SHIV NADAR
UNIVERSITY
CHENNAI

Rajiv Gandhi Salai, Kalavakkam – 603 110

SSN School of Engineering

DEPARTMENT OF
CIVIL AND INFRASTRUCTURE ENGINEERING

B.TECH.
CIVIL ENGINEERING

CURRICULUM & SYLLABUS

REGULATIONS 2025

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Equip the students with engineering knowledge and skills required for successful career in Civil or allied engineering industries or being an entrepreneur.

PEO 2: Impart analytical skills and comprehension to solve complex engineering problem through research-based projects which paves the way to pursue higher studies in institutions of higher learning and to work in Research organizations or Academic Institutions.

PEO 3: Inculcate ethical leadership qualities and lifelong professional knowledge acquisition to adopt to the changing global needs in their field of work.

PROGRAM OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Graduates will demonstrate in-depth knowledge and excel in the core areas of civil engineering such as structural, geotechnical, water resources and environmental engineering.

PSO 2: Graduates will be able to conceptualize, plan, design and develop sustainable civil engineering infrastructure considering present challenges and utilizing advanced technologies.

CURRICULUM

SEMESTER - I

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Matrices and Calculus	MD	4	3	1	0	4
2	Engineering Chemistry	MD	4	2	0	2	3
3	Communicative English	AEC	4	2	0	2	3
4	Engineering Graphics	MC	4	2	0	2	3
5	Engineering Mechanics for Civil Engineering	MC	3	3	0	0	3
6	Professional Ethics and Human Values	VAC	2	2	0	0	2
7	Programming in Python for Data Science	VAC	3	1	0	2	2
8	Makers Space Laboratory	SEC	4	0	0	4	2
9	Extra Academic Activity 1*	VAC	2	0	0	2	1*
Total			**30**	**15**	**1**	**14**	**22+1***

SEMESTER – II

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Differential Equations and Complex Functions	MC	3	3	0	0	3
2	Technical Writing	AEC	4	2	0	2	3
3	Engineering Physics	MD	5	3	0	2	4
4	Environmental Science	VAC	2	2	0	0	2
5	Civil Engineering Fundamentals and Practices	MC	7	3	0	4	5
6	Basic Electrical and Instrumentation Engineering	MC	3	3	0	0	3
7	Sustainability Practices Laboratory	SEC	4	0	0	4	2
8	Extra Academic Activity 2*	VAC	2	0	0	2	1*
Total			**30**	**16**	**0**	**14**	**22+1***

***Note at a later page on Extra Academic Activity.**

SEMESTER – III

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Statistics and Numerical Methods	MS	4	2	0	2	3
2	Strength of Materials	MC	3	3	0	0	3
3	Construction Techniques and Practices	MS	2	2	0	0	2
4	Construction Materials	MC	3	3	0	0	3
5	Design Thinking, Innovation and Entrepreneurship	SEC	5	1	0	4	3
6	Fluid Mechanics	MC	3	3	0	0	3
7	Strength of Materials Laboratory	MC	3	0	0	3	1.5
8	Construction Materials Laboratory	MC	3	0	0	3	1.5
9	Computer Aided Civil Engineering Drawing	SEC	2	0	0	2	1
Total			**28**	**14**	**0**	**14**	**21**

SEMESTER - IV

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Surveying Theory and Practice	MC	5	3	0	2	4
2	Concrete Technology	MC	3	3	0	0	3
3	Applied Hydraulics Engineering	MC	5	3	0	2	4
4	Soil Mechanics	MC	3	3	0	0	3
5	Material and Energy Science for Buildings	MS	2	2	0	0	2
6	Structural Analysis	MC	3	3	0	0	3
7	Computational Mechanics Laboratory	SEC	2	0	0	2	1
Total			**23**	**17**	**0**	**6**	**20**

SEMESTER – V

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Design of Reinforced Concrete Structures	MC	3	3	0	0	3
2	Construction Project management	MC	5	3	0	2	4
3	Foundation Engineering and Practices	MC	5	3	0	2	4
4	Water Supply Engineering	MC	3	3	0	0	3
5	Irrigation Engineering	MS	3	3	0	0	3
6	Machine Learning Techniques for Civil Engineers	MS	4	2	0	2	3
7	Construction Safety and Risk Management	VAC	1	1	0	0	1
Total			**24**	**18**	**0**	**6**	**21**

SEMESTER - VI

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Design of Steel Structures	MC	3	3	0	0	3
2	Railways, Airports and Harbour Engineering	MC	3	3	0	0	3
3	Wastewater Engineering and Laboratory	MC	5	3	0	2	4
4	Quantity Surveying and Costing	MC	3	3	0	0	3
5	Program Minor 1	MS	3	3	0	0	3
6	Program Minor 2	MS	3	3	0	0	3
7	Capstone Project Phase 1	PD	8	0	0	8	4
Total			**28**	**18**	**0**	**10**	**23**

SEMESTER - VII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Highway Engineering and Practice	MC	5	3	0	2	4
2	Green Built Environment	MC	3	3	0	0	3
3	Program Minor 3	MS	3	3	0	0	3
4	Program Minor 4	MS	3	3	0	0	3
5	Program Minor 5	MS	2	2	0	0	2
6	Introduction to Building Information Modeling	AEC	3	1	0	2	2
7	Capstone Project Phase 2	PD	12	0	0	12	6
8	Internship	SI	4	0	0	4	2
Total			**35**	**15**	**0**	**20**	**25**

SEMESTER - VIII

Sl. No.	Course Title	Course Category	Contact Periods	L	T	P	C
1	Program Minor 6	MS	2	2	0	0	2
2	Program Minor 7	MS	3	3	0	0	3
3	Capstone Project Phase 3	PD	4	0	0	4	2
Total			**9**	**5**	**0**	**4**	**7**

COURSE SUMMARY

The listed courses are broadly classified as per the recommendations from the UGC.

Sl. No.	Broad Category of Course	Minimum Credit Requirement	Actual Credits
1	Major Core (MC)	80	80
2	Minor Stream (MS)	32	32
3	Multidisciplinary (MD)	09	11
4	Ability Enhancement Course (AEC)	08	08
5	Skill Enhancement Course (SEC)	09	09
6	Value Added Courses (VAC)	06-08	07+2*
7	Summer Internship (SI)	02-04	02
8	Project Dissertation (PD)	12	12
Total		**160**	**161+2***

The semester wise credit breakup of the Curriculum based on the above credit breakup proposed by the UGC is as follows:

Semester / Category	MC	MS	MD	AEC	SEC	VAC	SI	PD	TOTAL
1	6	-	7	3	2	4 +1*	-	-	22+1*
2	11	-	4	3	2	2+1*	-	-	22+1*
3	12	5	-	-	4	-	-		21
4	17	2	-	-	1	-	-	-	20
5	14	6	-	-	-	1	-	-	21
6	13	6	-	-	-	-	-	4	23
7	7	8	-	2	-	-	2	6	25
8	-	5	-	-	-	-	-	2	7
Total	80	32	11	8	9	7+2*	2	12	**161+2***

* The credits earned through the Extra Academic Activities in Value Added Courses (VAC) are not included in the calculation of Cumulative Grade Point Average (CGPA).

MINOR STREAMS

The Department of Civil and Infrastructure Engineering offers the following list of Minor Streams.

1. Infrastructure Engineering (Foundation Minor)
2. Structural Engineering
3. Water Resources and Environmental Engineering (Foundation Minor)

Each Minor Stream has seven courses worth 19 credits. The student must enroll in any one of the above three Minor Streams. Minor Streams tagged with Foundations must not be enrolled by students whose Major Core courses overlap with the listed courses in the Minor Stream.

