ADITYA COLLEGE OF ENGINEERING, MADANAPALLE

(UGC - Autonomous Institution & Accredited with NAAC A+ Grade)

Approved by AICTE, New Delhi & Affiliated to JNTUA, Anantapuramu

Madanapalle - 517325, Annamayya (Dist.), A. P.

www.acem.ac.in

ACEM - R24 REGULATION

CIVIL ENGINEERING

COURSE STRUCTURE AND SYLLABUS

for

B. Tech. (Regular – Full Time)

(Effective for the Students Admitted into I Year from the Academic Year 2024 - 25 onwards)

and

B. Tech. (Lateral Entry Scheme)

(Effective for the Students getting Admitted into II Year through Later Entry Scheme from the Academic Year 2025 - 26 onwards)

ADITYA COLLEGE OF ENGINEERING: MADANAPALLE
Punganur Road, Valasapalle (Post), Madanapalle, Annamayya (Dist.,) – 517325.
(An Autonomous Institution)
Department of Civil Engineering

Institute Vision:

To impart quality in engineering education to meet the technological advances and industrial requirements with global standards.

Institute Mission:

- Provide quality technical education through skill-based trainings and promote research and development, and consultancy services.
- Offer state-of-the-art-infrastructure for supporting technological advances.
- Develop disciplined, creative and globally competent engineers.
- Equip and empower the faculty at all levels to promote innovations and technical advancements in various domains of engineering.

Department Vision:

To be a globally recognized civil engineering department that provides excellent education and research for building innovative infrastructure and sustainable communities."

Department Mission:

- Fostering excellence in teaching and learning through a balanced curriculum of theoretical science, technical skills, and practical application.
- Promoting innovative thinking and the use of emerging technologies for sustainable infrastructure design and construction.
- Instilling in students a strong foundation in engineering principles, professional ethics, and civic responsibility to make positive contributions to society as civil engineers.

Programme Outcomes (POs):

On Successful completion, the graduate will be able to,

- **PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2. Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

- **PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs):

On Successful completion, the graduate (Civil Engineering) will be able to,

- Analyze and design civil engineering structures using knowledge of structural analysis, mechanics, materials, and safety standards. Students will be able to design and evaluate structural systems like buildings, bridges, dams, and transportation infrastructure.
- Apply engineering principles to plan, design, construct, and maintain civil engineering works, including surveying, construction planning, project management, and infrastructure maintenance.

Programme Educational Objectives (PEOs):

After few years of graduation, the graduates of Civil Engineering are expected to

- Apply knowledge of mathematics, science, and engineering principles to identify, formulate, and solve civil engineering problems.
- Students will gain strong analytical and problem - solving skills to design civil engineering systems like bridges, roads, dams, and buildings.
- Students will become proficient in using software like Auto CAD, STAAD, and MATLAB to plan, execute, and interpret experiments and Analyze data.
- Work professionally with effective communication, teamwork, and leadership skills. Students will practice collaboration, written and oral communication, project management, and ethical decision-making.

B.Tech. – Civil Engineering
Course Structure & Syllabus – ACEM R24 Regulations
(Applicable from the academic year 2024-25 onwards)

INDUCTION PROGRAMME

S.No.	Name of the Course	Category	L-T-P-C
1.	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2.	Career Counselling	MC	2-0-2-0
3.	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4.	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5.	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6.	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7.	Remedial Training in Foundation Courses	MC	2-1-2-0
8.	Human Values & Professional Ethics	MC	3-0-0-0
9.	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10.	Concepts of Programming	ES	2-0-2-0

Group - A
B. Tech. – I Year I Semester

S. No.	Category	Course code	Name of the Course	L/D	T	P	Credits
1.	BS	24BSHB101T	Linear Algebra & Calculus	2	1	0	3
2.	BS	24BSHB103T	Engineering Physics	2	1	0	3
3.	ES	24ES02101T	Basic Electrical & Electronics Engineering	3	0	0	3
4.	ES	24ES03101T	Engineering Graphics	1	0	4	3
5.	ES	24ES05101T	Introduction to Programming	2	1	0	3
6.	BS	24BSHB103P	Engineering Physics Lab	0	0	2	1
7.	ES	24ES02101P	Electrical & Electronics Engineering Workshop	0	0	3	1.5
8.	ES	24ES05101P	Computer Programming Lab	0	0	3	1.5
9.	ES	24ES05102P	IT Workshop	0	0	2	1
10.	HM	24HMHS103L	NSS/ NCC/ Scouts & Guides/ Community Service	0	0	1	0.5
			Total	**10**	**3**	**15**	**20.5**

B.Tech. – I Year II Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	BS	24BSHB102T	Differential Equations & Vector Calculus	2	1	0	3
2.	BS	24BSHB105T	Engineering Chemistry	3	0	0	3
3.	HM	24HMHS101T	Communicative English	2	0	0	2
4.	ES	24ES01101T	Basic Civil & Mechanical Engineering	3	0	0	3
5.	PC	24PC01101T	Engineering Mechanics	2	1	0	3
6.	BS	24BSHB105P	Engineering Chemistry Lab	0	0	2	1
7.	HM	24HMHS101P	Communicative English Lab	0	0	2	1
8.	ES	24ES03102P	Engineering Workshop	0	0	3	1.5
9.	PC	24PC01101P	Engineering Mechanics & Building Practices Lab	0	0	3	1.5
10.	HM	24HMHS102L	Health and Wellness, Yoga and Sports	0	0	1	0.5
			Total	**12**	**2**	**11**	**19.5**

B.Tech. – II Year I Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	BS	24BSHB206T	Numerical and Statistical Methods	2	1	0	3
2.	HM	24HMHS204L	Universal Human Values– Understanding Harmony and Ethical Human Conduct	2	1	0	3
3.	PC	24PC01202T	Surveying	2	1	0	3
4.	PC	24PC01203T	Strength of Materials	2	1	0	3
5.	PC	24PC01204T	Fluid Mechanics	2	1	0	3
6.	PC	24PC01202P	Surveying Lab	0	0	3	1.5
7.	PC	24PC01203P	Strength of Materials Lab	0	0	3	1.5
8.	SE	24SE01201S	Building Planning and Drawing	0	1	2	2
9.	HM	24HMHS205A	Environmental Science	2	0	0	--
			Total	**10+2**	**6**	**8**	**20**

B.Tech. – II Year II Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	HM	**Management Elective – I (HM – I)**		2	0	0	2
		24HMHS206T	Managerial Economics and Financial Analysis				
		24HMHS207T	Organizational Behaviour				
		24HMHS208T	Business Environment				
2.	PC	24PC01205T	Engineering Geology	3	0	0	3
3.	PC	24PC01206T	Concrete Technology	3	0	0	3
4.	PC	24PC01207T	Structural Analysis	2	1	0	3
5.	PC	24PC01208T	Hydraulics & Hydraulic Machinery	2	1	0	3
6.	PC	24PC01205P	Engineering Geology Lab	0	0	3	1.5
7.	PC	24PC01206P	Concrete Technology Lab	0	0	3	1.5
8.	SE	24SEHS201S	Soft Skills	0	1	2	2
9.	ES	24ES03102T	Design Thinking & Innovation	1	0	2	2
			Total	**13**	**3**	**10**	**21**
Mandatory Community Service Internship (24IPIN301L) of 08 Weeks duration during Summer Vacation							

B.Tech. – III Year I Semester

S. No.	Category	Course Code	Name of the Course	L	T	P	Credits
1.	PC	24PC01309T	Water Resources Engineering	3	0	0	3
2.	PC	24PC05307T	Introduction to Quantum Technologies and Applications	2	1	0	3
3.	PC	24PC01310T	Design of Reinforced Concrete Structures	2	1	0	3
4.	PC	24PC01311T	Geotechnical Engineering	3	0	0	3
5.	PE	**Professional Elective – I (PE – I)**		3	0	0	3
6.	OE	**Open Elective – I (OE – I)**		3	0	0	3
7.	PC	24PC01311P	Geotechnical Engineering Lab	0	0	3	1.5
8.	PC	24PC01208P	Fluid Mechanics Hydraulic Machines Lab	0	0	3	1.5
9.	SE	24SE01302S	Estimation, Specifications, Costing & Valuation	0	1	2	2
10.	ES	24ES04301P	Tinkering Lab	0	0	2	1
11.	IP	24IPIN301L	Evaluation of Community Service Internship	-	-	-	2
			Total	**16**	**3**	**10**	**26**

Professional Elective – I (PE - I)

S. No.	Course Code	Name of the Professional Elective	L	T	P
1.	24PE01301T	Pre-stressed Concrete	2	1	0
2.	24PE01302T	Air Pollution and Control	3	0	0
3.	24PE01303T	Environmental Impact Assessment	3	0	0

Open Elective – I (OE - I)

S. No.	Course Code	Name of the Professional Elective	Offered by the Dept.	L	T	P
1.	24OE02301T	Electrical Safety Practices and Standards	EEE	3	0	0
2.	24OE03301T	Sustainable Energy Technologies	ME	3	0	0
3.	24OE04301T	Electronic Circuits	ECE	2	1	0
4.	24OE05301T	Java Programming	CSE	2	1	0
5.	24OE31301T	Fundamentals of Artificial Intelligence	CSE(AI)	2	1	0
6.	24OE05302T	Quantum Technologies and Applications	CSE	3	0	0
7.	24OEHB301T	Mathematics for Machine Learning and AI	Mathematics	2	1	0
8.	24OEHB302T	Materials Characterization Techniques	Physics	2	1	0
9.	24OEHB303T	Chemistry of Energy Systems	Chemistry	3	0	0
10.	24OEHS301T	English for Competitive Examinations	Humanities	3	0	0
11.	24OEHS302T	Entrepreneurship and New Venture Creation	Management	3	0	0

B.Tech. – III Year II Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	PC	24PC01312T	Design of Steel Structures	2	1	0	3
2.	PC	24PC01313T	Highway Engineering	2	1	0	3
3.	PC	24PC01314T	Environmental Engineering	3	0	0	3
4.	PE	**Professional Elective – II (PE – II)**		2	1	0	3
5.	PE	**Professional Elective – III (PE – III)**		3	0	0	3
6.	OE	**Open Elective – II (OE – II)**		3	0	0	3
7.	PC	24PC01313P	Highway Engineering Lab	0	0	3	1.5
8.	PC	24PC01314P	Environmental Engineering Lab	0	0	3	1.5
9.	SE	24SE01303S	Building Information Modelling	0	1	2	2
10.	MC	24MCHS309A	**Mandatory non-credit Course** Technical paper writing & IPR	2	0	0	-
11.	IP	24IPWS302L	Workshop	0	0	0	0
Total				**15+2**	**4**	**8**	**23**
Mandatory Industry Internship (24IPIN403L) of 08 weeks duration during summer vacation							

Professional Elective – II (PE - II)

S.No.	Course Code	Name of the Professional Elective	L	T	P
1.	24PE01304T	Design of Earthquake Resistant Structures	2	1	0
2.	24PE01305T	Open Channel Flow	2	1	0
3.	24PE01306T	Foundation Engineering	2	1	0

Professional Elective – III (PE - III)

S. No.	Course Code	Name of the Professional Elective	L	T	P
1.	24PE01307T	Cost effective Housing Techniques	3	0	0
2.	24PE01308T	Watershed Management	3	0	0
3.	24PE01309T	Advanced Structural Analysis	2	1	0

Open Elective – II (OE - II)

S. No.	Course Code	Name of the Professional Elective	Offered by the Dept.	L	T	P
1.	24OE02302T	Renewable Energy Sources	EEE	3	0	0
2.	24OE03302T	Automation and Robotics	ME	3	0	0
3.	24OE04302T	Digital Electronics	ECE	2	1	0
4.	24OE05303T	Operating Systems	CSE & Allied	3	0	0
5.	24OE31302T	Introduction of Machine Learning		2	1	0
6.	24OEHB304T	Optimization Techniques for Engineers	Mathematics	2	1	0
7.	24OEHB305T	Mathematical Foundation of Quantum Technologies		2	1	0

8.	24OEHB306T	Physics of Electronic Materials and Devices	Physics	3	0	0
9.	24OEHB307T	Chemistry of Polymers and Applications	Chemistry	3	0	0
10.	24OEHS303T	Academic Writing and Public Speaking	Humanities	3	0	0

B.Tech. – IV Year I Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	PC	24PC01415T	Finite Element Methods	2	1	0	3
2.	HM	**Management Elective – II (HM – II)**		2	0	0	2
3.	PE	**Professional Elective – IV (PE – IV)**		2	1	0	3
4.	PE	**Professional Elective – V (PE – V)**		3	0	0	3
5.	OE	**Open Elective – III (OE – III)**		3	0	0	3
6.	OE	**Open Elective – IV (OE – IV)**		3	0	0	3
7.	SE	24SE01404S	Skills in Civil Engineering software (STAADPRO/CAD/TEKL)	0	1	2	2
8.	MC	24MCHS413A	Audit Course Gender Sensitization	2	0	0	-
9.	IP	24IPIN403L	Evaluation of Industry Internship	-	-	-	2
Total				**15+2**	**3**	**2**	**21**

Management Elective – II (HM - II)

S. No.	Course Code	Name of the Professional Elective	L	T	P
1.	24HMHS410T	Business Ethics and Corporate Governance	2	0	0
2.	24HMHS411T	E-Business	2	0	0
3.	24HMHS412T	Management Science	2	0	0

Professional Elective – IV (PE - IV)

S. No.	Course Code	Name of the Professional Elective	L	T	P
1.	24PE01410T	Geo-synthetics and Reinforced Earth Structures	2	1	0
2.	24PE01411T	Railways, Airports, Docks and Harbour Engineering	3	0	0
3.	24PE01412T	Experimental Stress Analysis	2	1	0

Professional Elective – V (PE - V)

S. No.	Course Code	Name of the Professional Elective	L	T	P
1.	24PE01413T	Ground Improvement Techniques	3	0	0
2.	24PE01414T	Subsurface Investigation and Instrumentation	3	0	0
3.	24PE01415T	Transportation Economics	2	1	0

Open Elective – III (OE - III)

S. No.	Course Code	Name of the Professional Elective	Offered by the Dept.	L	T	P
1.	24OE02403T	Smart Grid Technologies	EEE	3	0	0
2.	24OE03403T	3D Printing Technologies	ME	3	0	0
3.	24PC04312T	Microprocessors and Microcontrollers	ECE	2	1	0
4.	24PC05204T	Data Base Management Systems	CSE& Allied	2	1	0
5.	24PE05305T	Cyber Security		3	0	0
6.	24OEHB408T	Wavelet transforms and its Applications	Mathematics	2	1	0
7.	24OEHB409T	Smart Materials and Devices	Physics	2	1	0
8.	24OEHB410T	Introduction to Quantum Mechanics		2	1	0
9.	24OEHB411T	Green Chemistry and Catalysis for Sustainable Environment	Chemistry	3	0	0
10.	24OEHS404T	Employability Skills	Humanities	3	0	0

Open Elective – IV (OE - IV)

S. No.	Course Code	Name of the Professional Elective	Offered by the Dept.	L	T	P
1.	24OE02404T	Electric Vehicles	EEE	3	0	0
2.	24OE03404T	Total Quality Management	ME	2	1	0
3.	24OE04403T	Transducers and Sensors	ECE	3	0	0
4.	24PE04416T	Internet of Things	CSE & Allied	3	0	0
5.	24OE05404T	Introduction to Computer Networks		3	0	0
6.	24PE05310T	Introduction to Quantum Computing		3	0	0
7.	24OEHB412T	Financial Mathematics	Mathematics	2	1	0
8.	24OEHB413T	Sensors and Actuators for Engineering Applications	Physics	3	0	0
9.	24OEHB414T	Chemistry of Nanomaterials and Applications	Chemistry	3	0	0
10.	24OEHS405T	Literary Vibes	Humanities	2	1	0

B.Tech. – IV Year II Semester

S. No.	Category	Course code	Name of the Course	L	T	P	Credits
1.	IP	24IPIN404L	Internship	-	-	-	4
2.	IP	24IPPR401L	Project	-	-	-	8
Total							**12**

COURSES OFFERED FOR HONOURS DEGREE IN CIVIL ENGINEERING

S. No.	Course code	Name of the Course	L	T	P	Credits
1.	24HON0101T	Soil Dynamics and Machine Foundation	2	1	0	3
2.	24HON0102T	Industrial Waste and Waste Water Management	3	0	0	3
3.	24HON0103T	Repair & Rehabilitation of Structures	3	0	0	3
4.	24HON0104T	Design and Drawing of Irrigation Structures	2	1	0	3
5.	24HON0105T	Road Safety Engineering	3	0	0	3
6.	24HON0106P	NDT Lab	0	0	3	1.5
7.	24HON0107P	ETABS/SAP Lab	0	0	3	1.5
Total						**18**

LIST OF MINORS OFFERED BY THE CIVIL ENGINEERING BUILDING PLANNING & CONSTRUCTION TECHNOLOGY

S. No.	Course code	Name of the Course	L	T	P	Credits
1.	24MBC0101T	Construction Materials	3	0	0	3
2.	24MBC0102T	Construction Methods	3	0	0	3
3.	24MBC0103T	Building Planning and Drawing	3	0	0	3
4.	24MBC0104T	Surveying	2	1	0	3
5.	24MBC0105T	Concrete Technology	2	1	0	3
6.	24MBC0106P	Concrete Technology Lab	0	0	3	1.5
7.	24MBC0107P	Surveying Lab	0	0	3	1.5
Total			**13**	**2**	**6**	**18**

B.Tech. – I Year
I Semester

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB101T	BS	**Linear Algebra & Calculus** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: Basic Knowledge of Mathematics

Course Objectives:

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the consistency and solution of systems of linear equations using matrix methods including echelon forms, normal forms, Gauss-Jordan method, and iterative techniques. (L4)

CO2: Apply the concepts of Eigenvalues, Eigenvectors, and orthogonal transformation to solve real-life problems. (L3)

CO3: Interpret the implications of Mean Value Theorems and apply Taylor’s and Maclaurin’s series to approximate and analyzes the behaviours of functions in single-variable calculus. (L4)

CO4: Examine functions of several variables using partial derivatives, Jacobians, and series expansions, and determine critical points using methods like Lagrange multipliers. (L4)

CO5: Evaluate double and triple integrals in various coordinate systems and apply them to determine areas and volumes in multivariable contexts. (L4)

Unit I: Matrices:

Rank of a matrix by echelon form, normal form. Cauchy–Binet formulae (without proof). Inverse of non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

Unit II: Eigen values, Eigenvectors and Orthogonal Transformation:

Eigen values, Eigenvectors and their properties, Diagonalization of a matrix, Cayley Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit III: Calculus:

Mean Value Theorems: Rolle’s Theorem, Lagrange’s mean value theorem with their geometrical interpretation, Cauchy’s mean value theorem, Taylor’s and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

Unit IV: Partial differentiation and Applications (Multi Variable Calculus):

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Taylor’s and Maclaurin’s series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit V: Multiple Integrals (Multi Variable Calculus):

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals)

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley &Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and, S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021).

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB103T	BS	**Engineering Physics** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: Fundamentals of Physics

Course Objectives:

To bridge the gap between Physics in school at 10+2 level and UG level engineering courses by identifying the importance of optical phenomenon like interference, diffraction, etc, enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the intensity variation of light due to Interference Diffraction and Polarization. (L4)

CO2: Analyze the properties of crystals and determine the type of structure using the X-ray Diffraction technique. (L4)

CO3: Summarize various types of Polarization of dielectric materials & Classify Magnetic materials. (L4)

CO4: Apply the fundamentals of quantum mechanics & free electron theory to the dimensional motion of particles. (L3)

CO5: Explain the basics concepts in semiconductors and identify the type of semiconductor using Hall effect. (L3)

Unit I: Wave Optics:

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit II: Crystallography and X-ray Diffraction:

Space lattice, Basis, Unit Cell and lattice parameters Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer –crystal structure determination by Laue's and powder methods.

Unit III: Dielectric and Magnetic Materials:

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials:

Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

Unit IV: Quantum Mechanics and Free Electron Theory:

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

Unit V: Semiconductors:

Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation **--** Direct and Indirect Band gap of semiconductors – Hall effect and its applications.

Text Books:

1. Palanisamy," Engineering Physics", Palanisamy, SciTech Publications.
2. K. Thyagarajan," Engineering Physics", McGraw Hill Publications.
3. A Text book of Engineering Physics, M. N. Avadhanulu, P. G. K. Shirsagar& TVS Arun Murthy, S. Chand Publications, 11th Edition 2019
4. Engineering Physics - D. K. Bhattacharya and Poonam Tandon, Oxford press (2015)

Reference Books:

1. Introduction to solid state physics, Charles Kittel 7th Edition, John Wiley and Sons.
2. Gaur and Gupta, "Engineering Physics", Dhanpatrai Publications.
3. Engineering Physics - M.R. Srinivasan, New Age international publishers (2009).
4. Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.2010

Online Resources:

1. https://www.youtube.com/watch?v=PEXSH8dB-Uk
2. https://www.youtube.com/watch?v=YvrwVK9ZqQY
3. https://www.digimat.in/nptel/courses/video/115107095/L01.html
4. https://www.youtube.com/watch?v=6QUFuZpCgGw
5. https://nptel.ac.in/courses/115/105/115105122/

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES02101T	ES	**Basic Electrical and Electronics Engineering** (Common to all branches of Engineering)	3	0	0	3

Part - A: Basic Electrical Engineering

Pre-requisites: Fundamentals of Physics

Course Objectives:

To expose to the field of electrical & electronics engineering, laws and principles of electrical/ electronic engineering and to acquire fundamental knowledge in the relevant field.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply KVL & KCL to AC & DC Circuits to determine the various electrical parameters. (L3)

CO2: Explain the construction and working principles of electrical machines and measuring instruments, and compare their functions and applications in practical scenarios. (L4)

CO3: Distinguish between various power generation systems and evaluate domestic energy consumption to calculate electricity bills and implement appropriate electrical safety measures. (L4)

Unit I: DC & AC Circuits:

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

Unit II: Machines and Measuring Instruments:

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

Unit III: Energy Resources, Electricity Bill & Safety Measures:

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various **Power Generation Systems:** Hydel, Nuclear, Solar & Wind power generation.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of "unit" used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

Text Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Books:

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition

2. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017.
3. Basic Electrical and Electronics Engineering, S. K. Bhatacharya, Person Publications, 2018, Second Edition.
4. E. Hughes, Electrical and Electronic Technology, PEARSON, 2010
5. 5. G. Rizzoni, Principles and Applications of Electrical Engineering, TMH, 2017

Online Resources:

1. https://nptel.ac.in/courses/108105053
2. https://nptel.ac.in/courses/108108076
3. https://archive.nptel.ac.in/courses/108/105/108105053

Part-B: Basic Electronics Engineering

Pre-Requisites: Basic fundamentals of Physics and Boolean Algebra

Course Objectives:

This course provides the student with the fundamental skills to understand the principles of digital electronics, basics of semiconductor devices like diodes & transistors, characteristics and its applications.

Course Outcomes (COs):

On successful completion of the course, Students will be able to

CO1: Apply the concept of science and mathematics to understand the working of diodes, transistors with characteristics. (L3)

CO2: Describe the operation of rectifiers, regulators, and amplifiers, and analyze the functional blocks of power supplies and electronic instrumentation systems for signal processing applications. (L4)

CO3: Interpret number systems and coding schemes, and construct basic combinational and sequential circuits using logic gates and Boolean algebra for digital system design. (L4)

Unit I: Semiconductor Devices:

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode - Zener Effect -Zener Diode and its Characteristics. Bipolar Junction Transistor - CB, CE, CC Configurations and Characteristics- Elementary Treatment of Small Signal CE Amplifier.

Unit II: Basic Electronic Circuits and Instrumentation:

Rectifiers and power supplies: Block diagram description of a DC power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple Zener voltage regulator. **Amplifiers:** Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response.

Electronic Instrumentation: Block diagram of an electronic instrumentation system.

Unit III: Digital Electronics:

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple combinational Circuits – Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Text Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Online Resources:

1. https://youtu.be/n9ZytPvXi7w
2. https://youtu.be/ngznoF6z0aw
3. https://youtu.be/S845RG7X70s
4. https://youtu.be/1OM3Bd8GXUo

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES03101T	**ES**	**Engineering Graphics** (Common to all branches of Engineering)	**1**	**0**	**4**	**3**

Pre-Requisites: Basics of Geometry & Mathematics

Course Objectives:

- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines and plane surfaces
- To improve the visualization skills for better understanding of projection of solids
- To develop the imaginative skills of the students required to understand Section of solids and Developments of surfaces.
- To make the students understand the viewing perception of a solid object in Isometric and Perspective projections.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Construct geometrical shapes, regular polygons, and engineering curves using standard drawing instruments and apply appropriate methods to draw plain, diagonal, and vernier scales. (L3)

CO2: Draw the orthographic projections of points, lines, and planes in various positions using reference planes and apply projection principles to solve related engineering problems. (L3)

CO3: Represent the projections of polyhedral and solids of revolution in different positions, including those inclined to reference planes. (L4)

CO4: Determine sectional views and true shapes of solids and develop their surfaces using appropriate geometric methods. (L4)

CO5: Convert isometric views to orthographic views and vice versa, and demonstrate basic 2D and 3D object modelling using CAD tools. (L4)

Unit I: Introduction:

Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general method, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

Unit II: Orthographic Projections:

Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

Unit III: Projections of Solids:

Types of solids: Polyhedral and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel toboth the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Unit IV: Sections of Solids:

Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Unit V: Conversion of Views:

Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

Text Books:

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Books:

1. Engineering Drawing, K.L. Narayana and P. Kannaiah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M. B. Shah and B.C. Rana, Pearson Education Inc,2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES05101T	ES	**Introduction to Programming** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: Nil

Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Demonstrate basics of computers, the concept of algorithm & flow chart and analyze the time & complexities of algorithms. (L4)

CO2: Write the algorithms, draw the flow charts and develop the programs using conditional statements of C-Language. (L3)

CO3: Write the algorithm, draw the flow chart and develop the programs using arrays & strings of C- Language. (L3)

CO4: Apply the Pointers & user defined Data types of C language and Develop solutions to real world problems. (L3)

CO5: Develop the programs using Functions for real world problems in C language. (L3)

Unit I: Introduction to Programming and Problem Solving:

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program, Algorithms, flowcharts (Using Día Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting. Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

Unit II: Control Structures:

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

Unit III: Arrays and Strings:

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

Unit IV: Pointers & User Defined Data types:

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

Unit V: Functions & File Handling:

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Text Books:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988.
2. "Schaum's Outline of Programming with C", Byron S Gottfried, McGraw-Hill Education, 1996.

Reference Books:

1. "Computing fundamentals and C Programming", Balagurusamy, E., McGraw-Hill Education, 2008.
2. "Programming in C", Rema Theraja, Oxford, 2016, 2nd Edition.
3. "C Programming, A Problem-Solving Approach", Forouzan, Gilberg, Prasad, CENGAGE, 3rd Edition.

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB103P	**BS**	**Engineering Physics Lab** (Common to all branches of Engineering)	**0**	**0**	**2**	**1**

Pre-Requisites: Fundamentals of Physics

Course Objectives:

- To study the concepts of optical phenomenon like Interference, Diffraction, etc
- To recognize the importance of energy, gap a study of conductivity.
- To study the parameters and applications of di-electric and magnetic materials by conducting experiments
- To verify the laws of stretched strings
- To Plot the intensity of the magnetic field of circular coil carrying current with distance.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Operate optical instruments like travelling microscope and spectrometer to measure the various physical quantities. (L2)

CO2: Examine the wavelengths of different Colors using diffraction grating. (L4)

CO3: Plot the intensity of the magnetic field of circular coil carrying current with distance. (L2)

CO4: Determine dielectric constant for dielectric materials. (L2)

CO5: Calculate the band gap of a given semiconductor and to Identify the type of semiconductor using Hall effect. (L3)

CO6: Examine the laws of stretched string using sonometer (L4)

List of Experiments

1. Determination of radius of curvature of a given Plano-convex lens by Newton's rings.
2. Determination of wavelengths of different spectral lines in mercury spectrum using
3. Diffraction grating in normal incidence configuration. Verification of Brewster's law
4. Determination of dielectric constant using charging and discharging method.
5. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
6. Determination of wavelength of Laser light using diffraction grating.
7. Estimation of Planck's constant using photoelectric effect.
8. Determination of the resistivity of semiconductors by four probe methods.
9. Determination of energy gap of a semiconductor using p-n junction diode.
10. Magnetic field along the axis of a current carrying circular coil by Stewart Gee's Method
11. Determination of Hall voltage, Hall coefficient and type of semiconductor (N-type or P-Type) using Hall effect.
12. Determination of temperature coefficients of a thermistor.
13. Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum.
14. 14.Determination of magnetic susceptibility by Kundt's tube method.
15. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
16. Sonometer: Verification of laws of stretched string.
17. Determination of young's modulus for the given material of wooden scale by non-uniform bending (or double cantilever) method.
18. Determination of Frequency of electrically maintained tuning fork by Melde's experiment

Note: Any Ten of the listed experiments are to be conducted and Two of these Ten experiments may be conducted in virtual mode.

Reference Book:

1. A Textbook of Practical Physics - S. Balasubramanian, M.N. Srinivasan, S. Chand Publishers, 2017.

Online Resources:

1. www.vlab.co.in
2. https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES02101P	**ES**	**Electrical and Electronics Engineering Workshop** (Common to all Branches of Engineering)	**0**	**0**	**3**	**1.5**

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
   - Provide some exercises so that hardware tools and instruments are learned to be used by the students.
2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
   - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
   - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.
   - Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

Part A: Electrical Engineering Lab

Pre-requisites: Fundamentals of Physics

Course Objectives:

To impart knowledge on the fundamental laws & theorems of electrical circuits, functions of electrical machines and energy calculations.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Verify KVL, KCL & various network theorems and Apply to AC & DC Electrical circuits to measure Electric Circuit parameters (R, L & C), Power, Power factor etc. (L3)

CO2: Conduct Experiments on AC&DC Machines, plot characteristics and measure the various electrical parameters or quantities. (L3)

CO3: Design suitable circuits and methodologies for the measurement of various electrical parameters; House hold and commercial wiring. (L3)

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Note: Minimum Six Experiments are to be performed.

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition

2. Power System Engineering, P.V. Gupta, M. L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition.

Part-B: Electronics Engineering Lab

Pre-requisites: Fundamentals of Physics

Course Objectives:

To impart knowledge on the principles of digital electronics and fundamentals of electron devices & its applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand the usage of electronic measuring instruments and Analyze the V-I characteristics of various electronic devices. (L4)

CO2: Develop various Analog Electronic Circuits such as Rectifier, Regulators and Amplifiers (L3)

CO3: Develop Digital Electronic Circuits such as Combinational and Sequential Circuits. (L3)

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Tables of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

Reference Books:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education,2009.

Note: Minimum Six Experiments are to be performed. All the experiments shall be performed using both Hardware and Software

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES05101P	ES	**Computer Programming Lab** (Common to all branches of Engineering)	0	0	3	1.5

Pre-Requisites: Nil

Course Objectives:

The course aims at providing students with hands – on experience and train them on the concepts of the C- programming language.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Read, understand, and trace the execution of programs written in C language. (L2)

CO2: Select the right control structure for solving the problem. (L3)

CO3: Develop C programs which utilize memory efficiently using programming constructs like pointers. (L3)

CO4: Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C. (L3)

Unit I: Week 1:

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

i) Basic Linux environment and its editors like Vi, Vim & Emacs etc.

ii) Exposure to Turbo C, gcc

iii) Writing simple programs using printf(), scanf()

Week 2:

Objective: Getting familiar how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

i) Sum and average of 3 numbers

ii) Conversion of Fahrenheit to Celsius and vice versa

iii) Simple interest calculation

Week 3:

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

i) Finding the square root of a given number

ii) Finding compound interest

iii) Area of a triangle using heron’s formulae

iv) Distance travelled by an object

Unit II: Week 4:

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial4: Operators and the precedence and as associativity:

Lab4: Simple computational problems using the operator’ precedence and associativity

i) Evaluate the following expressions.

a. A+B*C+(D*E) + F*G b. A/B*C-B+A*D/3

c. A+++B---A d. J= (i++) + (++i)

ii) Find the maximum of three numbers using conditional operator

iii) Take marks of 5 subjects in integers, and find the total, average in float

Week 5:

Objective: Explore the full scope of different variants of “if construct” namely if-else, null-else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for “if construct”.

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

i) Write a C program to find the max and min of four numbers using if-else.

ii) Write a C program to generate electricity bill.

iii) Find the roots of the quadratic equation.

iv) Write a C program to simulate a calculator using switch case.

v) Write a C program to find the given year is a leap year or not.

Week 6:

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

i) Find the factorial of given number using any loop.

ii) Find if the given number is a prime or not.

iii) Compute sine and cos series

iv) Checking a number palindrome

v) Construct a pyramid of numbers.

Unit III: Week 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7:1D Array manipulation, linear search

i) Find the min and max of a 1-D integer array.

ii) Perform linear search on1D array.

iii) The reverse of a 1D integer array

iv) Find 2's complement of the given binary number.

v) Eliminate duplicate elements in an array.

Week 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

i) Addition of two matrices

ii) Multiplication two matrices

iii) Sort array elements using bubble sort

iv) Concatenate two strings without built-in functions

v) Reverse a string using built-in and without built-in string functions

Unit IV: Week 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

i) Write a C program to find the sum of a 1D array using malloc()

ii) Write a C program to find the total, average of n students using structures

iii) Enter n students data using calloc () and display failed students list

iv) Read student name and marks from the command line and display the student details along with the total.

v) Write a C program to implement realloc ()

Week 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10: Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit-fields

i) Create and display a singly linked list using self-referential structure.

ii) Demonstrate the differences between structures and unions using a C program.

iii) Write a C program to shift/rotate using bitfields.

iv) Write a C program to copy one structure variable to another structure of the same type.

Unit V: Week 11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Eulers theorem.

i) Write a C function to calculate NCR value.

ii) Write a C function to find the length of a string.

iii) Write a C function to transpose of a matrix.

iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

Week 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

i) Write a recursive function to generate Fibonacci series.

ii) Write a recursive function to find the lcm of two numbers.

iii) Write a recursive function to find the factorial of a number.

iv) Write a C Program to implement Ackermann function using recursion.

v) Write a recursive function to find the sum of series.

Week 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

i) Write a C program to swap two numbers using call by reference.

ii) Demonstrate Dangling pointer problem using a C program.

iii) Write a C program to copy one string into another using pointer.

iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

Week14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

i) Write a C program to write and read text into a file.

ii) Write a C program to write and read text into a binary file using fread() and fwrite()

iii) Copy the contents of one file to another file.

iv) Write a C program to merge two files into the third file using command-line arguments.

v) Find no. of lines, words and characters in a file

vi) Write a C program to print the last n characters of a given file.

Text Books:

1. Ajay Mittal, Programming in C: A practical approach, Pearson 1st Edition 2010.
2. Byron Gottfried, Schaum's Outline of Programming with C, Mc Graw Hill; 2nd edition 1996.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India, 1988.
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition, 2011.

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES05102P	ES	**IT Workshop** (Common to all branches of Engineering)	0	0	2	1

Pre-Requisites: Nil

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To demonstrate configuring the system as Dual boot both Windows and other Operating Systems Viz. Linux, BOSS
- To teach basic command line interface commands on Linux.
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as Word processors, Spread sheets and Presentation tools.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Perform Hardware troubleshooting. (L3)
CO2: Demonstrate the Hardware components and inter dependencies. (L2)
CO3: Safeguard computer systems from viruses/worms. (L3)
CO4: Prepare Document/ Presentation by utilizing computer tools. (L3)
CO5: Perform calculations using spreadsheets. (L3)

PC Hardware & Software Installation:

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit it to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot (VMWare) with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web:

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate to the instructor how to access websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and Word:

Task 1: Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word –Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using LaTeX and Word to create a project certificate. Features to be covered: -Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.

Task 3: Creating project abstract Features to be covered: -Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered: -Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel:

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel –Accessing, overview of toolbars, saving excel files, Using help and resources.

Task 1: Creating a Scheduler -Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

Task 2: Calculating GPA -. Features to be covered: -Cell Referencing, Formulae in excel –average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

Lookup/Vlookup

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power Point

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations -Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting –Background, textures, Design Templates, Hidden slides.

AI Tools –ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: “You are a knowledgeable AI. Please answer the following question: What is the capital of France?”

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

Ex: Prompt: “In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality.”

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

Ex: Prompt: “Translate the following English sentence to French: ‘Hello, how are you doing today?’”

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware -A Handbook, Kate J. Chase, PHI (Microsoft), 1st Edition, 2004.
5. LaTeX Companion, Leslie Lamport, PHI/Pearson, 1st edition, 1994.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition, 2008.
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan–CISCO Press, Pearson Education, 3rd edition, 2008.

B.Tech. – I Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS103L	**HM**	**NSS/NCC/Scouts & Guides/Community Service** (Common to all branches of Engineering)	**0**	**0**	**1**	**0.5**

Pre-Requisites: Nil

Course Objectives:

- To impart discipline, character, and fraternity amongst young citizens
- To train them to work in teams/groups to enhance their team spirit.
- To enable the students to acquire leadership qualities.
- To induce social consciousness among students through various activities.
- To instill self-confidence and the ideals of selfless service
- To engage students in responsible and challenging actions for the common good.

Course Outcomes (COs):

On successful completion of the course, Students will be able to

CO1: Explain the importance of discipline, character and service motto. (L2)

CO2: Outline the needs and problems of the community. (L2)

CO3: Solve some societal issues by applying acquired knowledge, facts, and techniques. (L3)

CO4: Explore human relationships by analyzing social problems. (L4)

CO5: Determine to extend their help for the fellow beings and downtrodden people and Develop leadership skills and civic responsibilities. (L3)

Unit I: Orientation:

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i. Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii. Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii. Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv. Conducting talent show in singing patriotic songs-paintings- any other contribution.

Unit II: Nature & Care:

Activities:

i. Best out of waste competition.
ii. Poster and signs making competition to spread environmental awareness.
iii. Recycling and environmental pollution article writing competition.
iv. Organizing Zero-waste day.
v. Digital Environmental awareness activity via various social media platforms.
vi. Virtual demonstration of different eco-friendly approaches for sustainable living.
vii. Write a summary on any book related to environmental issues.

Unit III: Community Service:

Activities:

i. Conducting One Day Special Camp in a village contacting village-area leaders- Survey

ii. in the village, identification of problems- helping them to solve via media- authorities experts etc.
    a. Conducting awareness programs on Health-related issues such as General Health,

iii. Mental health, Spiritual Health, HIV/AIDS,
    a. Conducting consumer Awareness. Explaining various legal provisions etc.
    b. Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population

iv. Education.
    a. Any other Programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. Red Book - National Cadet Corps – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. Social Problems in India, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

B.Tech. – I Year
II Semester

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB102T	BS	**Differential Equations & Vector Calculus** (Common for all branches of Engineering)	2	1	0	3

Pre-Requisites: Basic Knowledge of Mathematics

Course Objectives:

- To enlighten the learners about the concepts of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them to advanced level by handling various real-world applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Solve the differential equations of first order and first degree and apply in Newton's law of Cooling and Electrical Circuits applications. (L3)

CO2: Solve the linear constant coefficient differential equations of higher order and apply in L-C-R Electrical Circuits and Simple Harmonic motion applications. (L3)

CO3: Find the solution to Partial Differential Equations and Homogeneous Linear Partial differential equations with constant coefficients and solve real time related problems. (L3)

CO4: Examine the physical meaning of different operators such as gradient, curl and divergence. (L4)

CO5: Determine the Line, Surface and Volume integrals using Vector Calculus and solve related engineering problems. (L4)

Unit I: Differential Equations of First Order and First Degree:

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

Unit II: Linear Differential Equations of Higher Order (Constant Coefficients):

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

Unit III: Partial Differential Equations:

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

Unit IV: Vector Differentiation:

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, del applied to vector point functions-Divergence and Curl, vector identities.

