA Lab themes and problem statements to ensure deeper interdisciplinary application and enhanced conceptual understanding.
- Preference shall be given to ensuring same-semester academic alignment, where subject faculty contribute to effective contextual integration of project-based learning.
- Continuous monitoring and documentation shall be ensured through logbooks, milestone tracking, and periodic progress reviews to maintain academic rigor and outcome alignment.
- Coordination with subject faculty shall be ensured for effective mapping of theoretical concepts into project execution and for evidence-based term work assessment.
- The IDEA Lab shall function as an institutional mechanism for implementing the CDIO (Conceive–Design–Implement–Operate) framework, promoting experiential and outcome-based learning through structured mini-projects.

Implementation Notes:

- Guide will assess subject's contribution using specific evidence such as:
    - Logbooks
    - Subject-specific outputs (e.g., simulations, designs)
    - Paper publications or review presentations

3) Guidelines for Assessment

Assessment Month	**Marks**
Month 1 (Formative 1)	50 marks

Month 2 (Formative 2)	50 marks
Month 3 (Formative 3)	50 marks

Total Assessment Structure

Component	Marks	Assessed By
Term work – Project Execution	50 Marks	Project Guide – Average of all innovation
Viva Voce (Final Evaluation)	50 Marks	External Examiner

Criteria	**Excellent (10)**	**Good (8)**	**Satisfactory (6)**	**Needs Improvement (4)**
1. Innovation	Highly original and disruptive idea solving a real-world or futuristic problem	Novel idea with a creative approach to a known problem	Moderately innovative; adapts existing solutions	Common or repetitive idea with minimal novelty
2. Design	User-centric, systematic design with professional-level tools, prototyping, or simulations	Logical structure; clearly presented using standard tools	Functional design but limited user perspective or refinement	Poor or confusing design with lack of user consideration
3. Engineering	Applies concepts from all same-semester subjects with clear integration and interdisciplinary depth	Applies knowledge from 4 or more subjects with relevance	Applies 2–3 subjects with moderate clarity	Applies 1 subject with weak or shallow connection
4. Implementation	Complete, fully functional prototype with rigorous testing and real-world validation	Working model with minor errors; partially tested	Prototype is incomplete; basic testing or debug attempt	Poorly implemented; fails to function properly
5. Application	Strong real-world relevance with alignment to SDGs/National Missions; impact clearly identified	Clear practical use-case with user/market relevance	Some practical value but limited clarity on impact	Vague or irrelevant application; weak user connect

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2613412211	Python Programming	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2613412211	Python Programming	--	--	--	--	--	--	25	25

Lab Objectives: To familiarize learners with Python's basic syntax, variables, data types, operators, and input/output functions.

1. To understand basic Python syntax and programming constructs.
2. To develop problem-solving skills using control structures and data structures.
3. To apply Python libraries for basic data processing and visualization.
4. To implement modular programming using functions.
5. To understand object-oriented programming concepts.
6. To use exception handling for error management.

Lab Outcomes: After completion of experiment, the learners will be able to

1. Write and execute basic Python programs.
2. Apply appropriate data structures and control logic.
3. Perform simple data analysis using Python libraries.
4. Develop modular and reusable code.
5. Implement programs using OOP concepts.
6. Handle runtime errors using exceptions.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Logical Thinking & Problem Solving: Ability to break down problems into smaller parts. Basic understanding of flowcharts or algorithmic thinking.	–	–
I	Introduction to Python	Installation, Features, Python Interpreter and its working, Syntax and Semantics, comments, imports, indentation, variables, data types, math arithmetic, operators. (comparison, logical, bitwise), expressions, print, formatting print, generating random numbers.	5	LO1
II	Python Data Structures & Flow Control	Strings, Lists, Dictionaries, Tuples, Sets; Slicing; properties, operations and methods of these data structures Conditional blocks using if, else and elif, Simple For loop, For loop using Ranges, While loops, Loop manipulation using Pass, Continue, Break.	5	LO2
III	Data Preprocessing and Python Libraries	Introduction to data preprocessing and its importance. Basic data cleaning techniques such as handling missing values and simple data transformation. List and dictionary comprehension for creating and modifying data collections. **NumPy:** Creating one-dimensional and two-dimensional arrays and performing basic operations. **Pandas:** Introduction to Series and DataFrames, creating DataFrames and basic data handling operations. **Matplotlib:** Basic data visualization using simple plots like line graphs and bar charts. **Scikit-learn:** Introduction to machine learning library and basic preprocessing methods such as scaling and normalization.	5	LO3
IV	Python Functions	Defining and calling functions, return, scope, function arguments (args and kwargs), recursive functions; Built-in functions: Lambda, Map, Filter, Reduce, Zip, Enumerate.	5	LO4