MINOR STREAM 1 - Infrastructure Engineering

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Urban Planning and Development	6	3	3	0	0	3
2	Alternative Building Materials and Technologies	6	3	3	0	0	3
3	Contract Laws and Administration	7	3	3	0	0	3
4	MINOR STREAM BASKET 1	7	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	2	2	0	0	2
6	MINOR STREAM BASKET 3	8	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	3	3	0	0	3

*Mandatory Course for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (2 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (3 Credit courses)***
Advanced Surveying	Remote Sensing Techniques and GIS	Robotics and Automation in Civil Engineering	Digital Operation Management and Building Information Modelling
Low Carbon Construction	Form work Engineering	Smart Cities	Construction Equipment and Machinery
Resilient and Sustainable Infrastructure	Watershed Conservation and Management	Geo-environmental Engineering	Ground Improvement Techniques
Traffic System Engineering	Plumbing (Water and Sanitation)	Air Quality Management	Pavement Engineering

Note: Students from B. Tech Civil Engineering must not opt for this Minor Stream

MINOR STREAM 2 - Structural Engineering

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Advanced Reinforced Concrete Design	6	3	3	0	0	3
2	Prestressed Concrete Structures	6	3	3	0	0	3
3	Repair and Rehabilitation of Structures	7	3	3	0	0	3
4	MINOR STREAM BASKET 1	7	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	2	2	0	0	2
6	MINOR STREAM BASKET 3	8	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	3	3	0	0	3

*Mandatory courses for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Finite Element Analysis	Structural Health Monitoring	Reinforced earth and Geosynthetics	Advanced Structural Analysis
Prefabricated Structures	Structural Design and Drawing	Disaster Preparedness and Management	Industrial Structures
Bridge Engineering	Tall Structures	Structural Dynamics and Earthquake Engineering	Advanced Foundation Engineering
Sustainable and Green Construction	Life Cycle Assessment	Composite structures	Cold form steel structures

#These courses are part of the Major Core courses for B.Tech. Civil Engineering.

MINOR STREAM 3 – Water Resources and Environmental Engineering

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Industrial Waste Management	6	3	3	0	0	3
2	Municipal Solid Waste Management	6	3	3	0	0	3
3	Hydrology	7	3	3	0	0	3
4	MINOR STREAM BASKET 1	7	3	3	0	0	3
5	MINOR STREAM BASKET 2	7	2	2	0	0	2
6	MINOR STREAM BASKET 3	8	2	2	0	0	2
7	MINOR STREAM BASKET 4	8	3	3	0	0	3

*Mandatory courses for the Minor Stream

The following is the tentative list of courses that may be offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (2 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (3 Credit courses)***
Environmental Modeling	Climate Change and Modeling	Environment Social Impact Assessment	Environment Issue and Sustainability
Water Quality and Management	Environment, Health and Safety	Environment Laws and policy	Transport of Water and wastewater
Water Resources Engineering	Irrigation and Environment drawing	Urban Water Infrastructure	Groundwater Engineering
Hazardous Waste Management	Noise Pollution Control engineering	Air Pollution	Biological Process for Contaminant Removal

Note: Students from B. Tech Civil Engineering must not opt for this Minor Stream

MICROSPECIALIZATION

The University proposes to offer Micro-Specializations to Undergraduate students. Its salient features are as follows:

1. Each Micro-Specialization has a defined structure in terms of three sequential components:
    - **Component I** - One Foundation course that constitutes a mandatory requirement and also a prerequisite for subsequent components.
    - **Component II** - Two courses from a specified vertical.
    - **Component III** - Project/Design/Term Paper
2. A Student would be required to complete all three components (10-14) from the specified stream to earn a Micro-Specialization.

Eligibility for Micro-Specialization registration

To register for a Micro-Specialization, the student must have completed all curricular requirements up to the previous semester and have a CGPA $\geq$ 8.5. The student must maintain a CGPA $\geq$ 8.5 without any backlog in the subsequent semesters to keep the Micro-Specialization registration active. The Micro-Specialization must not overlap with the Major Core courses or Minor Stream courses credited as part of the degree program.

Provisional List of Micro-Specialization Verticals

The following are the micro-specialization verticals that will be offered by our department:

1. Environmental Sustainability
2. Smart Infrastructure and Urban Planning

SYLLABUS

SEMESTER - I

Course Code	Category	MATRICES AND CALCULUS (Common to EEE, ECE, VLSI, MECH, CHEM, BME, CIVIL)	L	T	P	C	Contact Hours
	MD		3	1	0	4	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To apply the concepts of eigenvalues and eigenvectors in the reduction of quadratic form.
2. To obtain the Taylor's expansion of various functions and extreme values of functions.
3. To equip with the concepts of integral calculus and applying it in evaluating the integrals.
4. To apply the Green's theorem, Divergence theorem and Stokes theorem in engineering problems.

UNIT 1: MATRICES (12 HOURS)

Eigenvalues and Eigenvectors - Cayley-Hamilton Theorem - Diagonalization: Similarity transformation - Quadratic form – Reduction of quadratic form to canonical form using orthogonal transformation – Eigen values by Power method.

UNIT 2: DIFFERENTIAL CALCULUS (12 HOURS)

Curvature, radius of curvature - Cartesian and parametric forms – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes, Evolute as envelope of normals.

UNIT 3: MULTIPLE INTEGRALS (12 HOURS)

Double integrals, Triple integrals: Cartesian and polar coordinates – Change of order of integration, Change of variables, Area and volume as multiple integrals.

UNIT 4: VECTOR CALCULUS (12 HOURS)

Gradient and directional derivative - Divergence and curl – Vector identities - line integral, Surface integral, Volume integral- Green's theorem, Gauss divergence and Stoke's theorems.

UNIT 5: FUNCTIONS OF SEVERAL VARIABLE (12 HOURS)

Partial derivatives – Total derivative – Jacobian – Functions of two variables: Taylor's series and Maxima and minima– Constrained optimization using Lagrange's method.

TEXTBOOK:

1. B. S. Grewal, Higher Engineering Mathematics, 45th ed., Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCES:

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyze and diagonalize matrices using eigenvalues, eigenvectors, and similarity transformations.	KL3
CO2	Compute curvature, radius, and centre of curvature, and find evolutes and envelopes of plane curves.	KL3
CO3	Evaluate double and triple integrals in Cartesian and polar coordinates, change the order of integration, and compute areas and volumes using multiple integrals.	KL3
CO4	Evaluate vector integrals using gradient, divergence, curl, and theorems like Green's, Gauss, and Stokes	KL3
CO5	Evaluate partial derivatives, total derivatives, Jacobians, and use Taylor series and Lagrange's method to solve maxima, minima, and constrained optimization problems.	KL3

Course Code	Category	ENGINEERING CHEMISTRY	L	T	P	C	Contact Hours
	MD		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVE:

This course aims to:

1. To acquire knowledge on water chemistry and treatment methods relevant to industrial and engineering applications.
2. To apply electrochemical principles in energy storage systems, fuel cells, batteries, and supercapacitors.
3. To understand and analyze corrosion mechanisms and protection techniques for engineering materials under various environments.
4. To understand the properties, processing, and applications of polymers and composite materials.
5. To acquire knowledge on various material characterization techniques and apply the skills in laboratory analysis using modern analytical techniques.

UNIT 1: WATER AND ITS TREATMENT (12 HOURS)

Theory: Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA- numericals; Boiler feed water chemistry- scale formation, sludge, carryover, priming & foaming; Boiler corrosion: oxygen corrosion, acidic corrosion, Caustic embrittlement in boiler materials; Cooling water chemistry for heat exchangers, condensers, and IC engines. Anti-corrosion, anti-scaling, and antifreeze additives.

Laboratory Experiments

1. Estimation of hardness of water
2. Estimation of alkalinity

Laboratory Demonstration – Ion Exchange process

UNIT 2: ELECTROCHEMISTRY (12 HOURS)

Theory: Electrochemistry- redox reaction- Ion selective electrodes –Glass electrodes-measurement of pH-potentiometry; Energy systems for electric vehicles – Principles & electrochemistry of: H_2–O_2 fuel cell, Li-ion battery & Na-ion battery, Battery degradation mechanisms and thermal runaway relevance to EV and hybrid vehicles, Green Hydrogen, Supercapacitors: working principles and applications in regenerative braking.

Laboratory Experiments

3. Estimation of strong acid-Ph
4. Estimation of ferrous ion by potentiometry

UNIT 3: CORROSION (12 HOURS)

Theory: Corrosion- Types of corrosion – Dry corrosion, wet corrosion; Types of wet Corrosion-galvanic corrosion, differential aeration -simplified Pourbaix diagram interpretation- Rate of corrosion; Corrosion in Machine Parts: Stress Corrosion Cracking (SCC), Hydrogen Embrittlement, High-temperature corrosion, Fretting corrosion and erosion; Protective coatings for mechanical assemblies-anodizing, ceramic coatings, diffusion coatings. Microbiologically induced corrosion and concrete deterioration: biodeterioration of stone monuments. Microbial induced calcite precipitation: preparation and mechanism and utilization in biocementation, concrete repair and environmental remediation.

Laboratory Experiments

5. Estimation of dissolved oxygen
6.Estimation of Rate of corrosion

UNIT 4: ENGINEERING PLASTICS (12 HOURS)

Theory: Polymers – Properties: Crystallinity, Glass Transition temperature (Tg), Viscosity Average Molecular weight-viscosity method &PDI, tacticity; Fiber reinforced polymeric materials: Key properties of FRP materials and its application in construction industries; Polymer concrete: Polymer Impregnated concrete, polymer cement concrete, Fiber reinforced concrete; Elastomers & rubber chemistry: vulcanization and mechanical behavior; Polymer degradation mechanisms: thermal, oxidative, UV degradation relevance to mechanical design and durability.