Unit V: Vector Integration:

Line integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

1. Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn
3. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 14/e, Pearson Publishers, 2018.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education, 2017.

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB105T	BS	Engineering Chemistry	3	0	0	3

Pre-Requisites: Fundamentals of Chemistry

Course Objectives:

- To learn different purification methods and analyze the impurities present in water.
- To understand and apply the concepts of electrochemistry effectively.
- To train the students on the fundamentals and applications of polymers.
- To understand and apply the concepts of Cement, Refractories, Lubricants and Composite materials.
- To introduce basic principles of Micelle, colloids and Nano metals

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the hardness of the water using EDTA Method, causes & prevention methods of boiler troubles and demonstrate the softening methods of hard water. (L4)

CO2: Analyze the construction and working of electrochemical cells, batteries, and fuel cells, and differentiate various types of corrosion and protection techniques based on electrochemical principles. (L4)

CO3: Classify different types of polymers and elastomers based on their synthesis and properties, and analyze the efficiency of fuels using calorific value and fuel quality indicators. (L4)

CO4: Examine the structure and characteristics of composites, refractories, lubricants, and building materials, and determine their suitability for specific engineering applications. (L4)

CO5: Differentiate types of colloids and nanomaterials based on synthesis methods and stabilization techniques, and Analyze surface phenomena using adsorption isotherms and surface area concepts. (L4)

Unit I: Water Quality and Treatment:

Introduction –Soft Water and hard water, Estimation of hardness of water by EDTA Method, Estimation of dissolved oxygen - Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment. Specifications for drinking water, Bureau of Indian Standards (BIS) and World health organization (WHO) standards, ion-exchange processes - desalination of brackish water, reverse osmosis (RO) and electro dialysis.

Unit II: Electrochemistry and Corrosion:

Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations. Primary cells – Zinc-air battery, Secondary cells – Nickel-Cadmium (NiCad), and lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell – working of the cells.

Corrosion: Introduction to corrosion, electrochemical theory of corrosion, differential aeration cell corrosion, galvanic corrosion, metal oxide formation by dry electrochemical corrosion, Pilling Bedworth ratios and uses, Factors affecting the corrosion, cathodic and anodic protection, electroplating and electro less plating (Nickel and copper).

Unit III: Polymers and Fuel Chemistry:

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth polymerization Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene, PVC, Nylon 6:6 and Bakelite. Elastomers – Preparation, properties and applications of Buna-S, Buna-N, Thiokol. Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, Octane and Cetane values, alternative fuels- Propane, methanol and ethanol, bio-fuels- bio diesel.

Unit IV: Modern Engineering Materials:

Composites- Definition, Constituents, classification- particle, Fiber and structural Rein forced composites, properties and Engineering applications. Refractories- Classification, Properties, Factors affecting the refractory materials and Applications. Lubricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Viscosity Index, Flash point, Fire point, Cloud point, saponification and Applications. Building materials- Portland Cement, constituents, manufacturing of cement, Setting and Hardening of cement.

Unit V: Surface Chemistry and Nanomaterials:

Introduction to surface chemistry, colloids, micelle formation, synthesis of colloids (Braggs method), chemical and biological methods of preparation of nanometals and metal oxides, stabilization of colloids and nanomaterials by stabilizing agents, adsorption isotherm (Freundlich and Longmuir), BET equation (no derivation). Applications of colloids and nanomaterials – catalysis, medicine, sensors.

Text Books:

1. Jain and Jain, Engineering Chemistry, 16/e, Dhanpatrai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

1. G.V. Subba Reddy, K.N. Jayaveera and C. Ramachandraiah, Engineering Chemistry, Mc Graw Hill, 2020.
2. Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.
3. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
4. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman,1992.

Online Resources:

1. **https://youtu.be/HfBeICCOaG4?si=J7HNHoJ-xGymomXa**
2. **https://youtu.be/CKyo2M1mNqQ?si=xLqBkrqtYm3uyN3G**
3. **https://youtu.be/rG1qDXuRRoE?si=O0z5iQg7AUlZ_2Ik**
4. **https://youtu.be/cHw3H9_jrZo?si=7I38ZdeJ9r84HTNC**
5. **https://www.youtube.com/live/7zS5IUCmTuo?si=pP-EGEP49UCDX8lH**

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS101T	HM	**Communicative English** (Common to all branches of Engineering)	2	0	0	2

Pre-Requisites: Basics of LSRW skills

Course Objectives:

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students make them effective in speaking and writing skills and make them industry ready.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand the context, topic, and pieces of specific information from social or Transactional dialogues. (L2)

CO2: Apply grammatical structures to formulate sentences and correct word forms. (L3)

CO3: Analyze discourse markers to speak clearly on a specific topic in informal discussions. (L4)

CO4: Evaluate reading / listening texts and to write summaries based on global – Comprehension of these texts. (L5)

CO5: Create a coherent paragraph, essay, and resume. (L6)

Unit I: Human Values: Gift of Magi (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

Unit II: Nature: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to audio texts.

Speaking: Discussion in pairs /small groups on specific topics followed by short structure talks.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices -linkers, use of articles and zero article; prepositions.

Vocabulary: Homonyms, Homophones, Homographs.

Unit III: Biography: Elon Musk

Listening: Listening for global comprehension and summarizing what is listened to.

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed

Reading: Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing
Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations
Vocabulary: Compound words, Collocations

Unit IV: Inspiration: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.
Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions.
Reading: Studying the use of graphic elements in text stocon vey information, reveal trends /patterns/ relationships, communicate processes or display complicated data.
Writing: Letter Writing: Official Letters, Resumes
Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice
Vocabulary: Words often confused, Jargons

Unit V: Motivation: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension.
Speaking: Formal oral presentations on topics from academic contexts
Reading: Reading comprehension.
Writing: Writing structured essays on specific topics.
Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)
Vocabulary: Technical Jargons

Text Books:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023 (Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Online Resources:

Grammar:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Vocabulary:

1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES01101T	ES	**Basic Civil and Mechanical Engineering** (Common to all branches of Engineering)	3	0	0	3

Part – A: Basic Civil Engineering

Pre-Requisites: Basic Knowledge in Physics & Chemistry

Course Objectives:

- Get familiarized with the scope and importance of Civil Engineering sub-divisions.
- Introduce the preliminary concepts of surveying
- Acquire preliminary knowledge on Transportation and its importance in nation's economy and also learn water resource and water quality.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Identify the roles and disciplines within civil engineering and apply basic knowledge of construction materials and building techniques, including prefabricated construction, in practical civil engineering contexts. (L3)

CO2: Analyze the methods of horizontal and angular measurements used in surveying and interpret levelling and bearing data to generate contour maps and elevation profiles. (L4)

CO3: Differentiate types of transportation systems and pavement structures, and examine the basic components of water resources and environmental engineering systems including hydrology and water conveyance structures. (L4)

Unit I: Basics of Civil Engineering:

Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-Technical Engineering- Transportation Engineering Hydraulics and Water Resources Engineering - Environmental Engineering - Scope of each discipline - Building Construction and Planning- Construction Materials - Cement – Aggregate Bricks- Cement concrete- Steel. Introduction to Prefabricated Construction Techniques.

Unit II: Surveying:

Objectives of Surveying- Horizontal Measurements- Angular Measurements-Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

Unit III: Transportation Engineering:

Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Text Books:

1. Basic Civil Engineering, M. S. Palanisamy, Tata McGraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.

3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016.
3. Highway Engineering, S. K. Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.

Part - B: Basic Mechanical Engineering

Pre-Requisites: Basic Knowledge in Physics & Chemistry

Course Objectives:

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Identify the role of mechanical engineering across various industrial sectors and apply basic knowledge of engineering materials—including metals, ceramics, composites, and smart materials—in mechanical applications. (L3)

CO2: Differentiate between various manufacturing processes including CNC and smart manufacturing, and analyze the working principles of thermal systems such as engines, refrigeration cycles, and hybrid vehicles. (L4)

CO3: Examine the operating principles of different power plants and mechanical transmission systems, and classify types of robotic configurations based on their structure and applications. (L4)

Unit I: Introduction to Mechanical Engineering:

Role of Mechanical Engineering in Industries and Society-Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

Unit II: Manufacturing Processes:

Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – Working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

Unit III: Power Plants:

working principle of Steam, Diesel, Hydro, Nuclear power plants.

Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications. **Introduction to Robotics** - Joints & links, configurations, and applications of robotics. (**Note:** The subject covers only the basic principles of Civil and Mechanical Engineering systems. The evaluation shall be intended to test only the fundamentals of the subject)

Text Books:

1. Internal Combustion Engines by V. Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S. Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01101T	**PC**	**Engineering Mechanics**	**2**	**1**	**0**	**3**

Pre-Requisites: Basic Knowledge in Physics & Mathematics

Course Objectives:

- To get familiarized with different types of force systems
- To draw accurate free body diagrams representing forces and moments acting on a body to Analyze the equilibrium of system of forces.
- To teach the basic principles of centre of gravity, centroid and moment of inertia and determine them for different simple and composite bodies.
- To apply the Work-Energy method to particle motion
- To understand the kinematics and kinetics of translational and rotational motion of rigid bodies.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze coplanar and spatial force systems using vector methods, and evaluate the effects of moments, couples, and friction on static systems. (L4)

CO2: Examine the equilibrium conditions of planar and spatial force systems using free-body diagrams, vector algebra, and apply principles like Lami's Theorem and virtual work to determine structural stability. (L4)

CO3: Determine centroids, centres of gravity, and moments of inertia (area and mass) for simple and composite bodies using standard theorems and transfer principles. (L4)

CO4: Interpret rectilinear and curvilinear motion using kinematics and kinetics, and Analyze dynamic systems with D'Alembert's principle, work-energy, and impulse-momentum methods. (L4)

CO5: Analyze the motion of rigid bodies under translation, rotation, and general plane motion using kinematics, kinetics, energy principles, and momentum concepts. (L4)

Unit I: Introduction to Engineering Mechanics:

Basic Concepts: Scope and Applications Systems of Forces: Coplanar Concurrent Forces–Components in Space–Resultant–Moment of Force and its Application –Couples and Resultant of Force Systems.

Friction: Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, Cone of Static friction.

Unit II: Equilibrium of Systems of Forces:

Free Body Diagrams, Lami's Theorem, Equations of Equilibrium of Coplanar Systems, Graphical method for the equilibrium, Triangle law of forces, converse of the law of polygon of forces condition of equilibrium, Equations of Equilibrium for Spatial System of forces, Numerical examples on spatial system of forces using vector approach, Analysis of plane trusses. Principle of virtual work with simple examples

Unit III: Centroid:

Centroids of simple figures (from basic principles)–Centroids of Composite Figures. Centre of Gravity: Centre of gravity of simple body (from basic principles), Centre of gravity of composite bodies, Pappus theorems. Area Moments of Inertia: Definition–Polar Moment to inertia, Transfer

Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia. Mass Moment of Inertia: Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, Mass Moment of Inertia of composite bodies.

Unit IV: Rectilinear and Curvilinear motion of a particle:

Kinematics and Kinetics –D'Alembert's Principle - Work Energy method and applications to particle motion-Impulse Momentum method.

Unit V: **Rigid body Motion:**

Kinematics and Kinetics of translation, Rotation about fixed axis and plane motion, Work Energy method and Impulse Momentum method.

Text Books:

1. Engineering Mechanics, S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., , McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C. Dumir- S. Sengupta and Srinivas V. Veeravalli, University press. 2020. First Edition.
3. A Textbook of Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books:

1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education. 2017. First Edition.
2. Engineering Mechanics, Statics and Dynamics, I.H. Shames., PHI, 2002. 4th Edition.
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L. G. Kraige., John Wiley, 2008. 6th Edition.
4. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press, 2014. Second Edition.
5. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C. Pearson Education, Inc., New Delhi, 2022, 14th Edition.

Online Resources:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://www.youtube.com/watch?v=2E8IZy8aWhw&list=PL3OVqiyXzMVKMO-dDl0J3bsCJb91xfh6
3. https://www.iitg.ac.in/rkbc/me101/Presentation/L01-03.pdf

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB105P	BS	Engineering Chemistry Lab	0	0	2	1

Pre-Requisites: Fundamentals of Chemistry

Course Objectives:

- To provide solid foundation in chemistry laboratory to solve engineering problems.
- To apply the theoretical principles and perform experiments on hardness of water
- To apply the theoretical principles and perform experiments dissolved oxygen.
- To Illustrate the properties of analytical equipment's like Red wood, Viscometer and conductometry.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Calculate the hardness of water using EDTA method (L2)

CO2: Measure the strength of an acid present in secondary batteries. (L2)

CO3: Determine the cell constant and conductance of solutions. (L2)

CO4: Determine the physical properties like surface tension, adsorption and viscosity. (L2)

CO5: Examine the Iron and Calcium in cement (L4)

List of Chemistry Experiments

1. Determination of Hardness of a groundwater sample
2. Preparation of a Bakelite.
3. Determination of Viscosity of lubricating oil by Redwood Viscometer 1
4. Determination of Viscosity of lubricating oil by Redwood Viscometer 2
5. Determination of Strength of an acid in Pb-Acid battery
6. Determination of dissolved oxygen by Winkler's method
7. Determination of percentage of Iron in Cement sample by Colorimetry
8. Estimation of Calcium in Portland cement
9. Precipitation of Nanomaterials by precipitation method
10. Adsorption of acetic acid by charcoal
11. Determination of percentage moisture content in a coal sample
12. Determination of Calorific value of gases by Junker's gas Calorimeter

Note: Minimum Ten experiments are to be performed.

Reference Books:

1. Vogel's Text book of Quantitative Chemical Analysis, Sixth Edition – Mendham J et al, Pearson Education, 2012.
2. Chemistry Practical– Lab Manual, First edition, Chandra Sekhar KB, Subba Reddy GV and Jayaveera KN, SM Enterprises, Hyderabad, 2014.
3. Chemistry Laboratory Manual, Sri Krishna Hitech Publishing Company Pvt.Ltd,2nd Edition, A Ravi Krishanan, B Tirumala Rao, 2020-2021.

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS101P	**HM**	**Communicative English Lab** (Common to all branches of Engineering)	**0**	**0**	**2**	**1**

Pre-Requisites: Basics of LSRW skills

Course Objectives:

The main objective of introducing this course Communicative English Laboratory is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand the different aspects of the English language proficiency with emphasis on LSRW skills. (L2)

CO2: Apply communication skills through various language learning activities. (L3)

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension. (L4)

CO4: Evaluate and exhibit professionalism in participating in debates and group discussions. (L5)

CO5: Create effective Course Objectives. (L6)

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. Group Discussions-methods & practice
6. Debates - Methods & Practice
7. PPT Presentations/ Poster Presentation
8. Interview Skills
9. E-mail Writing
10. Resume Writing, Cover letter, SOP

Suggested Software:

- Walden Infotech
- Young India Films

Reference Books:

1. Raman Meenakshi, Sangeeta- Sharma. Technical Communication. Oxford Press.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw-HillEducationIndia,2016
3. Hewing’s, Martin. Cambridge Academic English(B2). CUP,2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2ndEd), Kindle,2013
5. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students, (3rd Ed) Trinity Press.

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES03102P	**ES**	**Engineering Workshop** (Common to all branches of Engineering)	**0**	**0**	**3**	**1.5**

Pre-Requisites: Nil

Course Objectives:

To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Identify workshop tools and their operational capabilities. (L3)

CO2: Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding. (L3)

CO3: Apply fitting operations in various applications. (L3)

CO4: Apply basic electrical engineering knowledge for House Wiring Practice (L3)

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints.
   a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.
   a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.
   a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre
5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Tube light e) Three phase motor f) Soldering of wires
6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.
7. **Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.
8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

Text Books:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019.
2. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
3. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01101P	PC	Engineering Mechanics & Building Practices Lab	0	0	3	1.5

Pre-Requisites: Basic Knowledge in Physics & Mathematics

Course Objectives:

- Verify the Law of Parallelogram of Forces and Lami's theorem.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Understand the layout of a building, concepts of Non-Destructive Testing and different Alternative Materials.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Determine the coefficient of friction between two different surfaces and between the inclined plane and the roller. (L2)

CO2: Verify Law of Parallelogram of forces and Law of Moment using force polygon and bell crank lever. (L3)

CO3: Determine the Centre of gravity different configurations. (L2)

CO4: Conduct experiments on Understand the Quality Testing and Assessment Procedures and principles of Non-destructive Testing. (L2)

CO5: Demonstrate safety practices in the construction industry. (L2)

Students have to perform any 10 of the following Experiments:

1. To study various types of tools used in construction.
2. Forces in Pin Jointed Trusses
3. Experimental Proof of Lami's Theorem
4. Verification of Law of Parallelogram of Forces.
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Determination of coefficient of Static and Rolling Friction.
7. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever
8. Study of Alternative Materials like M-sand, Fly ash, Sea Sand etc.
9. Field-Visit to understand the Quality Testing - report.
10. Safety Practices in Construction industry
11. Demonstration of Non-Destructive Testing - using Rebound Hammer & UPV
12. Study of Plumbing in buildings

Text Book:

1. Engineering Mechanics lab manual (2022), B. B. Gokaldas and Vandana Somkuwar, All India Council for Technical Education (AICTE).

B.Tech. – I Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS102L	HM	**Health and Wellness, Yoga and Sports** (Common to all branches of Engineering)	0	0	1	0.5

Pre-Requisites: Nil

Course Objectives:

- To maintain their mental and physical wellness upright and develop ability in them to cope up with the stress arising in the life.
- To create space in the curriculum to nurture the potential of the students in sports/games/yoga etc.
- To introduce a practice oriented introductory course on the subject.

Course Outcomes (COs):

On Successful Completion of the Course, Student will be able to

CO1: Be Physical fit to perform daily routine without undue fatigue. (L2)
CO2: Be Mentally alert and Socially Cohesive. (L2)
CO3: Consider success and failure equally. (L2)
CO4: Develop Positive Personality. (L3)
CO5: Improve Leadership qualities. (L3)

Unit I: **Health and Fitness:**

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

i) Organizing health awareness Programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

Unit II: Yoga:

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities: Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

Unit III: Sports and Fitness:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

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B.Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24BSHB206T	BS	Numerical and Statistical Methods	2	1	0	3

Pre-requisite: Basic Algebraic Equations and Statistics.

Course Objectives:

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications

Course Outcomes (COs):

On Successful Completion of the Course, Student will be able to

COl: Analyze various numerical methods and iterative techniques to solve algebraic and transcendental equations, and evaluate their applicability in civil engineering problems such as structural analysis and flow computations. (L4)

CO2: Analyze interpolation techniques and Lagrange's interpolation, along with least squares methods for curve fitting, to interpret and model engineering data relevant to Civil Engineering, including material behaviours, structural responses, and environmental trends. (L4)

CO3: Compare and apply numerical methods to solve ordinary differential equations arising in civil engineering problems, including structural dynamics, fluid flow, and geotechnical analysis. (L4)

CO4: Distinguish and apply statistical estimation and hypothesis testing concepts to interpret and validate civil engineering data, including material testing results, quality control, and survey analysis. (L4)

CO5: Select and apply appropriate statistical tests such as t-tests, F-test, and Chi-square tests to evaluate civil engineering data related to material strength comparison, process variability, and association between categorical variables in quality control and experimental studies. (L4)

Unit I: Solution of Algebraic & Transcendental Equations:

Introduction-Bisection Method-Iterative method, Regula-falsi method and Newton Raphson method System of Algebraic equations: Jacoby and Gauss Siedal method.

Unit II: Interpolation:

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Curve fitting: Fitting of straight line, second-degree and Exponential curve by method of least squares.

Unit III: Solution of Initial Value Problems to Ordinary Differential Equations:

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Euler's and modified Euler's methods- Runge-Kutta methods (second and fourth order).

Unit IV: Estimation and Testing of Hypothesis, Large Sample Tests:

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Unit V: Small Sample Tests:

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Text Books:

1. S S Sastry, Introductory Methods of Numerical Analysis, PHI Learning Private Limited.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2017, 44th Edition
3. Miller and Freund's, Probability and Statistics for Engineers,7/e, Pearson, 2008.India.

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2018, 10th Edition.
2. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Alpha Science International Ltd.,2021 5th Edition (9th reprint).
3. Ronald E. Walpole, Probability and Statistics for Engineers and Scientists, PNIE 4. H. K Das, Er.
4. Rajnish Verma, Higher Engineering Mathematics, S. Chand Publications,2014, Third Edition (Reprint 2021)

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview
2. https://onlinecourses.nptel.ac.in/noc24_ma05/preview
3. http://nptel.ac.in/courses/111105090

B.Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS204L	HM	**Universal Human Values– Understanding Harmony and Ethical Human Conduct** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: A basic understanding of human relationships, communication skills, and a willingness for self-reflection and ethical thinking are the prerequisites for this course.

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes (COs):

On Successful Completion of the Course, Student will be able to

CO1: Analyze the interrelationship between right understanding, human relationships, and physical facilities to identify how these contribute to holistic development and fulfilment of basic human aspirations. (L4)

CO2: Analyze the co-existence of the self and the body to distinguish their respective needs and evaluate the conditions necessary to ensure harmony, self-regulation, and health in the human being. (L4)

CO3: Differentiate core human values such as trust and respect, and examine their role in fostering harmonious relationships within the family and society, leading toward a universal human order. (L4)

CO4: Differentiate the four orders of nature and examine their interconnectedness to understand existence as co-existence, leading to a holistic perception of harmony in nature and the universe. (L4)

CO5: Examine how human values shape professional ethics and conduct, supporting competence and transition toward a value-based universal human order. (L4)

Unit I: Introduction to Value Education (6 lectures and 3 tutorials for practice session):

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness

Lecture 5: Happiness and Prosperity – Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

Unit II: Harmony in the Human Being (6 lectures and 3 tutorials for practice session):

Lecture 7: Understanding Human being as the Co-existence of the self and the body.

Lecture 8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

Unit III: Harmony in the Family and Society (6 lectures and 3 tutorials for practice session):
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

Unit IV: Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session):
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

Unit V: Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session):
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order
Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

Readings:

a. Text Book and Teachers Manual

The Textbook R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunder Lal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analysing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up"ordinary" situations rather than" extra-ordinary" situations. Such observations and their Analyzes are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included.

The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.

It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content.

Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by anyone department.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources

1. https://fdp-si.aicte-india.org/UHV- II%20Class%20Notes%20&%20Handouts-/UHV%20120Handout %/UHV%20Handout%Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDP Teaching Material/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

B.Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01202T	PC	Surveying	2	1	0	3

Pre-Requisites: Basics of Engineering Physics and Engineering Mathematics

Course Objectives:

This course introduces the principles and methods of surveying, covering both conventional and modern techniques. It develops skills in measuring, mapping, and data interpretation for engineering applications. Students learn to use instruments and apply surveying data in practical scenarios.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply surveying principles and methods using appropriate instruments to measure distances and Analyze bearings, angles, and corrections. (L3)

CO2: Analyze levelling and contouring data to determine elevations, landform characteristics, and compute areas and volumes for earthwork and reservoir design. (L4)

CO3: Interpret theodolite and traversing data to measure angles, perform trigonometrical levelling, and compute and adjust traverse measurements including omitted data. (L4)

CO4: Differentiate types of curves and apply modern surveying techniques such as EDM, Total Station, GPS, Drone, and LiDAR for effective spatial data collection and field applications. (L4)

CO5: Analyze aerial photographs and photogrammetric methods to evaluate perspective geometry, perform aerial triangulation, and produce accurate photographic maps using stereo-plotting and related techniques. (L4)

Unit I: Introduction and Basic Concepts:

Introduction, Objectives, classification and principles of surveying, surveying accessories. Introduction to Compass, levelling and Plane table surveying.

Linear Distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip – systems and W.C.B and Q.B systems of locating bearings.

Unit II: Levelling:

Types of levels, methods of levelling, and Determination of levels, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, methods of contour surveying.

Areas - Determination of areas consisting of irregular boundary and regular boundary.

Volumes- Determination of volume of earth work in cutting and embankments for level section, capacity of reservoirs.

Unit III: Theodolite Surveying:

Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.

Unit IV: Curves:

Types of curves and their necessity, elements of simple, compound, reverse curves. Introduction to Tacheometric Surveying.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station-advantages and Applications. Introduction to Global Positioning System. Introduction to Drone survey and LDAR Survey (Light Detection and Ranging).

Unit V: Photogrammetry Surveying:

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo-plotting instruments, mosaics, map substitutes.

Text Books:

1. Surveying (Vol– 1& 2) by Duggal SK, Tata Mc Graw Hill Publishing Co. Ltd. New Delhi, 5^{th} edition, 2019.
2. Text book of Surveying by C Venkatramaiah, Universities Press1st Edition,2011.

Reference Books:

1. Surveying (Vol–1), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Publications(P) ltd., New Delhi, 18thedition 2024.
2. Surveying (Vol–2), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Publications(P) ltd., New Delhi 17th 2022.
3. Surveying (Vol–3), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain- Laxmi Publications(P) ltd., New Delhi 16th 2023.
4. Plane Surveying and Higher Surveying by Chandra AM, New age International Pvt. Ltd., Publishers, New Delhi,3rdEdition,2015.
5. Surveying and Levelling by N. Basak Tata Mc Graw Hill Publishing Co. Ltd. New Delhi, 4^{th} edition, 2014.
6. Surveying (Vol 1, 2 & 3), by Arora K R, Standard Book House, Delhi. Edition: 12th, 2015.

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01203T	**PC**	**Strength of Materials**	**2**	**1**	**0**	**3**

Pre-Requisites: Fundamentals of Engineering Mechanics

Course Objectives:

This course introduces the fundamental concepts of Strength of Materials, including stress, strain, and the principles of elasticity and plasticity. It covers the analysis of shear force and bending moment in beams under various loading conditions. Students will learn to evaluate bending stresses, apply bending equations, and calculate section modulus for different cross-sectional shapes. The course also explores beam deflections and stress analysis in cylinders and columns subjected to external pressure.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the basic materials behaviour under the influence of different external loading conditions and the support conditions. (L3)

CO2: Evaluate shear force and bending moment in different types of beams under various loads, and construct S.F. and B.M. diagrams to identify points of contra flexure and load effects. (L4)

CO3: Determine bending and shear stresses in various beam sections using bending and shear stress theories, and apply torsion theory to circular shafts for design. (L4)

CO4: Determine the slope and deflection of beams using double integration, Macaulay's method, and moment area method for various loading conditions and support types. (L4)

CO5: Compare the behaviour of short and long columns under axial and eccentric loading using classical and empirical formulas, and determine stress distribution in thin and thick cylindrical shells using appropriate theories. (L4)

Unit I: Simple Stresses and Strains:

Elasticity and plasticity — Types of stresses and strains — Hooke's law — Factor of safety, Poisson's ratio - Relationship between Elastic constants — Bars of varying section — stresses in composite bars.

Unit II: Shear Force and Bending Moment:

Definition of beam — Types of beams — Concept of shear force and bending moment — Point of contra flexure — Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

Unit III: Flexural and Shear Stresses:

Flexural Stresses: Theory of simple bending — Assumptions — Derivation of bending equation, Neutral axis — Determination of bending stresses — section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections — Design of simple beams. Shear Stresses: Derivation of formula — Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections. Torsion – circular shafts only.

Unit IV: Deflection of Beams:

Double integration and Macaulay's methods — Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems — Moment area method — application to simple cases of cantilever.

Unit V: **Column and Thin and Thick Cylinder:**

Column -Introduction – Classification of columns – Axially loaded compression members – Euler 's crippling load theory – Derivation of Euler 's critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler 's critical stress – Limitations of Euler 's theory – Rankine – Gordon formula – Eccentric loading and Secant formula – Prof. Perry 's formula.

Thin and Thick Cylindrical Shells — Derivation of formula for longitudinal and circumferential stresses — hoop, longitudinal and volumetric strains — changes in diameter, and volume of thin cylinders. Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders distribution of stresses

Text Books:

1. Strength of Materials by R. K. Bansal, Lakshmi Publications, 16th Edition, 2022.
2. Strength of Materials by B. S. Basavarajaiah and P. Mahadevapura, Universities Press 3rd Edition, 2010.
3. Strength of Materials by J.K. Gupta and S.K. Gupta, Cengage publications 2nd edition ,2024.

Reference Books:

1. Advanced Mechanics of Solids, L.S Srinath, McGraw Hill Education, 2017, 3rd Edition
2. Strength of Materials - Fundamentals and Applications, T.D. Gunneswara Rao and Mudim by Andal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
4. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, New Delhi 7th edition 2022.
5. Strength of Materials by S.S. Ratan Tata McGrill Publications 3rd Edition, 2016.

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01204T	PC	Fluid Mechanics	2	1	0	3

Pre-Requisites: Basics of Engineering Mechanics and Engineering Physics.

Course Objectives:

The objective of this course is to provide a solid foundation in fluid mechanics, focusing on the properties, statics, and kinematics of fluids. It aims to develop analytical skills for solving problems related to fluid flow, pressure measurement, and pipe system analysis using key principles such as Bernoulli's equation and continuity equations. The course also emphasizes practical applications in energy losses, pipe networks, and fluid stability.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Differentiate between fluids and solids and apply fundamental fluid properties such as viscosity, surface tension, compressibility, and vapor pressure to describe fluid behaviour. (L4)

CO2: Examine fluid pressure measurement techniques and assess hydrostatic forces and buoyancy effects to determine the stability of submerged and floating bodies. (L4)

CO3: Differentiate types of fluid flow and apply continuity equations in Cartesian coordinates to examine fluid motion in one, two, and three dimensions. (L4)

CO4: Analyze fluid motion using Bernoulli's and momentum equations to solve practical problems in flow measurement and vortex flow. (L4)

CO5: Analyze energy losses in pipe flow and apply pipeline analysis methods for systems with pipes in series and parallel. (L4)

Unit I: Basic Concepts and Definitions:

Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; Variation of viscosity with temperature, Newton law of viscosity; Vapor pressure, Boiling point, Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility

Unit II: Fluid Statics:

Fluid Pressure: Pressure at a point, Pascal 's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies

Unit III: Fluid Kinematics:

Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three- Dimensional continuity equations in Cartesian coordinates.

Unit IV: Fluid Dynamics:

Surface and body forces; Equations of motion- Euler 's equation; Bernoulli 's equation– Derivation; Energy Principle; Practical applications of Bernoulli 's equation: Venturi meter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow– Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

Unit V: **Analysis of Pipe Flow:**

Energy losses in pipelines; Darcy– Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length Pipes in Parallel and Series**.**

Text Books:

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House22nd,2019.
2. K. Subrahmanyam, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

Reference Books:

1. R.K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P)Ltd., NewDelhi11thedition, 2024.
2. N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
3. Fluid Mechanics by Frank M. White, Henry Xue, Tata Mc Graw Hill,9th edition, 2022.
4. C.S.P. Ojha, R. Berndtsson and P.N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
5. Introduction to Fluid Mechanics & Fluid Machines by S K Som, Gautam Biswas, S Chakraborty Tata McGraw Hill, 3rd edition 2011

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01202P	PC	Surveying Lab	0	0	3	1.5

Pre-Requisites: Basic Knowledge on Surveying

Course Objectives:

To impart practical knowledge and skills in surveying techniques including chain surveying for road widening, compass and plane table methods, fly levelling using height of instrument and rise & fall methods, and advanced theodolite operations for angle, height, and distance measurements. The course also introduces the use of modern equipment like total stations for determining area, perimeter, inaccessible distances, and setting out curves, with an emphasis on accurate data collection and interpretation.

Course Outcomes (COs):

On Successful Completion of the Course, Student will be able to

CO1: Analyze the appropriate use of various linear and angular measuring instruments for different types of surveying tasks. (L4)

CO2: Examine linear and angular measurement data to identify potential sources of error and ensure measurement accuracy. (L4)

CO3: Interpret field data to compute area and volume for a variety of land surveying applications. (L4)

CO4: Analyze the functionality and application of modern surveying instruments such as total stations in complex field conditions. (L4)

CO5: Evaluate survey data and prepare accurate and comprehensive field notes for documentation and further analysis. (L4)

List of Experiments:

1. Chain survey of road profile with offsets in case of road widening.
2. Determination of distance between two inaccessible points by using compass.
3. Plane table survey finding the area of a given boundary by the method of radiation
4. Fly levelling: Height of the instrument method (differential levelling)
5. Fly levelling: rise and fall method.
6. Theodolite survey: determining the horizontal and vertical angles by the method of repetition method
7. Theodolite survey: finding the distance between two inaccessible points.
8. Theodolite survey: finding the height of far object.
9. Determination of area perimeter using total station.
10. Determination of distance between two inaccessible point by using total station.
11. Setting out a curve
12. Determining the levels of contours

Text Books:

1. B.C. Punmia, “SurveyingVol.1”, Laxmi Publications pvt. Ltd., New Delhi– 2009.
2. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune Vidyarthi Griha Prakashan, 1988.

Reference Books:

1. S. K. Duggal, “Surveying Vol.1”, Tata Mc Graw Hill Publishing Co. Ltd. New Delhi. 2009.
2. K.R. Arora, “Surveying Vol.1” Standard Book House, New Delhi. –2010.

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01203P	**PC**	**Strength of Materials Lab**	**0**	**0**	**3**	**1.5**

Pre-Requisites: Basic Knowledge on Strength of Materials

Course Objectives:

To experimentally evaluate the mechanical properties of engineering materials such as mild steel, wood, and springs by determining their tensile strength, yield strength, flexural strength, torsional properties, hardness, impact and shear resistance, and load-deflection behavior, thereby enhancing the understanding of material behavior under various loading conditions.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the stress-strain behavior of ductile metals by conducting tensile tests and interpreting the mechanical properties from the resulting curves. (L4)

CO2: Analyze the flexural response of steel and wood specimens under bending loads by evaluating load-deflection behavior. (L4)

CO3: Interpret torsional strength parameters such as modulus of rigidity and angle of twist by analyzing results from torsion testing of mild steel bars. (L4)

CO4: Evaluate the mechanical response of metals to sudden and gradual loads by analyzing hardness, impact, and shear test data. (L4)

CO5: Analyze the load-deflection characteristics of closely and open-coiled springs and determine stiffness and energy absorption capacity. (L4)

List of Experiments:

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test.
5. Hardness test.
6. Compression test on Open coiled springs
7. Tension test on Closely coiled springs
8. Compression test on wood/concrete
9. Izod/Charpy Impact test on metals
10. Shear test on metals
11. Continuous beam–deflection test.

Reference Books:

1. Davis, Troxell and Hawk, “Testing of Engineering Materials”, International Student Edition – McGraw Hill Book Co. New Delhi.
2. M L Gambhir and Neha Jamwal, “Building and construction materials-Testing and quality control”, McGraw Hill education (India)Pvt. Ltd.,2014.
3. Fenner, “Mechanical Testing of Materials”, George Newnes Ltd. London.
4. Holes K A, “Experimental Strength of Materials”, English Universities Press Ltd. London.
5. Suryanarayana A K, “Testing of Metallic Materials”, Prentice Hall of India Pvt. Ltd. New Delhi.
6. Kukreja C B, Kishore K. and Ravi Chawla “Material Testing Laboratory Manual”, Standard Publishers & Distributors1996.

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24SE01201S	SE	Building Planning and Drawing	0	1	2	2

Pre-Requisites: Basic Knowledge on Engineering Graphics

Course Objectives:

The program builds a strong foundation in building bye-laws and regulations, promoting responsible and compliant architectural practice. It offers in-depth knowledge of planning principles for residential and public buildings, with a focus on functionality, space optimization, and design efficiency. Through practical exercises in interpreting construction signs, structural bonds, and building design, students gain technical proficiency and confidence for real-world architectural applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the structural and functional significance of various bonds (English and Flemish) in masonry construction through detailed drawings. (L4)

CO2: Interpret and differentiate the design principles and components of doors, windows, ventilators, and roofs by preparing detailed technical drawings. (L4)

CO3: Examine and apply building bye-laws to develop line diagrams for residential buildings, ensuring compliance with regulatory standards. (L4)

CO4: Analyze the spatial relationships and functional zoning to generate plan, elevation, and sectional views from line diagrams for different building types (residential, hospital, industrial).(L4)

CO5: Distinguish and evaluate the architectural and structural elements in various building typologies by preparing comprehensive working drawings (plan, elevation, section) from conceptual designs. (L4)

Detailed Syllabus:

Students have to perform the following Experiments:

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows.
6. Detailing & Drawing of Ventilators &Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

Text Books:

1. Planning, designing and Scheduling, Gurcharan Singh and Jagdish Singh
2. Building planning and drawing by M. Chakraborti.

Reference Books:

1. National Building Code 2016(Volume-I&II).
2. Principles of Building Drawing, M G Shah and C M Kale, Trinity Publications, New Delhi.
3. Civil Engineering drawing and House planning, B. P. Verma, Khanna publishers, New Delhi.

4. Civil Engineering Building practice, Suraj Singh: CBS Publications, New Delhi, and Chennai
5. Building Materials and Construction, G. C Saha and Joy Gopal Jana, McGraw Hill Education (P) India Ltd. New Delhi.

B. Tech. – II Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS205A	HM	**Environmental Science** (Common to all branches of Engineering)	2	0	0	--

Pre-Requisites: Nil

Course Objectives:

- To make the students to get awareness on environment.
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the concepts of multidisciplinary environmental studies to real-world issues by identifying the interconnections between natural resources and environmental problems. (L3)

CO2: Analyze the structure, function, and energy dynamics of various ecosystems and apply ecological principles and biodiversity conservation strategies to evaluate environmental issues and promote sustainable ecosystem management. (L4)

CO3: Analyze the causes, effects, and control measures of various types of pollution and disasters, and apply appropriate pollution prevention and waste management strategies to mitigate environmental and public health risks. (L4)

CO4: Apply methods like rainwater harvesting, watershed management, and wasteland reclamation to practical scenarios and use of environmental laws (e.g., Air, Water, Wildlife Acts) to explain pollution control strategies to Encourage public awareness and responsible consumer behaviour. (L3)

CO5: Apply concepts of family welfare, value education, and IT in real-world contexts of environmental health and awareness. Use observations from field visits to identify environmental problems and local biodiversity. (L3)

Unit I: Multidisciplinary Nature of Environmental Studies:

Definition, Scope and Importance – Need for Public Awareness.

Natural Resources:

Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources

Unit II: Ecosystems:

Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.

b. Grassland ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit III: Environmental Pollution:

Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management:

Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Unit IV: Social Issues and the Environment:

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Unit V: Human Population and the Environment:

Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies. Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University
2. Grants Commission, Universities Press.
3. Palani Swamy, “Environmental Studies”, Pearson education

4. S. Azeem Unnisa, “Environmental Studies” Academic Publishing Company
5. Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, SciTech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E. Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M. Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications.
3. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
4. G.R. Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
5. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice Hall of India Private limited.