V	Classes and Objects	Class definition, object creation, class variables and methods, accessing class attributes, meaning of self, __init__, inheritance, overriding super class.	5	LO5
VI	Exceptional Handling	Exception, Types of errors, handling an exception, try, expect, else, try-finally clause, Argument of an Exception, Raising an Exception.	5	LO6

Suggested List of Experiments: (Expected Minimum 12 Experiments to be performed)

Sr. No.	List of Experiments	Hours	LO Mapping
1	Write Python program to 1. Swap two variables. a. Using temp variable b. Using comma operator c. Using bitwise XOR operator 2. Compute areas of the following (Find the equation and implement in python): 1. Circle 2. Square 3. Sphere 4. Triangle 5. Rectangle 3. Solve quadratic equation ax2+bx+c=0 . 4. Convert Celsius to Fahrenheit. 5. Generate a Random Number using random(), randint(), sample()[import random]	02	LO1
2	Write Python program to 1. Accept three sides of a triangle and print if the triangle is equilateral, isosceles or scalene. 2. Create a calculator. 3. Count the number of even and odd numbers from a series of numbers 5 to 100 using for and range(). 4. Display the Fibonacci sequence up to the nth term where n is provided by the user (use while loop). 5. Print the following pattern using a nested loop. * *** ***** *** *	04	LO1, LO2
3	Write Python program to 1. Write a program to count the number of each vowel in a string	02	LO3

	2. Write a program to remove all punctuation from the string provided by the user punctuations = '"!()-[]{};:'"\, <>. /?@#$%^&*_~"' 3. Write a program to check if the given string is Palindrome or not? Hint: Use membership operators IN, Not IN 4. Sum all the items in a list. 5. Implement Linear Search using List.		
4	Write Python program to 1. Create a tuple, and find the minimum and maximum number from it. 2. Find the repeated items of a tuple. 3. Print the number in words for Example: 1234 => One Two Three Four 4. Create a set, add member(s) in a set and perform the following operations: intersection of sets, union of sets, set difference, symmetric difference, clear a set. 5. Find length, maximum and the minimum value in a set.	04	LO3

5	Write Python program to
	1. a Create a numpy array with all ones
	b. Generate random integers from 5 to 10 and arrange them into 3 * 5 numpy array.
	c. Create 4 * 4 identity matrix using numpy function and find its mean value.
	d. Create 3 * 3 matrix and pad (fill) the borders with 0's.
	2.Create a 5 * 6 array between 10 to 1000 such that the difference between the elements are 12 and they are only even numbers. Print the even rows and odd columns from the array.
	3.Take user input for dimension of matrix and create the following pattern. Below is for 8 * 8 pattern.
	`[[0 1 0 1 0 1 0 1]`
	`[1 0 1 0 1 0 1 0]`
	`[0 1 0 1 0 1 0 1]`
	`[1 0 1 0 1 0 1 0]`
	`[0 1 0 1 0 1 0 1]`
	`[1 0 1 0 1 0 1 0]`
	`[0 1 0 1 0 1 0 1]`
	`[1 0 1 0 1 0 1 0]]`
		04	LO4

6	Write Python program to 1. Create data dictionary for below data, then convert it into data frame.	04	LO4

a. Print all the columns where the name of students begin with letter A and percentage is higher than 85 using " index" attribute.

b. Print Age column. Print average age.

c. Print 0^{th} and 2^{nd} index column using "iloc" function.

d.Update the Percentage column between 0 and 1.