Laboratory Experiments

7. . Molecular weight of water-soluble polymer by viscosity method
8. Finding the Tg point of different polymer - Demo

UNIT 5: MATERIAL CHARACTERISATION (12 HOURS)

Theory: Scanning Electron Microscopy (SEM): fracture analysis, wear analysis, microstructure; X-Ray Diffraction (XRD): phase identification in metals and alloys; Thermal analysis techniques: DSC Differential Scanning Calorimetry (DSC): Thermogravimetric Analysis (TGA); Material Hardness testing methods: Vickers, Rockwell, Brinell.

Laboratory Experiments

9.Estimation of Cu in Brass
10. Interpretation of TGA curves – Demo Bacteria

TEXT BOOKS:

1. Jain P.C. and Monika Jain, 'Engineering Chemistry' 17th edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2023.
2. S.S.Dara, 'The Text Book of Engineering Chemistry, S.Chand & Co.Ltd,New Delhi, 2011.

REFERENCE BOOKS

1. 1 N. F. Gray, Water Technology – An Introduction for Environmental Scientists and Engineers, 3rd ed., USA: Taylor & Francis, 2010.
2. S. Glasstone, An Introduction to Electrochemistry, New Delhi: East-West Press Pvt. Ltd., 2007.
3. B. Sundén, Hydrogen, Batteries and Fuel Cells, USA: Academic Press Inc., 2019.
4. R. Gowariker, N. V. Viswanathan, and J. Sreedhar, Polymer Science, New Delhi: New Age International (P) Ltd., Reprint, 2005.
5. B.Viswanath, B, P.S. Raghavan, 'Practical Physical Chemistry',.ViVa Books PVT. Ltd, New Delhi, 2012

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Apply standard analytical techniques to identify impurities in water samples and select appropriate treatment methods for domestic and industrial applications.	KL3
CO2	Analyze electrochemical systems to identify existing challenges and evaluate strategies for improving fuel cell and battery technologies for zero-emission mobility.	KL3
CO3	Identify the type of corrosion and analyze different preventive methods of corrosion in various industries.	KL3
CO4	Evaluate the mechanical and thermal performance of engineering polymers, elastomers, and rubbers to determine their durability and suitability for material design applications.	KL3
CO5	Apply SEM, XRD, thermal analysis, and hardness testing techniques to characterize materials and relate results to material chemistry.	KL3

Course Code	Category	COMMUNICATIVE ENGLISH	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. Enhance conversation fluency and networking skills in English.
2. Contribute efficiently to meetings and group discussions.
3. Deliver well-structured presentations and participate in interviews.
4. Learn the language and strategies of successful negotiations.
5. Communicate effectively during conflict-resolving situations.

UNIT 1 : CONVERSATION AND NETWORKING SKILLS (12 HOURS)

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Role-plays as a technique for practicing conversation. Writing professional emails.

UNIT 2 : MEETING AND GROUP DISCUSSION SKILLS (12 HOURS)

Setting up and holding meetings; organizing and conducting effective meetings; learning the language used to lead a meeting; practicing how to agree and disagree with ideas and people politely. Research and pre-meeting preparation and mock meetings. Making notes, summarizing, and reporting in meetings. Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Research and pre-GD preparation, and mock GDs for practice.

UNIT 3 : PRESENTATION AND INTERVIEW SKILLS (12 HOURS)

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Advance topic research and mock presentations for practice. Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interviewing language skills. Mock interviews for practice.

UNIT 4 : NEGOTIATION SKILLS AND ASSERTIVENESS (12 HOURS)

Negotiation strategies; negotiating effectively; exchanging and comparing information; building rapport with people; practicing the language used in negotiations; considering and respecting cultural differences while negotiating; making compromises. Communication styles: passive, aggressive and assertive. Reading case studies and mock negotiation role plays.

UNIT 5 : CONFLICT RESOLUTION AND DECISION-MAKING SKILLS (12 HOURS)

Resolving conflicts: listening actively to ideas; handling people smoothly; dealing with and attempting to solve conflicting problems. Making a decision: thinking about various possibilities before decision-making; communicating the pros and cons of a decision; presenting a mutually beneficial solution. Reading case studies and mock conflict resolution role plays. Developing cross-cultural communication skills.

TEXTBOOK:

1. C. L. Bovee and J. V. Thill, Business Communication Today, 15th ed., Pearson Education India, 2016.
2. S. A. Beebe and T. P. Mottet, Business and Professional Communication, 3rd ed., Pearson Higher Education AU, 2021.
3. H. Hirsch, Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals, 2nd ed., Wiley-IEEE Press, 2007.

REFERENCES:

1. C. H. Dodd, Managing Business and Professional Communication, 3rd ed., Allyn & Bacon/Pearson, 2012.
2. J. Dwyer, Communication for Business and the Professions: Strategies and Skills, 7th ed., Pearson Higher Education AU, 2012.
3. G. Hasson, Brilliant Communication Skills: What the Best Communicators Know, Do and Say, FT Press, 2012.
4. L. Jones and R. Alexander, New International Business English Updated Edition Student's Book: Communication Skills in English for Business Purposes, Vol. 3, Cambridge University Press, 2011.
5. K. Patterson, J. Grenny, R. McMillan, and A. Switzler, Crucial Conversations: Tools for Talking When Stakes Are High, Brilliance Audio, 2013.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Develop conversation skills and networking skills in English	KL3
CO2	Communicate effectively in meetings and group discussions	KL4
CO3	Deliver engaging presentations and professional interviews	KL5
CO4	Speak and negotiate strategically in formal and informal settings	KL4
CO5	Present effectively during conflict resolving situations	KL5

Course Code	Category	ENGINEERING GRAPHICS	L	T	P	C	Contact Hours
	MC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To introduce the use of drawing instruments and CAD tools for professional practice.
2. To enable clear and precise communication of engineering ideas through standard drawings
3. To provide a foundation for design, drafting, and manufacturing processes

UNIT 1 : FREEHAND SKETCHING AND PROJECTION OF POINTS AND LINES (9 HOURS)

Visualization concepts and Free Hand sketching: Visualization principles–Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.– **By Conventional Method.**

Projections of points when they are situated in different quadrants. Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes. Determination of true lengths and true inclinations by rotating line method. **– By Conventional Method.**

UNIT 2 : FUNDAMENTALS OF AUTOCAD – PROJECTION OF PLANES AND SOLIDS (9 HOURS)

Introduction to AutoCAD, DRAW tools, MODIFY tools, TEXT, DIMENSION.
Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating plane method. **Conventional and AutoCAD**

Projections of solids like prisms, pyramids, cylinder and cone, whose axis is parallel to one of the reference planes and inclined to the other by rotating object method. **Conventional and AutoCAD**.

UNIT 3 : SECTION OF SOLIDS (9 HOURS)

Sectional planes – when the cutting plane is inclined to one of the principal planes and perpendicular to the other, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. **Conventional and AutoCAD**.

UNIT 4 : DEVELOPMENT OF SURFACES (12 HOURS)

Development of lateral surfaces of simple and truncated solids in vertical position– prisms, cylinders, pyramids, cones. **Conventional and AutoCAD.**

UNIT 5 : ISOMETRIC PROJECTION (9 HOURS)

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions **Conventional and AutoCAD**.

TEXTBOOK:

1. K. Venugopal and V. Prabhu Raja, Engineering Drawing + AutoCAD, New Age International (P) Limited, 2022.
2. K. V. Natarajan, A Textbook of Engineering Graphics, 33rd ed., Chennai: Dhanalakshmi Publishers, 2020.
3. V. Ramesh Babu, A Textbook on Engineering Graphics. Chennai: VRB Publishers, 2022. ISBN: 978-93-95018-55-5.

REFERENCES:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2025.
2. S. Tickoo, AutoCAD 2017 for Engineers & Designers, 23rd ed., Dreamtech Press.
3. B. Agarwal and C. M. Agarwal, Engineering Drawing, 3rd ed., McGraw Hill, 2019.
4. N. S. Parthasarathy and V. Murali, Engineering Drawing, Oxford University Press, 2015.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Construct the orthographic views of an object and projection of points and lines.	KL3
CO2	Construct the Projection of Lines and Solids in conventional and CAD environment.	KL3
CO3	Construct the details of an object through sectional views, in conventional and CAD environment.	KL3
CO4	Develop the lateral surface of the solids in conventional and CAD environment.	KL3
CO5	Construct the three-dimensional isometric view in conventional and CAD environment.	KL3
CO6	Analyze the internal details of the machine component through sectional and isometric views.	KL4

Course Code	Category	ENGINEERING MECHANICS FOR CIVIL ENGINEERING	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVE:

This course aims to:

1. To understand the fundamental principles of mechanics, effect of force on rigid bodies, basics of Solid mechanics and the action of friction and rigid body motion.