Online Resources:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.og/learn/python?specialization=python#syllabus

B.Tech. – II Year II Semester

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS206T	HM	**Managerial Economics and Financial Analysis** (Common to CE, EEE, ECE, CSE & AI&DS)	2	0	0	2

Pre-Requisites: Nil

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand the significance of managerial economics, analyze demand and its elasticity, and apply appropriate forecasting methods for effective business decision-making. (L4)

CO2: Analyze production functions, cost behaviours, and economies of scale, and apply break-even analysis to determine optimal production and cost efficiency in business decisions. (L4)

CO3: Explain forms of business organizations and Analyze various market structures and pricing strategies for effective decision-making. (L4)

CO4: Explain the concept and components of working capital, identify sources of capital, and apply capital budgeting techniques for evaluating investment projects. (L4)

CO5: Apply accounting principles and conventions to prepare final accounts, and Analyze financial performance using key financial ratios. (L4)

Unit I: Managerial Economics:

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

Unit II: Production and Cost Analysis:

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and long run Production Function- Isoquants and Is costs.
Economies of Scale -Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

Unit III: Business Organizations and Markets:

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

Unit IV: Capital Budgeting:

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

Unit V: Financial Accounting and Analysis:

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Text Books:

1. Varshney & Maheshwari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial Economics S Chand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Resources:

1. https://www.slideshare.net/123ps/managerial-economics-ppt
2. https://www.slideshare.net/rossanz/production-and-cost-45827016
3. https://www.slideshare.net/darkyla/business-organizations-19917607
4. https://www.slideshare.net/balarajbl/market-and-classification-of-market

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS207T	HM	**Organizational Behaviour** (Common to CE, EEE, ECE, CSE & AI&DS)	2	0	0	2

Pre-Requisites: Nil

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Explain the nature, scope, and functions of organization and examine individual behavior aspects to improve organizational effectiveness. (L4)

CO2: Apply theories of motivation to analyze the performance problems (L4)

CO3: Analyze the different theories of leadership and their application in the organizations. (L4)

CO4: Evaluate group dynamics and demonstrate skills required for working in groups (L4)

CO5: Develop as powerful leader by applying relevant theories to solve problems of change within the organizations. (L4)

Unit I: Introduction to Organizational Behaviour:

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

Unit II: Motivation and Leading:

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory.

Unit III: Organizational Culture:

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader.

Unit IV: Group Dynamics:

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behaviour - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

Unit V: Organizational Change and Development:

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Text Books:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition.
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House.

Reference Books:

1. McShane, Organizational Behaviour, TMH
2. Nelson, Organisational Behaviour, Thomson.
3. Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson.
4. Aswathappa, Organisational Behaviour, Himalaya.

Online Resources:

1. https://www.slideshare.net/Knight1040/organizational- culture9608857
2. https://www.slideshare.net/AbhayRajpoot3/motivation - 165556714
3. https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
4. https://www.slideshare.net/vanyasingla1/organizational

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS208T	**HM**	**Business Environment** (Common to CE, EEE, ECE, CSE & AI&DS)	**2**	**0**	**0**	**2**

Pre-Requisites: Nil

Course Objectives:

- To make the student to understand about the business environment.
- To enable them in knowing the importance of fiscal and monitory policys.
- To facilitate them in understanding the export policy of the country.
- To Impart knowledge about the functioning and role of WTO.
- To Encourage the student in knowing the structure of stock markets.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply business environment concepts, classify types and industry structures, and assess environmental analysis pros and cons. (L3)

CO2: Apply concepts of public finance and evaluate recent trends and roles of institutions like RBI and Finance Commission. (L4)

CO3: Analyze India's Trade Policy (L4)

CO4: Analyze trade policies, agreements, EXIM policy, Bop issues, and WTO roles to assess global and Indian trade dynamics. (L4)

CO5: Analyze the Indian financial system, money and capital markets, SEBI regulations, and recent reforms including aspects of international finance. (L4)

Unit I: Overview of Business Environment:

Introduction – meaning Nature, Scope, significance, functions and advantages. Types Internal & External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis.

Unit II: Fiscal & Monetary Policy:

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

Unit III: India's Trade Policy:

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Unit IV: World Trade Organization:

Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Unit V: Money Markets and Capital Markets:

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.

Text Books:

1. Francis Cherunilam, International Business: Text and Cases, Prentice Hall of India.
2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition. HPH.

Reference Books:

1. K. V. Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
2. Sundaram, Black, International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
3. Chari. S. N, International Business, Wiley India.
4. E. Bhattacharya, International Business, Excel Publications, New Delhi.

Online Resources:

1. https://www.slideshare.net/ShompaDhali/business-environment-53111245
2. https://www.slideshare.net/rbalsells/fiscal-policy-ppt
3. https://www.slideshare.net/aguness/monetary-policy-presentationppt
4. https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982
5. https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
6. https://www.slideshare.net/viking2690/wto-ppt-60260883
7. https://www.slideshare.net/prateeknepal3/ppt-mo

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01205T	PC	Engineering Geology	3	0	0	3

Pre-Requisites: Basic knowledge of Earth Science, Engineering Physics, Chemistry, Mathematics, and Civil Engineering fundamentals.

Course Objectives:

To know the importance of Engineering Geology to the Civil Engineering. To enable the students, understand what minerals and rocks are and their formation and identification. To highlight significance/ importance/ role of Engineering Geology in construction of Civil Engineering structures. To enable the student, realize its importance and applications of Engineering Geology in Civil Engineering constructions. Concepts of Ground water and its geo physical methods.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the branches of geology and evaluate their significance in solving civil engineering problems through case studies of geological processes like weathering and river action. (L4)

CO2: Differentiate minerals and rocks based on physical properties to classify igneous, sedimentary, and metamorphic rocks, and interpret their structures and textures. (L4)

CO3: Analyze geological structures such as folds, faults, joints, and unconformities to assess their impact on the design and safety of civil engineering structures. (L4)

CO4: Examine the causes and effects of groundwater movement, earthquakes, landslides, and geophysical data to recommend mitigation strategies for engineering applications. (L4)

CO5: Analyze geological factors affecting the selection, design, and construction of dams, reservoirs, and tunnels to optimize site stability and structural safety. (L4)

Unit I: Introduction:

Branches of Geology, Importance of Geology in Civil Engineering with case studies, weathering of rocks, Geological agents, weathering process of Rock, Rivers and geological work of rivers.

Unit II: Mineralogy and Petrology

Definitions of mineral and rock-Different methods of study of mineral and rock. Physical properties of minerals and rocks for megascopic study for the following minerals and rocks. Common rock forming minerals: Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, grey, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khond alite and Slate.

Unit III: Structural Geology:

Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

Unit IV: Ground Water, Earthquakes and Land Slides:

Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques. Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

Unit V: **Geology of Dams, Reservoirs and Tunnels:**

Types and purpose of Dams, Geological considerations in the selection of a Dam site. Geology consideration for successful constructions of reservoirs, Life of Reservoirs. Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

Text Books:

1. Engineering Geology by N. Chenna Kesavulu, LaxmiPublications.2ndEdn2014.
2. Engineering & General Geology by Parbin Singh Katson educational series 8th 2023

Reference Books:

1. Engineering Geology by Subinoy Gangopadhay Oxford University press1stedition, 2012.
2. Engineering Geology by D. Venkat Reddy, VikasPublishing,2ndEdn,2017.
3. Environmental Geology (2013) K.S. Valdiya, 2nd Edition., McGraw Hill Publications.

Online Resources:

1. http://nptel.iitm.ac.in/video.php?subjectId=105105106
2. http://nptel.iitm.ac.in/video.php?courseId=1055&p=1
3. http://nptel.iitm.ac.in/video.php?courseId=1055&p=3
4. http://nptel.iitm.ac.in/video.php?courseId=1055&p=4

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01206T	**PC**	**Concrete Technology**	**3**	**0**	**0**	**3**

Pre-Requisites: Basics of civil and Mechanical Engineering.

Course Objectives:

This course introduces the properties, composition, and behaviours of concrete and its constituents. It develops understanding of both fresh and hardened concrete, including their testing and performance characteristics. Students also learn concrete mix design methods and explore special concretes for advanced applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the properties and behavior of cement and aggregates, including their roles in concrete performance. (L4)

CO2: Evaluate the workability and quality of fresh concrete through various tests and interpret their results for practical applications. (L4)

CO3: Assess the strength and durability characteristics of hardened concrete using both destructive and non-destructive testing methods. (L4)

CO4: Examine the effects of elasticity, creep, and shrinkage on concrete structures and their long-term performance. (L4)

CO5: Design concrete mixes using ACI and IS code methods and recommend appropriate special concretes for specific engineering needs. (L4)

Unit I: Cements:

Portland Cement–Chemical Composition–Hydration, Setting of Cement, Fineness of cement, Structure of hydrate cement– Test for physical properties – Different grades of cements–Admixtures–Mineral and chemical admixtures–accelerators, retarders, air entrains, plasticizers, super plasticizers, fly ash and silica fume.

Aggregates: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregates–Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate–Bulking of sand–Deleterious substances– Soundness–Alkali aggregate reaction–Thermal properties–Sieve analysis–Fineness modulus–Grading curves–Grading of fine & coarse Aggregates–Maximum aggregate size, Quality of mixing water.

Unit II: Fresh Concrete:

Steps in Manufacture of Concrete–proportion, mixing, placing, compaction, finishing, curing – including various types in each stage. Properties of fresh concrete-Workability – Factors affecting workability – Measurement of workability by different tests, setting times of concrete, Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete, Ready mixed concrete, Shot Crete.

Unit III: Hardened Concrete:

Water / Cement ratio – Abram's Law – Gel/space ratio – Nature of strength of concrete –Maturity concept – Strength in tension & compression – Factors affecting strength–Relation between compression & tensile strength–Curing, Testing of Hardened Concrete: Compression test –Tension test –Factors affecting strength– Flexure test –Splitting test – Non-destructive testing methods – Codal provisions for NDT.

Unit IV: Elasticity, Creep & Shrinkage:

Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage –types of shrinkage.

Unit V: Mix Design and Special Concretes:

Factors in the choice of mix proportions – Quality control of concrete- Statistical Methods Acceptance Criteria-Concepts Proportioning of concrete mixes by ACI method and IS Code method. Ready mixed concrete, Fibre reinforced concrete – Different types of fibres– Factors affecting properties of FRC, High performance concrete – Self consolidating concrete, Self-healing concrete.

Text Books:

1. Properties of Concrete by A.M. Neville –Pearson–4th edition
2. Concrete Technology by M.L. Gambhir. – Tata McGraw Hill Publishers, New Delhi 5th edition 2013.
3. Concrete Technology by Job Thomas, Cengage Publications,1st edition, 2015.

Reference Books:

1. Concrete Microstructure, Properties of Materials by P.K. Mehta and Moterio. McGraw Hill 4 th edition 2014
2. Concrete Technology, J.J. Brooks and A.M. Neville, Pearson, 2019, 2nd Edition.
3. Concrete Technology by M.S. Shetty. –S. Chand & Co.;2004
4. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi.

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01207T	PC	Structural Analysis	2	1	0	3

Pre-Requisites: Basic Knowledge on Strength of Materials

Course Objectives:

To develop a comprehensive understanding of energy theorems and the analysis of indeterminate structures, including fixed and continuous beams, through the application of methods such as slope-deflection and moment-distribution.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply strain energy principles and Castiglioni's First Theorem to determine deflections in simple beams and pin-jointed trusses. (L3)

CO2: Analyze statically and kinematically indeterminate trusses using Castiglioni's Second Theorem, identifying internal forces and deflections. (L4)

CO3: Apply principles of statics to determine shear force, bending moment, and deflection in fixed and continuous beams under various loading conditions, including support sinking and rotation. (L3)

CO4: Analyze continuous beams and portal frames using the slope-deflection method considering different support conditions and settlements. (L4)

CO5: Apply the moment distribution method to solve continuous beams and portal frames, including cases with support settlements. (L3)

Unit I: Energy Theorems:

Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces– Castiglioni's first theorem Deflections of simple beams and pin jointed trusses.

Unit II: Analysis of Indeterminate Trusses:

Indeterminate Structural Analysis Determination of static and kinematic indeterminacies– Solution of trusses with up to two degrees of internal and external indeterminacies– Castiglioni's–II theorem.

Unit III: Fixed Beams & Continuous Beams:

Introduction to statically indeterminate beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads– Shear force and Bending moment diagrams– Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

Unit IV: Slope-Deflection Method:

Introduction-derivation of slope deflection equations application to continuous beams with and without settlement of supports- Analysis of single bay portal frames without sway.

Unit V: Moment Distribution Method:

Introduction to moment distribution method Application to continuous beams with and without settlement of Supports-Analysis of single bay storey portal frames without sway.

Text Books:

1. Analysis of Structures– Vol-I&II by V.N. Vazirani & M.M. Ratwani, Khanna Publications, New Delhi.
2. Basic Structural Analysis by C.S. Reddy., Tata McGraw Hill Publishers.3rdedition 2017.

Reference Books:

1. Structural analysis by Aslam Kassimali Cengage publications 6th edition2020.
2. Structural analysis Vol. I and II by Dr. R. Vaidyanathan and Dr. Perumal–Laxmi publications. 3rd 2016
3. Introduction to structural analysis by B.D. Nautiyal, New Age international publishers, New Delhi.
4. Structural Analysis–D.S. Prakasa Rao- University press.
5. Strength of Materials and Mechanics of Structures by B.C. Punmia, Khanna Publications, New Delhi.

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01208T	**PC**	**Hydraulics and Hydraulics Machinery**	**2**	**1**	**0**	**3**

Pre-Requisites: Fundamentals of Engineering Mechanics and Fluid Mechanics

Course Objectives:

This course aims to develop students' understanding of fluid flow in pipes and open channels, including laminar, turbulent, and boundary layer concepts. It enables students to Analyze and design efficient flow systems, evaluate hydraulic jumps, turbines, and jet impacts. The course also focuses on pump performance, characteristic curves, and troubleshooting operational issues.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze laminar and turbulent flow in pipes using Reynolds experiment, Moody's diagram, and boundary layer theory. (L4)

CO2: Analyze velocity distribution and design of hydraulically efficient open channel sections. (L4)

CO3: Analyze specific energy, critical flow, and hydraulic jump for non-uniform open channel flow. (L4)

CO4: Analyze forces, work done, and efficiency of jets and hydraulic turbines using velocity triangles. (L4)

CO5: Analyze performance, efficiency, and operational issues of centrifugal pumps from characteristic curves. (L4)

Unit I: Laminar & Turbulent Flow in Pipes:

Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes- Moody 's diagram– Introduction to boundary layer theory.

Unit II: Uniform flow in Open Channels:

Open Channel Flow- Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Hydraulically efficient channel sections: Rectangular, trapezoidal and triangular channels, Energy and Momentum correction factor

Unit III: Non-Uniform Flow in Open Channels:

Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification- Elements and characteristics- Energy dissipation.

Unit IV: Impact of Jets:

Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes- Velocity triangles at inlet and outlet- Work done and efficiency Hydraulic Turbines: Classification of turbines; Pelton wheel and its design. Franci's turbine and its design efficiency-

Draft tube: theory-characteristic curves of hydraulic turbines.

Cavitation: causes and effects.

Unit V: **Pumps:**

Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies

Text Books:

1. P.M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, StandardBookHouse22nd, 2019.
2. K. Subrahmanyam, Theory and Applications of Fluid Mechanics, Tata McGraw Hill,2nd edition 2018

Reference Books:

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi 11thedition, 2024.
2. Fluid Mechanics by Frank M. White, Henry Xue, Tata McGrawHill,9thedition,2022.
3. C.S.P. Ojha, R. Berndts on and P.N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
4. Introduction to Fluid Mechanics &Fluid Machines by S K Som, Gautam Biswas, S Chakra borty 3rd edition 2011

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01205P	**PC**	**Engineering Geology Lab**	**0**	**0**	**3**	**1.5**

Pre-Requisites: Basic knowledge of Earth Science, Engineering Physics, Chemistry, Mathematics, and Civil Engineering fundamentals.

Course Objectives: To identify the Megascopic types of Ore minerals & Rock forming minerals. To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks. To identify the topography of the site & material selection

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze and classify rock-forming and ore-forming minerals through megascopic identification based on their physical properties. (L4)

CO2: Analyze and interpret the characteristics of igneous, sedimentary, and metamorphic rocks to identify their types, textures, and structures. (L4)

CO3: Analyze geological maps and construct geological cross-sections by interpreting features like tilted beds, faults, and unconformities. (L4)

CO4: Analyze structural geology problems and borehole data to assess geological formations and their relevance to engineering applications. (L4)

CO5: Analyze field observations, including the identification of minerals, rocks, and geological structures, to apply theoretical knowledge in practical scenarios. (L4)

List of Experiments:

1. Physical properties of minerals: Mega-scopic identification of
   a. Igneous rocks–Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Periphery, Basalt, etc.
   b. Sedimentary rocks–Sandstone, Ferruginous sandstone, Limestone, Shale, Laterite,
2. Mega-scopic description and identification of rocks.
   c. Rock forming minerals– Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmaline, Calcite, Gypsum, etc…
   d. Ore forming minerals– Magnetite, Hematite, Pyrite, Pyrolusite, Graphite, Chromite, etc… Conglomerate, etc.
   e. Metamorphic rocks–Biotite–Granite Gneiss, Slate, Muscovite & Biotite schist, Marble, Khond alite, etc.
3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
4. Simple Structural Geology problems.
5. Borehole data.
6. Strength of the rock using laboratory tests.
7. Fieldwork–To identify Minerals, Rocks, Geomorphology & Structural Geology.

Text Books:

1. Engineering Geology by N. Chenna Kesavulu, LaxmiPublications.2ndEdn2014.
2. Engineering & General Geology by Parbin Singh Katson educational series 8th 2023

Reference Books:

1. Engineering Geology by Subinoy Gango padhay Oxford University press1stedition, 2012.
2. Engineering Geology by D. Venkat Reddy, Vikas Publishing,2nd Edition, 2017,
3. Environmental Geology, S. Valdiya ,2nd Edition., McGraw Hill Publications, 2013.

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01206P	PC	Concrete Technology Lab	0	0	3	1.5

Pre-Requisites: Basics of Engineering Mechanics and Strength of Materials

Course Objectives:

The course develops practical skills in testing and evaluating cement, aggregates, and concrete to ensure material quality and compliance with standards. Students learn to assess workability, strength, and durability through laboratory experiments on fresh and hardened concrete. It prepares students for effective material selection, quality control, and performance analysis in civil engineering projects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the properties of cement and aggregates through tests like consistency, fineness, specific gravity, and water absorption (L4)

CO2: Analyze the workability of fresh concrete using compaction factor, slump, and Vee-bee tests. (L4)

CO3: Analyze the mechanical properties of hardened concrete, including strength, Young's modulus, and Poisson's ratio. (L4)

CO4: Analyze non-destructive testing results to assess the integrity and durability of concrete structures. (L4)

Detailed Syllabus:

1. Tests on Cement

a) Normal Consistency and Fineness of cement.
b) Initial setting time and Final setting time of cement.
c) Specific gravity and soundness of cement.
d) Compressive strength of cement.

2. Tests on Fine Aggregates

a) Grading and fineness modulus of Fine aggregate by sieve analysis.
b) Specific gravity of fine aggregate
c) Water absorption and Bulking of sand.

3. Tests on Coarse Aggregates

a) Grading of Coarse aggregate by sieve analysis.
b) Specific gravity of coarse aggregate
c) Water absorption of Coarse aggregates

4. Tests on fresh Concrete

a) Workability of concrete by compaction factor method
b) Workability of concrete by slump test
c) Workability of concrete by Vee-bee test.

5. Tests on Hardened Concrete

a) Compressive strength of cement concrete and Modulus of rupture
b) Young’s Modulus and Poisson’s Ratio
c) Split tensile strength of concrete.
d) Non-Destructive testing on concrete (for demonstration)

Text Books:

1. Properties of Concrete by A. M. Neville–PEARSON–4thedition
2. Concrete Technology by M.L. Gambhir. – Tata McGraw Hill Publishers, New Delhi 5th edition 2013.
3. Concrete Technology by Job Thomas, Cengagae Publications,1stedition,2015
4. Building construction and materials (Lab Manual) by Gambhir, TMH publishers 2017 edition.

References Books:

1. Concrete Microstructure, Properties of Materials by P.K. Mehta and Moterio. McGraw Hill 4th edition 2014
2. Concrete Technology by M.S. Shetty. – S. Chand&Co.;2004
3. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24SEHS201S	SE	**Soft Skills** (Common to all branches of Engineering)	0	1	2	2

Pre-Requisites: Basics of LSRW skills

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To enhance healthy relationship and understanding within and outside an organization
- To function effectively with heterogeneous teams Course Outcomes

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply effective communication techniques by understanding its significance, process, types, and overcoming barriers to enhance professional and interpersonal interactions. (L3)

CO2: Apply active listening, observation, curiosity, introspection, and critical thinking skills to enhance problem-solving, decision-making, and reflective practices. (L3)

CO3: Apply problem-solving techniques, conflict management strategies, and team decision-making methods to resolve issues and enhance collaboration in professional environments. (L3)

CO4: Analyze emotional and stress responses to identify triggers, evaluate coping strategies, and develop effective methods for emotional control and resilience in personal and professional contexts. (L4)

CO5: Analyze the importance of etiquette and grooming in professional settings to enhance personal branding and overcome workplace challenges. (L4)

Unit I: Soft Skills & Communication Skills Soft Skills:

Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills -Significance, process, types - Barriers of communication - Improving techniques.

Activities: Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches convincing-negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

Unit II: Critical Thinking:

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open mindedness – Creative Thinking - Positive thinking - Reflection

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

Unit III: Problem Solving & Decision Making:

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles

Activities: Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion

Unit IV: Emotional Intelligence & Stress Management:

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

Unit V: Corporate Etiquette:

Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette - Corporate grooming tips -Overcoming challenges

Activities: Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.

Text Books:

1. Mitra Barun K, Personality Development and Soft Skills, Oxford University Press, Pap/Cdr edition 2012
2. Dr Shikha Kapoor, Personality Development and Soft Skills: Preparing for Tomorrow, I K International Publishing House, 2018

Reference Books:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S. Chand& Co, 2012 (Revised edition)
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: Notion Press

6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher: Vayu Education of India, 2014

Online Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business-etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES03102T	ES	**Design Thinking & Innovation** (Common to all branches of Engineering)	1	0	2	2

Pre-Requisites: Nil

Course Objectives:

- Familiarize students with design thinking process as a tool for breakthrough innovation.
- Equip students with design thinking skills and ignite the minds to create innovative ideas.
- Develop solutions for real-time problems.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Explain fundamental elements and principles of design, and analyze the role of design thinking and material innovations in shaping modern industrial practices. (L4)

CO2: Apply the design thinking process—empathize, analyze, ideate, prototype—and use tools like journey maps and brainstorming to develop innovative solutions for product and social innovation. (L4)

CO3: Distinguish between creativity and innovation, and apply creative thinking in teams to develop and evaluate innovative ideas in organizational contexts. (L4)

CO4: Formulate problems and define product specifications by applying product design strategies and planning for value-driven innovation. (L4)

CO5: Apply design thinking principles to address business challenges and develop innovative business models, prototypes, and start-up strategies. (L4)

Unit I: Introduction to Design Thinking:

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

Unit II: Design Thinking Process:

Design thinking process (empathize, Analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

Unit III: Innovation:

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

Unit IV: Product Design:

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

Unit V: Design Thinking in Business Processes:

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs Design thinking for Start-ups-Defining and testing Business Models and Business Cases Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for start-up.

Text Books:

1. Tim Brown, Change by design, Harper Bollins (2009)
2. Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shrutin N Shetty, Design the Future, Norton Press
3. William Lid well, Universal Principles of Design- Kritinaholden, Jill Butter.
4. Chesbrough. H, The Era of Open Innovation – 2013

Online Resources:

1. https://nptel.ac.in/courses/110/106/110106124/
2. https://nptel.ac.in/courses/109/104/109104109/
3. https://swayam.gov.in/nd1_noc19_mg60/preview

B. Tech. – II Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24IPIN301L	**IP**	**Community Service Internship** (Common for all branches of Engineering)	**0**	**0**	**0**	**2**

Pre-Requisites: Problem-Solving & Critical Thinking, Communication & Presentation Skills, Teamwork & Collaboration Skills, Foundations in Ethics and Social Responsibility.

Course Objectives:

- To develop social awareness and responsibility among engineering students by engaging with real-world community needs.
- To apply basic engineering knowledge and problem-solving skills in designing practical solutions for local societal challenges.
- To foster teamwork, leadership, and communication skills through collaborative, interdisciplinary project work.
- To cultivate ethical reasoning, empathy, and intercultural understanding by working with diverse communities and stakeholders.
- To enhance students' ability to plan, execute, and document projects through structured project management and reporting.
- To bridge academic learning with practical experience, strengthening the relevance of engineering education to societal development.

Course Outcomes (COs):

On successful completion of the Course, Student will be able to

CO1: Apply engineering knowledge to identify and address community needs through structured service-based projects. (L3)

CO2: Work collaboratively in diverse teams to plan, execute, and evaluate community service initiatives. (L3)

CO3: Communicate project goals, processes, and outcomes effectively through written reports and oral presentations. (L3)

CO4: Assess the social, ethical, and environmental implications of engineering solutions implemented in community settings. (L4)

CO5: Evaluate personal and professional development achieved through community engagement, with emphasis on leadership, empathy, and social responsibility. (L4)

Community Service Internship……Experiential learning through community engagement

Introduction

- Community Service Internship is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Internship involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Internship is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Internship should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships.

The specific objectives are

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Internship

- Every student should put in 6 weeks for the Community Service Internship during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/ involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Internship should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Internship is a twofold one –
  - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.

- Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

Expected Outcomes

Benefits of Community Service Internship to Students Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity. Relationship with the Institution
- Stronger relationships with faculty

- Greater satisfaction with college
- Improved graduation rates

Benefits of Community Service Internship to Faculty Members

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

Benefits of Community Service Internship to Colleges and Universities

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

Benefits of Community Service Internship to Community

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

Suggestive List of Programmes Under Community Service Internship

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention Programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution

18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness Programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species 3
3. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complimenting the Community Service Internship the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath

7. AIDS awareness camp
8. Anti-Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash Programmes
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention Programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
    - i. Agriculture
    - ii. Health
    - iii. Marketing and Cooperation
    - iv. Animal Husbandry
    - v. Horticulture
    - vi. Fisheries
    - vii. Sericulture
    - viii. Revenue and Survey
    - ix. Natural Disaster Management
    - x. Irrigation
    - xi. Law & Order
    - xii. Excise and Prohibition
    - xiii. Mines and Geology
    - xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the Programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Departments. If the program is rolled out, the district Administration could be roped in for the successful deployment of the program.
- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Internship Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**

   • A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.

   • A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.

   • The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**

   • Based on the survey and the specific requirements of the habitation, different awareness campaigns and Programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**

   Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement Programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**

   During the last week of the Community Service Internship, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Internship, a daily logbook needs to be maintained by the student's batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the student

B. Tech. – III Year
I Semester

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01309T	PC	Water Resources Engineering	3	0	0	3

Pre-Requisites: Fundamentals of Fluid Mechanics

Course Objectives:

- Understand the fundamental concepts of hydrology, including precipitation, evaporation, infiltration, and runoff, and their significance in water resource management.
- Analyze hydrographs, unit hydrographs, and groundwater characteristics for estimating water availability and flood management.
- Evaluate the necessity, importance, and methods of irrigation, along with soil-water plant relationships and irrigation efficiencies.
- Apply silt theories and principles of canal design to ensure efficient water conveyance and management in irrigation systems.
- Assess the principles of diversion head works, water logging, canal lining, and the stability of hydraulic structures on permeable foundations.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the concepts of hydrologic cycle, precipitation types, and measurement techniques to compute rainfall, evaporation, infiltration, and runoff for water resource assessment. (L3)

CO2: Analyze hydrographs, unit hydrographs, and groundwater flow parameters for flood estimation and water resource planning. (L4)

CO3: Evaluate irrigation requirements, soil-water-plant relationships, duty, delta, and irrigation efficiencies for sustainable agricultural productivity. (L5)

CO4: Apply silt theories and design principles of irrigation canals to ensure effective water conveyance and prevent waterlogging. (L3)

CO5: Assess the stability of diversion head works, including weirs and barrages, using Bligh's and Khosla's theories for hydraulic structure design. (L5)

Unit I: Introduction to Hydrology:

Engineering Hydrology and Its Applications; Hydrologic Cycle; Precipitation- Types and forms, Rainfall Measurement, Types of Rain Gauges, Computation of Average Rainfall Over a Basin, Presentation and Interpretation of Rainfall Data. Evaporation- Factors Affecting Evaporation, Measurement of Evaporation; Infiltration- Factors Affecting Infiltration, Measurement of Infiltration, Infiltration Indices; Run off- Factors Affecting Run- off, Computation of Run-Off; Design Flood; Estimation of Maximum Rate of Run-Off; Separation of Base Flow.

Unit II: Hydrograph Analysis:

Hydrograph; Unit Hydrograph- Construction and Limitations of Unit Hydrograph, Application of The Unit Hydrograph to The Construction of a Flood Hydrograph Resulting from Rainfall of Unit Duration; S-Hydrograph.

Ground Water:

Introduction; Aquifer; Aquiclude; Aquifuge; Aquifer Parameters Porosity, Specific Yield, Specific Retention; Divisions of Sub–Surface Water; Water Table; Types of Aquifers; Storage Coefficient Co-efficient of Permeability and Transmissibility

Unit III: Irrigation:

Introduction; Necessity and Importance of Irrigation; Advantages and Ill Effects of Irrigation; Types of Irrigation; Methods of Application of Irrigation Water; Quality for Irrigation Water. Duty and Delta; Duty at Various Places; Relation Between Duty and Delta; Factors Affecting Duty; Methods of Improving Duty.

Water Requirement of Crops:

Types of Soils, Indian Agricultural Soils, Preparation of Land for Irrigation; Soil Fertility; Soil-Water-Plant Relationship; Vertical Distribution of Soil Moisture; Soil Moisture Tension; Soil Moisture Stress; Various Soil Moisture Constants; Limiting Soil Moisture Conditions; Depth and Frequency of Irrigation; Gross Command Area; Culturable Command Area; Culturable Cultivated and Uncultivated Area; Kor Depth and Kor Period; Crop Seasons and Crop Rotation; Irrigation Efficiencies; Determination of Irrigation Requirements of Crops; Assessment of Irrigation Water. Consumptive Use of Water-Factors Affecting Consumptive Use, Direct Measurement and Determination by Use of Equations (Theory Only)

Unit IV: Channels – Silt Theories:

Classification; Canal Alignment; Inundation Canals; Cross–Section of An Irrigation Channel; Balancing Depth; Borrow Pit; Spoil Bank; Land Width; Silt Theories–Kennedy 's Theory, Kennedy 's Method of Channel Design; Drawbacks in Kennedy 's Theory; Lacey 's Regime Theory- Lacey 's Theory Applied to Channel Design; Defects in Lacey 's Theory; Comparison of Kennedy 's and Lacey 's Theory.

Water Logging and Canal Lining:

Water Logging; Effects of Water Logging; Causes of Water Logging; Remedial Measures; Saline and Alkaline Soils and their Reclamation; Losses in Canal; Lining of Irrigation Channels – Necessity, Advantages and Disadvantages; Types of Lining; Design of Lined Canal.

Unit V: Diversion Head Works:

Types of Diversion Head Works; Diversion and Storage Head Works; Weirs and Barrages; Layouts of Diversion Head Works; Components; Causes and Failure of Hydraulic Structures on Permeable Foundations; Bligh 's Creep Theory; Khosla 's Theory; Determination of Uplift Pressure, Impervious Floors Using Bligh 's and Khosla 's Theory; Exit Gradient.

Text Books:

1. Irrigation and Water Power Engineering by Punmia &Lal, Laxmi Publications PVt. Ltd., New Delhi 17th Edition 2021
2. Engineering Hydrology by K. Subramanya, The Tata McGraw Hill Company, Delhi 5th Edition 2020

Reference Books:

1. Irrigation Engineering and Hydraulic Structures by S. K. Garg; Khanna Publishers, Delhi 36th Edition
2. Engineering Hydrology by Jayarami Reddy, Laxmi Publications PVt. Ltd., New Delhi 3rd Edition 2016
3. Irrigation and Water Resources & Water Power by P.N. Modi, Standard Book House 6th Edition 2020

Online Resources:

https://nptel.ac.in/courses/105101214

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC05307T	**PC**	**Introduction to Quantum Technologies and Applications** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisites: Fundamentals of Engineering Physics and Mathematics

Course Objectives:

- Introduce fundamental quantum concepts like superposition and entanglement.
- Understand theoretical structure of qubits and quantum information.
- Explore conceptual challenges in building quantum computers.
- Explain principles of quantum communication and computing.
- Examine real-world applications and the future of quantum technologies.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply fundamental quantum principles such as superposition, entanglement, uncertainty, and wave-particle duality to explain the behaviour of basic quantum systems like electrons, photons, and atoms. (L3)

CO2: Demonstrate conceptual understanding of qubits using spin and polarization to differentiate classical and quantum information systems, and illustrate key phenomena such as coherence, entanglement, and decoherence in basic quantum systems. (L3)

CO3: Illustrate the conceptual requirements for building a quantum computer by explaining system fragility, error correction, scalability, and comparing quantum hardware platforms like superconducting circuits, trapped ions, and photonics. (L3)

CO4: Examine the principles of quantum communication and computing by comparing classical and quantum gates, evaluating the impact of entanglement on secure communication, and analysing the feasibility of the quantum internet and its future applications. (L4)

CO5: Analyze the societal, ethical, and industrial implications of quantum technology adoption by evaluating real-world use cases, challenges related to cost and standardization, and India's strategic position in the global quantum research and career landscape. (L4)

Unit I: Introduction to Quantum Theory and Technologies:

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India 's Quantum Mission, EU, USA, China.

Unit II: Theoretical Structure of Quantum Information Systems:

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role.

Unit III: Building a Quantum Computer – Theoretical Challenges and Requirements:

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what‘s working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit IV: Quantum Communication and Computing – Theoretical Perspective:

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet –Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential.

Unit V: Applications, Use Cases, and the Quantum Future:

Real-world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, Psi Quantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape – India's opportunity in the global quantum race.

Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.
4. Alastair I.M. Rae, Quantum Physics: A Beginner's Guide, One world Publications, Revised Edition, 2005.
5. Eleanor G. Rieffel, Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books, 2014.
7. Bruce Rosenblum, Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press, 2nd Edition, 2011.
8. Giuliano Benenti, Giulio Casati, Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing, 2004.
9. K.B. Whaley et al., Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document, Quantum Flagship, European Commission, 2020.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, Meit Y/DST Publications, 2020 onward.

Online Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01310T	PC	Design of Reinforced Concrete Structures	2	1	0	3

Pre-Requisites: Basics of Strength of Materials

Course Objectives:

- Understand the fundamental methods of concrete structure design, including elastic, ultimate load, and limit state methods.
- Analyze and design reinforced concrete beams, slabs, staircases, columns, and footings using the Limit State Method as per IS codes.
- Evaluate the behavior of reinforced concrete members in terms of flexure, shear, torsion, bond, and anchorage.
- Apply design principles to ensure serviceability and safety of concrete structures under various loading conditions.
- Develop skills to use design aids and professional software for the analysis and design of RC structures.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the Limit State Method to analyze and design singly reinforced, doubly reinforced beams, flanged beams, slabs, and staircases for structural safety. (L3)

CO2: Analyze the behaviour of RC members under shear, torsion, and combined loading conditions to ensure structural integrity. (L4)

CO3: Design short columns and footings considering axial and eccentric loading conditions as per IS code provisions. (L5)

CO4: Apply IS code design aids and provisions for efficient design of reinforced concrete structural elements. (L3)

CO5: Evaluate the structural performance of RC elements using limit state principles and recommend appropriate design solutions. (L5)

Unit I: Methods of Design of Concrete Structures:

Concept of Elastic Method, Ultimate Load Method and Limit State Method – Working Stress Method as Detailed in IS Code - Design of Singly Reinforced Beam by Working Stress Method - Limit State Philosophy as Detailed in IS Code - Advantages of Limit State Method Over Other Methods - Analysis and Design of Singly and Doubly Reinforced Rectangular Beams by Limit State Method.

Unit II: Limit State Method - Flanged Beam, Shear &Torsion:

Analysis and Design of Flanged Beams – Use of Design Aids for Flexure - Behaviour of RC Members in Bond and Anchorage - Design Requirements as Per Current Code - Behaviour of RC Beams in Shear and torsion - Design of RC Members for Combined Bending, Shear and torsion - Serviceability.

Unit III: Limit State Design of Slabs and Staircase:

Analysis and Design of Cantilever, One Way, Two Way and Continuous Slabs Subjected to Uniformly Distributed Load for Various Boundary Conditions- –Introduction to Flat Slab.

Unit IV: Limit State Design of Columns:

Types of Columns – Design of Short Rectangular and Circular Columns for Axial, Uniaxial and Biaxial Bending.

Limit State Design of Footing:

Design of Wall Footing – Design of Axially and Eccentrically Loaded Rectangular Pad and Sloped Footings – Design of Combined Rectangular Footing for Two Columns Only.

Unit V: Limit State of Serviceability and Miscellaneous:

(Aspects of Deflection, Cracking aspects) Types of Staircases – Design of Dog-Legged Staircase

Text Books:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design, Laxmi Publications PVt. Ltd., New Delhi
2. P. C. Varghese, Limit State―Designed of Reinforced Concrete, Prentice Hall of India, New Delhi

Reference Books:

1. N. Krishnaraju, ―Structural Design and Drawing, Universities Press PVt ltd, Hyderabad.4rdedition 2020.
2. N.C. Sinha and S.K. Roy, ―Fundamentals of Reinforced Concrete, S. Chand Publishers
3. N. Subramanian, ―Design of Reinforced Concrete Structures, Oxford University Press

Online Resources:

https://archive.nptel.ac.in/courses/105/105/105105105/

Codes/Tables:

IS 456-2000 and relevant sheets (Pertaining to columns) of SP 16 Code books to be permitted into the examinations Hall.

NOTE: Assignment on preparation of drawing sheets detailing various RC Elements

All the designs to be taught in Limit State Method Following plates should be prepared by the students.

1. Reinforcement particulars of T-beams and L-beams.
2. Reinforcement detailing of continuous beams.
3. Reinforcement particulars of columns and footings.
4. Detailing of One-way, Two way and continuous slabs

Exam Pattern:

The end examination paper should consist of Part A and Part B.

Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part-B should consist of five questions on design out of which three are to be answered. Weightage for Part -A is 40% and Part-B is 60%.

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01311T	PC	Geotechnical Engineering	2	1	0	3

Pre-Requisites: Fundamentals of Strength of Materials

Course Objectives:

- Understand the classification and compaction characteristics of different soil types and their engineering significance.
- Analyze the concepts of effective stress, permeability, and seepage in soils and their impact on soil behavior.
- Apply stress distribution theories and settlement computations to evaluate soil response under loads.
- Evaluate shear strength properties of soil using various testing methods and their applications in geotechnical engineering.
- Assess the stability of slopes using different analytical methods and suggest suitable slope protection measures.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply BIS and Unified soil classification systems to classify soils based on their physical and index properties. (L3)

CO2: Analyze soil permeability and seepage problems using Darcy's law and flow net concepts for geotechnical design. (L4)

CO3: Apply stress distribution theories and consolidation analysis to predict soil behaviour and settlement under loading conditions. (L3)

CO4: Evaluate shear strength of soils using experimental methods and interpret test results for foundation design. (L5)

CO5: Assess slope stability and recommend suitable protection and stabilization measures for safe geotechnical practice. (L5)

Unit I: Introduction:

Soil Formation-Soil structure - Adsorbed water - Mass- Volume relationship — Relative density. Index Properties of Soils: Moisture Content, Specific Gravity, In-situ density, Grain size analysis — Sieve and Hydrometer methods — Consistency limits and indices -I.S. Classification of soils.

Unit II: Permeability:

Soil Water — Capillary Rise — Flow of Water Through Soils - Darcy's Law-Permeability Factors Affecting — Laboratory Determination of Coefficient of Permeability-Permeability of Layered Systems.

Seepage Through Soils:

Total, Neutral and Effective Stresses - Quick Sand Condition — Seepage Through Soils — Flow Nets: Characteristics and Uses.

Unit III: Stress Distribution in Soils:

Boussinesq's and Wester Guard's Theories for Point Loads and Areas of Different Shapes — Newmark’s Influence Chart Compaction: Mechanism of Compaction — Factors Affecting — Effects of Compaction on Soil Properties. — Field Compaction Equipment — Compaction Control’s.