Name	Age	Stream	Percentage
Rima	21	Math	58
Alok	19	Commerce	92
Anandita	20	Arts	85
Priyanka	18	Biology	30

2. Based on the dataset "imdb_1000.csv" answer the following

a. Read in 'imdb_1000.csv' and store it in a DataFrame named movies

b. Check the number of rows and columns

c. Check the data type of each column

d. Calculate the average movie duration

e. Sort by duration to find the shortest and longest movies (Hint: use sort values)

f. Count how many movies have each of the content ratings

g. Calculate the average star rating for movies 2 hours or longer, and compare that with the average star rating for movies shorter than 2 hours

h. Calculate the average duration for each genre

i. Determine the top rated movie (by star rating) for each genre

j. Calculate the average star rating for each genre, but only include genres with at least 10 movies

k.

https://www.w3schools.com/python/pandas/pandas_cleaning.asp

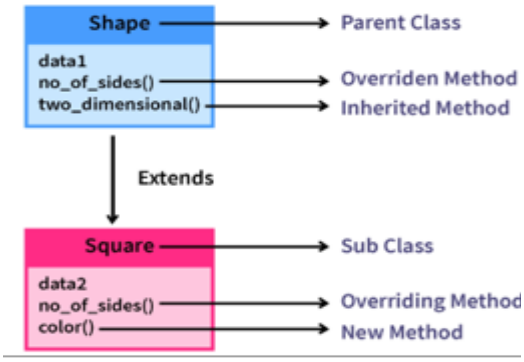
3. Create charts for below dataset.

	name	age	gender	state	num_children	num_pets
0	john	23	M	california	2	5
1	mary	78	F	dc	0	1
2	peter	22	M	california	0	0
3	jeff	19	M	dc	3	5
4	bill	45	M	california	2	2
5	lisa	33	F	texas	1	2
6	jose	20	M	texas	4	3

a. Scatter plot of two columns – name and num_children , num_children and num_pets

b. Bar plot of column values – name and age, between any other two columns of your choice.

	c. Line plot, multiple columns – name and num_children, num_pets d. Save plot to file - e. Bar plot with group by – Number of unique names per state		
7	Write Python program to 1. Write map function to return a list of numbers which are square of first 10 Fibonacci numbers. 2. Write a lambda function for adding 26 to its argument, also create a lambda function that multiplies argument x with argument y and print the result. 3. A twitter database is given in which we have username and tweets. users = [{"username": 'seema', "tweets": ["i love chocolate", "i am a student"]},{"username": 'arush', "tweets": []}, {"username": 'kumal', "tweets": ["India", "Python"]}, {"username": 'sam', "tweets": []}, {"username": 'lokesh', "tweets": ["i am good"]},] i) Filter out Users which don't have any tweets/Inactive Users ii) Filter inactive users with just username in uppercase. iii) Return a new list with the string "your name is" + name, but only if length of name is bigger than 4 using map , filter and Lambda names=['Rohan','Rhea','bob','to'] Output:['your name is Rohan', 'your name is Rhea']	04	LO3,LO4
8	Write Python program to 1. Create a Student class with details like rollno, name, marks for 5 subjects each out of 100. Create parameterized constructor and define function to calculate percentage and display student details (rollno, name, marks and percentage). 2. Create an Account class for a bank with variables number and balance. Create a constructor and two user defined function deposit and withdraw with appropriate arguments. Create class customer inherited from Account and with variables name, address, dob. Define constructor. Display details of customer along with balance amount after deposit and withdraw operation.	04	LO5, LO6

	3. Write a Python class named Student with two attributes student_id, student_name. Add a new attribute student_class. Create a function to display the entire attribute and their values in Student class with exception handling. 4. Write a Python class named Student with two instances student1, student2 and assign given values to the said instances attributes. Print all the attributes of student1, student2 instances with their values in the given format with exception handling. 5. WAP for method overriding & overloading of below diagram with exception handling : 		

Sr No	List of Assignments /Tutorials	Hrs
01	**Assignment Covers the topics first three modules of Python Programming Lab** Introduction to Python, Python data structures and & Flow Control, Data Preprocessing and Python Libraries	2
02	**Assignment Covers the topics next three modules of Python Programming Lab** Python Functions, Classes and Objects,Exceptional Handling	2

Text Books:

1. Dr. R. Nageswara Rao, Core Python Programming, 2nd Edition, Dreamtech Pres, Wiley Publication,2018.
2. Paul Barry, Head first Python: A Brain Friendly guide, 2nd Edition, O'Reilly publication, 2016.
3. Martin C. Brown, Python: The Complete Reference, 4th Edition, McGrawHill Education, 2018.