UNIT 1 : BASICS AND STATICS OF PARTICLES (9 HOURS)

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton's First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT 2 : EQUILIBRIUM OF BODIES (9 HOURS)

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force - Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT 3 : INTRODUCTION TO MECHANICS OF SOLIDS (9 HOURS)

Rigid bodies and deformable solids - Concepts of Stress and Strain - Elastic Constants - Deformation of axially loaded members - Centroid and centre of gravity - Centroids of lines and areas - Rectangular, Circular, Triangular areas by integration - T section, I section, Angle section, Hollow section by using standard of formula - Parallel axis Theorem and Perpendicular axis Theorem - Principal moments of inertia of plane areas - Mass moment of inertia for prismatic, cylindrical and spherical solids from first principle.

UNIT 4 : FRICTION (9 HOURS)

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT 5 : DYNAMICS OF PARTICLE (9 HOURS)

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse

and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

TEXTBOOK:

1. F.P.Beer, E.R.Johnston Jr., Vector Mechanics for Engineers (In SI Units): Statics and Dynamics, 12th Edition, New Delhi: McGraw-Hill, 2019.
2. S.Rajasekaran, G.Sankarasubramanian, Engineering Mechanics Statics and Dynamics, 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
3. R.C.Hibbeller, Ashok Gupta, Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, 2018.

REFERENCES:

1. S.S.Bhavikatti, K.G.Rajashekarappa, Engineering Mechanics, New Age International (P) Limited Publishers, 2004.
2. H.Irving Shames, G.Krishna Mohana Rao, Engineering Mechanics – Statics and Dynamics, 4th Edition, Pearson Education, 2006.
3. J.L.Meriam, L.G.Kraige, Engineering Mechanics- Statics - Volume 1, Dynamics Volume 2, Third Edition, John Wiley & Sons, 2018..

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyse force systems in structures using scalar and vector analytical techniques.	KL4
CO2	Analyse the 2D and 3D rigid bodies for equilibrium and reaction forces.	KL4
CO3	Compute the centroid and moment of inertia of various sections and solids.	KL3
CO4	Apply the concepts of friction to analyse the forces at the contact surfaces of various engineering systems.	KL4
CO5	Apply the concept of kinetics and kinematics to analyse the dynamics of particles.	KL4
CO6	Analyse complex 3D rigid body systems in equilibrium by applying engineering fundamentals, considering real-world situations.	KL4

Course Code	Category	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVE:

1. To provide students with a foundation in ethics and human values for personal, social, and professional life.
2. To enable students to understand and apply ethical principles in decision-making and workplace conduct.
3. To develop awareness of social responsibility, civic virtues, and sustainable practices in professional and personal contexts.

UNIT 1 : INTRODUCTION TO ETHICS AND VALUES (6 HOURS)

Meaning and scope of ethics, morals, and values, Life skills and emotional intelligence, Personal versus professional ethics, Stakeholders and their influence on decisions, Ethical dilemmas and methods of resolution, Case studies highlighting basic ethical issues.

UNIT 2 : RESPONSIBILITY, SOCIAL IMPACT, AND WORKPLACE CONDUCT (6 HOURS)

Attributes of a profession, roles, duties, and responsibilities, Professional obligations and social impact of decisions, Corporate Social Responsibility (CSR) and sustainable practices, Legal and social responsibilities, Workplace safety and rights, Case studies on societal and organizational ethical issues.

UNIT 3 : THEORIES AND DECISION-MAKING FRAMEWORKS (6 HOURS)

Major ethical theories: Utilitarianism, Deontology, Virtue Ethics, Rights-based approaches, Application of theories in professional scenarios, Decision-making frameworks for dilemmas, Responsibility for safety, health, and well-being, Risk assessment and accountability, Case studies illustrating applied concepts.

UNIT 4 : RIGHTS, GLOBAL ISSUES, AND ETHICAL CODES (6 HOURS)

Rights and duties in workplace, Professional standards and codes of conduct, Ethics audit: implementation and evaluation, Global challenges: environmental ethics, media ethics, bioethics, research ethics, Cross-cultural considerations and international case studies.

UNIT 5 : HUMAN VALUES AND PROFESSIONAL DEVELOPMENT (6 HOURS)

Nature, classification, and significance of human values, Value-based decision-making in personal and professional life, Integration of human values in daily life, Harmony with self, family, society, and environment, Developing positive attitudes, moral courage, and integrity, Strategies for

internalizing and applying values, Practical exercises and case studies on character building and ethical living.

TEXTBOOK:

1. R. Subramanian, Professional Ethics — Includes Human Values, 3rd ed. Oxford University Press, 2025.
2. R. R. Gaur, R. Asthana, and G. P. Bagaria, A Foundation Course in Human Values and Professional Ethics, 3rd rev. ed. Excel Books/New Delhi, 2023.

REFERENCES:

1. R. S. Naagarazan, A Textbook on Professional Ethics and Human Values, 3rd ed. New Age International, 2025.
2. A.N. Tripathi, Human Values, 3rd ed. New Age International Publishers, 2023.
3. V. R. Khosla and K. Bhagat, Human Values and Professional Ethics, 1st ed. Technical Publications, 2009

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Explain the basic concepts of ethics, morals, and values, and differentiate between personal and professional ethics.	KL2
CO2	Describe the responsibilities of professionals and the social and legal impact of their decisions, including CSR and workplace safety.	KL2
CO3	Discuss major ethical theories and their role in resolving ethical dilemmas in professional situations.	KL2
CO4	Identify rights, professional standards, ethical codes, and global challenges relevant to workplace and international practices.	KL2
CO5	Illustrate human values in personal and professional life to foster integrity, positive attitudes, and responsible behavior.	KL3

Course Code	Category	PROGRAMMING IN PYTHON FOR DATA SCIENCE	L	T	P	C	Contact Hours
	VAC		1	0	2	2	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVE:

- To learn Python fundamentals and modularity in problem solving.
- To learn data types in Python and file handling.
- To learn numerical computations using NumPy.
- To learn data manipulations using Pandas.
- To perform visualization and statistical analysis using Python libraries.

UNIT 1 : PYTHON FUNDAMENTALS (4 HOURS)

Introduction to Python – Expressions and operators - Variables and Assignment - conditional and Iterative statement; Functions: Local and global scope, Methods of passing arguments, Recursion.

UNIT 2 : DATA TYPES AND FILE HANDLING (3 HOURS)

Compound Data Types: Strings - Lists - Tuples - Dictionaries; File handling.

UNIT 3 : NUMPY FOR NUMERICAL COMPUTATION (2 HOURS)

Arrays in Python – Array creation in NumPy – Indexing and slicing operations – Arithmetic operations – Statistical operations using NumPy.

UNIT 4 : PANDAS FOR DATA MANIPULATION (3 HOURS)

Series and Data frames in Pandas – Data Loading - Indexing – Data cleaning and preprocessing - Data Manipulation: Sorting, grouping, handling missing values - statistical operations in data frames.

UNIT 5 : DATA VISUALISATION AND STATISTICS (3 HOURS)

Data visualization using Matplotlib: line, bar, scatter, pie, histogram, multiplots; Descriptive Statistics - Correlation Analysis.

SUGGESTED EXPERIMENTS

1. Develop a program to classify students as Excellent, Good, Average, or At Risk using conditional statements.
2. Develop a program to count the number of days with sales above the average using iterative statements.
3. Develop a recursive function to normalize a dataset using Min–Max normalization.
4. Develop a program using strings to count the number of valid and invalid emails.

5. Develop a program to remove duplicate values from a list and sort the cleaned data in ascending order.
6. Develop a program using tuples to store the customer transaction data and compute the total transaction amount.
7. Develop a program to store account number as key and customer details (name, balance, account type) as values using dictionaries and update account balance after deposit or withdrawal.
8. Develop a program to read transaction details from a CSV file and write suspicious transactions to a separate file.
9. A dataset contains monthly sales figures stored in a NumPy array. Develop a program to extract sales data for a specific range of months and access rows and columns using slicing.
10. A dataset of customer balances is stored in a NumPy array. Develop a program to compute quartiles (Q1, Q2, Q3) and interquartile range (IQR).
11. Loan applicant data includes income, age, and credit score is stored in a CSV file. Filter applicants satisfying multiple conditions (e.g., income > ₹50,000 and credit score > 700) using Pandas.
12. A bank wants to visually analyze customer, transaction, and revenue data to support decision-making. Develop a Python application that uses different Matplotlib plots to represent various types of data.
13. Mini Project on Exploratory Data Analysis.