Unit IV: Consolidation:

Types of Compressibility -Primary Consolidation and Secondary Consolidation - Stress History of Clay; E-P And E-Log P Curves — Normally Consolidated Soil, Over Consolidated Soil and Under Consolidated Soil — Pre-Consolidation Pressure and Its Determination — Terzaghi's I-D Consolidation Theory — Coefficient of Consolidation: Square Root Time and Logarithm of Time Fitting Methods.

Unit V: Shear Strength of Soils:

Importance of Shear Strength- Mohr's- Coulomb Failure Theories — Types of Laboratory Tests for Strength Parameters Strength Tests Based on Drainage Conditions — Critical Void Ratio — Liquefaction.

Text Books:

1. Soil Mechanics and Foundation Engg by K. R. Arora, Standard Publishers and DistributorsDelhi7thedition2009
2. Geotechnical Engineering by C. Venkatramaiah, New Age International PVt. Ltd, (2002).

Reference Books:

1. Soil Mechanics and Foundation by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications PVt. Ltd., New Delhi17thedition 2017
2. Geotechnical Engineering by Iqbal H. Khan, PHI Publishers, 4th edition.
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International PVt. Ltd, New Delhi 3rdedition 2016

Online Resources:

1. https://nptel.ac.in/courses/105101201
2. https://nptel.ac.in/courses/105105185

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01311P	PC	Geotechnical Engineering Lab	0	0	3	1.5

Pre-Requisites: Basics of Soil Classification

Course Objectives:

- Understand the fundamental index properties of soils and their significance in geotechnical engineering.
- Perform field and laboratory tests to determine in-situ density and compaction characteristics of soils.
- Evaluate the engineering properties of soil, including permeability, shear strength, and consolidation.
- Analyze the strength and deformation characteristics of soils through shear and compression tests.
- Interpret test results and relate engineering properties of soils to real-world geotechnical problems and design considerations.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply standard laboratory procedures to determine physical and index properties of soil such as specific gravity, consistency limits, and particle size distribution. (L3)

CO2: Analyze compaction, permeability, and consolidation characteristics of soil samples using laboratory test methods. (L4)

CO3: Evaluate shear strength parameters of soils using direct shear and triaxial tests for geotechnical design applications. (L5)

List of Experiments:

1. Determination of Index Properties
    a. Specific Gravity of Soil
    b. Grain Size Distribution – Sieve Analysis
    c. Grain Size Distribution - Hydrometer Analysis
    d. Liquid Limit and Plastic Limit Tests
    e. Shrinkage Limit and Differential Free Swell Tests
2. Determination of In-Situ Density and Compaction Characteristics
    a. Field Density Test (Sand Replacement Method)
3. Determination of Engineering Properties
    a. Permeability Determination (Constant Head Method)
    b. Permeability Determination (Falling Head Methods)
    c. Determination of Co-Efficient of Consolidation
    d. Direct Shear Test in Cohesion Less Soil
    e. Unconfined Compression Test in Cohesive Soil
    f. Laboratory Vane Shear Test in Cohesive Soil
    g. Tri-Axial Compression Test in Cohesion Less Soil
    h. California Bearing Ratio Test

Note: Any 10 of the above Experiments.

Text Books:

1. Lambe T.W., ―Soil Testing for Engineers‖, John Wiley and Sons, New York, 1951. Digitized 2008.
2. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.

Reference Books:

1. Saibaba Reddy, E. Ramasastri, K. ―Measurement of Engineering Properties of Soils‖, New age International (P) limited publishers, New Delhi, 2008.
2. G. Venkatappa Rao and Goutham. K. Potable, ―Geosynthetics Testing – A laboratory Manual‖, Sai Master Geo environmental Services PVt. Ltd., 1st Edition 2008.
1. Braja M. Das., ―Soil Mechanics: Laboratory Manual‖, Oxford University Press, eighth edition, 2012

Online Resources:

https://nptel.ac.in/courses/105101160

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01208P	PC	Fluid Mechanics Hydraulic Machines Lab	0	0	3	1.5

Pre-Requisites: Fundamentals of Physics and Mathematics

Course Objectives:

- Understand the principles of fluid mechanics and validate fundamental concepts through experiments.
- Determine discharge coefficients for various flow measurement devices and Analyze flow behavior.
- Evaluate energy losses in pipes, open channels, and hydraulic jumps to improve flow efficiency.
- Analyze the impact of jet forces on vanes and their applications in hydraulic machinery.
- Assess the performance characteristics of hydraulic turbines and pumps under different operating conditions.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply Bernoulli's equation and standard test procedures to verify fluid flow principles and measure coefficients of discharge for orifices, notches, and flow meters. (L3)

CO2: Analyze head losses due to friction and minor losses in pipe flow systems and evaluate the impact of jets on vanes. (L4)

CO3: Assess the performance characteristics of hydraulic turbines and pumps under different operating conditions to recommend optimal parameters. (L5)

List of Experiments:

1. Verification of Bernoulli ‘s Equation
2. Determination of Coefficient of Discharge for A Small Orifice by A Constant Head Method
3. Calibration of Venturi meter/ Orifice Meter
4. Calibration of Triangular / Rectangular/Trapezoidal Notch
5. Determination of Minor Losses in Pipe Flow
6. Determination of Friction Factor of a Pipeline
7. Determination of Energy Loss in Hydraulic Jump
8. Determination of Manning ‘s and Chezy ‘s Constants for Open Channel Flow.
9. Impact of Jet on Vanes
10. Performance Characteristics of Pelton Wheel Turbine
11. Performance Characteristics of Francis Turbine
12. Performance Characteristics of Kaplan Turbine
13. Performance Characteristics of a Single Stage / Multistage Centrifugal Pump

Note: Minimum 10 out of the above are to be conducted.

Text Books:

1. Desmukh T. S., A lab manual on Fluid Mechanics and Hydraulic Machines, Laxmi Publications
2. Dr. S.K. Panigrahi, Ms. L. Mohanty, Fluid Mechanics and Hydraulic Machines Laboratory Manual, S.K.KATARIA&SONS, Educational Publisher

Reference Books:

1. Dr. N. Kumara Swamy, Fluid Mechanics and Machinery Laboratory Manual, Chartor Publications
2. D. Sathish, Fluid Mechanics and Machinery Lab Manual, BP International Publications

Online Resources:

https://archive.nptel.ac.in/courses/112/106/112106311/

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24SE01302S	**SE**	**Estimation, Specifications, Costing and Valuation**	**0**	**1**	**2**	**2**

Pre-Requisites: Basics of Building Planning and Drawing

Course Objectives:

- Understand the various methods and types of estimates used in civil engineering projects.
- Develop detailed estimates for single and multi-storey buildings using standard estimation methods.
- Analyze rate analysis, abstract estimation, and bill preparation as per standard procedures.
- Prepare detailed specifications and tender documents for construction works.
- Evaluate the valuation, cost escalation, and value analysis of buildings.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply estimation techniques to prepare detailed estimates for various construction projects using standard measurement methods. (L3)

CO2: Develop abstract estimates and rate analysis for different civil engineering works and construction components. (L5)

CO3: Analyze preparation of measurement books and bill preparation as per AP State Government procedures and specifications. (L4)

CO4: Create detailed specifications and tender documents for construction projects following standard civil engineering practices. (L5)

CO5: Assess building valuation, cost escalation, and value analysis techniques for project cost management. (L5)

List of Experiments:

1. Activity Based on Learning Methods and Types of Estimates
2. Preparation of Detailed Estimate for A Single-Storied Residential Building Using Wall to Wall Method
3. Preparation of Detailed Estimate for A Single Storied Residential Building Using Centre Line Method for Earthwork, Foundations, Super Structure, Fittings Including Sanitary and Electrical Fittings &Paintings.
4. Preparation of Detailed Estimate for A Two Storied Residential Building Using Centre Line Method for Earthwork, Foundations, Super Structure, Fittings Including Sanitary and Electrical Fittings &Paintings.
5. Activity Based Learning of Estimate Data and Rate Analysis
6. Preparation of Abstract Estimate for The Detailed Estimate in Exercise No.3
7. Preparation of Abstract Estimate for The Detailed Estimate in Exercise No.4
8. Writing of Measurement Book and Bill Preparation as Per AP State Govt Procedure for Detailed Estimate in No. 3 and Abstract Estimate of No. 6
9. Writing of Detailed Specifications for Various Items of Estimate and Preparing A Model Tender Document for The Work Listed in No. 3 and 6
10. Activity Based Learning for Valuation of Buildings, Cost Escalation Procedures and Value Analysis for Any One Work.

Text Books:

1. B.N. Dutta - Estimating and Costing in Civil Engineering, CBS Publishers & Distributors, 28th Revised Edition (2020).
2. Rangwala - Estimating, Costing and Valuation, Charotar Publishing House, 2023.
3. D.D. Kohli& R.C. Kohli - ATextbook of Estimating and Costing (Civil), S. Chand Publishing, 2011.

Reference Books:

1. M. Chakraborty- Estimating, Costing, Specification &Valuation in Civil Engineering, 29th Edition (2021).
2. Gurcharan Singh - Estimating, Costing and Valuation, Standard Publishers, 2018.
3. V.N. Vazirani& S.P. Chandola - Civil Engineering Estimating & Costing, Khanna Publishers, 4th Edition (2001).

Online Resources:

1. https://onlinecourses.swayam2.ac.in/nou20_cs11/preview
2. https://www.coursera.org/learn/construction-cost-estimating

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24ES04301P	**ES**	**Tinkering Lab** (Common to all branches of Engineering)	**0**	**0**	**2**	**1**

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives:

- Encourage Innovation and Creativity
- Provide Hands-on Learning and Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
- Impart Problem-Solving mind-set

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply fundamental engineering concepts to design and build working prototypes. (L3)

CO2: Analyze the properties and functions of various materials, tools, and technologies to determine them suitability for specific tasks or projects. (L4)

CO3: Collaborate effectively in teams to solve interdisciplinary engineering problems (L4)

CO4: Evaluate tools and techniques to develop solutions with potential for real-world applications and entrepreneurship. (L5)

CO5: Evaluate and improve prototype performance based on testing and feedback (L5)

List of Experiments:

1. Make your own parallel and series circuits using breadboard for any application of your choice.
2. Design and 3D print a Walking Robot
3. Design and 3D Print a Rocket.
4. Temperature & Humidity Monitoring System (DHT11 + LCD)
5. Water Level Detection and Alert System
6. Automatic Plant Watering System
7. Bluetooth-Based Door Lock System
8. Smart Dustbin Using Ultrasonic Sensor
9. Fire Detection and Alarm System
10. RFID-Based Attendance System
11. Voice-Controlled Devices via Google Assistant
12. Heart Rate Monitoring Using Pulse Sensor
13. Soil Moisture-Based Irrigation
14. Smart Helmet for Accident Detection
15. Milk Adulteration Detection System
16. Water Purification via Activated Carbon
17. Solar Dehydrator for Food Drying
18. Temperature-Controlled Chemical Reactor
19. Ethanol Mini-Plant Using Biomass
20. Smart Fluid Flow Control (Solenoid + pH Sensor)
21. Portable Water Quality Tester
22. AI Crop Disease Detection
23. AI-based Smart Irrigation

24. ECG Signal Acquisition and Plotting
25. AI-Powered Traffic Flow Prediction
26. Smart Grid Simulation with Load Monitoring
27. Smart Campus Indoor Navigator
28. Weather Station Prototype
29. Firefighting Robot with Sensor Guidance
30. Facial Recognition Dustbin
31. Barcode-Based Lab Inventory System
32. Growth Chamber for Plants
33. Biomedical Waste Alert System
34. Soil Classification with AI
35. Smart Railway Gate
36. Smart Bin Locator via GPS and Load Sensors
37. Algae-Based Water Purifier
38. Contactless Attendance via Face Recognition

1. Note: The students can also design and implement their own ideas, apart from the list of experiments mentioned above.

2. Note: A minimum of 8 to 10 experiments must be completed by the students.

Professional Elective – I (PE – I)

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01301T	PE	Pre-Stressed Concrete	2	1	0	3

Pre-Requisites: Fundamentals of Strength of Materials

Course Objectives:

- Understand the principles, methods, and materials used in prestressed concrete.
- Analyze various losses of prestress in both pre-tensioned and post-tensioned members.
- Design prestressed concrete beams considering flexure and shear forces.
- Evaluate deflections in prestressed concrete structures and their controlling factors.
- Analyze the behaviour of composite beams under different loading conditions.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the principles and methods of prestressing to explain the need for high-strength materials in structural applications. (L3)

CO2: Analyze different types of prestress losses and their impact on structural performance under various loading conditions. (L4)

CO3: Design prestressed concrete beams considering flexural and shear stresses as per IS code provisions. (L5)

CO4: Evaluate deflections in prestressed beams and suggest appropriate control measures for serviceability requirements. (L5)

CO5: Analyze stress distribution and differential shrinkage in composite beams for effective structural behaviour assessment. (L4)

Unit I: Introduction:

Principles of Pre-Stressing – Prestressing Systems - Pre-Tensioning and Post Tensioning- Advantages and Limitations of Pre-Stressed Concrete- Need for High Strength Materials. Methods of Pre-Stressing: Pre-Tensioning (Hoyer System) and Post-Tensioning Methods (Freyssinet System and Gifford- Udall System)

Unit II: Losses of pre-stress:

Loss of Pre-Stress in Pre-Tensioned and Post-Tensioned Members Due to Elastic Shortening, Shrinkage and Creep of Concrete, Relaxation of Stress in Steel, Anchorage Slip and Frictional Losses.

Unit III: Flexural and Shear:

Analysis of Beams for Flexure and Shear - Beams Pre-Stressed with Straight, Concentric, Eccentric, Bent and Parabolic Tendons- Kern Line - Cable Profile - Design of PSC Beams (Rectangular and I Sections) Using IS 1343. Analysis and Design of Rectangular and I Beams for Shear. Introduction to Transmission Length and End Block (No Design and Analytical Problems).

Unit IV: Deflections:

Control of Deflections- Factors Influencing Deflections - Short Term Deflections of Uncracked Beams- Prediction of Long Time Deflections

Unit V: Composite beams:

Different types-Proposed and Un-Proposed -Stress Distribution-Differential Shrinkage-Analysis of Composite Beams

Text Books:

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill Publications 6th edition 2018
2. Prestressed concrete by Rajagopalan, Narosa Publishing House 2nd edition 2017

Reference Books:

1. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, John Wiley & Sons 3rd edition 2010
2. Prestressed Concrete Design by Praveen Nagrajan, Pearson publications, 2013.
3. Prestressed Concrete by Ramamuratam, Dhanpatrai Publications 2020 edition
4. BIS code on ―prestressed concrete‖, IS: 1343 to be permitted into the examination Hall

Online Resources:

1. **https://archive.nptel.ac.in/courses/105/106/105106118/**
2. **https://nptel.ac.in/courses/105106117**

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01302T	PE	Air Pollution and Control	3	0	0	3

Pre-Requisites: Basics of Environmental Science

Course Objectives:

- Understand the sources, classification, and effects of air pollution on humans and the environment.
- Analyze meteorological factors influencing air pollution and dispersion modelling.
- Design and evaluate control measures for particulate pollutants.
- Apply techniques for controlling gaseous pollutants through chemical and physical processes.
- Assess vehicular and indoor air pollution and propose control strategies.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of sources, classification, and global effects of air pollution to explain their impact on human health and the environment. (L3)

CO2: Analyze meteorological parameters affecting air pollution dispersion and predict pollutant concentration using Gaussian and box models. (L4)

CO3: Design control systems for particulate matter removal using appropriate techniques such as cyclones, scrubbers, and electrostatic precipitators. (L5)

CO4: Apply suitable technologies for gaseous pollutant removal through adsorption, absorption, and combustion methods. (L3)

CO5: Evaluate vehicular and indoor air pollution sources and recommend effective mitigation strategies for air quality management. (L5)

Unit I: Air Pollution:

Definition - Sources &Classification of Air Pollutants - Effects of Air Pollution On Humans, Plants and Materials- Global Effects - Air Quality and NAAQS - National Clean Air Programme- Sampling of Pollutants in Ambient Air - Stack Sampling

Unit II: Meteorology and Air Pollution:

Factors Influencing Air Pollution, Wind Rose, Mixing Depths, Lapse Rates and Dispersion - Atmospheric Stability, Plume Rise and Dispersion, Prediction of Air Quality, Box Model - Gaussian Model - Dispersion Coefficient - Application of Tall Chimney for Pollutant Dispersion.

Unit III: Control of Particulate Pollutants:

Properties of Particulate Pollution - Particle Size Distribution - Control Mechanism - Dust Removal Equipment - Design and Operation of Settling Chambers, Cyclones, Wet Dust Scrubbers, Fabric Filters &ESP.

Unit IV: Control of Gaseous Pollutants:

Process and Equipment for The Removal by Chemical Methods - Design and Operation of Absorption and Adsorption Equipment - Combustion and Condensation Equipment.

Unit V: Automobile and Indoor Pollution:

Vehicular Pollution – Sources and Types of Emission – Effect of Operating Conditions-Alternate Fuels and Emissions-Emission Controls and Standards, Strategies to Control Automobile Pollution– Causes of Indoor Air Pollution-Changes in Indoor Air Quality-Control and Air Cleaning Systems-Indoor Air Quality

Text Books:

1. Rao, M. N. and Rao H. V. N., Air Pollution, Tata McGraw-Hill, New Delhi, 2007
2. Khare M, Sharma P, Kota, S.H, Sumanth C, Air Pollution Science Engineering and Management Fundamentals, CRC Press, 2024.
3. Noel, D. N., Air Pollution Control Engineering, Tata McGraw Hill Publishers, 1999.

Reference Books:

1. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H
2. Air Pollution Control Engineering by Nevers, McGraw-Hill, Inc., 2000.
3. Rao, C. S., Environmental Pollution Control Engineering, New Age International, New Delhi, 2006.
4. Mahajan S. P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
5. Peavy H. S., Rowe D. R. and Tchobanoglous G., Environmental Engineering, McGraw Hill, New York, 1985.

Online Resources:

https://archive.nptel.ac.in/courses/105/107/105107213/

B. Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01303T	PE	Environmental Impact Assessment	3	0	0	3

Pre-Requisites: Fundamentals of Environmental Science

Course Objectives:

- Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
- Analyze the impact of developmental activities on land use, soil, and water resources.
- Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
- Develop environmental audit procedures and assess compliance with environmental regulations.
- Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply various methodologies for conducting Environmental Impact Assessments for developmental projects. (L3)

CO2: Analyze the impact of land-use changes on soil, water, and air quality using EIA tools and frameworks. (L4)

CO3: Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments for project clearance. (L5)

CO4: Develop environmental audit reports and assess compliance with environmental policies and regulatory requirements. (L5)

CO5: Apply environmental acts and regulations related to EIA for sustainable project planning and implementation. (L3)

Unit I: Concepts and Methodologies of EIA:

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters-Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis

Unit II: Impact of Developmental Activities and Land use:

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact. SSS

Unit III: Assessment of Impact on Vegetation, Wildlife and Risk Assessment:

Introduction - Assessment of Impact of Development Activities on Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing Environmental Risk Assessment-Advantages of Environmental Risk Assessment.

Unit IV: Environmental Audit:

Introduction - Environmental Audit &Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

Unit V: Environmental Acts and Notifications:

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

Text Books:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G. Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania & Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Resources:

https://archive.nptel.ac.in/courses/124/107/124107160/

Open Elective – I
(OE - I)

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE02301T	OE	**Electrical Safety Practices and Standards** (Common to CE, ECE, CSE, AI&DS, CSE-AI & CSE- AI&ML)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Electrical Fundamentals such as Current, Voltage, Resistance, and Power.
- Familiarity with Basic Electrical Components and Safe Handling Practices.

Course Objectives:

- To understand the principles of electrical safety, hazards, and the causes and effects of electrical shocks along with preventive measures.
- To apply safe practices during installation, operation, and maintenance of electrical systems in residential, commercial, industrial, and hazardous environments.
- To develop knowledge of earthing, safety management, and relevant rules and regulations including the Electricity Act, 2003 for ensuring safe electrical practices.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Describe the fundamentals of electrical safety, including electric shock effects, hazards, arc blast, and causes of electrical failures. (L3)

CO2: Analyze safety components such as conductors, insulators, overvoltage protection, static electricity control, and electrical safety equipment. (L4)

CO3: Analyze grounding and bonding concepts, including system and equipment grounding, earthing practices, and safety distance determination. (L4)

CO4: Analyze safety practices in electrical installations and usage environments including first aid procedures and case studies of electrical accidents. (L4)

CO5: Evaluate electrical safety standards, codes, and regulations including NFPA, OSHA, IEEE, NESC, and statutory requirements. (L5)

Unit I: Introduction to Electrical Safety:

Fundamentals of Electrical safety - Electric Shock-physiological effects of electric current- Safety requirements–Hazards of electricity–Arc–Blast–Causes for electrical failure.

Unit II: Safety Components:

Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment ‘s-Fire extinguishers for electrical safety.

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Unit III: Grounding:

General requirements for grounding and bonding- Definitions- System grounding - Equipment grounding - The Earth-Earthing Practices-Determining safe approach distance- Determining arc hazard category.

Unit IV: Safety Practices:

General first aid-Safety in handling handheld electrical appliances tools-Electrical safety in train stations-swimming pools, external lighting installations, medical locations - Case studies.

Unit V: Standards for Electrical Safety:

Electricity Acts- Rules & regulations- Electrical standards - NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate

Text Books:

1. Massimo A. G. Mitolo, ― Electrical Safety of Low-Voltage Systems‖, Mc Graw Hill, USA,2009.
2. Mohamed El-Sharkawi, ―Electric Safety-Practice and Standards‖, CRC Press, USA,2014

Reference Books:

1. Kenneth G. Mastrullo, Ray A. Jones,―The Electrical Safety Program Book‖, Jones
2. And Bartlett Publishers, London, 2nd Edition, 2011.
3. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
4. Fordham Cooper, W., ―Electrical Safety Engineering‖, Butter worth and Company, London,1986.
5. John Cadick, Mary Capelli -Schell Pfeffer, Dennis K. Neitzel, ―Electrical Safety Handbook, McGraw- Hill, New York, USA, 4th edition, 2012.

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE03301T	OE	**Sustainable Energy Technologies** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Energy Sources and Electrical Fundamentals.
- Familiarity with Environmental Science and Sustainability Concepts.

Course Objectives:

- To demonstrate the importance the impact of solar radiation, solar PV modules
- To understand the principles of storage in PV systems
- To discuss solar energy storage systems and their applications.
- To get knowledge in wind energy and bio-mass
- To gain insights in geothermal energy, ocean energy and fuel cells.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Analyze solar radiation parameters, solar geometry, and photovoltaic module characteristics to estimate solar energy availability and design basic off-grid solar PV systems. (L4)

CO2: Apply the principles of battery operation, selection, installation, and maintenance for effective energy storage in solar photovoltaic systems. (L3)

CO3: Analyze the performance of solar energy collection and storage methods for suitable thermal energy applications such as heating, cooling, drying, and power generation. (L4)

CO4: Evaluate the operational characteristics and energy conversion potential of wind and biomass energy systems for practical renewable energy applications. (L5)

CO5: Analyze the working principles, performance, and applications of geothermal, ocean, and fuel cell technologies in sustainable energy generation. (L4)

Unit I: Solar Radiation Modules and System:

Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

Solar PV Modules and PV Systems: PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

Unit II: Storage in PV Systems:

Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

Unit III: Solar Energy Collection:

Flat Plate and Concentrating Collectors, Classification of Concentrating Collectors, Orientation.

Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

Unit IV: Wind Energy:

Sources and Potentials, Horizontal and Vertical Axis Windmills, Performance Characteristics, Betz Criteria, Types of Winds, Wind Data Measurement.

Bio-Mass: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

Unit V: Geothermal Energy:
Origin, Applications, Types of Geothermal Resources, Relative Merits
Ocean Energy: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges
Fuel Cells: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J. K. Nayak/TMH
2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

Reference Books:

1. Principles of Solar Engineering - D. Yogi Goswami, Frank Krieth & John F Kreider / Taylor &Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa
4. Non-conventional Energy Source- G.D Roy/Standard Publishers

Online Resources:

1. https://nptel.ac.in/courses/112106318
2. https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPV7WE-r&si=-mwIa2X-SuSiNy13
3. https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPV7WE-r&si=Apfjx6oDfz1Rb_N3
4. https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE04301T	OE	**Electronic Circuits** (Common to CE, EEE, CSE, AI&DS, CSE-AI & CSE-AI&ML)	2	1	0	3

Pre-Requisites:

- Basic Knowledge of Semiconductor Devices and Electronic Components.
- Familiarity with Fundamental Circuit Analysis Concepts.

Course Objectives:

- To understand semiconductor diodes, their characteristics and applications.
- To explore the operation, configurations, and biasing of BJTs.
- To study the operation, analysis, and coupling techniques of BJT amplifiers.
- To learn the operation, applications and uses of feedback amplifiers and oscillators.
- To analyse the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Apply the concepts of semiconductor diodes and their applications in rectifiers, clipping, and clamping circuits. (L3)

CO2: Apply the operating principles of BJT and biasing techniques to analyze transistor circuits as amplifiers and switches. (L3)

CO3: Analyze the performance of single-stage and multistage amplifiers using different configurations and coupling schemes. (L4)

CO4: Analyze feedback amplifiers and oscillator circuits based on their characteristics and configurations(L4)

CO5: Evaluate the performance of operational amplifiers and their applications in analog circuit design. (L5)

Unit I: Semiconductor Diode and Applications:

Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode.

Unit -II: Bipolar Junction Transistor (BJT):

Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self-Bias, Bias Stability, Bias Compensation using Diodes.

Unit III: Single Stage Amplifiers:

Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage Amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

Unit IV: Feedback Amplifiers:

Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

Unit V: Op-Amp:

Classification of IC 'S, basic information of Op-amp, ideal and practical Op-amp, 741 op- amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp: Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

Text Books:

1. Electronics Devices and Circuits, J. Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

Reference Books:

1. Electronics Devices and Circuits Theory, R. L. Boylestad, Lousis Nashelsky and K. Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N. Salivahanan, and N. Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S. Sedra and K.C. Smith, 5th Edition, Oxford University Press.

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE05301T	**OE**	**Java Programming** (Common to CE, EEE & ECE)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Programming Concepts and Problem-Solving.
- Familiarity with Algorithms, Flowcharts, and Basic Computer Operations.

Course Objectives:

- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception
- handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java ap is for program development

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Apply fundamental object-oriented programming concepts in Java to develop simple programs using data types, variables, operators, and control statements. (L3)

CO2: Apply object-oriented concepts by designing and implementing classes and methods in Java, including constructors, method overloading, method overriding, access control, and parameter passing techniques. (L3)

CO3: Analyze and implement array operations and advanced object-oriented concepts in Java, including inheritance, interfaces, and dynamic method dispatch, to develop structured and e usable programs. (L4)

CO4: Apply Java packages, standard libraries, exception handling mechanisms, and I/O streams to develop robust programs with proper error handling and file processing. (L3)

CO5: Develop Java applications using strings, multithreading, JDBC, and JavaFX GUI. (L5)

Unit I: Object Oriented Programming:

Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, Variables, and Operators :Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with print f() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator? Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, for–Each for Loop, Break Statement, Continue Statement.

Unit II: Classes and Objects:

Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Unit III: Arrays:
Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.
Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Unit IV: Packages and Java Library:
Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java. Lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Autoun boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.
Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.
Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java

Unit V: String Handling in Java:
Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.
Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, inter thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface
Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:
1. JAVA one step ahead, Anitha Seth, B.L. Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object-Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:
1. The complete Reference Java, 11thedition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:
1. https://nptel.ac.in/courses/106/105/106105191/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE31301T	**OE**	**Fundamentals of Artificial Intelligence** (Common to CE, EEE & ECE)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Programming and Problem-Solving Concepts.
- Familiarity with Logic, Probability, and Discrete Mathematics.

Course Objectives:

- To learn the distinction between optimal reasoning Vs. human like reasoning.
- To understand the concepts of state space representation, exhaustive search, heuristic
- search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Apply intelligent agent concepts, problem-solving techniques, and search algorithms for solving AI-based problems. (L3)

CO2: Illustrate game-playing strategies, alpha-beta pruning, and constraint satisfaction techniques for decision-making problems. (L3)

CO3: Examine first-order logic, inference mechanisms, and knowledge representation techniques for AI reasoning systems. (L4)

CO4: Analyze planning algorithms, planning graphs, and hierarchical planning approaches for automated decision systems. (L4)

CO5: Examine probabilistic reasoning methods and Bayesian Networks for decision-making under uncertainty. (L4)

Unit I: Introduction to AI:

Intelligent Agents, Problem-Solving Agents,

Searching for Solutions: Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

Unit II: Games:

Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, Logic-Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

Unit III: First-Order Logic:

Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

Unit IV: Planning:

Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

Unit V: Probabilistic Reasoning:

Acting under Uncertainty, Basic Probability Notation Bayes 'Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Text Books:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

Reference Books:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE05302T	**OE**	**Quantum Technologies and Applications** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Physics and Mathematical Fundamentals.
- Familiarity with Waves, Energy, and Fundamental Computing Concepts.s

Course Objectives:

- To introduce the fundamentals of quantum mechanics relevant to quantum technologies.
- To explain key quantum phenomena and their role in enabling novel technologies.
- To explore applications in quantum computing, communication, and sensing.
- To encourage understanding of emerging quantum-based technologies and innovations.

Course Outcomes (COs):

After completion of the course, Students will be able to

CO1: Apply the fundamental principles of quantum theory such as superposition, entanglement, uncertainty principle, and wave-particle duality to explain the behaviour of quantum systems conceptually. (L3)

CO2: Analyze the structure and working of quantum information systems by comparing classical bits and qubits, coherence and decoherence, and the role of entanglement in information processing. (L4)

CO3: Analyze the theoretical challenges and requirements involved in building a quantum computer, including decoherence, noise, scalability, stability, and error correction. (L4)

CO4: Evaluate the principles and significance of quantum communication and quantum computing, including QKD, quantum gates, quantum parallelism, and the concept of the quantum internet. (L5)

CO5: Evaluate the applications, industrial relevance, future scope, and career opportunities in quantum technologies with reference to healthcare, materials, sensing, logistics, and global quantum initiatives. (L5)

Unit I: Fundamentals of Quantum Mechanics:

Classical vs Quantum Paradigm, Postulates of Quantum Mechanics, Wavefunction and Schrödinger Equation (Time-independent), Quantum states, Superposition, Qubits, Measurement, Operators, and Observables, Entanglement and Non-locality.

Unit II: Quantum Computing:

Qubits and Bloch Sphere, Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates, Quantum Circuits, Basic Algorithms: Deutsch-Jozsa. Gover ‘s, Shor ‘s (conceptual), Error Correction and Decoherence.

Unit III: Quantum Communication and Cryptography:

Teleportation & No-Cloning, BB84 Protocol, Quantum Networks & Repeaters, Classical vs Quantum Cryptography, Challenges in Implementation.

Unit IV: Quantum Sensors and Metrology:

Quantum Sensing: Principles and Technologies, Quantum-enhanced Measurements, Atomic Clocks, Gravimeters, Magnetometers, NV Centres, Industrial Applications.

Unit V: Quantum Materials and Emerging Technologies:

Quantum Materials: Superconductors, Topological Insulators, Quantum Devices: Qubits, Josephson Junctions, National Quantum Missions (India, EU, USA, China), Quantum Careers and Industry Initiatives

Text Books:

1. Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)
2. "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)

Reference Books:

1. "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
2. "Quantum Physics: A Beginner 's Guide" by Alastair I.M. Rae
3. "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
4. IBM Quantum Experience and Qiskit Documentation **(https://qiskit.org/)**

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB301T	**OE**	**Mathematics for Machine Learning and AI** (Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Matrices, Vectors, and Calculus.
- Familiarity with Probability, Statistics, and Algebra Fundamentals.

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
- Necessarily of harnessing alternate energy resources such as solar energy and its basic concepts.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

Course Outcomes (COs):
After completion of the course, Students will be able to:

CO1: Apply linear algebra concepts to ML techniques like PCA and regression. (L3)
CO2: Analyze probabilistic models and statistical methods for AI applications. (L4)
CO3: Implement optimization techniques for machine learning algorithms. (L3)
CO4: Utilize vector calculus and transformations in AI-based models. (L3)
CO5: Develop graph-based AI models using mathematical representations. (L5)

Unit I: Linear Algebra for Machine Learning
Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

Unit II: Probability and Statistics for AI:
Probability distributions: Gaussian, Binomial, Poisson. Bayes 'Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains

Unit III: Optimization Techniques for ML:
Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton 's method, BFGS method.

Unit IV: Vector Calculus &Transformations:
Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

Unit V: Graph Theory for AI:
Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Text Books:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.

2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Online Resources:

1. MIT– Mathematics for Machine Learning https://ocw.mit.edu
2. Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/
3. Deep AI – Mathematical Foundations for AI https://deepai.org

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB302T	**OE**	**Materials Characterization Techniques** (Common to all branches of Engineering**)**	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Materials Science and Solid-State Physics.
- Familiarity with Waves, Optics, and Fundamental Spectroscopy Concepts.

Course Objectives:

- To provide exposure to different characterization techniques.
- To explain the basic principles and analysis of different spectroscopic techniques.
- To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
- To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Analyze crystal structures and microstructural parameters of polycrystalline materials using powder X-ray diffraction techniques, including Bragg's law, intensity analysis, crystallite size estimation, and SAXS. (L4)

CO2: Apply Scanning Electron Microscopy (SEM) techniques to examine specimen preparation, imaging modes, and surface morphology of materials. (L3)

CO3: Analyze the principles and applications of Transmission Electron Microscopy (TEM) for image formation, diffraction studies, and microstructural characterization of materials. (L4)

CO4: Apply spectroscopic techniques such as UV-Visible, Raman, FTIR, and X-ray photoelectron spectroscopy to interpret the composition and structural characteristics of materials. (L3)

CO5: Analyze the electrical and magnetic properties of materials using conductivity measurements, Hall effect, and magnetization characterization techniques such as VSM and SQUID. (L4)

Unit I: Structure Analysis by Powder X-Ray Diffraction:

Introduction, Bragg 's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X- ray scattering (SAXS) (in brief).

Unit II: Microscopy Technique -1 –Scanning Electron Microscopy (SEM):

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

Unit III: Microscopy Technique -2 - Transmission Electron Microscopy (TEM):

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

Unit IV: Spectroscopy Techniques:
Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

Unit V: Electrical & Magnetic Characterization Techniques:
Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Text Books:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) PVt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwel land Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications – Khalid Sultan – Wiley – 2021.
4. **Materials Characterization Techniques -**Sam Zhang, Lin Li, Ashok Kumar - CRC Press - 2008

Online Resources:

1. https://nptel.ac.in/courses/115/103/115103030/
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB303T	**OE**	**Chemistry of Energy Systems** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Chemistry, Chemical Reactions, and Electrochemical Concepts.
- Familiarity with Energy Sources and Fundamental Thermodynamic Principles.

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
- Necessarily of harnessing alternate energy resources such as solar energy and its basic concepts.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Solve the problems based on electrode potential, Describe the Galvanic Cell Differentiate between Lead acid and Lithium-ion batteries, Illustrate the electrical double layer (L4)

CO2: Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells, Classify the fuel cell (L4)

CO3: Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion. (L3)

CO4: Apply the photo voltaic technology, demonstrate about solar energy and prospects Illustrate the Solar cells, discuss about concentrated solar power (L3)

CO5: Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures Describe the liquification methods. (L3)

Unit I: Electrochemical Systems:

Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction, Lead-acid, Nickel- cadmium, Lithium-ion batteries and their applications.

Unit II: Fuel Cell:

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

Unit III: Photo and Photo Electrochemical Conversions:

Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

Unit IV: Solar Energy:

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

Unit V: Hydrogen Storage:

Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel, and Organic hydrogen carriers

Text Books:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services and corporation)
2. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al. 4.Hydrogen storage by Levine Klebonoff

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHS301T	**OE**	**English for Competitive Examinations** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of English Grammar and Sentence Construction.
- Familiarity with Vocabulary, Comprehension, and Writing Skills.

Course Objectives:

- To enable the students to learn about the structure of competitive English
- To understand the grammatical aspects and identify the errors
- To enhance verbal ability and identify the errors
- To improve word power to answer competitive challenges
- To make them ready to crack competitive exams

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Apply grammatical concepts such as nouns, pronouns, adjectives, articles, degrees of comparison, adverbs, conjunctions, prepositions, and tag questions to identify and correct errors in sentences. (L3)

CO2: Apply knowledge of tenses, voice, reported speech, subject–verb agreement, modals, and conditional clauses to analyse and rectify grammatical errors in competitive examination contexts. (L4)

CO3: Analyze verbal ability questions involving sentence completion, analogies, word groups, critical reasoning, verbal deduction, para-jumbles, and reading comprehension to select appropriate responses. (L4)

CO4: Apply vocabulary-building strategies and reading techniques to interpret passages, infer meanings, and solve questions related to vocabulary, comprehension, and contextual usage effectively. (L3)

CO5: Evaluate and employ appropriate writing skills such as paragraph development, note-making, summarizing, précis writing, paraphrasing, essay writing, and punctuation for competitive examination requirements. (L5)

Unit I: Grammer-1:

Nouns – classification – errors – Pronouns -types-errors-Adjectives-types-errors-Articles-definite - indefinite - Degrees of Comparison – Adverbs - types - errors-Conjunctions-usage –Prepositions - usage -Tag Questions, types-identifying errors- Practice

Unit II: Grammer-2:

Verbs – tenses – structure – usages – negatives – positive s- time adverbs - Sequence of tenses - If Clause – Voice - active voice and passive voice- reported Speech – Agreement - subject and verb-Modals-Spotting Errors-Practices

Unit III: Verbal Ability:

Sentence completion-Verbal analogies-Word Groups-Instructions-Critical Reasoning-Verbal deduction- Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

Unit IV: Reading Comprehension and Vocabulary:
Competitive Vocabulary: Word Building – Memory Techniques-Synonyms, Antonyms, Affixes-Prefix & Suffix-One-word substitutes-Compound Words-Phrasal Verbs-Idioms and Phrases-Homophones- Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods

Unit V: Writing for Competitive Examinations:
Punctuation- Spelling rules- Word Order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs- Essay writing-types

Text Books:
1. Wren & Martin, English for Competitive Examinations, S. Chand & Co, 2021
2. Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.

Reference Books:
1. Hari Mohan Prasad, Objective English for Competitive Examination, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, English for Success in Competitive Exams, Oxford 2016
3. Shalini Verma, Word Power Made Handy, S Chand Publications
4. Neira, Anjana Dev & Co. Creative Writing: A Beginner's Manual. Pearson Education India, 2008.
5. Abhishek Jain, Vocabulary Learning Techniques Vol. I &II, RR Global Publishers 2013.
6. Michel Swan, Practical English Usage, Oxford,2006.

Online Resources:
1. https://www.grammar.cl/english/parts-of-speech.htm
2. https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3. https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active- passive-voice
4. https://languagetool.org/insights/post/verb-tenses/
5. https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
6. https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

B.Tech. – III Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHS302T	OE	**Entrepreneurship and New Venture Creation** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Understanding of Business, Markets, and Economic Concepts.
- Familiarity with Communication, Problem-solving, and Creative thinking skills.

Course Objectives:

- To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
- To encourage creativity and innovation
- To enable them to learn pitching and presentation skills
- To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
- To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

Course Outcomes (COs):

After completion of the course, Students will be able to:

CO1: Analyze entrepreneurial mindset, attributes, leadership, and role models to understand their impact on economic development. (L4)

CO2: Evaluate problems and customer needs using design thinking principles, customer segmentation, and persona validation. (L5)

CO3: Analyze customer needs to design solutions, develop MVP/prototypes, assess market potential, and size opportunities. (L4)

CO4: Evaluate business models, financial planning, and go-to-market strategies; develop lean canvas, sales plans, and funding approaches. (L5)

CO5: Evaluate venture scaling potential, develop persuasive storytelling, and prepare an investor-ready pitch deck. (L5)

Unit I: Entrepreneurship Fundamentals and Context:

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

Unit II: Problem & Customer Identification:

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, ‗Get out of the Building ‘and Venture Activity.