References:

1. Bill Lubanovic, Introducing Python Modern computing in simple packages, 3rd Edition, O'Reilly publication, 2019.

2. Wes McKinney, Python for Data Analysis, 2nd Edition, O'Reilly publication, 2017.

3. Jeeva Jose, P. Sojan Lal, Introduction to Computing and Problem Solving with Python, 1st Edition, Khanna Publication, 2019.

Online References:

Sr. No.	**Website Name**
1.	https://nptel.ac.in/courses/106106145
2.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Assessment:

Practical Exam: A Practical exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
2698442212	Indian Knowledge System	1	--	1	15	--	15	15	45	1.5

Course Code	Course Name	Examination Scheme					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT-I	IAT-II	Total					
2698442212	Indian Knowledge System	–	–	–	--	--	25	--	25

Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country.
3. To analyse sustainable practices in in ancient India.
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance.

Course Outcomes:

1. Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.

3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5. Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.		
I	**Introduction to** **The Indian Knowledge System (I.K.S.)**	Basic knowledge and scope of IKS, IKS in ancient India and modern India,, Preservation of culture, tradition and Dharma through education. Sources of Education, Aim of Education, Curriculum, methods of learning, Reviving, Knowledge (Ancient Scientific Discoveries) **Self-Learning Topics: Macaulay's Education Policy and Max Mullar Ideology in destroying Indian Tradition**	5 2	CO1
II	**Development of Scientific Thoughts in Ancient India**	Development in Science, Technology, Astronomy, Mathematics, and Life Sciences – Life Science, Physiology, Ayurveda, etc. Discoveries during Ancient times **Self-Learning Topics: Technological Innovations in Ancient India, Architecture and Engineering**	5 2	CO2
III	**Development of Arts & Culture in India**	Development of Arts & Culture in India, Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc.), Development in performing arts & culture: Music, Art of singing, Art of dancing, Natyakala, Cultural traditions and Folk arts **Self-Learning Topics: Origin and Evolution of Indian Classical Music and Dance, Natyashastra by Bharata Muni, Handicrafts and Decorative Arts**	5 3	CO3

IV	**Good Governance in Ancient India**	Introduction to Indian religions, Moral and Ethical Governance, Vishva Kalyan through Vasudhaiva Kutumbkam, Principles of Good Governance about Ramayana, Mahabharat, Artha Sastra and Kauṭilyan State, Scientific Explanation of Vedic or traditional system of society for Good Governance **Self-Learning Topics: Governance Models and Kingdoms, Court System and Judges, Crime, Punishment & Fairness**	5 3	CO4
V	**Contribution of Indian Scientist & Nobel Laureates**	Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada & Charak Rabindranath Tagore, C.V. Raman, Har Gobind Khorana, Mother Teresa, Subrahmanyan Chandrasekhar, Amartya Sen, V.S. Naipaul, Venkatraman Ramakrishnan, Kailash Satyarthi and Abhijit Banerjee **Self-Learning Topics: Indian Contributions to Global Science**	5 2	CO5
VI	**Sustainable Practices in Ancient India**	Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc Yoga, Pranayam and meditation for health and well-being. **Self-Learning Topics: Vaastu Shastra, principles, Minimalism and non-materialism.**	5 3	CO6
		Total	**60**	

Text Books:

1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019.
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)
5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihas evam Parichay,

Chaukhambha Sanskrit Sansthaan, New Delhi, 2017

9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan) 6. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
10. Traditional Knowledge System in India, Amit Jha
11. J. K. Bajaj and M. D. Srinivas, Timeless India Resurgent India, Centre for Policy Studies, Chennai, 2001

Online References:

Sr. No.	Website Name
1.	https://swayam.gov.in/explorer?searchText=iks
2.	https://iksindia.org/book-list.php
3.	https://iksindia.org/index.php

Assessment: Internal Assessment:

Term Work: 25 Marks = Attendance 5 marks + Assignments 20 Marks

List of Assignments (Answer the questions about in 500 words)

1. Role of Indian Knowledge System in Preserving Culture and Education
2. Scientific and Technological Advancements in Ancient India
3. Development of Arts and Culture in India
4. Principles of Good Governance in Ancient India
5. Contributions of Indian Scientists and Nobel Laureates
6. Sustainable Practices in Ancient India.