TEXTBOOK:

1. S. Sridhar, J. Indumathi, and V. M. Hariharan, Python Programming. Pearson India, 2023.
2. A. B. Downey, Think Stats: Exploratory Data Analysis, 3rd ed. O'Reilly Media, 2025.

REFERENCES:

1. W. McKinney, Python for Data Analysis. O'Reilly Media, 2022.
2. A.B. Downey, Think Python, 3rd ed. O'Reilly Media, 2024. [Online]. Available: https://allendowney.github.io/ThinkPython/
3. R. S. Kenett, S. Zacks, and P. Gedeck, Modern Statistics: A Computer-Based Approach with Python. Springer, 2022.
4. K. Beecher, Computational Thinking – A Beginner's Guide to Problem Solving and Programming. British Computer Society (BCS), 2017.
5. J. V. Guttag, Introduction to Computation and Programming Using Python, 3rd ed. MIT Press, 2021.
6. A.Agresti and M. Kateri, Foundations of Statistics for Data Scientists with R and Python, 1st ed. CRC Press, 2022.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Apply sequential, alternate, and iterative approaches for solving problems.	KL3
CO2	Solve problems by using different datatypes and files.	KL3
CO3	Develop Python programs for numerical computations using NumPy.	KL3
CO4	Develop Python programs for data manipulation using Pandas.	KL3
CO5	Select appropriate Matplotlib visualization techniques to accurately represent data trends, patterns, and analytical outcomes.	KL5

Course Code	Category	MAKERS SPACE LABORATORY	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

- To provide hands-on experience to the students in various basic engineering practices in Mechanical and Civil Engineering
- To provide hands-on training to the students in electrical wiring practices and the use of electronic components.

LIST OF EXPERIMENTS:

Mechanical & Civil Engineering Practice

1. **Makers Lab Safety & Tool Handling:** Lab orientation, workflow, PPE, power tool safety, material handling, measurement and marking, Outcome*:* Safe operation of makers lab tools.
2. **Power Tool Carpentry – Utility Product Fabrication:** Cutting, drilling, sanding, joint preparation. *Fabrication:* **Pen stand/utility box,** *Outcome:* Confidence in real carpentry operations.
3. **Carpentry Joints & Building Components:** Fabrication using lap and mortise–tenon joints. *Fabrication:* **Mini door/window frame or wall shelf,** *Outcome:* Understanding structural wood joints used on site.
4. **Plumbing Practice – Domestic Water Supply:** Pipe cutting, joining, and fitting (PVC & GI). *Fabrication:* **Wash basin plumbing system,** *Outcome:* Knowledge of household plumbing installation.
5. **Plumbing System Layout & Drainage:** Assembly of supply and drainage lines. *Fabrication:* **Mini water distribution / sanitary line model,** *Outcome:* Understanding real building plumbing layouts.
6. **Machining Practice – Functional Metal Component:** Drilling, tapping, countersinking, and work holding. *Fabrication:* **Fixture plate/tool holder,** *Outcome:* Exposure to workshop machining operations.
7. **Sheet Metal Fabrication – Industrial Product:** Cutting, bending, folding, riveting. *Fabrication:* **Mobile stand / small enclosure/duct prototype:** *Outcome:* Sheet metal fabrication skills.

8. **Mechanical Mechanism Models:** Assembly and study of motion systems. *Models:* **Gear train, belt-pulley, slider-crank, scissor mechanism.** *Outcome:* Practical understanding of motion transmission.
9. **Real-Life Mechanical Systems Study:** Hands-on observation and disassembly. *Systems:* **Hand pump, flush tank, pedestal fan mechanism.** *Outcome:* Linking theory with real engineering products.
10. **3D Printing – Engineering Prototyping:** Design and fabrication using additive manufacturing. *Fabrication:* **Mechanical bracket / civil pipe or truss model,** *Outcome:* Exposure to modern manufacturing practices.
11. **Laser Cutting & Hybrid Fabrication:** Laser cutting of wood/acrylic and integration with other materials. *Fabrication:* **Building layout plate/phone stand,** *Outcome:* Understanding digital fabrication workflows.

Electrical & Electronics Engineering Practice

1. **Domestic Electrical Wiring Practice:** Assemble a single-phase domestic wiring circuit for operating household appliances using fuse, switch, lamp, energy meter and test its operation. *Outcome***:** Demonstrate domestic electrical wiring practices.
2. **Electrical Measurements in RLC Circuit**: Assemble a single-phase RLC circuit and measure electrical quantities-voltage, current, power, and power factor. *Outcome*: Understand the practical measurement of electrical quantities in RLC circuit.
3. **Electrical Fault Simulation and Protection:** Identifying and analyzing common electrical faults. *Outcome:* Understand electrical faults, working of protective devices, and earthing systems for electrical safety.
4. **Soldering Practice**: Assembly and testing of mobile phone charging circuit. *Outcome:* Hands-on skill in soldering, component identification, and testing.
5. **Relay Control Circuit Using Logic Gates:** Assembly and testing of a relay-based control circuit using logic gates. *Outcome:* Understand the operation of a relay control circuit using logic gates.
6. **AC signal Parameters Measurement and Analysis**: Measurement of amplitude and frequency in a rectifier circuit using a CRO. *Outcome:* Understand the usage of CRO and measurement of AC signal parameters.

7. **Sensor and Actuator Interfacing:** Integration of sensors and actuators with a microcontroller. *Outcome:* Understand the programming of embedded controller for interfacing sensors and actuators.

8. **Dis-assembly and assembly of electrical home appliances**: Grinder Mixer, Ceiling Fan. *Outcome:* Hands-on skill in disassembling, assembling of domestic electrical appliances.

REFERENCE BOOKS

1. S Gowri, T Jeyapoovan, "Engineering Practices Laboratory Manual", 5th Edition, Vikas Publishing, 2016.
2. V Ramesh Babu, "Engineering Practices Laboratory", VRB Publications, 2006.
3. Willis H Wagner, Howard Bud Smith, Mark W Huth, "Modern Carpentry", 12th Edition, 2015.
4. P C Sharma, "Production Technology: Manufacturing Process", S Chand publisher, 2006.
5. David W Rongey, "A Complete Guide to Home Electrical Wiring", 2013.
6. K Jeyachandran, S Natarajan, S Balasubramanian, "A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Identify and explain makers lab safety practices, PPE usage, tools, workflow, and engineering materials used in fabrication.	KL2
CO2	Perform carpentry, plumbing, machining, and sheet metal work to fabricate real-time civil engineering components, domestic water supply systems and to manufacture functional mechanical components.	KL3
CO3	Apply modern fabrication techniques such as 3D printing and laser cutting to develop mechanical and civil engineering models and prototypes to meet practical engineering requirements.	KL3
CO4	Construct electrical circuits and demonstrate their working.	KL3
CO5	Demonstrate the implementation and control of electronic circuits for practical applications.	KL3

SEMESTER – II

Course Code	Category	DIFFERENTIAL EQUATIONS AND COMPLEX FUNCTIONS	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVE:

- To understand the concept of ordinary and partial differential equations and utilize it in solving engineering problems.
- Find the Laplace Transforms of standard functions and solve second order linear ordinary differential equations with constant coefficients.
- To construct Analytic functions and evaluate integrals using Cauchy's integral formula.

UNIT 1 : ORDINARY DIFFERENTIAL EQUATIONS (9 HOURS)

Solution of second and higher order linear differential equations with constant coefficients (RHS functions – $e^{mx}, sinmx, cosmx, x^n, x^n f(x),\ e^{mx} f(x)$), Application to harmonic oscillation of an undamped Mass-Spring system- Method of variation of parameters – Simultaneous linear differential equations with constant coefficients of first order.

UNIT 2 : LAPLACE TRANSFORMS (9 HOURS)

Definition, properties – Transform of elementary functions, unit step function and unit impulse function, shifting theorems – Transforms of derivatives and integrals, Evaluation of integrals by Laplace transforms – Periodic functions – Initial and final value theorems.

UNIT 3 : INVERSE LAPLACE TRANSFORMS (9 HOURS)

Inverse transforms – Definition, Properties – Method of Partial Fractions, Inverse Laplace transforms of derivatives and integrals – Convolution theorem – Applications of Convolution Theorem – Ordinary Differential Equations: Solution by using Laplace Transforms.