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing:

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer ‘s needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and

potential scale of the opportunity.
Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit IV: Business & Financial Model, Go-to-Market Plan:
Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.
Business planning: components of Business plan- Sales plan, People plan and financial plan.
Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analyzing financial performance. Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy. Choosing a form of business organization specific to your venture, identifying sources of
Funds: Debt & Equity, Map the Start-up Life-cycle to Funding Options.
Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit V: Scale Outlook and Venture Pitch Readiness:
Understand and identify potential and aspiration for scale vis-a-vis your venture idea. Persuasive Storytelling and its key components. Build an Investor ready pitch deck.
Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities, Ideation Techniques (Brainstorming, SCAMPER, Mind Mapping, Role-Playing etc).

Text Books:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha.
2. Entrepreneurship, Mc Graw Hill, 11th Edition. (2020)
3. Ries, E. The Lean Start-up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, (2011).
4. Osterwalder, A., & Pigneur, Y. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. John Wiley & Sons. (2010).

Reference Books:

1. Simon Sinek, Start with Why, Penguin Books limited. (2011)
2. Brown Tim, Change by Design Revised & Updated: How Design Thinking
3. Transforms Organizations and Inspires Innovation, Harper Business. (2019)
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

Online Resources:

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

B. Tech. – III Year
II Semester

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01312T	PC	Design of Steel Structures	2	1	0	3

Pre-Requisites: Fundamentals of strength of materials, Structural Analysis

Course Objectives:

- Understand the properties, types, and applications of structural steel in construction.
- Analyze the behaviour and design of bolted and welded connections for steel structures.
- Design tension and compression members, including built-up members and column bases.
- Develop steel structural elements such as beams, plate girders, roof trusses, and gantry girders.
- Apply plastic analysis concepts to the design of continuous beams and portal frames.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply limit state design principles to analyse structural steel properties, section types, and connection design using bolted and welded joints. (L3)

CO2: Analyze and design tension and compression members, including built-up sections and column bases for structural adequacy. (L4)

CO3: Develop design solutions for beams, plate girders, roof trusses, and gantry girders as per IS code standards. (L5)

CO4: Apply plastic analysis methods to design continuous beams and portal frames for efficient structural performance. (L3)

CO5: Evaluate the structural behaviour and design adequacy of steel members under various load combinations and configurations. (L5)

Unit I: Introduction to Structural Steel and Design of Connections:

General -Types of Steel -Properties of Structural Steel - I.S. Rolled Sections - Concept of Limit State Design - Design of Simple and Eccentric Bolted and Welded Connections - Types of Failure and Efficiency of Joint – Prying Action - Introduction to HSFG bolts

Unit II: Design of Tension and Compression Members:

Behaviour and Design of Simple and Built-Up Members Subjected to Tension - Shear Lag Effect Design of Lug Angles - Tension Splice - Behaviour of Short and Long Columns - Euler's Column Theory Design of Simple and Built-Up Compression Members with Lacings and Battens - Design of Column Bases - Slab Base and Gusseted Base

Unit III: Design of Beams:

Design of Laterally Supported and Unsupported Beams - Design of Built-Up Beams - Design of Plate Girders

Unit IV: Industrial Structures:

Design of Roof Trusses – Loads on Trusses – Purlin Design Using Angle and Channel Sections – Truss Design, Design of Joints and End Bearings–Design of Gantry Girder - Introduction to Pre-Engineered Buildings.

Unit V: Plastic Analysis and Design:

Introduction to Plastic Analysis - Theory of Plastic Analysis - Design of Continuous Beams and Portal Frames Using Plastic Design Approach.

Text Books:

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010
2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

Reference Books:

3. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India PVt Limited, 2013
4. Jack C. McCormac& Stephen F. C Sernak - Structural Steel Design, Pearson, 7th Edition, 2023.
5. William T. Segui & Farid Soleimani - Steel Design, Cengage, 7th Edition, 2023.
6. Sarwar Alam S Raz, Structural Design in Steel, New Age International Publishers, 2014
7. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

Online Resources:

https://nptel.ac.in/courses/105105162

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01313T	PC	Highway Engineering	2	1	0	3

Pre-Requisites: Fundamentals of Surveying, Engineering Mechanics and Strength of Materials

Course Objectives:

- Understand the history, importance, and planning aspects of highway development in India.
- Apply geometric design principles for highway alignment, sight distance, and curves.
- Analyze traffic characteristics, capacity, level of service, and road safety measures.
- Design flexible and rigid pavements using IRC guidelines.
- Evaluate highway construction materials, testing methods, and maintenance techniques.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply highway planning and alignment principles to design geometric elements including horizontal curves, gradients, and sight distances as per IRC standards. (L3)

CO2: Analyze traffic flow, volume, capacity, and level of service to implement effective road safety measures on highways. (L4)

CO3: Design flexible and rigid pavements using appropriate IRC guidelines considering subgrade, base, and surface course requirements. (L5)

CO4: Apply construction practices and material specifications for highway pavement and drainage system design. (L3)

CO5: Assess pavement condition, construction materials, and maintenance techniques to recommend suitable rehabilitation strategies. (L5)

Unit I: Planned Highway Development in India:

Highway development in India – Necessity for Highway Planning- Different Road Development Plans- Classification of Roads- Road Network Patterns – Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

Unit II: Geometric Design of Highways:

Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical Alignment-Gradients- Vertical curves.

Unit III: Traffic Engineering Studies:

Basic Parameters of Traffic-Volume, Speed and Density – Definitions and their inter relation – Highway capacity and level of service concept – factors affecting capacity and level of service - Traffic Volume Studies- Data Collection and Presentation-Speed studies- Data Collection and Presentation- - Road Accidents-Causes and Preventive measures- Accident Data Recording – Condition Diagram and Collision Diagrams.

Unit IV: Intersection Design:

Conflicts at Intersections- Channelization: Objectives –Traffic Islands and Design criteria- Types of At-Grade Intersections – Types of Grade-Separated Intersections- Rotary Intersection – Concept of Rotary and Design Criteria- Advantages and Disadvantages of Rotary Intersections.

Unit V: Pavement Design:
Types of Pavements – Difference Between Flexible and Rigid Pavements – Pavement Components – Sub Grade, Sub Base, Base and Wearing Course – Functions of Pavement Components – Design Factors – Flexible Pavement Design Methods – G.I Method, CBR Method, (As Per IRC 37-2002) – Design of Rigid Pavements – Critical Load Positions - Westergaard's Stress Equations – Computing Radius of Relative Stiffness and Equivalent Radius of Resisting Section – Stresses in Rigid Pavements – Design of Expansion and Contraction Joints in CC Pavements. Design of Dowel Bars and Tie Bars.

Text Books:

1. Highway Engineering – S.K. Khanna &C. E. G. Justo, Nem chand & Bros., 9th edition (2011).
2. Transportation Engineering, Volume I, C Venkat Ramaiah, Universities Press, 2015

Reference Books:

1. Principles of Highway Engineering by L. R. Kadiyali, Khanna Publishers
2. Traffic Engineering and Transportation Planning by L. R. Kadiyali and Lal- Khanna Publications 9th edition
3. Highway Engineering – Dr. S. K. Sharma, S. Chand Publishers 2014 edition

Online Resources:

https://nptel.ac.in/courses/105101087

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01314T	PC	Environmental Engineering	3	0	0	3

Pre-Requisites: Basics of Environmental Studies, Basic Civil Engineering and Chemistry

Course Objectives:

- Understand the sources, demand estimation, and quality parameters of water.
- Apply water treatment processes for purification and supply.
- Analyze storage, distribution, and operation of water supply systems.
- Design sewerage systems, stormwater drainage, and plumbing networks.
- Evaluate sewage treatment, sludge management, and water reuse methods.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of water quality standards to explain sources, impurities, and significance of waterborne diseases for public health protection. (L3)

CO2: Design unit processes of water treatment plants including coagulation, sedimentation, filtration, and disinfection systems. (L5)

CO3: Analyze water distribution networks and pumping station requirements for effective water supply management. (L4)

CO4: Design sewerage systems including stormwater and sanitary sewers considering hydraulic and environmental criteria. (L5)

CO5: Assess sewage treatment methods and advanced wastewater management techniques for environmental compliance. (L5)

Unit I: Water Supply:

Estimation of Surface and Subsurface Water Resources - Predicting Demand for Water- Impurities of Water and Their Significance - Physical, Chemical and Bacteriological Analysis - Waterborne Diseases - Standards for Potable Water. Intake of Water: Pumping and Gravity Schemes.

Unit II: Water Treatment:

Objectives - Unit Operations and Processes - Principles, Functions, and Design of Water Treatment Plant Units, Aerators of Flash Mixers, Coagulation and Flocculation – Clarifloccuator- Plate and Tube Settlers – Pulsator Clarifier - Sand Filters - Disinfection - Softening, Removal of Iron and Manganese - Defluoridation- Softening - Desalination Process - Residue Management - Construction, Operation and Maintenance Aspects

Unit III: Water Storage and Distribution:

Storage and Balancing Reservoirs - Types, Location and Capacity. Distribution System: Layout, Hydraulics of Pipe Lines, Pipe Fittings, Valves Including Check and Pressure Reducing Valves, Meters, Analysis of Distribution Systems, Leak Detection, Maintenance of Distribution Systems, Pumping Stations and Their Operations - House Service Connections.

Unit IV: Planning and Design of the Sewerage System:

Characteristics and Composition of Sewage - Population Equivalent - Sanitary Sewage Flow Estimation - Sewer Materials - Hydraulics of Flow in Sanitary Sewers - Sewer Design - Storm Drainage-Storm Runoff Estimation - Sewer Appurtenances - Corrosion in Sewers - Prevention and Control – Sewage Pumping-Drainage in Buildings - Plumbing Systems for Drainage

Unit V: Sewage Treatment and Disposal:

Objectives – Selection of Treatment Methods – Principles, Functions, - Activated Sludge Process and Extended Aeration Systems – Trickling Filters – Sequencing Batch Reactor (SBR) – UASB – Waste Stabilization Ponds – Other Treatment Methods – Reclamation and Reuse of Sewage – Recent Advances in Sewage Treatment – Construction, Operation and Maintenance Aspects. – Discharge Standards-Sludge Treatment -Disposal of Sludge

Text Books:

1. Environmental Engineering by H. S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill Education (India) PVt Ltd, 2014
2. Environmental Engineering, I and II by BC Punmia, Std. Publications.

Reference Books:

1. Environmental Engineering, I and II by SK Garg, Khanna Publications.
2. Environmental Pollution and Control Engineering CS Rao, Wiley Publications
3. Waste water engineering by Metcalf and Eddy, McGraw Hill, 2015.
4. Environmental Engineering by D. P. Sincero and G.A Sincero, Pearson 2015.
5. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr. Wiley, 2007.

Online Learning Resources:

https://nptel.ac.in/courses/103107084

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01313P	PC	Highway Engineering lab	0	0	3	1.5

Pre-Requisites: Basics of Highway Engineering and Engineering Materials

Course Objectives:

- Understand the properties and behaviour of aggregates and bitumen used in highway construction.
- Perform standard laboratory tests on aggregates and bitumen to evaluate their suitability for road construction.
- Analyze the strength, durability, and performance characteristics of pavement materials.
- Assess the quality and compliance of highway materials with standard specifications.
- Develop hands-on skills for material testing and interpretation of test results.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply standard test procedures to determine physical properties of coarse aggregates including specific gravity, water absorption, and shape characteristics. (L3)

CO2: Evaluate mechanical properties of aggregates including abrasion resistance, impact strength, and crushing value for pavement suitability. (L5)

CO3: Analyze physical and chemical properties of bituminous materials and perform Marshall stability tests to assess optimum binder content for pavement design. (L4)

List of Experiments:

I. Test on Aggregates:

1. Specific Gravity Determination of the Coarse Aggregate Sample
2. Determination of Abrasion Value of the Coarse Aggregate Sample.
3. Determination of Impact Value of Coarse Aggregate
4. Determination of Elongation Index of Coarse Aggregate
5. Determination of Flakiness Index of Coarse Aggregate
6. Determination of Aggregate Crushing Value of Coarse Aggregate
7. Determination of Water Absorption Capacity of the Coarse Aggregate Sample.

II. Test on Bitumen:

1. Specific Gravity Determination of The Bitumen/Asphalt Sample.
2. Penetration Test on Bitumen.
3. Viscosity Determination of Bituminous Binder
4. Determination of Softening Point of The Asphalt/Bitumen Sample
5. Determination of Ductility Value of The Bitumen Sample
6. Estimation of Loss of Bitumen on Heating
7. Bitumen Extraction Test

Text Books:

1. Highway Material Testing Manual, Khanna, Justo and Veera Raghavan, Nem Chand Brothers

Reference Books:

1. IS 383 :1993 —Specification for Coarse and Fine Aggregates from Natural Sources for Concrete
2. 1S 1201 -1220 (1978) —Methods for testing tars and bituminous materials
3. IRC SP 53 -2010 —Guidelines on use of modified bitumen

Online Resources: https://ts-nitk.vlabs.ac.in/

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01314P	PC	Environmental Engineering lab	0	0	3	1.5

Pre-Requisites: Fundamentals of Environmental Engineering, Chemistry and Fluid Mechanics

Course Objectives:

- Understand the principles and methods of water and wastewater sampling and preservation.
- Perform standard laboratory tests to determine water quality parameters.
- Analyze wastewater characteristics and assess pollution levels.
- Evaluate the effectiveness of treatment processes using chemical and biological tests.
- Develop hands-on skills in advanced laboratory techniques for environmental monitoring.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply appropriate sampling and preservation techniques to measure physical and chemical parameters of water and wastewater samples. (L3)

CO2: Analyze key water quality indicators including BOD, COD, turbidity, and chlorine content through standard laboratory methods. (L4)

CO3: Evaluate the efficiency of water treatment processes and perform microbiological analysis for coliform detection and sludge characterization. (L5)

List of Experiments:

I. Analysis of Water Sample:

1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water

II. Analysis of Waste Water Sample:

1. Estimation of suspended, volatile and fixed solids
2. Determination of Sludge Volume Index in waste water
3. Determination of Dissolved Oxygen
4. Estimation of B.O.D.
5. Estimation of C.O.D.
6. Determination of TKN and Ammonia Nitrogen in wastewater
7. Determination of total and faecal coliform (Demonstration only)

Note: Minimum 10 out of the above experiments are to be carried out.

Text Books:

1. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.

2. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

Reference Books:

1. Environmental Engineering Laboratory Manual by Dr. S.K. Panigrahi, L. Mohanty, S.K. Kataria& Sons

Online Resources:

1. https://ee1-nitk.vlabs.ac.in/
2. https://ee2-nitk.vlabs.ac.in/

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24SE01303S	SE	Building Information Modeling	0	1	2	2

Pre-Requisites: Basics of Engineering Graphics, AutoCAD and Building Planning

Course Objectives:

- Understand the fundamentals of Building Information Modeling (BIM) and Autodesk Revit.
- Develop proficiency in Revit ‘s basic drawing and editing tools for structural and architectural modeling.
- Create 3D models of buildings, including walls, floors, ceilings, roofs, stairs, and railings.
- Analyze different components such as curtain walls, doors, windows, and structural elements.
- Apply various visualization and detailing techniques to generate callouts, elevations, and sections.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply BIM fundamentals and Autodesk Revit interface to explain the workflow and principles of building information modelling. (L3)

CO2: Apply basic drawing, editing, and modification tools in Revit for creating and modifying building models effectively. (L3)

CO3: Analyze architectural elements such as walls, doors, windows, floors, ceilings, and roofs using BIM modelling techniques. (L4)

CO4: Construct structural elements including grids, columns, stairs, railings, and ramps using BIM tools for structural detailing. (L5)

CO5: Evaluate 3D views, sections, and elevations generated from BIM models for visualization, coordination, and project documentation. (L5)

List of Experiments:

1. Introduction to BIM & Autodesk Revit - About Autodesk and AutoCAD, Workflow and BIM, Revit Terms, Overview of The Interface, Starting Projects, Viewing Commands.
2. Basic Drawing and Editing tools - Using General Drawing tools, Editing Elements, Working with Modification tools.
3. Setting Up Levels and Grids - Setting up Levels and Grids, Creating Structural Grids, Adding Columns, Linking and Importing CAD files.
4. Modeling Walls Modelling Walls, Modifying Walls, Model Exterior Shell, Add Interior Walls.
5. Working with Doors and Windows Inserting Doors and Windows, Loading Door and Window Types from Library, Creating Additional Door and Window Sizes.
6. Working with Curtain Walls Creating Curtain Walls, Adding Curtain Grids, Working with Curtain Wall Panels, Attaching Mullions to Curtain Grids.
7. Working with Views Setting the View Display, Duplicating Views, Adding Callout Views, Elevations and Sections. Adding Components Adding Component, Modifying Component, Working with Elements.
9. Modelling floors Modelling& Modifying Floors, Joining Geometry, Creating Shaft Openings, Creating Sloped Floors

10. Modelling Ceilings & Roofs Modelling Ceilings, Adding Ceiling Fixtures, Creating Ceiling Soffits, Modelling Roofs
11. Modeling Stairs and Railing Creating Component Stairs, Modifying Component Stairs, Working with Railings, Sketching Custom Stairs, Creating Ramps.

Text Books:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston ―BIM HANDBOOK, Wiley, 2ndEdition, 2011
2. Wing, Eric. Autodesk Revit Architecture 2017: No Experience Required. Indianapolis: John Wiley & Sons, 2016

Reference Books:

1. Kim, Marcus, Lance Kirby, and Eddy Krygiel. Mastering Autodesk Revit 2017 for architecture. 1st ed. IN polis, IN: John Wiley & Sons, 2016.
2. Garber, Richard. BIM Design: Realizing the Creative Potential of Building Information Modeling. AD Smart 02. Chichester, U.K.: Wiley, 2004
3. Peter B. and Nigel D., ―BIM in Principle and in Practice‖, 1 st Edition, ICE Publishing, 2014.
4. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors,
5. Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, John Wiley & Sons, 2008.
6. BIM and Construction Management: Proven tools, Methods, and Workflows, Brad Hardin, Sybex, 2009.
7. Building Information Modeling: BIM in Current and Future Practice, Karen Kensek and Douglas Noble, Wiley, 2014, First Edition.

Online Resources:

1. https://minnodillc.com/building-information-modeling-bim/
2. https://www.skyfilabs.com/online-courses/building-information-modelling-course

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24MCHS309A	MC	**Technical Paper Writing and Intellectual Proper Rights** (Common to all branches of Engineering)	2	0	0	-

Pre-Requisites:

- Basic Knowledge of Academic Writing and Research Fundamentals.
- Familiarity with Technical Communication and Ethical Practices.

Course Objectives:

- To enable the students to practice the basic skills of research paper writing
- To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
- To practice the basic skills of performing quality literature review
- To help them in knowing the significance of real-life practice and procedure of Patents.
- To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply clarity, precision, and coherence to produce effective and plagiarism-free technical writing. (L4)

CO2: Analyze key components of a research paper to develop a well-structured synopsis. (L4)

CO3: Evaluate publication processes and citation practices to prepare accurate and ethical manuscripts. (L4)

CO4: Analyze intellectual property types, treaties, and trademark processes to assess protection mechanisms. (L4)

CO5: Examine copyright and patent laws to determine ownership and registration procedures. (L4)

Unit I: Principles of Technical Writing:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language –highlighting your findings-discussing your limitations –hedging and criticizing –plagiarism and paraphrasing.

Unit II: Technical Research Paper Writing:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature-Problems and Framing Research Questions- Synopsis.

Unit III: Process of Research and Publication:

Process of research: publication mechanism: types of journals- indexing-seminars- conferences-proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results-citation rules.

Unit IV: Introduction to Intellectual Property:

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, importance of intellectual property rights.

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Unit V: Law of Copyrights and Patents:

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of Patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Text Books:

1. Deborah. E. Bouchoux, Intellectual Property Rights, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. Technical Communication Principles and practices. Oxford.

Reference Books:

1. R. Myneni, Law of Intellectual Property, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, Intellectual Property Rights Tata Mcgraw Hill, 2001
3. P.Naryan, Intellectual Property Law, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. English for Writing Research Paper Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, Technical Writing Style

Online Resources:

1. https://theconceptwriters.com.pk/principles-of-technical-writing/
2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting .html
3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting .html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

Professional Elective – II
(PE - II)

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01304T	PE	Design of Earthquake Resistant Structures	2	1	0	3

Pre-Requisites: Basics of Structural Analysis, Strength of Materials, and Reinforced Concrete Structures

Course Objectives:

- Understand the fundamental concepts of engineering seismology, including earthquake phenomena, seismic waves, and measuring instruments.
- Analyze the principles of structural vibrations, degrees of freedom, and dynamic response of structures to earthquake ground motions.
- Evaluate conceptual design strategies, seismic design principles, and methods for improving earthquake resistance in structures.
- Apply earthquake-resistant design principles to reinforced concrete and masonry buildings using IS codes and lateral force methods.
- Assess the role of structural walls non-structural elements, and ductility considerations in enhancing earthquake resistance.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of earthquake mechanisms, seismic waves, and seismic zones to explain measuring techniques and instruments. (L3)

CO2: Analyze vibratory systems, SDOF models, damping effects, and earthquake-induced dynamic forces for structural response evaluation. (L4)

CO3: Evaluate conceptual design strategies, ductility factors, and seismic design methods for ensuring structural resilience. (L5)

CO4: Apply IS code provisions and lateral force methods for seismic design of reinforced concrete and masonry buildings. (L3)

CO5: Assess the significance of structural walls, non-structural elements, and ductile detailing in enhancing earthquake resistance. (L5)

Unit I: Engineering Seismology:

Earthquake Phenomenon - Cause of Earthquakes-Faults- Plate Tectonics- Seismic Waves- Terms Associated with Earthquakes-Magnitude/Intensity of An Earthquake-Scales- Energy Released-Earthquake Measuring Instruments Seismogram -Seismoscope, Seismograph, - Strong Ground Motions- Seismic Zones of India.

Theory of Vibrations:

Elements of A Vibratory System- Degrees of Freedom-Continuous System- Lumped Mass Idealization-Oscillatory Motion-Simple Harmonic Motion-Free Vibration of Single Degree of Freedom (SDOF) System- Undamped and Damped-Critical Damping-Logarithmic Decrement-Forced Vibrations-Harmonic Excitation-Dynamic Magnification Factor-Excitation by Rigid Based Translation for SDOF System-Earthquake Ground Motion.

Unit II: Conceptual Design:

Introduction-Functional Planning-Continuous Load Path-Overall Form-Simplicity and Symmetry-Elongated Shapes-Stiffness and Strength-Horizontal and Vertical Members-Twisting of Buildings-Ductility-Ductility Relationships-Flexible Buildings-Framing Systems-Choice of Construction Materials-Unconfined Concrete-Confined Concrete-Masonry-Reinforcing Steel.

Introduction to Earthquake Resistant Design:
Seismic Design Requirements-Regular and Irregular Configurations-Basic Assumptions-Design Earthquake Loads-Basic Load Combinations-Permissible Stresses-Seismic Methods of Analysis-Factors in Seismic Analysis-Equivalent Lateral force Method.

Unit III: Reinforced Concrete Buildings:
Principles of Earthquake Resistant Deign of RC Members-Structural Models for Frame Buildings - Seismic Methods of Analysis- Is Code Based Methods for Seismic Design - Vertical Irregularities - Plan Configuration Problems- Lateral Load Resisting Systems- Determination of Design Lateral forces as Per Is 1893 (Part-1):2016- Equivalent Lateral force Procedure- Lateral Distribution of Base Shear.

Unit IV: Masonry Buildings:
Introduction- Elastic Properties of Masonry Assemblage- Categories of Masonry Buildings-Behaviours of Unreinforced and Reinforced Masonry Walls- Behaviour of Walls- Box Action and Bands- Behaviours of Infill Walls- Improving Seismic Behaviours of Masonry Buildings- Load Combinations and Permissible Stresses- Seismic Design Requirements- Lateral Load Analysis of Masonry Buildings.

Unit V: Structural Walls and Non-Structural Elements:
Strategies in The Location of Structural Walls- Sectional Shapes- Variations in Elevation- Cantilever Walls Without Openings –Failure Mechanism of Non-Structures- Effects of Non-Structural Elements On Structural System- Analysis of Non-Structural Elements- Prevention of Non-Structural Damage Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction-Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors Affecting Ductility- Ductile Detailing Considerations as Per Is 13920-2016 - Behaviours of Beams, Columns and Joints in RC Buildings During Earthquakes

Text Books:

1. Earthquake Resistant Design of structures – S. K. Duggal, Oxford University Press
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.

Reference Books:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons.
2. Earthquake Resistant Design of Building structures by Vinod Hosur, Wiley India Pvt. Ltd.
3. Elements of Mechanical Vibration by R.N. Iyengar, I.K. International Publishing House Pvt. Ltd.
4. Masory and Timber structures including earthquake Resistant Design –Anand S. Arya, Nem chand & Bros.
5. Earthquake Tips – Learning Earthquake Design and Construction, C.V.R. Murthy
6. BIS Codes: 1. IS 1893(Part-1):2016 or Latest codes; 2. IS 13920:2016. 3. IS 4326. 4. IS 456:2000 or latest.

Online Resources:
https://nptel.ac.in/courses/105107204

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01305T	PE	Open Channel Flow	2	1	0	3

Pre-Requisites: Fundamentals of Fluid Mechanics, Hydraulics and Mathematics

Course Objectives:

- Explain the principles governing fluid flow in pipelines and networks, including steady and unsteady flow conditions.
- Apply fundamental concepts of uniform and varied flow in open channels for analyzing hydraulic structures and networks.
- Analyze the behaviours of unsteady flows in open channels, including wave motion and dam break scenarios.
- Evaluate sediment transport mechanisms and their impact on hydraulic structures, reservoirs, and river morphology.
- Design and assess hydraulic models, flow measurement devices, and physical models for hydraulic applications.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the principles of fluid flow in pipelines and open channels to describe steady and unsteady flow conditions. (L3)

CO2: Analyze uniform and varied flow in open channels using theoretical and computational approaches for hydraulic design. (L4)

CO3: Analyze the impact of unsteady flow phenomena such as surges and dam breaks in open channels for flood mitigation. (L4)

CO4: Evaluate sediment transport processes and their influence on river morphology and performance of hydraulic structures. (L5)

CO5: Develop and validate hydraulic models for flow measurement and physical modelling applications in fluid mechanics. (L5)

Unit I: Hydraulics of Pipelines and Pipe Networks:

Review of Fluid Mechanics. Reynolds Transport Theorem and Applications. Steady Flow Analysis of Pipe Network Systems. Unsteady Flows - Basic Equations of Water Hammer, Solution By Method of Characteristics. Network Analysis

Unit II: Steady Varied Flows in Open Channels:

Basic Concepts of Uniform Flow. Specific Energy and Specific force Concepts. Dynamic Equation for Spatially Varied Flows. Flow Profile Computations. Introduction to Hec-Ras. Spatially Varied Flows and Rapidly Varied Flows – Applications.

Unit III: Unsteady Flows in Open Channels:

Equations of Motion. Uniformly Progressive Wave. Rapidly Varied Unsteady Flow – Positive and Negative Surges. Dam Break Problem

Unit IV: Sediment Transport:

Sediment Properties – Inception of Sediment Motion – Bed forms. Bed Load Suspended Load – total Sediment Transport. Design of Stable Channels and Regime Channels. Reservoir Sedimentation and Trap Efficiency.

Unit V: Flow Measurements and Hydraulic Modeling:
Sharp-Crested Weirs, Broad-Crested Weirs, Critical Depth Flumes. Recent Advancement in Open Channel Flow Measurements. Physical Modelling in Hydraulics. Dimensional Analysis. Modelling Closed Flows and Free Surface Flows. Distorted Models. Design of Physical Models.

Text Books:

1. Flow in Open Channels, Subramanya K., Tata McGraw Hill Pub., N Delhi2015
2. Flow through Open Channels, Rajesh Srivastava, Oxford Univ. Press. N Delhi, 2011
3. Open Channel Hydraulics, Chow, V.T., McGrawHillInc.NYork,1979

Reference Books:

1. Open Channel Hydraulics, French, R.H., McGraw Hill Pub Co., NYork,1986
2. Open Channel Hydraulics, Terry Sturm, Tata McGraw Hill Pub. N Delhi,2011

Online Resources:

https://nptel.ac.in/courses/105/106/105106114/

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01306T	PE	Foundation Engineering	2	1	0	3

Pre-Requisites: Basics of Soil Mechanics, Engineering Geology and Strength of Materials

Course Objectives:

- Understand the need for soil exploration and various methods used in site investigations.
- Analyze the stability of slopes under different conditions using various stability methods.
- Apply earth pressure theories to analyse retaining walls and soil pressures.
- Evaluate the bearing capacity and settlement characteristics of shallow foundations.
- Assess the load-carrying capacity and settlement of deep foundations, including pile and well foundations.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply principles of soil exploration, field testing, and investigation to prepare soil reports for foundation design. (L3)

CO2: Analyze slope stability using different failure theories and numerical methods for safe geotechnical construction. (L4)

CO3: Apply earth pressure theories to determine the stability of retaining walls under various loading conditions. (L3)

CO4: Evaluate the bearing capacity and settlement of shallow foundations using theoretical and field methods. (L5)

CO5: Analyze deep foundations including pile and well foundations for their load-carrying capacity and settlement behaviour. (L4)

Unit I: Soil Exploration:

Need - Methods of Soil Exploration - Boling and Sampling Methods — Field Tests Penetration Tests — Plate Load Test — Pressure Meter — Planning of Programme and Preparation of Soil Investigation Report.

Unit II: Earth Slope Stability:

Infinite and Finite Earth Slopes - Types of Failures – Factor of Safety of Infinite Slopes Stability Analysis by Swedish Arc Method, Standard Method of Slices, Friction Circle Method — Taylor's Stability Number- Stability of Slopes of Earth Dams Under Different Conditions.

Unit III: Earth Pressure Theories:

Rankine's Theory of Pressure - Earth Pressures in Layered Soils — Coulomb's Earth Pressure Theory — Rebhann's and Cullman's Graphical Method.

Retaining Walls: Types of Retaining Walls -Stability of Retaining Walls.

Unit IV: Shallow Foundations:

Types - Choice of Foundation Location of Depth Bearing Capacity — Terzaghi 'S, Meyerhof's and Skempton's Methods

Allowable Bearing Pressure:

Safe Bearing Pressure Based on N- Value Allowable Bearing Pressure; Safe Bearing Capacity and Settlement from Plate Load Test Allowable Settlements of Structures — Estimation of Consolidation of Settlement.

Unit V: Pile Foundations:

Types of Piles — Load Carrying Capacity of Piles Based on Static Pile Formulae — Dynamic Pile Formulae — Pile Load Tests Load Carrying Capacity of Pile Groups in Sands and Clays — Settlement of Pile Groups.

Well Foundations:

Types - Different Shapes of Wells - Components of Wells Functions and Forces on Well Foundation — Sinking of Wells Tilts and Shifts.

Text Books:

1. Geotechnical Engineering by C. Venkataramaiah, New Age Publications (2002).
2. Soil Mechanics and Foundation Engineering by Arora, Standard Publishers and Distributors, Delhi 7th edition 2009
3. Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi publications PVt. Ltd., New Delhi 17th edition 2017.

Reference Books:

1. Soil Mechanics and Foundation Engineering by Purushtoma Raj, Pearson Publications 2nd edition 2013
2. Principles of Foundation Engineering by Das, B.M., - (1999)–6th edition (Indian edition) Thomson Engineering
3. Foundation Engineering by Varghese, P. C., Prentice Hall of India., New Delhi.
4. Foundation Engineering by V. N. S. Murthy, CRC Press, New Delhi.

Online Resources:

https://nptel.ac.in/courses/105105176

Professional Elective – III (PE - III)

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01307T	PE	Cost Effective Housing Techniques	3	0	0	3

Pre-Requisites: Basics of Building Materials, Building Construction and Concrete Technology

Course Objectives:

- Analyze the housing scenario in urban and rural areas, including challenges in housing finance and urban planning.
- Explore and evaluate innovative low-cost housing technologies for sustainable construction.
- Investigate alternative building materials and infrastructure services for cost-effective housing solutions.
- Assess rural housing techniques, including traditional mud housing, soil stabilization, and fire treatment for roofing.
- Develop strategies for housing in disaster-prone areas, with a focus on earthquake, cyclone, and flood-resistant construction.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of urban and rural housing to examine the role of finance and planning in housing development. (L3)

CO2: Evaluate and recommend cost-effective construction techniques including prefabrication and innovative roofing/flooring systems. (L5)

CO3: Assess the feasibility of alternative building materials and infrastructure solutions for low-cost housing applications. (L5)

CO4: Analyze traditional rural housing methods and propose modern techniques for improving rural housing quality. (L4)

CO5: Design housing solutions for disaster-prone areas by incorporating earthquake, cyclone, and flood-resistant construction strategies. (L5)

Unit I: Housing Scenario:

Introducing - Status of Urban Housing - Status of Rural Housing

Housing Finance: Introducing - Existing Finance System in India - Government Role as Facilitator - Status at Rural Housing Finance – Impedimently in Housing Finance and Related Issues

Land Use and Physical Planning for Housing:

Introduction - Planning of Urban Land - Urban Land Ceiling and Regulation Act - Efficiency of Building Bye Lass -Residential Densities

Housing the Urban Poor: Introduction - Living Conditions in Slums - Approaches and Strategies for Housing Urban Poor.

Unit II: Development and Adoption of Low-Cost Resilient Housing Technology:

Introduction - Adoption of Innovative Cost-Effective Construction Techniques - Adoption of Precast Elements in Partial Prefabrication- Adopting of total Prefabrication of Mass Housing in India- General Remarks on Pre Cast Rooting/Flooring Systems -Economical Wall System - Single Brick Thick Loading Bearing Wall - 19cm Thick Load Bearing Masonry Walls - Half Brick Thick Load Bearing Wall – Fly-Ash Gypsum Thick for Masonry- Stone Block Masonry - Adoption of Precast R.C. Plank and Join System for Roof/Floor in The Building.

Unit III: Alternative Building Materials for Low-Cost Housing:

Introduction - Substitute for Scarce Materials – Ferro-Cement - Gypsum Boards – Timber

Substitutions - Industrial Wastes - Agricultural Wastes - Alternative Building Maintenance
Low-Cost Infrastructure Services: Introduction - Present Status - Technological Options - Low-Cost Sanitation - Domestic Wall- Water Supply, Energy.

Unit IV: Rural Housing:
Introduction Traditional Practice of Rural Housing Continuous - Mud Housing Technology Mud Roofs - Characteristics of Mud - Fire Treatment for Thatch Roof - Soil Stabilization -Rural Housing Program

Unit V: Housing in Disaster Prone Areas:
Introduction – Earthquake - Damages to Houses - Traditional Prone Areas - Type of Damages and Railways of Non-Engineered Buildings - Repair and Restore Action of Earthquake Damaged Non-Engineered Buildings Recommendations for Future Constructions. Requirements of Structural Safety of Thin Precast Roofing Units Against Earthquake Forces Status of R&D in Earthquake Strengthening Measures - Floods, Cyclone, Future Safety

Text Books:

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low-cost housing by A. K. Lal – Newage international publishers.
3. Low-cost Housing – G.C. Mathur by South Asia Books

Reference Books:

1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai. G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama Chandra Murthy &G. Annamalai. E. & F. N. Spon Publishers

Online Resources:
https://nptel.ac.in/courses/124107001

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01308T	PE	Watershed Management	3	0	0	3

Pre-Requisites: Basics of Hydrology, Irrigation Engineering and Environmental Engineering

Course Objectives:

- Understand the concept of watershed management, stakeholder roles, pollution sources, and environmental guidelines for water quality.
- Analyze soil erosion processes, sediment yield, and wetland hydrology, including the role of water in wetland ecosystems.
- Evaluate surface water and groundwater interactions, wetland water quality, and hydrological models for effective watershed planning.
- Apply principles of wetland hydrologic assessment, water harvesting, and watershed treatment system design to real-world scenarios.
- Assess irrigation planning, participatory water management, and water footprint concepts to ensure sustainable water resource utilization.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply watershed management concepts and environmental policies to explain pollution control strategies related to water quality. (L3)

CO2: Analyze erosion processes, wetland water budgets, and sediment transport models to assess land degradation and conservation needs. (L4)

CO3: Evaluate surface and groundwater interactions, wetland treatment efficiency, and hydrological models for integrated water resource management. (L5)

CO4: Apply water harvesting techniques, hydrologic modelling, and wetland design methods for sustainable watershed management. (L3)

CO5: Assess irrigation water management strategies, drought mitigation policies, and the role of water footprint in agricultural sustainability. (L5)

Unit I: Introduction:

Concept of Watershed, Introduction to Watershed Management, Different Stakeholders and Their Relative Importance, Watershed Management Policies and Decision Making, Watershed Management Practices in Arid and Semiarid Regions, Short Term and Long-Term Strategic Planning, Types and Sources of Pollution, Environmental Guidelines for Water Quality, Perspective on Recycle and Reuse.

Unit II: Erosion:

Morphometry, Soil Erosion - Erosion - Factors Affecting Erosion, Effects of Erosion on Land Fertility and Land Capability, Soil Erosion Modelling, Erosivity and Erodibility - Sediment Yield and Sedimentation- Wetland Definitions and The Role of Water in Wetland Structure and Function, Introduction to Wetland Water Budgets and Hydro-Period Components of The Water Budget: Inflows, Outflows, and Storage, Precipitation and Runoff, Evapotranspiration

Unit III: Surface Water:

Surface Water Flows: Structures and Channels, Groundwater-Surface Water Exchange in Wetlands, Surface Water Flows Ii and Wetland Hydrology Case Studies, Flow and Mixing in Wetlands Wetland Water Quality Information: Nutrients, Organic/Inorganic Contaminants, Sediments and Colloids, Wetland Transport Models I: Plug Flow, Cstrs and Cstrs in Series; Intro to Method of Moments.

Unit IV: Wetland Hydrologic Assessment:
Physical and Biological Processes, Anthropogenic and Climate Change Impacts on Wetland Hydrology, Modelling Wetland Hydrology, Hydraulics, and Hydrodynamics, Introduction to Wetland Treatment Systems Design - Water Harvesting: Rainwater Harvesting, Catchment Harvesting, Harvesting Structures - Model Watershed – Government and Ngo Projects.

Unit V: Irrigation Management:
Rain Water Management. Planning and Operation of Irrigation Systems. Conjunctive Use of Water. Participatory Irrigation Management and Integrated Water Resources Management (IWRM), Water Management Policy During Droughts. Predicting Effect of Water Shortage on Crops. Introduction to Water Footprint of Crops and Its Applications. Blue, Green and Grey Water Foot Print.

Text Books:
1. T. O. Randhir, Watershed Management: Issues and Approaches, IWA Publishing, 2006
2. J. V. S. Murty, Watershed Management, New Age International, 2013

Reference Books:
1. D. K. Majumdar, Irrigation Water Management, Prentice Hall, 2014
2. K. N. Brooks, P. F. Folliott, J. A. Magner, Hydrology and the Management of Watersheds, Wiley-Blackwell, Fourth edition, 2012
3. E. M. Tideman, Watershed Management: Guidelines for Indian Conditions, Omega Scientific Publishers, 1996
4. R. Rajora, Integrated Watershed Management: Field Manual for Equitable, Productive and Sustainable Development, Rawat Publications, 2019

Online Resources:
https://nptel.ac.in/courses/105101010
https://nptel.ac.in/courses/126105334

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01309T	PE	Advanced Structural Analysis	2	1	0	3

Pre-Requisites: Basics of Structural Analysis, Strength of Materials and Theory of Structures

Course Objectives:

- Understand the fundamental concepts of arches, including three-hinged and two-hinged arches, and analyse the effects of horizontal thrust, bending moment, normal thrust, and radial shear.
- Apply the moment distribution method to analyse single-bay, single-story portal frames with and without side sway.
- Analyze continuous beams and portal frames using Kani ‘s Method, including cases with and without settlement of supports.
- Solve structural problems using the flexibility method for continuous beams and single-bay portal frames, considering support settlements and side sway effects.
- Evaluate the stiffness method for analysing continuous beams and single-bay portal frames with and without side sway, ensuring structural stability and performance

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the analysis of three-hinged and two-hinged arches to determine horizontal thrust, bending moment, normal thrust, and radial shear. (L3)

CO2: Apply the moment distribution method to analyze single-bay, single-story portal frames with and without side sway. (L3)

CO3: Analyze continuous beams and portal frames using Kani's Method including cases with and without settlement of supports. (L4)

CO4: Solve structural problems using the flexibility method for continuous beams and portal frames considering settlement and side sway effects. (L4)

CO5: Evaluate the stiffness method for analyzing continuous beams and single-bay portal frames ensuring structural stability and performance. (L5)

Unit I: Arches:

Three Hinged and Two Hinged Arches, Elastic Theory of Arches– Eddy S Theorem –Determination of Horizontal Thrust, Bending Moment, Normal Thrust and Radial Shear–Effect of Temperature-Determination of Horizontal Thrust Bending Moment, Normal Thrust and Radial Shear–Rib Shortening and Temperature Stresses.

Unit II: Moment Distribution Method for Frames:

Analysis of Single Bay Single Storey Portal Frame Including Sides Way–Substitute Frame Analysis by Two Cycle Method.

Unit III: Kani’s Method:

Analysis of Continuous Beams with and Without Settlement of Supports-Single Bay Single Storey Portal Frames with and Without Side Sway.

Unit IV: Flexibility Methods:

Flexibility Methods- Introduction-Application to Continuous Beams Including Support Settlements—Analysis of Single Bay Single Storey Portal Frames Without and With Side Sway.

Unit V: Stiffness Methods
Stiffness Methods – Introduction – Application to Continuous Beams Including Support Settlements – Analysis of Single Bay Single Storey Portal Frames Without and With Side Sway.

Text Books:
1. Analysis of structures by Vazrani &Ratwani– Khanna Publications.
2. Theory of structures by Ramamuratam, Jain book depot, New Delhi.

Reference Books:
1. Structural analysis by R.S. Khurmi, S. Chand Publications, New Delhi.
2. Basic Structural Analysis by K. U. MuthuetalI. K. International Publishing House Pvt. Ltd
3. Theoryof Structures by Gupta SP, GS Pundit and R Gupta, Vol II, Tata McGraw Hill Publications Company td.
4. D. S. Prakash Rao, ―Structural Analysis: A Unified Approach‖, Universities Press

Online Resources:
https://archive.nptel.ac.in/courses/105/106/105106050/

Open Elective – II
(OE - II)

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE02302T	OE	**Renewable Energy Sources** (Common to CE, ECE, CSE, CSE AI&DS, CSE-AI, & CSE-AI&ML)	3	0	0	3

Pre-Requisite:

- Basic Knowledge of Energy Concepts and Electrical Fundamentals.
- Familiarity with Conventional and Non-Conventional Energy Sources.

Course Objectives:

- To understand the fundamental principles of various renewable energy sources such as solar, wind, geothermal, ocean, and biomass energy.
- To analyze solar radiation parameters, solar thermal systems, and photovoltaic technologies for effective energy conversion.
- To study the working principles, design considerations, and performance analysis of wind energy conversion systems.
- To explore geothermal and ocean energy resources, their extraction methods, applications, and feasibility, particularly in the Indian context.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe solar energy fundamentals including solar radiation geometry, solar collectors, and thermal energy storage systems. (L3)

CO2: Analyze photovoltaic energy systems including PV cell characteristics, module design, and standalone and grid-connected configurations. (L4)

CO3: Examine wind energy systems including wind turbine components, aerodynamic forces, energy estimation, and site selection criteria. (L4)

CO4: Evaluate geothermal energy resources, characteristics, applications, and prospects for sustainable energy generation. (L5)

CO5: Assess miscellaneous renewable energy technologies including tidal, wave, biomass, and fuel cell systems for energy production. (L5)

Unit I: Solar Energy:

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Unit II: PV Energy Systems:

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

Unit III: Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

Unit IV: Geothermal Energy:

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Unit V: Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text Books:

1. G. D. Rai, ―Non-Conventional Energy Sources‖, 4th Edition, Khanna Publishers, 2000.
2. Chetan Singh Solanki ―Solar Photovoltaics fundamentals, technologies and applications‖ 2nd Edition PHI Learning Private Limited. 2012.

Reference Books:

1. Stephen Peake, ―Renewable Energy Power for a Sustainable Future‖, Oxford International Edition, 2018.
2. S. P. Sukhatme, ―Solar Energy‖,3rd Edition, Tata Mc Graw Hill Education PVt. Ltd, 2008.
3. B H Khan , ― Non-Conventional Energy Resources‖, 2nd Edition, Tata Mc Graw Hill Education PVt Ltd, 2011.
4. S. Hasan Saeed and D.K.Sharma,―Non-Conventional Energy Resources‖,3rd Edition, S.K.Kataria& Sons, 2012.
5. G. N. Tiwari and M.K.Ghosal, ―Renewable Energy Resource: Basic Principles and Applications‖, Narosa Publishing House, 2004.

Online Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE03302T	OE	**Automation and Robotics** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Electrical, Electronic, and Mechanical Fundamentals.
- Familiarity with Control Systems and Basic Programming Concepts.

Course Objectives:

- Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes.
- Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
- Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
- Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
- Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the concepts of automation, manufacturing systems, production types, automation strategies, and hardware components to identify and implement suitable automation solutions in manufacturing environments. (L3)

CO2: Analyze automated flow lines and assembly line balancing techniques to improve production efficiency in manufacturing systems. (L4)

CO3: Analyze the configuration, components, actuators, and sensor systems of industrial robots for effective selection and application in automation tasks. (L4)

CO4: Apply manipulator kinematics, dynamics, and trajectory planning techniques for robot motion control and path optimization. (L3)

CO5: Apply robot programming methods and evaluate robotic applications in manufacturing processes such as material handling, welding, painting, assembly, and inspection. (L3)

Unit I: Introduction to Automation:

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

Unit II: Automated Flow Lines:

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

Unit III: Introduction to Industrial Robotics:

Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

Unit IV: Manipulator Kinematics:

Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

Unit V: Robot Programming:

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Automation, Production systems and CIM, M.P. Groover/ Pearson Edu.
2. Industrial Robotics -M.P. Groover, TMH.

Reference Books:

1. Robotics, FuKS, McGrawHill,4th edition,2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering, Richard D. Klafter, Prentice Hall
4. Robotics, Fundamental Concepts and analysis–Ashitave Ghosal, Oxford Press,1/e,2006
5. Robotics and Control, Mittal RK & NagrathIJ, TMH.

Online Resources:

1. https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl- gt76o
2. https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3Z JgwEjyE

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE04302T	OE	**Digital Electronics** (Common to CE, EEE, CSE, AI&DS, CSE-AI & CSE-AI&ML)	2	1	0	3

Pre-Requisites:

- Basic Knowledge of Binary Number Systems and Boolean Algebra.
- Familiarity with Logic Gates and Basic Electronic Circuits.

Course Objectives:

- To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
- To analyze combinational circuits like adders, subtractors, and code converters.
- To explore combinational logic circuits and their applications in digital design.
- To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
- To gain knowledge about programmable logic devices and digital IC 's.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply Boolean algebra, logic simplification techniques, and combinational circuit design to solve digital logic problems. (L3)

CO2: Analyze combinational circuits such as adders, subtractors, and code converters for efficient digital system design. (L4)

CO3: Analyze various combinational logic circuits and their applications in digital systems. (L4)

CO4: Analyze sequential logic circuits including latches, flip-flops, counters, and shift registers. (L4)

CO5: Evaluate programmable logic devices and digital ICs for designing reliable digital systems. (L5)

Unit I: Logic Simplification and Combinational Logic Design:

Review of Boolean Algebra and De Morgan 's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex- NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

Unit II: Introduction to Combinational Design I:

Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

Unit III: Combinational Logic Design II:

Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

Unit IV: Sequential Logic Design:

Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

Unit V: Programmable Logic Devices:

ROM, Programmable Logic Devices (PLA and PAL). Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

Text Books:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE05303T	OE	**Operating Systems** (Common to CE, ECE & EEE)	3	0	0	3

Prerequisites: Computer Fundamentals, Programming in C, Data Structures, and Computer Organization & Architecture.

Course Objectives:

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the architecture, functions, services, system structures, and interfaces of operating systems to explain their role in managing computing environments. (L4)

CO2: Apply process management, multithreading, scheduling algorithms, synchronization, and inter-Process communication mechanisms to solve process coordination and resource-sharing problems. (L3)

CO3: Analyze memory management and virtual memory techniques, including paging, segmentation, and page replacement strategies, to optimize memory utilization and system performance. (L4)

CO4: Evaluate deadlock handling methods, file system organization, and secondary storage Management techniques to improve system efficiency, reliability, and resource utilization. (L5)

CO5: Evaluate operating system protection and security mechanisms, including access control, authentication, cryptography, and threat mitigation techniques, to enhance system and network security. (L5)

Unit I: Operating Systems Overview, System Structures:

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Unit II: Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication:

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems -Dining philosophers' problem, Readers and writers' problem.

Unit III: Memory-Management Strategies, Virtual Memory Management:

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

Unit IV: Deadlocks, File Systems:

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

Unit V: System Protection, System Security:

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Text Books:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.
2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.
2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 2012.
3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009
4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Resources:

1. https://nptel.ac.in/courses/106/106/106106144/
2. http://peterindia.net/OperatingSystems.html

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE31302T	OE	**Introduction to Machine Learning** (Common to CE, EEE and ECE)	2	1	0	3

Pre-Requisites:

- Basic Knowledge of Programming and Problem-Solving Techniques.
- Familiarity with Probability, Statistics, and Linear Algebra Fundamentals.

Course Objectives:

- To introduce the fundamental concepts and types of machine learning.
- To develop a deep understanding of supervised and unsupervised learning algorithms.
- To understand mathematical foundations of learning models and algorithms.
- To evaluate model performance using appropriate statistical and analytical tools.
- To apply machine learning techniques to solve real-world problems using tools such as Scikit-learn.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Interpret machine learning fundamentals, linear regression models, and evaluation metrics for predictive analytics. (L3)

CO2: Apply classification algorithms such as Logistic Regression, KNN, Naïve Bayes, Decision Trees, and Random Forests for supervised learning tasks. (L3)

CO3: Analyze support vector machines, ensemble learning methods, and hyperparameter optimization strategies. (L4)

CO4: Inspect clustering and dimensionality reduction techniques for unsupervised learning applications. (L4)

CO5: Examine advanced machine learning applications including reinforcement learning, neural networks, feature engineering, and model deployment. (L4)

Unit I: Introduction to Machine Learning and Linear Models:

Definition and Scope of Machine Learning, Applications and Types of Learning: Supervised, Unsupervised, Reinforcement, Linear Regression: Least Squares, Cost Function, Gradient Descent, Polynomial Regression and Overfitting, Evaluation Metrics: RMSE, MAE, R^2 Score, Bias-Variance Trade off.

Unit II: Classification Algorithms:

Classification Overview and Decision Boundaries, Logistic Regression: Sigmoid Function and Cost, K-Nearest Neighbors (KNN), Naïve Bayes Classifier, Decision Trees and Random Forests, Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score.

Unit III: Support Vector Machines and Ensemble Methods:

Support Vector Machines: Concepts, Kernels, Hyperplane and Margin Concepts, Kernel Tricks: RBF and Polynomial, Ensemble Learning: Bagging, Boosting, and Voting, Gradient Boosting, AdaBoost, and XG Boost, Model Tuning and Hyperparameter Optimization.

Unit IV: Unsupervised Learning Techniques:

Clustering Overview: Applications, K-Means Clustering Algorithm, Hierarchical Clustering, DBSCAN and Density-Based Methods, Principal Component Analysis (PCA) for Dimensionality Reduction, Silhouette Score, Davies-Bouldin Index for Cluster Validation.

Unit V: Advanced Topics and Applications:

Reinforcement Learning Basics and Markov Decision Processes, Introduction to Neural Networks and Deep Learning, Cross-Validation Techniques: k-Fold, Leave-One-Out, Feature Engineering and

Feature Selection, Deployment of ML Models (Flask, Streamlit, etc.), Case Studies: Medical Diagnosis, Spam Detection, Credit Scoring.

Text Books:

1. Tom Mitchell, Machine Learning, McGraw-Hill Education.
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow, O‘Reilly Media.
3. Ethem Alpaydin, Introduction to Machine Learning, MIT Press.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press.
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer.

Online Resources:

1. Coursera – Machine Learning by Andrew Ng (Stanford University)
2. Scikit-learn Documentation
3. Kaggle Learn – Machine Learning
4. Google‘s Machine Learning Crash Course
5. YouTube – StatQuest with Josh Starmer

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB304T	OE	**Optimization Techniques for Engineers** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisite:

- Basic Knowledge of Algebra, Matrices, and Calculus.
- Familiarity with Mathematical Modeling and Problem-Solving Techniques.

Course Objectives:

- To understand the formulation and solution of linear programming problems, including graphical and simplex-based approaches.
- To analyse advanced linear programming concepts such as duality, transportation, and assignment problems for efficient resource allocation.
- To develop knowledge of unconstrained optimization techniques, including direct search and gradient-based methods for solving real-world problems.
- To apply constrained optimization methods such as feasible direction methods and sequential linear programming to engineering problems.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry. (L3)

CO2: Analyze and Interpret solutions are transportation models to address real -world problems. (L3)

CO3: Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications. (L3)

CO4: Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives. (L3)

CO5: Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives. (L5)

Unit I: Linear Programming I:

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two-phase Simplex Method, Big-M method.

Unit II: Linear programming II:

Duality in Linear Programming Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

Unit III: Non-Linear Programming:

Unconstrained optimization techniques Introduction: Classification of Unconstrained minimization methods, Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

Unit IV: Non-Linear Programming:
Constrained optimization techniques Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

Unit V: Geometric Programming:
Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

Text Books:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

Reference Books:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India PVt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ee122/preview
2. https://archive.nptel.ac.in/courses/111/105/111105039/
3. https://onlinecourses.nptel.ac.in/noc21_ce60/preview

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB305T	**OE**	**Mathematical Foundation of Quantum Technologies** (Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisite:

- Basic Knowledge of Matrices, Vectors, and Complex Numbers.
- Familiarity with Calculus, Probability, and Elementary Physics Concepts.

Course Objectives:

- To provide students with essential linear algebra foundations including vector spaces, inner products, and operators for quantum mechanical applications.
- To develop understanding of the transition from finite-dimensional systems to infinite dimensional function spaces and Hilbert space concepts.
- To establish quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution principles.
- To enable students to apply quantum mechanical principles to solve problems in simple quantum systems and understand statistical interpretation.
- To introduce advanced concepts in composite systems, measurement processes, and modern perspectives in quantum mechanics.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the principles of Vector spaces to solve mathematical problems. (L3)

CO2: Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems. (L4)

CO3: Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution. (L4)

CO4: Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations. (L5)

CO5: Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory. (L6)

Unit I: Linear Algebra Foundation for Quantum Mechanics:

Vector spaces definition and examples (R^2, R^3, function spaces), Inner products (dot product, orthogonality, normalization), Linear operators (matrices, eigenvalues, eigenvectors), Finite dimensional examples (2×2 matrices, spin-1/2 systems), Dirac notation introduction ($|\psi\rangle$, $\langle\varphi|$, $\langle\varphi|\psi\rangle$), Change of basis (transformations, unitary matrices).

Unit II: From Finite to Infinite Dimensions:

Function spaces (L^2 space, square-integrable functions), Inner products for functions ($\int\psi^*\varphi\, dx$), Orthogonal function sets (Fourier series, basis functions), Introduction to Hilbert space concept (complete inner product spaces), Position and momentum representations (wave functions), Operators on functions (d/dx, multiplication by x).

Unit III: Quantum Mechanical Formalism:

Mathematical formulation (states as vectors, observables as operators), Measurement theory (Born rule, expectation values, probabilities), Uncertainty relations (mathematical derivation from commutators), Time evolution (Schrödinger equation, unitary evolution).

Unit IV: Applications and Statistical Interpretation:
Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

Unit V: Advanced Topics:
Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Text Books:

1. David J. Griffiths, Darrell F. Schroeter, ―Introduction to Quantum Mechanics‖, 3rd Edition, Cambridge University Press (2018).
2. R. Shankar, Principles of Quantum Mechanics, 2nd Edition, Kluwer Academy/Plenum Publishers (1994).

Reference Books:

1. George. F. Simmons, ―Introduction to Topology and Modern Analysis‖, MedTech Science Press.
2. Gilbert Strang, Linear Algebra and Its Applications, 4th Edition, Cengage Learning (2006).
3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).

Online Resources:

1. https://eclass.uoa.gr/modules/document/file.php/CHEM248/Griffiths%20%20Introduction%20to%20Quantum%20Mechanics%203rd%20ed%202018.pdf
2. https://fisica.net/mecanica-quantica/Shankar%20%20Principles%20of%20quantum%20mechanics.pdf

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB306T	**OE**	**Physics of Electronic Materials and Devices** (Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisites:
- Basic Knowledge of Semiconductor Physics and Electronic Fundamentals.
- Familiarity with Crystal Structures, Materials Properties, and Basic Device Concepts.

Course Objectives:
- To make the students to understand the concept of crystal growth, defects in crystals and thin films.
- To provide insight into various semiconducting materials and their properties.
- To develop a strong foundation in semiconductor physics and device engineering.
- To elucidate excitonic and luminescent processes in solid-state materials.
- To understand the principles, technologies, and applications of modern display systems.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze phase diagrams, crystal growth mechanisms, crystal defects, and thin film deposition techniques for the characterization of engineering materials. (L4)

CO2: Apply the principles of semiconductors to analyse charge carrier transport, carrier concentration, conductivity, mobility, and temperature-dependent semiconductor behaviour. (L3)

CO3: Analyze the operating principles and characteristics of semiconductor devices such as PN junctions, heterojunctions, transistors, and MOSFETs. (L4)

CO4: Apply the principles of excitonic and luminescent processes to interpret light emission phenomena in solid-state materials and optoelectronic devices. (L3)

CO5: Analyze the working principles and applications of modern display technologies, including LCD, holographic displays, light-field displays, head-mounted displays, MOEMS, and MEMS displays. (L4)

Unit I: Fundamentals of Materials Science:

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

Unit II: Semiconductors:

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

Unit III: Physics of Semiconductor Devices:

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

Unit IV: Excitons and Luminescence:

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter band luminescence, Direct and indirect gap materials.

Photoluminescence: General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence: General Principles of electroluminescence, light emitting diode, diode laser.

Unit V: Display Devices:
LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Text Books:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4thedition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.
4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

Online Resources:

1. https://nptel.ac.in/courses/113/106/113106062/
2. https://onlinecourses.nptel.ac.in/noc20_ph24/preview

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB307T	**OE**	**Chemistry of Polymers and Applications** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisite:

- Basic Knowledge of Chemistry, Chemical Bonding, and Organic Compounds.
- Familiarity with Basic Material Properties and Chemical Reactions.

Course Objectives:

- To understand the basic principles of polymers
- To understand natural polymers and their applications.
- To impart knowledge to the students about synthetic polymers, their preparation and importance.
- To enumerate the applications of hydrogel polymers
- To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Classify the polymers, explain polymerization mechanism, differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer (L4)

CO2: Describe the physical and chemical properties of natural polymers and modified cellulosic. (L4)

CO3: Differentiate Bulk, solution, Suspension and emulsion polymerization, describe fibers and elastomers, Identify the thermosetting and thermo polymers. (L4)

CO4: Identify types of polymer networks, describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery. (L3)

CO5: Explain classification and mechanism of conducting and degradable polymers. (L3)

Unit I: Polymers-Basics and Characterization:

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit II: Natural Polymers & Modified Cellulosics:

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified Cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit III: Synthetic Polymers:

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers (PE, PVC), Butadiene polymers (BUNA-S, BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit IV: Hydrogels of Polymer Networks:
Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Unit V: Conducting and Degradable Polymers:
Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.
Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S. Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J. Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B. Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

B. Tech. – III Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHS303T	OE	**Academic Writing and Public Speaking** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of English Grammar, Vocabulary, and Writing Skills.
- Familiarity with Oral Communication and Presentation Basics.

Course Objectives:

- To encourage all round development of the students by focusing on writing skills
- To make the students aware of non-verbal skills
- To develop analytical skills
- To deliver effective public speeches

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the principles and features of academic writing to compose clear, coherent, concise, and well-structured descriptive, analytical, persuasive, and critical texts. (L3)

CO2: Develop academic and professional documents such as abstracts, project proposals, internship applications, technical papers, and journal articles by applying appropriate writing, editing, proofreading, and ethical citation practices. (L3)

CO3: Analyze and construct different forms of academic writing such as argumentative essays, exploratory essays, book reviews, film reviews, summaries, and statements of purpose. (L4)

CO4: Demonstrate effective public speaking skills by applying presentation strategies, stage dynamics, audience engagement techniques, and response strategies in academic contexts. (L3)

CO5: Apply the principles and features of academic writing to compose clear, coherent, concise, and well-structured descriptive, analytical, persuasive, and critical texts. (L3)

Unit I: Introduction to Academic Writing:

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

Unit II: Academic Journal Article:

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

Unit III: Essay & Writing Reviews:

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

Unit IV: Public Speaking:

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

Unit V: Public Speaking and Non-Verbal Delivery:
Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics Paralanguage - Signs

Text Books:

1. Critical Thinking, Academic Writing and Presentation Skills: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)
2. Pease, Allan & Barbara. The Definitive Book of Body Language RHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei Effective Academic Writing,2Ed.,2014.sserPytisrev in UdrofxO
2. Shalini Verma, Body Language, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata, Communication Skills 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, Technical Communication Process and Product, Pearson, New Delhi, 2014
5. Elbow, Peter. Writing with Power. OUP USA, 1998

Online Resources:

1. www.android.universityupdates.in | www.universityupdates.in |
2. https://telegram.me/jntua www.android.previousquestionpapers.com |
3. www.previousquestionpapers.com |
4. https://telegram.me/jntua www.android.universityupdates.in |
5. https://www.youtube.com/watch?v=nzGo5ZC1gMw
6. https://www.youtube.com/watch?v=Qve0ZBmJMh4
7. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal aspects-of-delivery/
8. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
9. https://archive.nptel.ac.in/courses/109/107/109107172/#
10. https://archive.nptel.ac.in/courses/109/10

B. Tech. – IV Year
I Semester

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC01415T	PC	Finite Element Methods	2	1	0	3

Pre-Requisites: Basics of Strength of Materials and Structural Analysis

Course Objectives:

- Understand the fundamental principles of the Finite Element Method (FEM) and its applications in structural analysis.
- Apply the concepts of elasticity, stress-strain relationships, and displacement functions in FEM.
- Develop finite element formulations for1D, 2D, and 3D elements.
- Analyze bar, beam, and plane stress/strain problems using shape functions and stiffness matrices.
- Implement solution techniques such as numerical integration, static condensation, and element assembly.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the basic principles, advantages, and limitations of FEM to model and solve engineering problems using appropriate element types. (L3)

CO2: Derive shape functions and stiffness matrices for 1D bar and beam elements and apply them in structural analysis. (L3)

CO3: Analyze continuous beams and plane stress/strain problems using the Finite Element Method with appropriate boundary conditions. (L4)

CO4: Develop iso parametric formulations for 2D elements such as CST and LST for solving complex engineering problems. (L5)

CO5: Evaluate solution techniques for assembling global stiffness matrices and solving FEM equations for structural and thermal problems. (L5)

Unit I: Introduction to FEM:

Introduction to Finite Element Method – Basic Equations in Elasticity Stress – Strain Equation – Concept of Plane Stress – Plane Strain Advantages and Disadvantages of FEM. Element Shapes – Nodes – Nodal Degree of Freedom Displacement Function – Natural Coordinates – Strain Displacement Relations.

Unit II: Finite Element Analysis:

Lagrangian– Serendipity Elements – Hermite Polynomials – Regular, Irregular 2 D &3D –Element – Shape Functions Up to Quadratic formulation. Finite Element Analysis (FEA) of –One Dimensional Problems – Bar Element – Shape Functions Stiffness Matrix – Stress –
Strain Relation

Unit III: Finite Element Analysis Functions:

FEA Beam Elements – Stiffness Matrix - Shape Function– Analysis of Continuous Beams.

Unit IV: Finite Element Analysis Elements:

FEA Two-Dimensional Problem – CST – LST Element – Shape Function – Stress – Strain.
Isoperimetric formulation – Concepts of, Isoperimetric Elements for2D Analysis - Formulation of CST Element.

Unit V: Solution Techniques:

Numerical Integration, Static Condensation, Assembly of Elements and Solution Techniques for Static Loads.

Text Books:

1. A first course in Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.
2. Introduction to finite Elements in Engineering by Tirupati R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall of India

Reference Books:

1. Finite Element Aanalysis by P. Seshu, PHI Learning Private Limited
2. Concepts and applications of Finite Element Analysis by Robert D. Cook et al., Wiley India Pvt. Ltd.
3. Applied Finite Element Analysis by G. Ramamurty, I.K. International Publishing House Pvt. Ltd.

Online Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105041/#
2. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-me43/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24SE01404S	SE	Skills in Civil Engineering Software (STAADPRO/CAD/TEKLA)	0	1	2	2

Pre-Requisites: Basics of Engineering Graphics, Structural Analysis, and Basics of CAD Software

Course Objectives:

- Provide fundamental knowledge of Auto CAD and Tekla for 2D drafting and 3D modelling.
- Train students in structural analysis and design using STAAD.Pro
- Develop skills in reinforcement detailing and structural component modelling.
- Introduce seismic and nonlinear analysis for structural safety evaluation.
- Enable students to apply civil engineering software tools for real-world projects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply AutoCAD tools to create 2D drawings and structural detailing for civil engineering projects. (L3)

CO2: Develop 3D building models and analyze site topography using Revit for architectural and structural coordination. (L5)

CO3: Analyze structural systems of multi-story buildings using STAAD Pro and ETABS under gravity and lateral load conditions. (L4)

CO4: Evaluate seismic and performance-based structural analysis for high-rise structures using advanced software tools. (L5)

CO5: Apply SAP2000 for bridge modelling, water tank design, and advanced structural analysis to develop comprehensive engineering solutions. (L3)

List of Experiments:

1. Determination of Basic Drawing and Editing Commands in AutoCAD
2. Creation of a 2D Floor Plan for a Residential Building in AutoCAD
3. Development of Structural Detailing for Beams and Columns in AutoCAD
4. Application of Reinforcement Detailing for Slabs and Footings in AutoCAD
5. Creation and analysis of a steel column using TEKLA
6. Modelling a Roof Truss by TEKLA
7. Design of a Composite Beam by TEKLA
8. Column Base Plate Design by TEKLA
9. Determination of STAAD.Pro Interface and Structural Model Setup
10. Analysis and Design of a Simply Supported Beam in STAAD.Pro
11. Development of Structural Analysis for a Multi-Story RCC Building in STAAD.Pro
12. Application of Seismic Load Analysis on a Building Structure in STAAD.Pro

Text Books:

1. George Omura, Brian C. Benton – Mastering AutoCAD 2025 and AutoCAD LT 2025, Wiley, 2025 Edition
2. TEKLA Structural Designer 2023 Engineers Hand Book by Trimble Solutions Corporation

Reference Books:

1. Phil Read, Eddy Krygiel, James Vandezande – BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, and Contractors, John Wiley & Sons, 4th Edition, 2023
2. Nighat Yasmin Ph.D., Introduction to AutoCAD 2025 for Civil Engineering Applications, SDC Publications, 2024 Edition.

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24MCHS413A	**MC**	**Gender Sensitization** (Common to all branches of Engineering)	**2**	**0**	**0**	**--**

Pre-Requisites:

- Basic Understanding of Society, Culture, and Human Relationships.
- Familiarity with Social Issues and Communication Skills

Course Objectives:

- To enable students to understand the gender related issues, vulnerability of women and men
- To familiarize them about constitutional safeguard for gender equality
- To expose the students to debates on the politics and economics of work
- To help students reflect critically on gender violence
- To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply fundamental concepts and terminology related to gender to examine attitudes, socialization processes, and the construction of gender roles in society. (L3)

CO2: Analyze gender roles, relationships, discrimination, and demographic issues to interpret their impact on individuals and society. (L4)

CO3: Analyze issues related to gender and labour, including unpaid work, unrecognized labour, work distribution, and gender mainstreaming in the context of sustainable development and human rights. (L4)

CO4: Evaluate the causes, forms, and consequences of gender-based violence from human rights and social perspectives. (L5)

CO5: Analyze the representation of gender in films, electronic media, advertisements, popular literature, and cultural practices to promote gender-sensitive perspectives and just relationships. (L4)

Unit I: Understanding Gender:

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit II: Gender Roles and Relations:

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences-Declining Sex Ratio- Demographic Consequences-Gender Spectrum.

Unit III: Gender and Labour:

Division and Valuation of Labour-Housework: The Invisible Labour- ―My Mother doesn ‘t Work. ‖ ―Share the Load. ‖-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming.

Unit IV: Gender Based Violence:

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women -Consequences of gender-based violence.

Unit V: Gender and Culture

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language-Just Relationships

Text Books:

1. A. Suneetha, Uma Bhrugubanda, et al. Towards a World of Equals: A Bilingual Textbook on Gender‖, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. Gender Trouble: Feminism and the Subversion of Identity. UK Paperback Edn. March 1990

Reference Books:

1. Wtatt, Robin and Massood, Nazia, Broken Mirrors: The dowry Problems in India, London: Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), Women in Developing Countries, Assessing Strategies for Empowerment, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., Gender and Governance, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, Women and Politics World Wide, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, GenderSensitization: Issues and Challenges (English, Hardcover), Raj Publications, 2019
6. A. Revathy& Murali, Nandini, A Life in Trans Activism (Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. **Understanding Gender chrome-extension:**
   a) //kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf
   b) https://onlinecourses.swayam2.ac.in/nou24_hs53/preview
2. **Gender Roles and Relations**
   a) https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes
   b) https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408
   c) https://onlinecourses.swayam2.ac.in/cec23_hs29/preview
3. **Gender and Labour**
   a) https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed
   b) https://onlinecourses.nptel.ac.in/noc23_mg67/preview
4. **Gender-Based Violence**
   a) https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en
   b) https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls

c) https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **Gender And Culture:**

a) https://gender.study/psychology-of-gender/culture-impa4. ct-gender-roles-identities/ https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/ https://archive.nptel.ac.in/courses/109/106/109106136/

6. **Abdulali Sohaila. —I Fought For My Life…and Won. Available online** (at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

Management Elective – II (HM - II)

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS410T	HM	**Business Ethics and Corporate Governance** (Common to all branches of Engineering)	2	0	0	2

Pre-Requisites:

- Basic Understanding of Business, Management, and Organizational Concepts.
- Familiarity with Social Responsibility, Ethics, and Legal Awareness.

Course Objectives:

- To make the student understand the principles of business ethics
- To enable them in knowing about the ethics in management
- To facilitate the student 'role in corporate culture
- To impart knowledge about the fair-trade practices
- To encourage the student in knowing about the corporate governance

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze ethical principles, value systems, business ethics, and CSR in organizational contexts. (L4)

CO2: Evaluate ethical theories (e.g., Utilitarianism, Distributive Justice) and apply them across functional areas. (L5)

CO3: Analyze corporate culture, leadership styles, and their impact on organizational effectiveness. (L4)

CO4: Evaluate legal and ethical compliance requirements related to corporate governance, environmental protection, and fair-trade practices. (L5)

CO5: Evaluate corporate governance practices, roles of boards, auditors, and committees (e.g., Cadbury Committee) in ensuring transparency and accountability. (L5)

Unit I: Ethics:

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behaviour. Value systems -Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management-Corporate Social Responsibility – Issues of Management – Crisis Management.

Unit II: Ethics in Management:

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics –Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

Unit III: Corporate Culture:

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

Unit IV: Legal Frame Work:

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

Unit V: Corporate Governance:

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate Scams-Committees in India and abroad, corporate social responsibility. BoDs' composition, Cadbury Committee - Various committees - Reports -Benefits and Limitations.

Text Books:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference Books:

1. Dr. K. Nirmala, Karunakara Readdy. Business Ethics and Corporate Governance, HPH
2. H.R. Machiraju: Corporate Governance, HPH, 2013
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M. Khandelwal. Indian Ethos and Values for Managers

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS411T	HM	**E-Business** (Common to all branches of Engineering)	2	0	0	2

Pre-Requisites:

- Basic Knowledge of Business and Internet Fundamentals.
- Familiarity with Computer Applications and Online Communication.

Course Objectives:

- To provide knowledge on emerging concept on E-Business related aspect.
- To understand various electronic markets & business models.
- To impart the information about electronic payment systems & banking.
- To create awareness on security risks and challenges in E-commerce.
- To the students aware on different e-marketing channels & strategies.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply concepts of e-business, e-commerce functions, internet services, and online shopping to identify business opportunities and advantages. (L3)

CO2: Analyze and evaluate electronic market types, business models (B2B, B2C, B2G), portals, and auction systems for strategic business decisions. (L5)

CO3: Apply various electronic payment methods (cards, UPI, wallets, crypto) and evaluate infrastructure and regulatory requirements for business transactions. (L4)

CO4: Analyze and evaluate e-commerce security risks, cyber threats, and protection mechanisms including firewalls, SSL/TLS, and digital signatures. (L4)

CO5: Evaluate online marketing strategies, digital advertising, social media, ECRM, and e-supply chain management to improve business performance. (L5)

Unit I: Electronic Business:

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce – E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Unit II: Electronic Markets and Business Models:

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) -Business to Government(B2G)-Auctions-B2B Portals in India

Unit III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic **Fund Transfer (EFT):** Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Unit IV: E-Security:

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

Unit V: E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research–

E-Marketing Planning: Online branding, social media marketing, Role of AI&ML in E-Marketing and email marketing.

E-Business Strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (e-CRM) E-supply chain management (e-SCM)

Text Books:

1. Arati Oturkar & Sunil Khilari. E-Business. Everest Publishing House, 2022
2. P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011

Reference Books:

1. Debjani, Kamalesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill‘s, 2005
2. Dave Chaffey. E-Commerce E-Management, Second Edition, Pearson, 2012.
3. Henry Chan. E-Commerce Fundamentals and Application, Raymond Leatham Wiley India 2007
4. S. Jaiswal. E-Commerce Galgotia Publication Pvt Ltd., 2003.

Online Resources:

1. https://www.slideshare.net/fatimahAlkreem/ebessppt-67935771
2. https://www.slideshare.net/VikramNani/e-commerce-business-models
3. https://www.slideshare.net/RiteshGoyal/electronic-payment-system
4. https://www.slideshare.net/WelingkarDLP/electronic-security
5. https://www.slideshare.net/Ankitha2404/emarketing-ppt

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24HMHS412T	**HM**	**Management Science** (Common to all branches of Engineering)	**2**	**0**	**0**	**2**

Pre-Requisites:

- Basic Understanding of Business, Management, and Organizational Concepts.
- Familiarity with Quantitative Reasoning and Problem-solving skills.

Course Objectives:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in modern management

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze management principles, classical theories, and organizational structures to interpret their role in organizational effectiveness. (L4)

CO2: Apply production methods, inventory techniques (EOQ, ABC), and marketing strategies in solving operational and business problems. (L3)

CO3: Analyze HRM functions such as recruitment, training, and performance appraisal to improve workforce effectiveness. (L4)

CO4: Evaluate strategic alternatives and project management techniques (PERT, CPM) for effective decision-making and project execution. (L5)

CO5: Evaluate modern management tools like MIS, ERP, CRM, and SCM in enhancing organizational performance and competitiveness. (L5)

Unit I: Introduction to Management:

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor ‘s Scientific Theory-Henry Fayol‘s principles - Elton Mayo‘s Human relations - Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Unit II: Operations Management:

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Marketing Management - Concept -Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution -Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Unit III: Human Resources Management (HRM):

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal

Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Unit IV: Strategic & Project Management:
Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management:** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Unit V: Contemporary Issues in Management:
Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management –sustainability and corporate social responsibility.

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023
2. A.R Aryasri, Management Science, TMH, 2019

Reference Books:

1. Stoner, Freeman, Gilbert. Management, Pearson Education, New Delhi, 2019.
2. Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005.
3. Thomas N. Duening & John M. Ivancevich, Management Principles and Guidelines, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
5. Samuel C. Certo, Modern Management, 9/e, PHI, 2005

Online Resources:

1. https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
2. https://nptel.ac.in/courses/112107238
3. https://archive.nptel.ac.in/courses/110/104/110104068/
4. https://archive.nptel.ac.in/courses/110/105/110105069/
5. https://onlinecourses.nptel.ac.in/noc24_mg112/

Professional Elective – IV (PE - IV)

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01410T	PE	Geo Synthetics and Reinforced Earth Structures	2	1	0	3

Pre-Requisites: Basic knowledge of soil mechanics, foundation engineering, retaining structures, embankments, and pavement engineering concepts.

Course Objectives:

- Understand the concept and applications of reinforced earth, including friction coefficient determination.
- Analyze the classification, functions, and durability aspects of geosynthetics and their advantages over conventional materials.
- Design reinforced earth retaining walls considering stability mechanisms and material selection.
- Evaluate the performance of reinforced embankments and their foundation mattresses for settlement and stability control.
- Develop reinforced soil beds and analyse reinforced pavements using standard design approaches.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply fundamental principles to explain the effects of reinforcement on soil properties and reinforced earth behaviour. (L3)

CO2: Analyze types of geosynthetics, their functions, and durability aspects in various geotechnical applications. (L4)

CO3: Design reinforced earth retaining walls considering stability mechanisms and reinforcement layout configurations. (L5)

CO4: Evaluate reinforced embankments and foundation mattresses with respect to settlement and load-bearing capacity. (L5)

CO5: Design and analyze reinforced pavements and soil beds using standard geosynthetic methodologies. (L5)

Unit I: Reinforced Earth:

Concept, Effects of Reinforcement on Soils – Equal Confining and Psuedo Cohesion Concepts, Materials, Friction Coefficient – Definition, Laboratory Determination, Factors Affecting Fiction Coefficient; Application of Reinforced Earth

Unit II: Geosynthetics:

Geosynthetics - Advantages Over Conventional Materials - Classification Based On Material Type and Function - Types of Geosynthetics - Functions of Geosynthetics - Tests On Geosynthetics - Durability Aspects of Geosynthetics - Applications of Geosynthetics.

Unit III: Reinforced Earth Retaining Walls:

Introduction, Stability Mechanisms, Design of Reinforced Earth Retaining Wall - Selection of Materials - Geotechnical Analysis - Reinforcement Layout and Spacing - Stability Analysis - Advantages Over Conventional Retaining Walls

Unit IV: Reinforced Embankment:

Introduction, Design of Reinforced Embankment, Foundation Mattress Below the Embankment - Purpose and Function of Foundation Mattresses -Components of Reinforced Mattress - Design of

Reinforced Mattress - Design Calculations for Settlement Control, Bearing Capacity, and Long-Term Performance. Field Implementation and Monitoring Techniques.

Unit V: Reinforced Soil Beds:
Introduction, Factors Affecting the Behavior of Reinforced Soil Beds, Analysis and Design
Reinforced Pavements: Benefits of Placing Reinforcement in Flexible Pavement Layers, Design of Reinforced Pavements by Giroud and Noiray Approach and Modified CBR Method.