UNIT 4 : ANALYTICAL FUNCTIONS (9 HOURS)

Analytic functions – necessary and sufficient conditions, Cauchy-Riemann equations in Cartesian and polar form (with proof) – Properties – harmonic functions, Construction of analytic function, conformal mapping – some standard transformations w = z + c, cz, 1/z, bilinear transformation.

UNIT 5 : COMPLEX INTEGRATION (9 HOURS)

Line integral – Cauchy's integral theorem – Cauchy's integral formula, Taylor's and Laurent's series, Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour (except the poles on the real axis).

TEXTBOOK:

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCES:

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Solve second and higher order linear ordinary differential equations with constant coefficients, handle simultaneous linear ODEs	KL4
CO2	Obtain the Laplace Transforms of standard functions.	KL4
CO3	Apply the concepts of inverse Laplace Transforms in solving differential equations.	KL3
CO4	Solve problems in Analytic functions and construction of analytic functions using C-R equations	KL3
CO5	Compute line integrals, residues, and real integrals via residue theorems.	KL3

Course Code	Category	TECHNICAL WRITING	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Communicative English*					

COURSE OBJECTIVES:

The learners will be able:

1. To Prepare effective Instructions, Checklists and Emails.
2. To write different kinds of paragraphs and argumentative essays.
3. To Develop and revise effective resumes, cover letters and SOPs
4. To Document and organise various kinds of reports, case studies and white papers.
6. To Create well-structured proposals and press releases.

UNIT 1 : WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS (12 HOURS)

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples. Reading sample instructional texts and professional email models. Language Skills: Tenses – Present and past

UNIT 2 : WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS (12 HOURS)

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Reading and writing model argumentative essays and sample analytical paragraphs; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion.
Sample essays. Language skills: Connectors and definitions.

UNIT 3 : WRITING JOB APPLICATIONS AND SUMMARIES (12 HOURS)

Writing job applications, resumes, and cover letters. Writing the statement of purpose (SOP):
Outline – professional narrative, previous experience, research interests, and career goals. Writing summaries: reading the text; identifying main and supporting ideas. Writing paraphrases:
step-by-step paraphrasing; text comparison; sentence analysis. Language skills: subject-verb agreements.

UNIT 4 : WRITING REPORTS, CASE STUDIES AND WHITE PAPERS (12 HOURS)

Writing datasheets: outline – descriptions, graphics, benefits, features, specifications, requirements, and contact information. Writing abstracts. Reading sample reports, case studies and whitepapers. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search

for solutions, implementation of the solution and results. Language skills: Active voice, passive voice

UNIT 5 : WRITING PROPOSALS AND PRESS RELEASES (12 HOURS)

Writing business proposals: format – title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea. Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section. Language skills: Correction of errors, proofreading and editing.

TEXT BOOKS:

1. Laplante, P. A. (2018). Technical writing: A practical guide for engineers, scientists, and nontechnical professionals. CRC Press.
2. David Bonamy. (2013) Technical English Level 2 Course Book. Pearson

REFERENCES:

1. Kmiec, D., & Longo, B. (2017). The IEEE guide to writing in the engineering and technical fields. John Wiley & Sons.
2. Lewis Lansford; Peter Astley. (2013). Oxford English for Careers: Engineering 1: Student's Book. Oxford University Press.
3. Mark Ibbotson. (2008). Cambridge English for Engineering, 2008, Cambridge University Press.
4. Rubens, P. (2002). Science and technical writing: A manual of style. Routledge

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Write instructions, checklists and emails with clarity and readability	KL3
CO2	Compose paragraphs, and structure an argumentative essay effectively	KL4
CO3	Create and edit resumes, cover letters and SOPs concisely	KL4
CO4	Document well-structured reports, case studies and white papers	KL5
CO5	Develop effective proposals and press releases	KL5

Course Code	Category	ENGINEERING PHYSICS	L	T	P	C	Contact Hours
	MD		3	0	2	4	5
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

The objective of this course is to enable the student to

- Comprehend and identify different crystal structures and their imperfections.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Explain physics of semiconductors.
- Provide an overview of the characteristics of sound, architectural acoustics and the production and applications of ultrasound.
- Understand the origin of laser action, production of laser, fibre optics and their applications.

UNIT 1: CRYSTAL PHYSICS (9 HOURS)

Single crystalline, polycrystalline (common metals/alloys) and amorphous materials– single crystals – Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) – Crystal Imperfections with Examples – Point, line (Edge and Screw dislocations –Burger vectors) Surface (stacking faults) and Volume defects-Crystals in scintillation detectors (CsI, LSO, BGO and NaI).

LABOARTORY EXPERIMENT

1. Determination of the Young's modulus of the given metal/alloy.

UNIT 2: QUANTUM PHYSICS (9 HOURS)

Black body radiation – Planck's radiation law (Qualitative) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect (Conceptual)– Photoelectric effect (conceptual)- Properties of Matter waves – wave particle duality – Schrödinger's wave equations – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states – Applications-Scanning electron microscopy(SEM)-Transmission electron microscopy(TEM).

LABOARTORY EXPERIMENT

2. Determination of the Planck's constant and the work function using photoelectric effect.

UNIT 3: SEMICONDUCTORS (9 HOURS)

Classification of semiconductors based on doping and band gap – Intrinsic semiconductor – Concept of hole – carrier concentration derivation –Fermi level and its variation with temperature – electrical conductivity – band gap determination –Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Variation of Fermi level with temperature and impurity concentration

LABOARTORY EXPERIMENT

3.Determination of the band gap of a semiconductor.

UNIT 4: ACOUSTICS AND ULTRASONICS (9 HOURS)

Acoustics: Classification and characteristics of Sound – decibel – Weber–Fechner law– Sabine's formula (conceptual) —factors affecting the acoustics of buildings and their remedies.

Ultrasonics: Production of ultrasonics by Magnetostriction and Piezoelectric methods – acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B, C and M– scan displays- Phased Array Ultrasound and Time of Flight Diffraction techniques.

LABOARTORY EXPERIMENT

4.Determination of the velocity of sound in the given liquid and compressibility of the liquid using an Ultrasonic interferometer.

UNIT 5: LASERS AND OPTICS (9 HOURS)

Lasers: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients –Conditions for Laser action – Types of lasers (Qualitative) – Nd: YAG, Basics of diode lasers- Industrial and Medical Applications.

Fiber optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types of optical fibres (material, refractive index, mode) – Fibre Optical Communication system (Block diagram) – Applications- Active and passive fiber sensors – pressure and temperature-fiber optic endoscopy.

LABOARTORY EXPERIMENT

5. Determination of the grating element/wavelength, and the particle size using a laser.
6. Determination of the numerical aperture and acceptance angle of the given optical fibre.

TEXT BOOKS:

1. R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Publishers, 2012.
2. S. Singaravadivelu and A. Chandrasekaran, Engineering Physics, Chennai: Vedha Publications, 2022.
3. R. A. Serway and J. W. Jewett, Physics for Scientists and Engineers, Cengage Learning, 2010.
4. S. Sharma and J. Sharma, *Engineering Physics*, Pearson, 2006.

REFERENCES:

1. D. Halliday, R. Resnick, and J. Walker, Principles of Physics, Wiley, 2015.

2. P. A. Tipler and G. Mosca, Physics for Scientists and Engineers with Modern Physics, W. H. Freeman, 2007.
3. M. N. Avadhanulu and P. G. Kshirsagar, A Textbook of Engineering Physics, 9th rev. ed., S. Chand & Co. Ltd., 2012.
4. H. K. Malik and A. K. Singh, Engineering Physics, 2nd ed., McGraw Hill, 2016.
5. B. K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India Pvt. Ltd., 2012.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyze crystal structures and the influence of imperfections on their properties.	KL4
CO2	Comprehend the quantum mechanical principles to correlate with experimental results and their applications.	KL2
CO3	Analyze the physics of semiconductors.	KL4
CO4	Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.	KL4
CO5	Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.	KL2

Course Code	Category	ENVIRONMENTAL SCIENCE	L	T	P	C	Contact Hours
	VAC		**2**	**0**	**0**	**2**	2

Course Level		*Prerequisite Courses: Nil*

COURSE OBJECTIVES:

This course aims to:

1. To develop a better understanding of human relationship with environment.
2. To explain the importance of conservation of resources.
3. To create awareness on pollution and environmental degradation.
4. To acquire knowledge on sustainable development.
5. To apply technical skills for solving environmental problems.

UNIT 1 : ECOSYSTEM AND BIODIVERSITY (6 HOURS)

Structure and function of an ecosystem – energy flow- food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition and types– values of biodiversity – threats to biodiversity-conservation of biodiversity: In-situ and ex-situ conservation of biodiversity; role of individuals and communities in biodiversity conservation.