Text Books:

1. An Introduction to Soil Reinforcement and Geosynthetics‖ By G.L. Siva Kumar Babu, University Press
2. Fundamentals of Geosynthetics Engineering, Sanjay Kumar Shukla and Jian-Hua Yin, CRC Press, 2017, 1st edition.
3. Reinforced Soil and its Engineering Applications, Swami Saran, I.K. International Publishing House Pvt. Ltd., 2019, 1st edition.

Reference Books:

1. Designing with Geosynthetics by Robert M Koerner, R.M. Pearson Education Inc., 2012, 6th edition
2. Advances in Geosynthetics by G. Venkatapparao, Sai Master Geo environmental Services Pvt. Ltd. Publications
3. Designing with Geosynthetics, Koerner, R.M., Pearson Education Inc., 2012, 6th edition
4. IS:13162-1992; IS:14293& 94-1995; IS:14324-1995; IS:14714-1999, Geotextiles –Methods of Tests
5. IRC: SP:102-2014: Guidelines for design and construction of reinforced soil walls.

Online Resources:
1. https://archive.nptel.ac.in/courses/105/106/105106052/
2. https://onlinecourses.nptel.ac.in/noc20_ce06/preview

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01411T	PE	Railways, Airports, Docks and Harbor Engineering	3	0	0	3

Pre-Requisites: Basic understanding of transportation engineering, surveying, geometric design, traffic engineering, and infrastructure planning principles.

Course Objectives:

- Understand the components and geometric design principles of railway tracks.
- Analyze the principles of railway track design, signalling, and interlocking.
- Evaluate airport site selection, runway orientation, and terminal area planning.
- Design runways and taxiways based on aircraft characteristics and geometric elements.
- Assess the requirements and classification of ports, harbours, docks, and navigation aids.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of railway track components and functions to explain track geometry and requirements for rail transportation. (L3)

CO2: Apply geometric design principles to railway track layout, signalling, and interlocking systems for safe train operation. (L3)

CO3: Evaluate airport planning aspects including site selection, runway design, and terminal planning based on safety standards. (L5)

CO4: Design runways and taxiways based on geometric standards, traffic volume, and safety regulations as per ICAO guidelines. (L5)

CO5: Analyze ports and harbour structures including docks, breakwaters, and navigation aids for effective coastal infrastructure design. (L4)

Unit I: Railway Engineering:

Introduction – Permanent Way Components – Cross Section of Permanent Way – Functions and Requirements of Rails, Sleepers and Ballast – Types of Gauges – Creep of Rails –Theories Related to Creep – Coning of Wheels – Adzing of Sleepers – Rail Fastenings.

Unit II: Geometric Design of Railway Track:

Gradients – Grade Compensation – Can't and Negative Super Elevation – Can't Deficiency –Degree of Curves – Safe Speed on Railway Track – Points and Crossings – Layout and Functioning of Left Hand Turn Out and Right-Hand Turn Outs – Station Yards – Signaling and Interlocking.

Unit III: Airport Engineering:

Airport Site Selection – Factors Affecting Site Selection and Surveys- Runway Orientation –Wind Rose Diagram – Basic Runway Length – Correction for Runway Length – Terminal Area – Layout and Functions – Concepts of Terminal Building – Simple Building, Linear Concept, Pier Concept and Satellite Concept – Typical Layouts.

Unit IV: Geometric Design of Runways and Taxiways:

Aircraft Characteristics – Influence of Characteristics on Airport Planning and Design –Geometric Design Elements of Runway – Standards and Specifications - Functions of Taxiways – Taxiway

Geometric Design – Geometric Elements and Standard Specifications –Runway and Taxiway Lighting.

Unit V: Ports and Harbors:
Harbor's - Requirements of Ports and Harbors – Types of Ports – Classification of Harbors –Docks and Types of Docks – Dry Docks, Wharves and Jetties – Breakwaters: Layouts of Different Types of Harbors and Docks – Dredging Operations – Navigation Aids

Text Books:
1. A Text Book of Railway Engineering-S.C. Saxena and S. Arora, Dhanpatrai and Sons, New Delhi 2010.
2. Highway, railway, Airport and Harbour Engineering – K.P. Subramanian, Scitech Publishers

Reference Books:
1. Harbour, Dock and Tunnel Engineering – R. Srinivasan, Charotar Publishing House Pvt. Limited, 200
2. Railway Track Engineering by J.S. Mundrey McGraw Hill Education 5th edition 2017
3. A Text book of Transportation Engineering – S.P. Chandola – S. Chand & Co. Ltd. – (2001)

Online Resources:
1. https://nptel.ac.in/courses/105107123
2. https://archive.nptel.ac.in/courses/114/106/114106025/
3. https://www.mkube.co.in/product-detail/railways-airports-docks-and-harbour-engineering

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01412T	PE	Experimental Stress Analysis	2	1	0	3

Pre-Requisites: Basic knowledge of strength of materials, stress–strain relationships, structural analysis, and engineering measurements.

Course Objectives:

- Understand the principles and advantages of experimental stress analysis.
- Explain strain measurement techniques using strain gauges and their applications.
- Analyze strain rosettes and apply non-destructive testing methods for concrete.
- Understand the fundamental principles of photo elasticity and its applications.
- Apply two-dimensional photo elasticity methods for stress analysis in materials.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply principles and merits of experimental stress analysis to explain measurement techniques for stress determination. (L3)

CO2: Analyze strain measurement techniques using various strain gauge configurations and rosette data interpretation methods. (L4)

CO3: Evaluate concrete structures using NDT methods and analyze strain rosette data for structural integrity assessment. (L5)

CO4: Apply the theory of photo elasticity to determine stress distributions in models under two-dimensional loading conditions. (L3)

CO5: Analyze two-dimensional photo elasticity techniques for experimental stress analysis and fringe pattern interpretation. (L4)

Unit I: Principles of Experimental Approach:

Merits of Experimental Analysis Introduction, Uses of Experimental Stress Analysis Advantages of Experimental Stress Analysis, Different Methods –Simplification of Problems.

Unit II: Strain Measurement using Strain Gauges:

Definition of Strain and Its Relation of Experimental Determinations Properties of Strain-Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical Strain Gauges - Inductance Strain Gauges – LVDT – Resistance Strain Gauges – Various Types –Gauge Factor – Materials of Adhesion Base.

Unit III: Strain Rosette's and Non – Destructive Testing of Concrete:

Introduction – The Three Elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge. Ultrasonic Pulse Velocity Method –Application to Concrete. Hammer Test – Application to Concrete.

Unit IV: Theory of Photo Elasticity:

Introduction –Temporary Double Refraction – The Stress Optic Law –Effects of Stressed Modelling a Polar Scope for Various Arrangements – Fringe Sharpening. Brewster 's Stress Optic Law

Unit V: Two-Dimensional Photo Elasticity:

Introduction – Isochramic Fringe Patterns- Isoclinic Fringe Patterns Passage of Light Through Plane Polariscope and Circular Polariscope - Isoclinic Fringe Patterns –Compensation Techniques –

Calibration Methods – Separation Methods – Scaling Model to Prototype Stresses – Materials for Photo – Elasticity Properties of Photo elastic Materials.

Text Books:

1. Experimental stress analysis by J.W. Dally and W.F. Riley, College House Enterprises2005
2. Experimental stress analysis by Dr. Sadhu Singh. Khanna Publishers 4th edition

Reference Books:

1. Experimental Stress analysis by U.C. Jindal, Pearson Publications 2012 edition
2. Experimental Stress Analysis by L.S. Srinath, MC. Graw Hill Company Publishers

Online Resources:

1. https://archive.nptel.ac.in/courses/112/106/112106068/#
2. https://archive.nptel.ac.in/courses/112/106/112106198/#

Professional Elective –V (PE - V)

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01413T	PE	Ground Improvement Techniques	3	0	0	3

Pre-Requisites: Fundamental knowledge of soil mechanics, geotechnical engineering, foundation engineering, and groundwater control methods.

Course Objectives:

- Understand various dewatering methods, including sumps, well points, and electro-osmosis, for effective groundwater control.
- Analyze the properties and applications of grouts, grouting techniques, and post-grouting tests for soil and rock stabilization.
- Evaluate different densification techniques for granular and cohesive soils, such as vibro-compaction, preloading, and thermal methods.
- Apply stabilization techniques, including mechanical, chemical, and bituminous stabilization, to improve soil properties.
- Assess the design principles of reinforced earth walls and the role of geosynthetics in soil improvement and slope stability.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply methods of dewatering and grouting to explain their importance in foundation engineering and site preparation. (L3)

CO2: Analyze densification techniques for granular and cohesive soils to enhance soil strength for construction purposes. (L4)

CO3: Evaluate the effectiveness of soil stabilization methods for different ground conditions and construction requirements. (L5)

CO4: Apply reinforced earth principles and geosynthetics for soil retention and foundation stability under various loading scenarios. (L3)

CO5: Assess expansive soil problems, identification methods, and suitable foundation techniques including under-reamed piles. (L5)

Unit I: Expansive Soils:

Problems of Expansive Soils – Tests for Identification – Methods of Determination of Swell Pressure. Improvement of Expansive Soils – Foundation Techniques in Expansive Soils – Under Reamed Piles.

Unit II: Strain Measurement using Strain Gauges:

Dewatering: Methods of De-Watering- Sumps and Interceptor Ditches- Single, Multi Stage Well Points - Vacuum Well Points- Horizontal Wells-Foundation Drains-Blanket Drains - Criteria for Selection of Fill Material Around Drains –Electro-Osmosis.

Grouting: Objectives of Grouting- Grouts and Their Properties- Grouting Methods- Ascending, Descending and Stage Grouting- Hydraulic Fracturing in Soils and Rocks- Post Grout Test

Unit III: Strain Rosette's and Non – Destructive Testing of Concrete:

Densification Methods in Granular Soils: In – Situ Densification Methods in Granular Soils Vibration at The Ground Surface, Impact at The Ground Surface, Vibration at Depth, Impact at Depth.

Densification Methods in Cohesive Soils: In – Situ Densification Methods in Cohesive Soils Preloading or Dewatering, Vertical Drains – Sand Drains, Sand Wick Geo drains – Stone and Lime Columns – Thermal Methods

Unit IV: Stabilization:
Methods of Stabilization-Mechanical-Cement- Lime-Bituminous-Chemical Stabilization with Calcium Chloride, Sodium Silicate and Gypsum

Unit V: Reinforced Earth:
Principles – Components of Reinforced Earth – Factors Governing Design of Reinforced Earth Walls – Design Principles of Reinforced Earth Walls.
Geosynthetics: Geotextiles- Types, Functions and Applications – Geogrids and Geo Membranes – Functions and Applications

Text Books:

1. Engineering Principles of Ground Modification, Haussmann M.R., McGraw-Hill International Edition (1990).
2. Ground Improvement Techniques, Dr. P. Purushottam Raj. Laxmi Publications, New Delhi University science press, New Delhi 2nd edition 2016

Reference Books:

1. Ground Improvement, Moseley M.P. Blackie Academic and Professional, Boca Taton, Florida, USA (1993).
2. Ground Improvement Techniques, Nihar Ranajan Patra Vikas Publications, New Delhi
3. Ground Control and Improvement, Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) John Wiley and Sons, New York, USA.

Online Resources:

1. https://archive.nptel.ac.in/courses/105/108/105108075/
2. https://archive.nptel.ac.in/courses/105/105/105105210/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01414T	PE	Subsurface Investigation and Instrumentation	3	0	0	3

Pre-Requisites: Basic understanding of soil mechanics, soil classification, foundation engineering, and field-testing techniques.

Course Objectives:

- Understand the fundamental concepts of soil formation, classification, and stratification processes.
- Analyze various soil exploration methods, including boring, drilling, and sampling techniques.
- Evaluate borehole logging methods and groundwater observations for site investigation.
- Apply field testing techniques such as SPT, PLT, PMT, CPT, and geophysical methods to assess soil properties.
- Assess soil exploration report preparation, including instrumentation and data interpretation.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of soil formation processes and classification methods to explain stratification phenomena and soil profiles. (L3)

CO2: Analyze soil exploration methods and sampling techniques for various geotechnical site investigation applications. (L4)

CO3: Evaluate borehole logging, groundwater observations, and their influence on soil properties for foundation design. (L5)

CO4: Apply field testing procedures including penetration tests and geophysical methods to assess subsurface conditions. (L3)

CO5: Assess soil exploration report writing and field instrumentation techniques for comprehensive site investigations. (L5)

Unit I: Introduction:

Introduction: Soil formation, Types of Soils, Physical and Chemical Weathering, Soil Transport, Deposition and Stratification Phenomena and Soil Classification.

Unit II: Methods of Soil Exploration:

Methods of Boring, Auguring and Drilling. Machinery Used for Drilling, Types of Augers and Their Usage for Various Projects. Soil Sampling: Sampling Methods, Types of Samples, Storage of Samples and Their Transport. Sample Preparation, Sample Sizes, Types of Sampler‘s Specifications for Testing.

Unit III: Borehole Logging:

Logging of Boreholes - Logging Methods - Groundwater Observations –Water Table Fluctuations and Effects - Preparation of Soil Profiles and Exploration Report.

Unit IV: Field Testing of Soils:

Methods and Specifications – Visual Identification Tests, Standard Penetration Test (SPT), Plate Load Test (PLT), Pressure Meter Test (PMT) Dilatometer Test (DMT) Vane Shear Test (VST), Cone Penetration Test (CPT), Becker Penetration Test (BPT), Analysis of Test Results. Geophysical Methods of Soil Exploration- Seismic Refraction, Electrical Resistivity, Cross Hole Test.

Unit V: Report Writing:

Soil Exploration Reports- Identification, Calculations and Preparation. Field Instrumentation: Strain Gauges, Piezometer, Pressure Cells, Inclinometers, Proving Ring, Load Cells, Displacement Gauges

Text Books:

1. Site Investigation, Clayton C. R., Matthews M. C and Simons N. E., Blackwell Science. 2005
2. Geotechnical Instrumentation for Monitoring Field Performance, John Dunn cliff, Wiley Interscience, 2008

Reference Books:

1. Basic and Applied Soil Mechanics- A.S. Rao and Gopal Ranjan, New Age International.
2. IS:1892-Code of Practice for subsurface investigation for foundation, 1979
3. IS: SP36 Part 1-Compendium of India Standards on Soil Engineering-Laboratory Testing of Soils for Civil Engineering Purposes, 1987.
4. IS: SP36 Part 2-Compendium of India Standards on Soil Engineering-Field Testing of Soils for Civil Engineering Purposes, 1988.

Online Resources:

1. https://archive.nptel.ac.in/courses/105/103/105103182/
2. https://onlinecourses.nptel.ac.in/noc25_ce27/preview
3. https://onlinecourses.nptel.ac.in/noc22_ce81/preview

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE01415T	PE	Transportation Economics	2	1	0	3

Pre-Requisites: Basic knowledge of transportation engineering, engineering economics, traffic engineering, and project evaluation methods.

Course Objectives:

- Understand the fundamentals of transportation project development and decision-making.
- Analyze transportation costs, including agency and user costs.
- Evaluate vehicle operating costs and traffic congestion economics.
- Apply economic evaluation methods for transportation projects.
- Assess financing methods and risk analysis in transportation projects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of transportation project development and financial planning processes to describe overall project lifecycle management. (L3)

CO2: Analyze transportation cost structures including demand elasticity and supply elasticity for economic planning. (L4)

CO3: Evaluate vehicle operating costs and traffic congestion pricing strategies for transportation system optimization. (L5)

CO4: Apply economic analysis techniques to assess the feasibility and viability of transportation infrastructure projects. (L3)

CO5: Assess financial models, PPP strategies, and risk analysis methods for road project planning and implementation. (L5)

Unit I: Introductory Concepts in Transportation Decision Making:

Overall Transportation Project Development, Budgeting, Financial Planning, The Process of Transportation Project Development, Models Associated with Transportation Impact Evaluation Professional Ethics.

Unit II: Transportation Costs:

Transportation Costs Classification of Transportation Costs, Transportation Agency Costs, Transportation User Costs, General Structure and Behavior of Cost Functions and Road Pricing. Estimating Transportation Demand and Supply - Supply Equilibration, Dynamics of Transportation Demand and Supply, Elasticity of Travel Demand and Supply, Classification of Elasticity.

Unit III: Vehicle Operating Costs:

Fuel Costs - Maintenance and Spares, Depreciation - Crew Costs -Value of Travel Time Savings - Accident Costs. Economics of Traffic Congestion - Pricing Policy

Unit IV: Economic Analysis of Projects:

Economic Analysis of Projects - Methods of Evaluation - Cost-Benefit Ratio, First Year Rate of Return, Net Present Value, and Internal-Rate of Return Methods; Indirect Costs and Benefits of Transport Projects

Unit V: Financing of Road Projects:

Financing of Road Projects - Methods – Private Public Partnership (PPP) - toll Collection -Economic Viability of Design-Build-Operate-Transfer Schemes – Risk Analysis – Value for Money Analysis - Case Studies.

Text Books:

1. Winfrey, Economic analysis for Highways, International Textbook Company, Pennsylvania, 1969.
2. Sarkar, P. K., and Maitri, V., Economics in Highway and Transportation Planning, Standard Publisher, New Delhi, 2010.

Reference Books:

1. IRC, Manual on Economic Evaluation of Highway Projects in India, SP30, 2007
2. David, H., and Brewer, A., Transport: An Economics and Management Perspective. Oxford University Press, UK, 2000.
3. Quinet, E., and Vickerman, R., Principles of Transport Economics, Edward Elgar Pub, 2005
4. Button, K. J., Transport Economics, Elgar, 2010

Online Resources:

1. https://archive.nptel.ac.in/courses/105/104/105104098/
2. https://archive.nptel.ac.in/content/storage2/courses/105101087/01-Ltexhtml/p2/p.html

Open Elective – III
(OE - III)

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE02403T	OE	**Smart Grid Technologies** (Common to CE, ECE, CSE, AI&DS, CSE-AI & CSE - AI&ML)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Electrical Power Systems and Power System Components.
- Familiarity with Fundamental Communication Concepts and Electrical Measurements.

Course Objectives:

- To provide an understanding of the evolution of the electric power system and the need for Smart Grid technologies.
- To familiarize students with the architecture, components, and enabling technologies of Smart Grids.
- To develop knowledge of Wide Area Monitoring Systems (WAMS), including synchro phasor technology, PMUs, and PDCs.
- To introduce the concepts and applications of smart metering, AMR, and Advanced Metering Infrastructure (AMI).
- To impart understanding of communication technologies and protocols used in Smart Grid systems.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe the evolution, architecture, and enabling technologies of Smart Grid systems along with national and international deployment initiatives. (L3)

CO2: Analyze Wide Area Monitoring Systems using synchro phasor technology, PMU, and PDC for grid monitoring and blackout analysis. (L4)

CO3: Examine smart metering systems including AMR, AMI, smart meter functionalities, and demand-side management applications. (L4)

CO4: Analyze communication technologies and protocols used in Smart Grid systems including RF, PLC, optical fiber, and mobile communication. (L4)

CO5: Evaluate Smart Grid applications and cybersecurity aspects including renewable integration, energy storage systems, EVs, and security risk assessment. (L5)

Unit I: Introduction to Smart Grid:

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid Road map for India – Smart Grid Architecture.

Unit II: Wide Area Monitoring System:

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchro phasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

Unit III: Smart Meters:

Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits –AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

Unit IV: Information and Communication Technology:

Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

Unit V: Smart Grid Applications and Cyber Security:

Applications: Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid –House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES –Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

Text Books:

1. James Momoh, "SMART GRID: Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

Reference Books:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2. Fereidoon.P. Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, New York, 2012

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE03403T	OE	**3D Printing Technologies** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Engineering Materials and Manufacturing Processes.
- Familiarity with Technical Drawing and Design Fundamentals.

Course Objectives:

- Understand the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
- Demonstrate the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
- Define the processes and classifications of rapid tooling and reverse engineering techniques.
- Identify common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
- Familiarize RP-related software and its role in applications such as design, anufacturing, and medical fields.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the fundamentals of rapid prototyping technologies, including classification, processes, comparison with traditional manufacturing methods, and their role in product development. (L3)

CO2: Analyze working principles, materials, advantages, limitations, and applications of solid and liquid based rapid prototyping systems such as FDM, LOM, SLA, DLP, and SGC. (L4)

CO3: Analyze powder-based and other rapid prototyping systems including SLS, DMLS, LENS, EBM, 3DP, BPM, and SDM for suitable engineering and manufacturing applications. (L4)

CO4: Apply reverse engineering and rapid tooling concepts including scanning methods, data processing, and tool development for product design and manufacturing. (L3)

CO5: Evaluate errors in 3D printing processes, related software tools, data formats, and applications of rapid prototyping in engineering, medical, and industrial domains. (L5)

Unit I: Introduction to 3D Printing:

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Unit II: Solid and Liquid Based RP Systems:

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

Unit III: Powder Based & other RP Systems:

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM). Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three-Dimensional Printing (3DP), Ballistic

Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

Unit IV: Rapid Tooling & Reverse Engineering:
Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods. Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

Unit V: Errors in 3D Printing and Applications:
Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, Surgi Guide, 3-matic, 3D-Doctor, Sim plant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Text Books:

1. Chee Kai Chua and Kah Fai Leong, ―3D Printing and Additive Manufacturing Principles and Applications‖ 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, ―Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing‖, Springer, 2/e, 2010.

Reference Books:

3. Frank W. Liou, ―Rapid Prototyping & Engineering Applications‖, CRC Press, Taylor & Francis Group, 2011.
4. Rafiq Noorani, ―Rapid Prototyping: Principles and Applications in Manufacturing‖, John Wiley & Sons, 2006.

Online Learning Resources:

1. NPTEL Course on Rapid Manufacturing.
2. https://nptel.ac.in/courses/112/104/112104265/
3. https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
4. https://slideplayer.com/slide/6927137/
5. https://www.mdpi.com/2073-4360/12/6/1334
6. https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf
7. https://lecturenotes.in/subject/197
8. https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
9. https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
10. https://www.youtube.com/watch?v=NkC8TNts4B4.

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC04312T	OE	**Microprocessors and Microcontrollers** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: Basics of Digital Electronics and Programming

Course Objectives:

- To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
- To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
- To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
- To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
- To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Learn the fundamental architectural concepts of microprocessors. Apply knowledge of 8086 architecture to identify the roles of Bus Interface Unit (BIU) and Execution Unit (EU) in instruction execution. (L3)

CO2: Analyse the 8086-instruction set and addressing modes to develop assembly language programs for arithmetic and logical operations. (L4)

CO3: Examine and Interfacing of Peripheral devices with the 8086 microprocessors. (L4)

CO4: Analyse the fundamentals of 8051 and the function of SFRs and I/O ports in executing control operations. (L4)

CO5: Evaluate the interfacing of peripheral devices with the 8086 microprocessors for efficient system performance. (L5)

Unit I: 8086 Architecture:

Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

Unit II: 8086 Programming:

Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

Unit III: 8086 Interfacing:

Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

Unit IV: 8051 Architecture:

Microcontroller - Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

Unit V: 8051 Programming:

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts

Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Text Books:

1. Chee Kai Chua and Kah Fai Leong, ―3D Printing and Additive Manufacturing Principles and Applications‖ 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, ―Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing‖, Springer, 2/e, 2010.

Reference Books:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PC05204T	OE	**Data Base Management System** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites: Basics of Programming

Course Objectives:

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the foundational concepts and characteristics of database systems to distinguish them from traditional file systems and identify various types of database users and applications. (L3)

CO2: Analyze relational model concepts and integrity constraints to evaluate data consistency, and apply relational algebra, relational calculus, and basic SQL commands for data definition and manipulation in structured schemas. (L4)

CO3: Apply SQL constructs to retrieve and manipulate relational data, and analyze the use of constraints, views, and relational set operations for building consistent and relationally complete database applications. (L4)

CO4: Analyze database schemas to identify functional dependencies and apply normalization techniques to achieve lossless join and dependency preservation, ensuring minimal redundancy and data consistency. (L4)

CO5: Analyze the concepts of transaction management, including ACID properties, serializability, and concurrency control protocols, and apply recovery techniques and indexing methods to ensure data consistency, isolation, and efficient retrieval. (L4)

Unit I: Introduction:

Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database. **Entity Relationship Model:** Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model:

Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

Unit III: SQL:

Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

Unit IV: Schema Refinement (Normalization):
Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

Unit V: Transaction Concept:
Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing f Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.
Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Text Books:
1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan,TMH (For Chapter 1 and Chapter 5)

Reference Books:
1. Introduction to Database Systems, 8thedition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Online Resources:
1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666 728202 2456_shared/overview

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE05305T	OE	**Cyber Security** (Common to CE, EEE & ECE)	3	0	0	3

Pre-Requisites: Basic knowledge of Computer Fundamentals, Programming, Data Structures, and Computer Networks.

Course Objectives:

- To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behaviour and various classifications of cybercrimes.
- To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
- To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.
- To familiarize students with the tools and techniques used in committing cybercrimes, such as phishing, malware, DoS/DDoS attacks, and code-based exploits.
- To analyse the implications of cybercrime for organizations, including the cost of cyberattacks, intellectual property issues, and challenges posed by social computing and web-based threats.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of cybercrime concepts, classifications, and legal frameworks including Indian ITA 2000 to identify cyber offenses. (L3)

CO2: Analyze cyberattack strategies, social engineering techniques, and attack vectors used by cyber criminals to assess system vulnerabilities. (L4)

CO3: Examine security challenges and threats in mobile and wireless environments to recommend appropriate protection mechanisms. (L4)

CO4: Evaluate various cybercrime tools and techniques such as phishing, malware, and network attacks to detect and mitigate security breaches. (L5)

CO5: Design organizational cybersecurity strategies considering privacy, legal, and social implications to ensure secure computing environments. (L5)

Unit I: Introduction to Cybercrime:

Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Unit II: Cyber Offenses:

How Criminals Plan Them Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Unit III: Cybercrime:

Mobile and Wireless Devices Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones.

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies a Measures in Mobile Computing Era, Laptops.

Unit IV: Tools and Methods Used in Cybercrime:

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Unit V: Cyber Security: Organizational Implications:

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text Books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapur, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

Online Resources:

1. http://nptel.ac.in/courses/106105031/40
2. http://nptel.ac.in/courses/106105031/39
3. http://nptel.ac.in/courses/106105031/38

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB408T	**OE**	**Wavelet Transforms and Its Applications** (Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Calculus, Linear Algebra, and Transforms.
- Familiarity with Signals and Mathematical Analysis.

Course Objectives:

- To introduce the fundamental concepts of wavelets, wavelet expansion, and wavelet transform.
- To develop understanding of multiresolution analysis (MRA) and its role in signal representation.
- To explain the implementation of the Discrete Wavelet, transform (DWT) using filter banks and related structures.
- To provide knowledge of time-frequency analysis and compare wavelet transform with Fourier-based methods.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms. (L3)
CO2: Illustrate the multi resolution analysis ad scaling functions. (L5)
CO3: Implement discrete wavelet transforms with multirate digital filters. (L3)
CO4: Understand multi resolution analysis and identify various wavelets and evaluate their time-frequency resolution properties. (L3)
CO5: Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields. (L5)

Unit I: Wavelets:

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

Unit II: A Multiresolution Formulation of Wavelet Systems:

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

Unit III: Filter Banks and the Discrete Wavelet Transform:

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis -From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

Unit IV: Time-Frequency and Complexity:

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

Unit V: Bases and Matrix Examples:

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Text Books:

1. C. Sidney Burrus, Ramesh A. Gopinath, ―Introduction to Wavelets and Wavelets Transforms‖, Prentice Hall, (1997).
2. James S. Walker, ―A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999).

Reference Books:

1. Raghuveer Rao, ―Wavelet Transforms‖, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

Online Resources:

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm
4. https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB409T	OE	**Smart Materials and Devices** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites:

- Basic Knowledge of Materials Science and Solid-State Physics.
- Familiarity with Material Properties and Basic Characterization Techniques.

Course Objectives:

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To explain the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe the classification, characteristics, and applications of smart materials, including shape memory, chromoactive, magnetorheological, photoactive materials, and polymer composites. (L3)

CO2: Apply the optical, electrical, dielectric, piezoelectric, ferroelectric, pyroelectric, and magnetic properties of smart materials to explain their functional behavior. (L3)

CO3: Discuss the synthesis methods of smart materials using chemical routes, mechanical alloying, and thin film deposition techniques. (L3)

CO4: Analyze the role of characterization techniques such as X-ray diffraction, Raman spectroscopy, UV-Visible spectroscopy, SEM, TEM, and AFM in determining the structural and morphological properties of smart materials. (L4)

CO5: Evaluate the working principles and applications of smart material-based devices such as robotic hands, piezoelectric devices, MEMS, and intelligent systems. (L5)

Unit I: Introduction to Smart Materials:

Historical account of the discovery and development of smart materials, Shape memory materials, chromo active materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

Unit II: Properties of Smart Materials:

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

Unit III: Synthesis of Smart Materials:

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

Unit IV: Characterization Techniques:

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

Unit V: Smart Materials based Devices:

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Text Books:

1. Yaser Dahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005

Reference Books:

1. Gauenzi, P. Smart Structures, Wiley, 2009.
2. Mahmood Aliof khazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0, Chaudhary Mustansar Hussain, Paolo Di Sia, Springer,2022.
4. Fundamentals of Smart Materials, Mohsen Shahin poor, Royal Society of Chemistry, 2020

Online Resources:

NPTEL course link: **https://onlinecourses.nptel.ac.in/noc22_me17/preview**

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB410T	**OE**	**Introduction to Quantum Mechanics** Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Calculus, Linear Algebra, and Differential Equations.
- Familiarity with Classical Mechanics, Waves, and Elementary Physics Concepts

Course Objectives:

- To understand the fundamental differences between classical and quantum mechanics.
- To study wave-particle duality, uncertainty principle, and their implications.
- To learn and apply Schrödinger equations to basic quantum systems.
- To use operator formalism and mathematical tools in quantum mechanics.
- To explore angular momentum, spin and their quantum mechanical representations.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe the fundamental principles of quantum mechanics, including wave-particle duality, uncertainty principle, and Schrödinger wave equations for describing microscopic systems. (L3)

CO2: Apply quantum mechanical principles to analyze one-dimensional systems such as potential step, potential well, potential barrier, periodic potential, and harmonic oscillator. (L4)

CO3: Discuss the operator formalism of quantum mechanics, including operator algebra, eigenvalues, eigenvectors, and matrix representation of wave functions and operators. (L3)

CO4: Analyze the mathematical tools of quantum mechanics, including matrix algebra, Hermitian operators, Dirac notation, expectation values, and ladder operators. (L4)

CO5: Evaluate angular momentum and spin systems using angular momentum operators, Pauli spin matrices, Clebsch–Gordon coefficients, and rigid rotator models. (L5)

Unit I: Principles of Quantum Mechanics:

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation. Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle. Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

Unit II: One-Dimensional Problems and Solutions:

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunnelling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

Unit III: Operator Formalism:

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

Unit IV: Mathematical Tools for Quantum Mechanics:

The concept of row and column matrices, Matrix algebra, Hermitian operators – definition. Dirac 's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

Unit V: Angular Momentum and Spin:

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half (1/2), Spin angular momentum, Pauli 's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

Text Books:

1. Quantum Mechanics. Vol 1, A. Messaia North-Holland Pub. Co., Amsterdam, (1961).
2. A Text Book of Quantum Mechanics. P M. Mathews and K. Venkatesam, Tata McGraw Hill, New Delhi, (1976).
3. Introduction to Quantum Mechanics. R. H. Dicke and J. P. Witke, Addison-Wisley Pub. Co.Inc., London, (1960).
4. Quantum Mechanics. S.L. Gupta, V. Kumar, H.V. Sarama and R.C. Sharma, Jai Prakash Nath& Co, Meerut, (1996).

Reference Books:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

Online Resources:

1. https://archive.nptel.ac.in/courses/115/101/115101107/
2. https://archive.nptel.ac.in/courses/122/106/122106034/
3. https://nptel.ac.in/courses/115106066

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB411T	OE	**Green Chemistry and Catalysis for Sustainable Environment** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Chemistry, Chemical Reactions, and Catalysis.
- Familiarity with Environmental Science and Sustainable Development Concepts.

Course Objectives:

- To understand principle and concepts of green chemistry.
- To understand the types of catalysis and industrial applications.
- To apply green solvents in chemical synthesis.
- To enumerate different sourced of green energy.
- To apply alternative greener methods foe chemical reactions

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the Green chemistry Principles for day-to-day life as well as synthesis, describe the sustainable development and green chemistry, explain economic and un-economic reactions, Demonstrate Polymer recycling. (L3)

CO2: Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis (L3)

CO3: Demonstrate Green solvents and importance, Discuss Supercritical carbon dioxide, Explain Supercritical water, recycling of green solvents. (L3)

CO4: Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis. (L4)

CO5: Discuss Alternative green methods like Photo redox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sono chemical reactions, examples and applications. (L3)

Unit I: Principles and Concepts of Green Chemistry:

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

Unit II: Catalysis and Green Chemistry:

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

Unit III: Green Solvents in Chemical Synthesis:

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbon dioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recycling of green solvents.

Unit IV: Emerging Greener Technologies:

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock 's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

Unit V: Alternative Greener Methods:

Photochemical Reactions - Examples, Advantages and Challenges, Photo redox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sono chemical reactions, examples and applications.

Text Books:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

Reference Books:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva, Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHS404T	OE	**Employability Skills** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Communication and Writing Skills.
- Familiarity with Presentation, Teamwork, and Interpersonal Skills.

Course Objectives:

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply goal-setting and self-management techniques, including SMART goals, motivation strategies, and SWOT analysis, for personal and professional development. (L3)

CO2: Develop professional written communication such as resumes, CVs, cover letters, emails, and statements of purpose by applying appropriate writing conventions and etiquette. (L3)

CO3: Demonstrate effective technical presentation skills through planning, preparation, stage management, and delivery of PPT and poster presentations in academic and professional contexts. (L3)

CO4: Analyze group behaviour, team dynamics, leadership qualities, and corporate etiquette to participate effectively in group discussions, debates, and collaborative tasks. (L4)

CO5: Evaluate interview situations and employ appropriate job-cracking strategies, including interview preparation, answering techniques, and mock interview performance, to enhance employability. (L5)

Unit I: Goal Setting and Self-Management:

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis.

Unit II: Writing Skills:

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose).

Unit III: Technical Presentation Skills:

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation.

Unit IV: Group Presentation Skills:

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation-Group Discussion-Debate –Corporate Etiquette.

Unit V: Job Cracking Skills:

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews.

Text Books:

1. Sabina Pillai, Agna Fernandez. Soft Skills & Employability Skills, 2014.Cambridge Publisher.
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback, Sage Publications. 2015
2. Sherfield Montgomery Moody, Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. Personality Development and Soft Skills - Preparing for Tomorrow .1 Edition, Wiley, 2017.
4. M. Sen Gupta, Skills for Employability, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, The Basics f Communication Skills A Relational Perspective, Sage press, 2012.

Online Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

Open Elective – IV
(OE - IV)

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE02404T	**OE**	**Electric Vehicles** (Common to CE, ECE, CSE, AI&DS, CSE-AI & CSE - AI&ML)	**3**	**0**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Electrical and Electronic Fundamentals.
- Familiarity with Energy Storage Systems and Electric Machines.

Course Objectives:

- Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
- Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.
- Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.
- Design and analyse the various control structures for Electric vehicle.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe the evolution, configuration, and system architecture of electric vehicles along with environmental impacts and comparison of EV technologies. (L3)

CO2: Analyze electric vehicle propulsion systems including motor configurations, transmission types, and vehicle dynamics for performance evaluation. (L4)

CO3: Examine fuel cell systems and hybrid electric vehicle technologies including modelling, performance characteristics, and system comparison. (L4)

CO4: Analyze battery charging systems and control strategies including charger architecture, wireless charging, and feedback controller design for EV applications. (L4)

CO5: Evaluate energy storage technologies and energy management systems in electric vehicles, including batteries, supercapacitors, SMES, and smart grid integration. (L5)

Unit I: Introduction to EV Systems and Energy Sources:

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

Unit II: EV Propulsion and Dynamics:

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi-motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

Unit III: Fuel Cells:

Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

Unit IV: Battery Charging and Control:

Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless Charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach-PI controller 's designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

Unit V: Energy Storage Technologies:

Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super Capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA.

Text Books:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition
2. Ali Emadi, ―Advanced Electric Drive Vehicles‖, CRC Press, 2017,1st Edition

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.
2. Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt,‖ Energy Storage in Power Systems‖ Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition
3. A.G. Ter-Gazarian, ―Energy Storage for Power Systems‖, the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.
4. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, ―Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2004,1st Edition
5. James Larminie, John Lowry, ―Electric Vehicle Technology Explained‖, Wiley, 2003,2nd Edition.

Online Resources:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE03404T	OE	**Total Quality Management** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites:

- Basic Understanding of Management and Organizational Concepts.
- Familiarity with Problem-Solving and Process Improvement Basics.

Course Objectives:

- Familiarize the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Understand the extent of customer satisfaction by the application of various quality concepts.
- Demonstrate the importance of Quality standards in Production

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the fundamental concepts of Total Quality Management, including quality dimensions, quality planning, and quality cost analysis for improving organizational quality performance. (L3)

CO2: Analyze the historical evolution of TQM, contributions of quality gurus, strategic planning concepts, and barriers in implementing Total Quality Management practices. (L4)

CO3: Analyze customer satisfaction, employee involvement, continuous process improvement, and supplier partnership concepts to enhance organizational quality systems. (L4)

CO4: Apply quality improvement tools such as benchmarking, QFD, Taguchi method, TPM, FMEA, Six Sigma, and other quality management tools for process enhancement. (L3)

CO5: Evaluate quality management systems including ISO 9000, ISO 14000, and QS 9000 standards, along with their implementation, documentation, and auditing processes. (L5)

Unit I: Introduction:

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

Unit II: Historical Review:

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

Unit III: TQM Principles:

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

Unit IV: TQM Tools:

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

Unit V: Quality Systems:
Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Text Books:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015
4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Resources:

1. https://www.youtube.com/watch?v=VD6tXadibk0
2. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
3. https://blog.capterra.com/what-is-total-quality-management/
4. https://nptel.ac.in/courses/110/104/110104080/
5. https://onlinecourses.nptel.ac.in/noc21_mg03/preview
6. https://nptel.ac.in/courses/110/104/110104085/
7. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE04403T	OE	**Transducers and Sensors** (Common to CE, EEE, CSE, AI&DS, CSE-AI & CSE - AI&ML)	3	0	0	3

Pre-Requisites:
- Basic Knowledge of Electrical Measurements and Instrumentation Fundamentals.
- Familiarity with Basic Electrical and Electronic Components.

Course Objectives:
- To understand characteristics of Instrumentation System and the operating principle of motion transducers.
- To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
- To provide knowledge on flow transducers and their applications.
- To study the working principles of pressure transducers.
- To introduce working principle and applications of force and sound transducers.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the characteristics of instrumentation systems and operating principles of motion transducers for measurement applications. (L4)

CO2: Analyze the working principles and applications of temperature transducers and piezo-electric sensors. (L4)

CO3: Apply flow transducers and evaluate their performance in practical measurement systems. (L3)

CO4: Analyze the working principles and performance of pressure transducers in industrial applications. (L4)

CO5: Evaluate force and sound transducers for suitable measurement and sensing applications. (L5)

Unit I: Introduction:
General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.
Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

Unit II: Temperature Transducers:
Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.
Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

Unit III: Flow Transducers:
Bernoulli ‘s principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

Unit IV: Pressure Transducers:
Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high- and low-pressure measurement.

Unit V: Force and Sound Transducers:

Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

Text Books:

1. A.K. Sawhney, ―A course in Electrical and Electronics Measurements and Instrumentationl, Dhanpat Rai& Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, ―Instrumentation Devices and Systems‖, TATA McGraw Hill publications, 2007.