UNIT 2 : NATURAL RESOURCES (6 HOURS)

Forest, Water, Food, Energy, Mineral and Land resources – uses and case studies on over exploitation of natural resources; Conservation of natural resources; Equitable use of resources for sustainable lifestyles

UNIT 3 : CURRENT ENVIRONMENTAL AND SOCIAL ISSUES (6 HOURS)

Air pollution – particulate pollution (Smog, acid rain, climate change and global warming, ozone layer depletion); Water pollution; Soil pollution and solid waste management; Noise pollution; Nuclear pollution; Role of an individual in the prevention of pollution. Disaster management; Human health and Environment: Issues with water and sanitation; Human rights, HIV/AIDS, Women and child welfare.

UNIT 4 : SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL GOVERNANCE (6 HOURS)

Sustainable development goals (SDGs): Origin, Purpose, importance, and challenges in achieving SDG; Circular economy (4 R and 10 R); Upcycling and waste to wealth strategies; Extended Producer Responsibility; Green buildings; Electric and hybrid electric vehicles; Mission LiFE and Sustainable Lifestyle Practices; Environmental legislations: National Green Tribunal; National missions and policies towards SDGs; ESG framework and corporate sustainability.

UNIT 5 : ENGINEERING INTERVENTIONS TO REDUCE ENVIRONMENTAL STRESSES (6 HOURS)

Role of technology in environmental studies – AI and IoT- Real time data collection and analysis – Environmental modelling and simulation – GIS – Remote sensing – satellite and sensors – Use of drone for aerial mapping and surveying.

TEXTBOOKS

1. Anubha Kaushik and Kaushik, C. P. "Environmental Science and Engineering", New Age International Publishers, 14thEdition, 2014.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014
3. M.H. Fulekar, Bhawana Pathak and R. K. Kale, 'Environment and sustainable development' Springer Nature, 2013.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Acquire the basic concepts of ecosystems; understand the importance of biodiversity and conservation strategies	KL2
CO2	Develop knowledge on natural resources and equitable use of natural resource.	KL2
CO3	Analyse the current environmental problems and its plausible solutions.	KL2
CO4	Explain the concept of sustainable development, its importance and key challenges in implementation of sustainable goals.	KL2
CO5	Describe the role of technology for assessment and management of environment and human health.	KL2

Course Code	Category	CIVIL ENGINEERING FUNDAMENTALS AND PRACTICES	L	T	P	C	Contact Hours
	MC		**3**	**0**	**4**	**5**	7

Course Level		*Prerequisite Courses: Engineering Mechanics*

COURSE OBJECTIVES:

This course aims to:

1. To introduce fundamentals of Civil Engineering to Students.
2. To expose students to sustainable practices and innovative technologies that are currently being adopted in civil engineering.
3. To inculcate practical skills in applying engineering principles to real-world problems using both traditional methods and modern software tools.
4. To kindle innovation and interest to give solution to current problems in Civil Engineering through development of model and prototype using fundamentals of Civil Engineering.

UNIT 1 : CIVIL ENGINEERING MATERIALS (9 HOURS)

Scope and Significance of Civil Engineering, Material Properties, types and uses of civil engineering materials and their usage- Aggregates, Cement, Cement mortar, Concrete and Steel, Green materials-recycling and reuse of materials.

UNIT 2 : SOLIDS AND FLUIDS (9 HOURS)

Statics: Forces, moments, equilibrium, Centre of gravity – Moment of Inertia, applications in civil engineering, Strength of Materials: Stress, strain, young's modulus, Material characterisation. Fluid Mechanics: Properties of fluids – laminar and Turbulent Flow – Flow measurement.

UNIT 3 : HYDROLOGY AND WATER MANAGEMENT (9 HOURS)

Hydrology: Hydrological cycle – Water Budget Equation. Principles of irrigation – Types of irrigation systems – Types of Crops cultivated in India – Aquaponics – Hydroponics. Water quality standards and treatment methods. Introduction to Wastewater treatment.

UNIT 4 : TRANSPORTATION AND GEOTECHNICAL ENGINEERING (6 HOURS)

Surveying and Geoinformatics: Principles, classification, measurements of distances and angles, levelling, area determination. Introduction to Transportation Engineering: Planning, design, and management of transport systems. Soil Mechanics: Soil types, properties, Types of foundations, bearing capacity.

UNIT 5 : INTRODUCTION TO DATA ANALYSIS AND AI (9 HOURS)

Basics of Excel commands – Correlation and regression – Graph Plotting – Optimization methods – Introduction to AI in Civil Engineering.

PRATICAL EXERCISES

1. CIVIL ENGINEERING MATERIALS

a. Tests on Aggregates (Physical Properties)

b. Cement Properties

2. SOLIDS AND FLUIDS

a. Verification of Equilibrium of Forces

b. Flow Measurement in Pipes

3. HYDROLOGY AND WATER MANAGEMENT

a. Water Quality Analysis

b. Model Study of Irrigation / Aquaponics System – Demo

4. TRANSPORTATION AND GEOTECHNICAL ENGINEERING

a. Surveying – Levelling

b. Index Properties of Soil

5. INTRODUCTION TO DATA ANALYSIS AND AI

a. Data Analysis using MS Excel

b. Introductory AI Application in Civil Engineering

TEXT BOOKS:

1. B. C. Punmia, Basic Civil Engineering. Laxmi Publications, 2021.
2. G. K. Hiraskar, Basic Civil Engineering. S. Chand Publishing, 2021.
3. S. S. Bhavikatti, Basic Civil Engineering and Engineering Mechanics (All India). New Age International Publishers, 2022.
4. G. Shanmugam, M. S. Palanichamy, and S. Ravindran, Basic Civil and Mechanical Engineering. McGraw Hill Education India, 2024.
5. P. K. Jayasree, K. Balan, and V. Rani, Practical Civil Engineering. CRC Press (Taylor & Francis Group), 2023.

REFERENCES:

1. R. C. Brinker, P. R. Wolf, and C. D. Harper, Elementary Surveying: An Introduction to Geomatics, 15th ed., Pearson Education, 2021.
2. M. Casini, Ed., Proceedings of the 3rd International Civil Engineering and Architecture Conference (CEAC 2023), Springer, 2024.
3. S. V. Klyuev, N. I. Vatin, and L. S. Sabitov, Eds., Industrial and Civil Construction 2022: Selected Papers, Lecture Notes in Civil Engineering, vol. 436, Springer, 2023.
4. T. Kang and Y. Lee, Eds., Proceedings of the 2021 4th International Conference on Civil Engineering and Architecture (ICCEA 2021), Springer, 2022.
5. W. F. Chen, Ed., The Civil Engineering Handbook, 2nd ed., CRC Press, Taylor & Francis Group, 2021.

BIS PUBLICATIONS

1 Bureau of Indian Standards, *IS 269: Specification for Ordinary Portland Cement*, New Delhi, India.

2 Bureau of Indian Standards, IS 383: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete, New Delhi, India.
3 Bureau of Indian Standards, IS 2386 (Parts 1, 3 & 4): Methods of Test for Aggregates for Concrete, New Delhi, India.
4 Bureau of Indian Standards, IS 4031 (Parts 4 & 5): Methods of Physical Tests for Hydraulic Cement, New Delhi, India.
5 Bureau of Indian Standards, IS 456: Plain and Reinforced Concrete – Code of Practice, New Delhi, India.
6 Bureau of Indian Standards, IS 516: Methods of Tests for Strength of Concrete, New Delhi, India.
7 Bureau of Indian Standards, IS 2952: Methods for Measurement of Flow of Water in Closed Conduits, New Delhi, India.
8 Bureau of Indian Standards, IS 10500: Drinking Water – Specification, New Delhi, India.
9 Bureau of Indian Standards, IS 3025 (Part 1): Methods of Sampling and Test for Water and Wastewater, New Delhi, India.
10 Bureau of Indian Standards, IS 2720 (Parts 2, 4 & 5): Methods of Test for Soils, New Delhi, India.
11 Bureau of Indian Standards, IS 1200 (Part 1): Methods of Measurement of Building and Civil Engineering Works – Earthwork, New Delhi, India.
12 Bureau of Indian Standards, IS 1722: Specification for Dumpy Level and Levelling Staff, New Delhi, India.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Analyze the properties and uses of various civil engineering materials, including their sustainability aspects.	KL4
CO2	Apply principles of Solids and fluids to solve problems related to forces, moments, material properties, and flow measurement.	KL3
CO3	Design and analyze systems for hydrology and water management, integrating concepts such as flow, irrigation and treatment processes.	KL4
CO4	Utilize surveying and geoinformatics techniques and geotechnical knowledge to plan, design, and manage infrastructure projects.	KL4
CO5	Utilize data analysis techniques, apply optimization methods, and create visual data representations using various AI based tools.	KL3
CO6	Design and demonstrate a sustainable model using suitable materials through investigation, experimentation, report and presentation.	KL4

Course Code	Category	BASIC ELECTRICAL AND INSTRUMENTATION ENGINEERING	L	T	P	C	Contact Hours
	MC		**3**	**0**	**0**	**3**	3

Course Level		*Prerequisite Courses: Nil*

COURSE OBJECTIVES:

This course aims to:

1. To provide fundamental knowledge of electrical circuits, transformers, and electrical machines used in basic engineering systems.
2. To introduce the principles of sensors and instrumentation for measurement of physical parameters.
3. To enable students to relate theoretical concepts with practical electrical and instrumentation applications.

UNIT 1 : DC AND AC CIRCUITS (9 HOURS)

Fundamental electrical quantities: current, voltage, power, and energy. Ohm's Law and Kirchhoff's Laws. Series, parallel, and series–parallel DC circuits. Star–delta transformation. Energy storage elements: resistance, inductance, and capacitance. Transient analysis of RL, RC, and RLC circuits.
AC fundamentals: sinusoidal waveforms, RMS and average values, phasor representation. Analysis of single-phase AC circuits with R, L, and C elements. Resonance. Power in AC circuits and power factor.
Illustration of basic DC and AC circuits to verify circuit laws and transient response.

UNIT 2 : TRANSFORMERS (9 HOURS)

Principle of electromagnetic induction. Construction and working of single-phase transformers. EMF equation. Ideal and practical transformer concepts. Transformer losses, efficiency, and voltage regulation. Open-circuit and short-circuit tests. Autotransformers and introduction to three-phase transformers. Cooling methods and applications.
Demonstration of different tests on single-phase transformers to evaluate efficiency, losses, and voltage regulation under different load conditions.

UNIT 3 : DC MACHINES (9 HOURS)

Principle of electromechanical energy conversion. Construction and working of DC generators and DC motors. EMF and torque equations. Types of DC machines: shunt, series, and compound. Characteristics of DC motors. Starting methods. Speed control techniques. Losses, efficiency, and applications.
Laboratory session on DC motor and DC Generator Characteristics.

UNIT 4 : AC MACHINES (9 HOURS)

Classification of AC machines. Construction and working principle of three-phase induction motors. Rotating magnetic field. Slip, torque, and speed characteristics. Losses and efficiency. Starting methods of induction motors. Single-phase induction motors. Introduction to synchronous machines and their applications.
Demonstration of load test on single phase and three phase induction motor.

UNIT 5 : SENSORS AND INSTRUMENTATION (9 HOURS)

Basics of measurement systems. Elements of instrumentation. Classification of sensors and transducers. Static and dynamic characteristics. Measurement of displacement, temperature, pressure, flow, and speed. Types of sensors: resistive, inductive, capacitive, piezoelectric, thermal, and optical sensors. Signal conditioning and basics of data acquisition. Industrial applications.
Laboratory session on various sensors and instrumentation.

TEXT BOOKS:

1. D. P. Kothari and I. J. Nagrath, Basic Electrical and Electronics Engineering, 3rd reprint, McGraw Hill Education (India) Private Limited, 2016.
2. G. Rizzoni, Principles and Applications of Electrical Engineering, McGraw Hill Education (India) Private Limited, 2010.
3. S. Salivahanan, R. Rengaraj, and G. R. Venkatakrishnan, Basic Electrical and Instrumentation Engineering, McGraw Hill, 2017.

REFERENCES:

1. S. K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson India, 2011.
2. V. Del Toro, Electrical Engineering Fundamentals, New Delhi: Pearson Education, 2015.
3. L. S. Bobrow, Foundations of Electrical Engineering, Oxford University Press, 2013.
4. R. Prasad, Fundamentals of Electrical Engineering, Prentice Hall of India, 2006.
5. N. Mittle, Basic Electrical Engineering, 24th reprint, Tata McGraw Hill, 2016.
6. A.E. Fitzgerald, D. E. Higginbotham, and A. Grabel, Basic Electrical Engineering, McGraw Hill Education (India) Private Limited, 2009.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Apply Ohm's law, Kirchhoff's laws, and basic circuit principles to analyze DC and AC circuits.	KL4
CO2	Analyze the working principles and performance characteristics of single-phase transformers..	KL4
CO3	Examine the construction, operation, and characteristics of DC machines	KL4
CO4	Apply the fundamental concepts of AC machines to understand their operation in engineering applications.	KL3
CO5	Explain the working principles and characteristics of basic sensors and transducers used in instrumentation.	KL2
CO6	Apply electrical and instrumentation concepts to analyze simple practical systems and measurements in real-world engineering applications.	KL4

Course Code	Category	SUSTAINABLE PRACTICES LABORATORY	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To understand the basics of 17 SDGs and to identify sustainability challenges aligned with specific SDGs.
2. To analyze the current sustainability practices of the campus and their impacts.
3. To perform basic experiments related to water, energy and air quality.
4. To design and present SDG-based experimental or community solutions.
5. To demonstrate ethical and responsible decision-making for sustainable development..

UNIT 1 : INTRODUCTION TO SDGs (18 HOURS)

Introduction to SDG - Mapping local problems to SDGs - case studies of successful SDG interventions.

UNIT 2 : GOOD HEALTH AND WELL BEING (SDG 3) (16 HOURS)

Air quality monitoring (PM2.5, PM10, CO_2) in college campus - Noise pollution Measurement - Ergonomics and mental well-being survey - Analysis of sanitation and hygiene practices.

UNIT 3 : CLEAN WATER AND SANITATION (SDG 6) (12 HOURS)

Analysis of ground water quality testing in college hostel (pH, turbidity, hardness, TDS) - Analysis of drinking water samples. Design of low-cost water filtration models - Study of water consumption patterns.

UNIT 4 : AFFORDABLE AND CLEAN ENERGY (SDG 7) (6 HOURS)

Comparison of renewable vs non-renewable energy sources - Energy audit of laboratory/ classroom - Proposals for energy management - Designing of small solar/wind energy models.

UNIT 5 : SUSTAINABLE CITIES AND RESPONSIBLE CONSUMPTION (6 HOURS)

Segregation and quantification of food waste in hostel campus - proposal for composting or vermicomposting. Segregation and quantification of plastic waste in college campus - Management of plastic waste.

TEXT BOOKS:

1. S. Hazra and A. Bhukta, Sustainable Development Goals: An Indian Perspective, Springer International Publishing, 2020.
2. A.Ziai, Development Discourse and Global History: From Colonialism to the Sustainable Development Goals, Routledge, 2016.

REFERENCES:

1. UNESCO, Education for Sustainable Development Resources, UNESCO Publishing, Paris, France, 2017.
2. United Nations, Transforming Our World: The 2030 Agenda for Sustainable Development, United Nations, New York, NY, USA, 2015.
3. NITI Aayog, Government of India, SDG India Index Reports, NITI Aayog, New Delhi, India, 2018.
4. World Bank, World Bank Open Data, World Bank Publications, Washington, DC, USA, n.d.

BIS PUBLICATIONS

1 Bureau of Indian Standards, Methods for Measuring Air Pollution—Code of Practice, IS 5182:2019, New Delhi, India, 2019.

2 Bureau of Indian Standards, Greenhouse Gases—Code of Practice, IS/ISO 14064-1:2018, New Delhi, India, 2018.

3 Bureau of Indian Standards, Environmental Management Systems—Code of Practice, IS/ISO 14001:2015, New Delhi, India, 2015.

4 Bureau of Indian Standards, Solid Waste Management—Segregation, Collection and Utilization at Household/Community Level—Guidelines, IS 16557:2016 (Reaffirmed 2021), New Delhi, India, 2016.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Demonstrate understanding on the fundamental knowledge history, scope and challenges of the SDGs.	KL2
CO2	Analyze the progress made towards achieving the SDGs.	KL4
CO3	Apply sustainability principles to analyze and evaluate societal and environmental aspects that are relevant to economy, health, safety, culture and environment.	KL4
CO4	Conduct sustainability assessments of the campus facilities and operations by implementing multi-disciplinary team projects in collaboration with campus stakeholders using the available resources in relevance to the societal and environmental aspects.	KL3
CO5	Monitor and report the project results of the sustainability initiatives to diverse audiences.	KL3