Reference Books:

1. Doebelin. E.O, ―Measurement Systems Application and Design‖,McGraw Hill International, New York, 2004.
2. Nakra B.C andChaudharyK.K , ―Instrumentation Measurement and Analysis‖, Second Edition, Tata McGraw-Hill Publication Ltd.2006.

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE04416T	**OE**	**Internet of Things** (Common to CE, EEE & ECE)	**3**	**0**	**0**	**3**

Pre-Requisites: Fundamentals of Electronics, Programming, Microcontrollers, and Computer Networks.

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply IoT fundamentals including architecture, communication models, and protocols for IoT system design. (L3)

CO2: Analyze microcontroller-based prototyping techniques to interface sensors and actuators with IoT systems. (L4)

CO3: Analyze IoT architectures, reference models, and communication protocols such as MQTT, CoAP, and 6LoWPAN. (L4)

CO4: Analyze device discovery mechanisms and cloud-based services for IoT applications(L4)

CO5: Evaluate UAV-based IoT systems, their components, and applications in real-world Scenarios. (L5)

Unit I: Introduction to IoT:

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

Unit II: Prototyping IoT Objects using Microprocessor/Microcontroller:

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

Unit III: IoT Architecture and Protocols:

Architecture Reference Model- Introduction, Reference Model and architecture, IoT Reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

Unit IV: Device Discovery and Cloud Services for IoT:

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

Unit V: UAV IoT:

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller (ESC), GPS, IMU, Ultrasonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones (IoD)- Case study Fly Base.

Text Books:

1. Vijay Madisetti and ArshdeepBahga, ― Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, ― From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence‖, 1st Edition, Academic Press, 2014.
4. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
5. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
6. Francis daCosta, ―Rethinking the Internet of Things: A Scalable Approach to Connecting Everything‖, 1st Edition, Apress Publications, 2013
7. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 9781-4493- 9357-1
8. DGCA RPAS Guidance Manual, Revision 3 – 2020
9. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Resources:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/
3. https://nptel.ac.in/courses/106105166/5
4. https://nptel.ac.in/courses/108108098/4

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OE05404T	OE	**Introduction to Computer Networks** (Common to CE, EEE & ECE)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Computers and Communication Fundamentals.
- Familiarity with Data Representation and Operating System Basics.

Course Objectives:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of software and hardware components to design and implement computer network solutions. (L3)

CO2: Design and develop error control, routing, and congestion control algorithms for efficient network communication. (L3)

CO3: Analyze the functionality of different layers in a computer network and their interaction in data communication. (L4)

CO4: Evaluate existing routing protocols based on performance metrics and network requirements. (L5)

CO5: Evaluate and select appropriate transport protocols based on application requirements and network conditions(L5)

Unit I: Computer Networks and the Internet:

What Is the Internet? Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks, Reference Models, Multimedia Networks, Guided Transmission Media, Wireless Transmission.

Unit II: The Data Link Layer, Access Networks, and LANs:

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols, Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page (Packet)

Unit III: The Network Layer:

Routing Algorithms, Internetworking, The Network Layer in The Internet.

Unit IV: The Transport Layer:

Connectionless Transport: UDP, The Internet Transport Protocols: TCP, Congestion Control.

Unit V: The Application Layer:

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet ‘s Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distributed Networks.

Text Books:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, 6th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6th Edition, Pearson, 2019.

Reference Books:

1. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akhtar, Networks for Computer Scientists and Engineers, Oxford Publishers, 2016.

Online Resources:

1. https://nptel.ac.in/courses/106105183/25
2. https://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24PE05310T	OE	**Introduction to Quantum Computing** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites: Basics of Mathematics and Physics

Course Objectives:

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply the fundamental concepts of quantum mechanics, including superposition, entanglement, and quantum states, in quantum computing applications. (L3)

CO2: Construct and analyze quantum circuits using standard gates. (L4)

CO3: Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's. (L3)

CO4: Develop simple quantum programs using Qiskit or similar platforms. (L5)

CO5: Analyze applications and challenges of quantum computing in real-world domains. (L4)

Unit I: Fundamentals of Quantum Mechanics and Linear Algebra:

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

Unit II: Quantum Gates and Circuits:

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

Unit III: Quantum Algorithms and Complexity:

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover‘s Search Algorithm, Shor‘s Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

Unit IV: Quantum Programming and Simulation Platforms:

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

Unit V: Applications and Future of Quantum Computing:

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.

2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB412T	OE	**Financial Mathematics** (Common to all branches of Engineering)	2	1	0	3

Pre-Requisites:

- Basic Knowledge of Calculus, Probability, and Statistics.
- Familiarity with Algebra and Fundamental Financial Concepts.

Course Objectives:

- To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
- To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
- To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
- To equip students with computational techniques for pricing financial derivatives.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply fundamental financial concepts such as arbitrage, valuation, and risk to analyse and solve basic financial problems. (L3)

CO2: Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs) to solve the financial problems. (L3)

CO3: Analyse option pricing models and mathematical techniques used in financial derivatives. (L4)

CO4: Evaluate interest rate models and bond pricing methodologies for financial decision - making. (L5)

CO5: Utilize computational techniques such as Monte Carlo simulations for financial modelling. (L3)

Unit I: Asset Pricing and Risk Management:

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

Unit II: Stochastic Models in Finance:

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito‘s Lemma, Ito Integral, and Ito Isometry.

Unit III: Interest Rate and Credit Modelling:

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

Unit IV: Fixed-Income Securities and Bond Pricing:

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

Unit V: Exotic Options and Computational Finance:

Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Lookbacks. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Text Books:

1. Ales Cerny, Mathematical Techniques in Finance: Tools for Incomplete Markets, Princeton University Press.
2. S.R. Pliska, Introduction to Mathematical Finance: Discrete-Time Models, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas& Steven E. Shreve, Methods of Mathematical Finance, Springer, New York.
2. John C. Hull, Options, Futures, and Other Derivatives, Pearson.

Online Resources:

1. MIT– Mathematics for Machine Learning https://ocw.mit.edu
2. Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
3. National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB413T	OE	**Sensors and Actuators for Engineering Applications** (Common to all branches of Engineering)	3	0	0	3

Pre-Requisites:

- Basic Knowledge of Physics and Electrical Measurement Concepts.
- Familiarity with Basic Electronic Components and Signal Principles.

Course Objectives:

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To explain the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To explain the required sensor and actuator for interdisciplinary application

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Describe the principles, fabrication methods, and applications of sensors and actuators used in engineering systems. (L3)

CO2: Apply the working principles of temperature and mechanical sensors to measure thermal and mechanical parameters in practical applications. (L3)

CO3: Illustrate the operating principles and characteristics of optical and acoustic sensors used for detection and signal conversion. (L3)

CO4: Analyze the working principles and applications of magnetic and electromagnetic sensors and actuators in measurement and control systems. (L4)

CO5: Evaluate the performance and applications of chemical and radiation sensors for monitoring physical and environmental parameters. (L5)

Unit I: Introduction to Sensors and Actuators:

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only)

Deposition: Chemical Vapor Deposition

Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

Unit II: Temperature and Mechanical Sensors:

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors

Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working, Force sensors, Strain gauges, Tactile sensors,

Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

Unit III: Optical and Acoustic Sensors:

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors-based sensors, Photomultipliers.

Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles.

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

Unit IV: Magnetic and Electromagnetic Sensors:
Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto strictive sensors and actuators.

Unit V: Chemical and Radiation Sensors:
Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.
Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Text Books:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A. Hall and C.E. Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D. Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G. Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

Online Resources:

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHB414T	**OE**	**Chemistry of Nanomaterials and Applications** (Common to all branches of Engineering)	**3**	**0**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of Chemistry, Materials Science, and Atomic Structure.
- Familiarity with Chemical Bonding and Basic Characterization Concepts.

Course Objectives:

- To understand basics and characterization of nanomaterials.
- To understand synthetic methods of nanomaterials.
- To apply various techniques for characterization of nanomaterials.
- To understand Studies of Nano-structured Materials
- To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Classify the nanostructure materials; describe scope of nanoscience and importance technology. (L3)

CO2: Describe the top-down approach, explain aerosol synthesis and plasma arc technique, differentiate chemical vapor deposition method and electrode position method, Discuss about high energy ball milling. (L4)

CO3: Discuss different technique for characterization of nanomaterial, explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis. (L4)

CO4: Explain synthesis and properties and applications of nanomaterials, discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials. (L4)

CO5: Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation. (L3)

Unit I: Basics and Characterization of Nanomaterials:

Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit II: Synthesis of Nanomaterials:

Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapor deposition method, electrodeposition method, high energy ball milling method.

Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

Unit III: Techniques for Characterization:

Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

Unit IV: Studies of Nano-structured Materials:

Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials

Unit V: Advanced Engineering Applications of Nanomaterials:

Applications of Nano Particle, nanorods, nanowires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

Text Books:

1. NANO: The Essentials: T Pradeep, Mac Graw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

Reference Books:

1. Concepts of Nano chemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures &Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007. Nanomaterials

B. Tech. – IV Year I Semester

Course Code	Category	Name of the Course	L	T	P	C
24OEHS405T	**OE**	**Literary Vibes** (Common to all branches of Engineering)	**2**	**1**	**0**	**3**

Pre-Requisites:

- Basic Knowledge of English Language and Reading Comprehension.
- Familiarity with Literary Forms such ss Poetry, Prose, Drama, and Fiction.

Course Objectives:

- To inculcate passion for aesthetic sense and reading skills
- To encourage respecting others ‘experiences and creative writing
- To explore emotions, communication skills and critical thinking
- To educate how books serve as the reflection of history and society
- To provide practical wisdom and duty of responding to events of the times

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Analyze the themes, poetic devices, and social relevance of the prescribed poems to interpret literary expression and meaning. (L4)

CO2: Analyze the plot, themes, characterization, and literary elements of Twelfth Night to interpret dramatic techniques and contextual significance. (L4)

CO3: Examine the themes, characterization, and narrative techniques in the prescribed short stories to interpret human values and social perspectives. (L4)

CO4: Evaluate the ideas, style, and autobiographical elements in the prescribed prose essays and autobiographical writings to relate literary texts to personal and social contexts. (L5)

CO5: Analyze the plot, themes, characterization, and literary features of Hard Times to interpret the social concerns and artistic vision of the novelist. (L4)

Unit I: Poetry:

1. Ulysses- Alfred Lord Tennyson
2. Ain ‘t I woman? -Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore.

Unit II: Drama: Twelfth Night- William Shakespeare:

1. Shakespeare -life and works
2. Plot & sub-plot and Historical background of the play
3. Themes and Criticism
4. Style and literary elements
5. Characters and characterization.

Unit III: Short Story:

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

Unit IV: Prose: Essay and Autobiography:

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston

3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

Unit V: Novel: Hard Times- Charles Dickens:

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens. Hard Times. (Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC. William Shakespeare. Twelfth Night. Oxford University Press,2016.

Reference Books:

1. WJ Long. History of English Literature, Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.
3. Dhanvel, SP. English and Soft Skills, Orient Blackswan,2017.
4. New Horizon, Pearson publications, New Delhi 2014
5. Vimala Ramarao, Explorations Volume-II, Prasaranga Bangalore University,2014.
6. Dev Neira, Anjana & Co. Creative Writing: A Beginner's Manual. Pearson India, 2008.

Online Resources:

1. https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
2. https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
3. https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
4. https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
5. https://www.litcharts.com/lit/twelfth-night/themes
6. https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

B. Tech. – IV Year
II Semester

B. Tech. – IV Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24IPIN404L	**IP**	**Internship** (Common for all branches of Engineering)	**0**	**0**	**0**	**4**

Pre-Requisites:

- Fundamental knowledge of core engineering concepts, laboratory practices, tools, and relevant software for applying technical skills in practical environments.
- Ability to work collaboratively in teams with basic proficiency in technical communication, including report writing and presentations.
- Awareness of professional ethics, safety practices, organizational processes, and readiness to learn and adapt in workplace settings.

Course Objectives:

- To provide practical exposure to professional environments for applying engineering knowledge and technical skills to real-world problems.
- To develop the ability to work effectively in multidisciplinary teams and understand organizational structure and processes.
- To enhance communication skills for preparing technical reports, delivering presentations, and engaging in professional interactions.
- To build analytical skills for studying practices, workflows, and technologies to identify inefficiencies and suggest improvements.
- To cultivate critical thinking and professional ethics for evaluating solutions, project outcomes, and personal growth in a societal and environmental context.

Course Outcomes (COs):

On successful completion of the Internship, Student will be able to:

CO1: Apply engineering knowledge and technical skills to perform assigned tasks and solve real-world problems in professional environments. (L3)

CO2: Collaborate with multidisciplinary teams to understand organizational processes and effectively contribute to project execution. (L3)

CO3: Communicate technical information effectively through reports, presentations, and professional interactions with supervisors and team members. (L3)

CO4: Analyse practices, workflows, and technologies to identify inefficiencies and propose appropriate improvements. (L4)

CO5: Evaluate processes, project outcomes, and personal professional development based on technical, economic, environmental, ethical, and societal considerations. (L5)

B. Tech. – IV Year II Semester

Course Code	Category	Name of the Course	L	T	P	C
24IPPR401L	**IP**	**Project** (Common for all branches of Engineering)	**0**	**0**	**0**	**8**

Pre-Requisites:

- Fundamental knowledge of core engineering concepts, tools, and relevant software, along with awareness of sustainability principles and environmental considerations in engineering practice.
- Ability to work collaboratively in teams with basic skills in problem-solving and technical communication, including report writing and presentations.

Course Objectives

- To provide opportunities for applying engineering knowledge and technical skills in developing sustainable solutions to real-world problems.
- To develop the ability to analyze project requirements, team dynamics, and organizational processes with a focus on sustainability and effective project execution.
- To enhance skills in analyzing and communicating technical information through reports, presentations, and professional interactions, incorporating sustainability perspectives.
- To build competency in evaluating engineering designs, methodologies, and technologies based on sustainability, ethical, environmental, and societal considerations.
- To foster creativity and innovation in designing and developing sustainable engineering solutions aligned with global sustainable development goals.

Course Outcomes (COs):

On successful completion of the Course, Student will be able to

CO1: Apply engineering knowledge and technical skills to develop sustainable solutions for real-world problems considering resource efficiency and environmental impact. (L3)

CO2: Analyze team dynamics, organizational processes, and sustainability aspects to plan, manage, and execute project activities effectively in multidisciplinary environments. (L4)

CO3: Analyze and communicate technical information effectively through project reports, presentations, and professional interactions, incorporating sustainability considerations. (L4)

CO4: Evaluate design approaches, methodologies, and technologies to identify problems and justify appropriate engineering solutions based on sustainability, ethical, environmental, and societal considerations. (L5)

CO5: Design and develop innovative and sustainable engineering solutions or prototypes for real-world problems by integrating appropriate tools and techniques aligned with sustainable development goals. (L6)

HONOURS DEGREE
in CE

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0101T	Soil Dynamics and Machine Foundation	2	1	0	3

Pre-Requisites: Basic knowledge of soil mechanics, foundation engineering, structural dynamics, and vibration analysis concepts.

Course Objectives:

- Understand the fundamentals of vibration and response of single/multiple-degree-of-freedom systems.
- Analyze the wave propagation in soil deposits and evaluate dynamic soil properties.
- Perform vibration analyses for machine foundations, considering different loading conditions.
- Design block foundations for reciprocating and impact machines based on codal provisions.
- Analyze and design machine foundations on piles, considering different modes of vibration.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply principles of vibration theory to explain fundamentals of SDOF/MDOF systems and dynamic soil properties. (L3)

CO2: Analyze seismic wave propagation and evaluate dynamic soil properties for site characterization and foundation design. (L4)

CO3: Perform vibration analyses of rigid foundation blocks using different dynamic models for machine foundation design. (L4)

CO4: Design machine foundations for reciprocating and impact-type machines considering dynamic loads and frequency constraints. (L5)

CO5: Analyze the response of pile-supported machine foundations and develop design solutions for industrial applications. (L4)

Unit I: Fundamentals of Vibration:

Definitions, Simple Harmonic Motion, Response of SDOF Systems of Free and Forced Vibrations with And Without Viscous Damping, Frequency Dependent Excitation, Systems Under Transient Loads, Rayleigh ‘s Method of Fundamental Frequency, Logarithmic Decrement, Determination of Viscous Damping, Transmissibility, Systems with Two and Multiple Degrees of Freedom, Vibration Measuring Instruments.

Unit II: Wave Propagation and Dynamic Soil Properties:

Propagation of seismic waves in soil deposits -Attenuation of stress waves, Stress-strain behavior of cyclically loaded soils, Strength of cyclically loaded soils, Dynamic soil properties - Laboratory and field-testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils: An introduction and evaluation using simple methods.

Unit III: Vibration Analyses:

Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation

Unit IV: Design of Machine Foundations:

Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques

Unit V: Machine Foundations on Piles:

Introduction, Analysis of piles under vertical vibrations, Analysis of piles under translation and rocking, Analysis of piles under torsion, Design procedure for a pile supported machine foundation.

Text Books:

1. S. Prakash, Soil Dynamics, McGraw Hill, 1st Edition, 1981.
2. F. E. Richart, J. R. Hall, and R. D. Woods, Vibrations of Soils and Foundations, Prentice Hall Inc., 1st Edition, 1970.

Reference Books:

1. I. Chowdhary and S. P. Dasgupta, Dynamics of Structures and Foundation, 1st Edition, 2009.
2. S. D. Arya, M. O'Neil, and G. Pincus, Design of Structures and Foundations for Vibrating Machines, Gulf Publishing Co., 1st Edition, 1979.
3. S. Prakash and V. K. Puri, Foundation for Machines: Analysis and Design, John Wiley & Sons, 1st Edition, 1998.
4. N. S. V. Kameswara Rao, Vibration Analysis and Foundation Dynamics, Wheeler Publishing Ltd., 1st Edition, 1998.
5. Swami Saran, Soil Dynamics and Machine Foundation, Galgotia Publishing, 1st Edition, 1999.
6. S. L. Kramer, Geotechnical Earthquake Engineering, Prentice Hall, 1st Edition, 1996.

Online Resources:

https://nptel.ac.in/courses/105101005

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0102T	Industrial Waste and Waste Water Management	3	0	0	3

Pre-Requisites: Basic understanding of environmental engineering, water supply, wastewater treatment, and chemistry fundamentals.

Course Objectives:

- To understand the various sources and characteristics of industrial wastewater and its impacts on natural water bodies and sewer systems.
- To explain and differentiate primary and preliminary treatment methods for industrial effluents.
- To illustrate advanced treatment techniques including nutrient and heavy metal removal.
- To examine and summarize the characteristics and treatment needs of effluents from major industries like sugar, steel, petroleum, textiles, and tanneries.
- To develop awareness of common effluent treatment plants (CETPs), their design
- considerations, and operational challenges.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of industrial wastewater sources to identify their characteristics and explain effects on sewers and water bodies. (L3)

CO2: Apply suitable preliminary and primary treatment methods such as equalization, neutralization, and oil separation for industrial effluents. (L3)

CO3: Analyze various advanced waste treatment methods including nitrification, phosphorous and heavy metal removal for effluent quality. (L4)

CO4: Assess the composition of industrial effluents and recommend suitable treatment strategies based on regulatory standards. (L5)

CO5: Design components of Common Effluent Treatment Plants (CETPs) and address operational and economic challenges. (L5)

Unit I: Pollution:

Sources of Pollution - Physical, Chemical, Organic & Biological properties of Industrial Wastes - Difference between industrial & municipal waste waters - Sources and Flow Rates of Municipal Wastewater -Characteristics of Municipal Wastewater - Effects of industrial effluents on sewers and Natural water Bodies.

Unit II: Treatments:

Pre-& Primary Treatment - Equalization, Proportioning, Neutralization, Oil separation by Floating-Waste Reduction-Volume Reduction-Strength Reduction. Waste Treatment Methods - Nitrification and De-Nitrification-Phosphorous removal -Heavy metal removal - Membrane Separation Process -Air Stripping and Absorption Processes - Special Treatment Methods - Disposal of Treated Waste Water.

Unit III: Liquid Waste Origin I:

Manufacturing Process and liquid waste origin, Characteristics and Composition from Textiles, Paper and Pulp industries, Sugar Mills, Tanneries, Dairy and Oil Refineries.

Unit IV: Liquid Waste Origin II:

Manufacturing Process and liquid waste origin, Characteristics and Composition from Steel, Pharmaceutical Plants, Petroleum Refineries, Atomic Energy Plants and other Mineral Processing Industries.

Unit V: Treatment of Waste Water:

Joint Treatment of Raw Industries waste water and Domestic Sewage – Common Effluent Treatment Plants (CETP) – Location, Design, Operation and Maintenance Problems – Economical aspects. Development of integrated treatment for waste water – zero polluting industry concept – Reuse and recycle of waste water.

Text Books:

1. Rao, M.N. & Dutta, A.K. ―Waste Water Treatment‖, 3rd Edition, IBH Publishers, 2020.
2. Patwardhan-‖ Industrial Waste Water Treatment‖- PHI learning Pvt. Ltd, 2017

Reference Books:

1. Metcalf, L., and Eddy, P. Wastewater Engineering; Treatment and Reuse. 5th Edition, Tata McGraw-Hill, New Delhi, 2013.
2. Arceivala, S. J. and Asolekar, S. R. Wastewater Treatment for Pollution Control. 3rd Edition, McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2006.
3. Bureau of Indian Standards for analysis of water and wastewater (IS3025)
4. Anil K. De. Environmental Chemistry, New Age International Ltd., New Delhi, 2003
5. Hammer, Mark J. Water and Wastewater Technology, Prentice Hall, New Jercy, 2001

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc24_ce53/preview
2. https://onlinecourses.nptel.ac.in/noc2s1_ce25/preview

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0103T	Repair & Rehabilitation of Structures	3	0	0	3

Pre-Requisites: Fundamental knowledge of concrete technology, strength of materials, structural analysis, and reinforced concrete design.

Course Objectives:

- Understand the causes of deterioration and distress in concrete structures and the importance of rehabilitation.
- Familiarize with condition/damage assessment and evaluation techniques using NDT and field/lab tests.
- Gain knowledge on the selection and application of suitable materials and techniques for concrete repair.
- Learn various rehabilitation and retrofitting methods including case studies and demolition techniques.
- Understand the importance of protection, maintenance, and structural health monitoring (SHM) for ensuring long-term durability.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of deterioration causes to identify types of structural damage and interpret crack nature using IS 456 guidelines. (L3)

CO2: Analyze condition assessment and damage evaluation procedures using both field and laboratory-based NDT techniques. (L4)

CO3: Evaluate appropriate repair materials and techniques based on type and severity of damage in concrete structures. (L5)

CO4: Apply suitable retrofitting and rehabilitation strategies including engineered demolition methods with reference to case studies. (L3)

CO5: Analyze the significance of corrosion mitigation, preventive maintenance, and SHM in enhancing structural service life. (L4)

Unit I: Introduction:

Deterioration of structures with aging, need for rehabilitation - Deterioration of concrete structures: Causes of distress Causes of distress in concrete structures, construction and design failures, Distress in concrete due to physical and chemical deterioration. Deterioration due to water leakage, fire –detection & mitigation of the same. Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components. Measurement of cracks as per IS456 -interpretation of the cause of particular type of crack.

Unit II: Conditional/damage assessment & Evaluation of Structures:

Condition assessment and distress-diagnostic techniques, Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability by use of NDT equipment’s.

Unit III: Materials for Repair:

Materials for Repair materials - Criteria for durable concrete repair, Methodology, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. Corrosion damage of reinforced concrete - repair and prevention measures - Surface deterioration, Efflorescence, causes, prevention and protection Surface coatings and painting – Water proofing

Unit IV: Rehabilitation Methods:

Rehabilitation methods Retrofitting, RCC Jacketing, Fiber wrapping, Building and restoration of earthquake damaged masonry structure, Method for foundation rehabilitation; Case studies - Demolition techniques: Engineered demolition techniques for Dilapidated structures – case studies.

Unit V: Protection and Maintenance:

Protection & maintenance of structures - Deterioration due to ageing, inadequate maintenance Facets of Maintenance, importance of Maintenance various aspects of Inspection. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring / Structural health monitoring (SHM)–Definition maintenance of structures and motivation for SHM, Basic components of SHM and its working mechanism.

Text Books:

1. B. Bhattacharjee, Concrete Structures-Repair, Rehabilitation and Retrofitting, CBS Publishers and Distributors Pvt Ltd, 2017
2. R. Dodge Woodson, Concrete Structures-Protection, Repair and Rehabilitation, Elsevier, 2009.

Reference Books:

1. CPWD, Handbook on Repair and Rehabilitation of RCC Buildings, Govt of India Press, New Delhi, 2014.
2. Allen, Harold Roper, and Denison Campbell, Concrete Structures: Materials, Maintenance and Repair, Longman Scientific and Technical, UK, 1st Edition, 1991.
3. R. Dodge Woodson, Concrete Structures: Protection, Repair and Rehabilitation, Elsevier, 1st Edition, 2009.
4. Kenneth and Carper, Forensic Engineering, CRC Press, 1st Edition, 2000.
5. W. H. Ranson, Building Failures – Diagnosis and Avoidance, E. & F.N. Spon, 1st Edition, 1981.
6. R. Holland, Appraisal and Repair of Reinforced Concrete, Thomas Telford Ltd., Edition and Year not specified.

Online Resources:

https://onlinecourses.nptel.ac.in/noc20_ce26/preview

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0104T	Design and Drawing of Irrigation Structures	2	1	0	3

Pre-Requisites: Basic knowledge of fluid mechanics, hydraulics, irrigation engineering, and engineering drawing principles.

Course Objectives:

- Impart fundamental knowledge on various irrigation systems, soil moisture concepts, and canal design principles.
- Provide an understanding of the design aspects of diversion head works and their components.
- Introduce the functional and structural design of canal structures and cross-drainage works.
- Develop analytical skills in assessing the design and safety of storage head works, including gravity and earth dams.
- Explain the importance and design aspects of spillways and energy dissipation arrangements
- in hydraulic structures.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply principles of irrigation systems, soil moisture concepts, and canal design methods including silt and tractive force theories. (L3)

CO2: Analyze components and layout of diversion head works and apply design principles for weirs and silt control systems. (L4)

CO3: Design canal structures such as canal regulators, Sarda-type falls, and cross-drainage works for effective water conveyance. (L5)

CO4: Analyze structural stability and seepage characteristics of gravity dams and earth dams using appropriate design considerations. (L4)

CO5: Apply principles of spillway hydraulics and energy dissipation mechanisms in the design of spillway structures. (L3)

Unit I: Irrigation Systems:

Types of irrigation systems, Soil moisture, Irrigation water requirements, Irrigation efficiencies, Methods of application of irrigation water, Water logging – Causes and remedial measures - Canal Systems: Types of canals, Principles of design of stable irrigation canals, Silt theories, Tractive force theory, Design of lined canal, Design of longitudinal section.

Unit II: Design of Diversion Head Works:

Types of hydraulic structures, Layout of a diversion head work, Design of vertical drop weir, Silt control in head works.

Unit III: Design of Canal Structures:

Canal regulators, Types of canal falls, Design of Sarda type fall, Types of cross drainage works.

Unit IV: Storage Head Works:

Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam Earth dams: Types of earth dams, Causes of failure of earth dams, Seepage analysis, Seepage control, Stability analysis.

Unit V: Spillways and Energy Dissipation Systems:

Types of spillways, Ogee spillway, Principles of energy dissipators.

Text Books:

1. Modi, P. M., 2000, Irrigation Water Resources and Hydropower Engineering, Standard Book Publishing Company, New Delhi.
2. Asawa, G. L., 1996, Irrigation Engineering, New Age International Publishing Company, New Delhi

Reference Books:

1. Arora, K. L., 1996, Irrigation Water Resources Engineering, Standard Book Publishing Company, New Delhi.
2. Murthy, C. S. N., 2002, Water Resources Engineering – Principles and Practice, New Age International Publishing Company, New Delhi
3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures, Wiley Eastern Ltd.,

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0105T	Road Safety Engineering	3	0	0	3

Pre-Requisites: Basic understanding of transportation engineering, traffic engineering, highway geometry, and accident analysis concepts.

Course Objectives:

- Provide foundational knowledge about the causes and trends of road accidents and the impact of human, vehicle, and roadway factors on highway safety.
- Introduce statistical tools and procedures for interpreting and analysing crash data including black spot and hotspot investigations.
- Explain the principles and components of road safety management systems and the role of audits and crash investigations.
- Impart understanding of crash reconstruction techniques using physical evidence, kinematic principles, and accident scenarios.
- Promote awareness of safety improvement measures in highway planning, design, operation,
- and enforcement including policy and stakeholder roles.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of road accident trends, human and vehicle factors to explain the Indian scenario of road safety. (L3)

CO2: Apply statistical methods for crash data analysis and conduct black spot and hotspot identification for safety interventions. (L3)

CO3: Analyze the structure of road safety management systems, road safety audit processes, and data needs for improving safety. (L4)

CO4: Analyze crash reconstruction cases using physical evidence to calculate speed, drag, and impact forces for different accident types. (L4)

CO5: Evaluate and recommend mitigation measures including forgiving road design, safety signs, and road safety law enforcement. (L5)

Unit I: Basics of Road Safety:

Road accidents, Trends, Global and Indian level, Crash Causation, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India.

Unit II: Statistical Interpretation and Analysis of Crash Data:

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Hot spot analysis, Case Studies.

Unit III: Road Safety Management System:

Multi-causal dynamic systems approach to safety; Crash Vs. Accident; Road safety improvement strategies; Elements of a road safety plan, Speed management, Safety data Needs; Intersection Safety, Safe vehicle design. Road Safety Audits: Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies

Unit IV: Crash Reconstruction:

Describe the basic information that can be obtained from the roadway surface, Basic physics related to crash reconstruction, speed for a various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

Unit V: Mitigation Measures:

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation, and accident control measures, Highway Safety Measures during construction, Highway geometry, and safety; Design of Forgiving roads and self-explaining roads, Effective Road Signs and Street Lighting, Safety in urban areas; Public transport and safety; Road safety policy-making, Stakeholders involvement; Road safety law.

Text Books:

1. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (Reprinted 2002).
2. M. Ohidul Haque, Road Safety: Data Collection, Analysis, Monitoring, And Countermeasure Evaluations with Cases, University Press of America, 2008.

Reference Books:

1. IRC: SP: 88-2019 Manual on Road Safety Audit
2. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 1st Edition, 2016.
3. Rune Elvik, Alena Hoye, and Truls Vaa, The Handbook of Road Safety Measures, Emerald Group Publishing, 2nd Edition, Sept 2009.
4. R. P. Roess, E. S. Prassa, and W. R. Mcshane, Traffic Engineering, Prentice Hall, 2011.

Online Resources:

https://ebrdelearning.com/road-safety-engineering-e-learning-course

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0106P	NDT Lab	0	0	3	1.5

Pre-Requisites: Basic knowledge of concrete technology, structural engineering, and laboratory testing methods for construction materials.

Course Objectives:

- Understand the fundamental principles and significance of non-destructive testing (NDT) in concrete structures.
- Apply various NDT techniques to evaluate the structural integrity and quality of concrete.
- Analyze data from NDT methods to detect cracks, voids, rebar position, corrosion, and other defects.
- Evaluate the durability and in-situ strength characteristics of concrete using advanced testing techniques.
- Develop competence in interpreting NDT results for effective decision-making in structural
- health monitoring.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply Rebound Hammer and Ultrasonic Pulse Velocity tests to assess surface hardness and detect internal concrete defects. (L3)

CO2: Analyze corrosion risk and carbonation depth using Half-Cell Potential and Carbonation Depth tests for structural assessment. (L4)

CO3: Evaluate compressive strength and concrete integrity using Penetration Resistance and Impact Echo testing methods. (L5)

CO4: Detect reinforcement layout, cover depth, and subsurface anomalies using Rebar Locator and Ground Penetrating Radar. (L4)

CO5: Interpret results from Acoustic Emission and core testing methods for structural damage diagnosis and condition assessment. (L5)

List of Experiments:

1. To assess the surface hardness and compressive strength of concrete by using Rebound Hammer Test
2. To determine the quality, uniformity, and presence of cracks or voids in concrete by Ultrasonic Pulse Velocity Test
3. To evaluate the compressive strength of hardened concrete using probe penetration by Penetration Resistance Test
4. To measure the depth of carbonation in concrete this leads to corrosion of reinforcement by Carbonation Depth Test
5. To assess the corrosion potential of reinforcing steel in concrete by Half-Cell Potential Test
6. To detect reinforcement position, diameter, and concrete cover over rebars by Rebar Locator
7. To detect subsurface features, rebar locations, and voids in concrete structures by Ground Penetrating Radar
8. To monitor crack propagation and damage activity in structural components by Acoustic Emission Technique

9. To extract cores for testing and conduct visual and microscopic analysis of concrete quality.
10. To evaluate thickness, delamination’s, and voids in concrete slabs or pavements by Impact Echo Test
11. To measure strain, temperature, or crack growth in structural components using embedded optical fibers.
12. To identify surface-breaking defects in non-porous materials BY Dye Penetrant Testing

Honours Degree

Course Code	Name of the Course	L	T	P	C
24HON0107P	ETABS and SAP Lab	0	0	3	1.5

Pre-Requisites: Fundamental understanding of structural analysis, reinforced concrete design, and computer-aided structural modelling concepts.

Course Objectives:

- To understand the interface, tools, and modelling environment of ETABS and SAP2000 for structural design.
- To develop and analyse multi-storey buildings, shear walls, and frames under various loads using ETABS and SAP2000.
- To perform structural modelling, assign loads, and interpret analysis results for real-world building and infrastructure systems.
- To evaluate performance-based seismic behaviour and nonlinear analysis techniques using advanced structural software.
- To design and optimize structural components like water tanks and bridges using
- advanced modelling tools.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply ETABS and SAP2000 interface tools to model and analyze structural systems for civil engineering applications. (L3)

CO2: Analyze multi-story buildings and shear wall systems under lateral and gravity loads using ETABS structural software. (L4)

CO3: Analyze and interpret the behaviour of structural models using performance-based and nonlinear seismic analysis methods. (L4)

CO4: Evaluate the design of structural elements such as frames, water tanks, and bridges using SAP2000 software tools. (L5)

CO5: Develop detailed structural models and conduct advanced simulations to support safe and economical design decisions. (L5)

List of Experiments:

1. Determination of ETABS Interface and Structural Modelling Techniques
2. Analysis of a Multi-Story Building under Lateral Loads in ETABS
3. Development of Structural Analysis for a Shear Wall System in ETABS
4. Application of Performance-Based Seismic Analysis in ETABS
5. Determination of Structural Analysis of a Simple Frame using SAP2000
6. Development of a Bridge Model and Load Analysis in SAP2000
7. Analysis and Design of an Elevated Water Tank using SAP2000
8. Application of Nonlinear Analysis for a Structural System using SAP2000

MINOR DEGREE
in
Building Planning & Construction Technology

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0101T	Construction Materials	3	0	0	3

Pre-Requisites: Basic knowledge of building materials, construction practices, and material testing fundamentals.

Course Objectives:

- To Understand the Types, Physical Characteristics, Testing, and Deterioration of Natural and Artificial Stones Used in Construction.
- To Explain and Classify Various Structural Clay Products Such as Bricks, Tiles, Terracotta, Porcelain, and their Manufacturing Processes and Applications.
- To Analyze and Apply the Knowledge of Cement, Aggregates, and Admixtures to Evaluate the Properties of Fresh and Hardened Concrete, Including Mix Design.
- To Evaluate and Apply the Knowledge of Wood and Timber—Its Properties, Preservation, Defects, Testing, and Uses in Building Construction.
- To Understand and Interpret the Composition, Application Techniques, and Properties of Paints, Varnishes, Enamels, and Surface Finishes.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of conventional and modern construction materials to explain their properties, composition, and engineering applications. (L3)

CO2: Analyze the mechanical, chemical, and durability properties of construction materials under various environmental conditions. (L4)

CO3: Evaluate the performance and suitability of building materials including concrete, steel, bricks, and timber for construction use. (L5)

CO4: Apply material testing standards to assess quality control and material selection for sustainable construction practices. (L3)

CO5: Assess advances in construction materials including green materials, composites, and smart materials for modern infrastructure. (L5)

Unit I: Stones:

Introduction - Rock-Forming Minerals - Classification of Rocks - Quarrying of Stones - Seasoning of Stone -Dressing of Stone - Uses of Stones - Characteristics of Good Building Stones - Testing of Stones -Deterioration of Stones - Durability of Stones - Preservation of Stones - Selection of Stones - - Common Building Stones - Artificial Stones - Applications of Stones.

Unit II: Structural Clay Products:

Introduction - Physical Properties of Clays - Classification of Bricks - Ingredients of Good Brick Earth -Characteristics of Good Brick - Manufacturing of Bricks - Different Forms of Bricks - Testing of Bricks -Defects of Bricks - Clay Tiles - Fire-Clay Bricks or Refractory Bricks – Terracotta – Porcelain – Stoneware –Earthenware – Glazing – Majolica - Application of Clay Products.

Unit III: Cement Concrete:

Introduction - Portland Cement - Chemical Composition - Hydration of Cement- Manufacture of Cement -Testing of Cement - Types of Cement – AGGREGATES - Classification of Aggregates - Fine Aggregate & Coarse Aggregate - Testing of Aggregates - Quality of Mixing & Curing Water – Admixtures for Concrete -Principles of Mix Design - Fresh and Hardened Properties.

Unit IV: Crash Reconstruction:

Introduction - Classification of Trees - Growth of Trees - Classification of Timber (IS: 399) - Structure of Timber - Characteristics of Good Timber - Seasoning of Timber - Defects In Timber - Diseases of Timber -Decay of Timber - Preservation of Timber (IS: 401) - Fire Resistance of Timber - Testing of Timber (IS: 1708)

Suitability of Timber For Specific Uses - Properties of Wood - Wood Products - Applications of Wood and Wood-Products.

Unit V: Paints Enamels and Varnishes:

Introduction - Composition of Oil Paint - Characteristics of An Ideal Paint - Preparation of Paint - Covering Power of Paints - Pigment Volume Concentration (P.V.C.) - Painting Plastered Surfaces - Painting Wood Surfaces - Painting Metal Surfaces - Defects - Enamel - Distemper - Water Wash and Colour Wash – Varnish French Polish - Wax Polish - Miscellaneous Paints.

Text Books:

1. S.K. Duggal, Building Materials, New Age International Pvt. Ltd., 3rd Revised Edition, 2008.
2. P.C. Varghese, Building Materials, PHI Learning Pvt. Ltd., 2nd Edition, 2015.

Reference Books:

1. M. L. Gambhir, Building Materials, Tata McGraw Hill Publishing Co. Ltd., 4th Edition, 2013.
2. S. S. Bhavikatti, Building Materials, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2015.
3. B. C. Punmia, Building Materials, Laxmi Publications Pvt. Ltd., 2010.
4. Jagadish, Venkatarama Reddy, Alternate Building Materials and Technology, New Age International Publishers, 2010.
5. Surendra Singh, Engineering Materials, Vikas Publishing House Pvt. Ltd., 2014.
6. P. D. Kulkarni et al., Civil Engineering Materials, Tata McGraw Hill Publishing Co. Ltd., 2008.

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0102T	Construction Methods	3	0	0	3

Pre-Requisites: Basic understanding of building construction, surveying, and construction materials and techniques.

Course Objectives:

- To Understand the Importance, Types, and Selection of Foundations for Various Site Conditions.
- To Identify and Apply Construction Techniques of Different Types of Masonry and Structural Components.
- To Describe and Evaluate Different Types and Techniques of Plastering Used in Construction.
- To Examine the Properties, Applications, and Construction Methods of Various Flooring Types.
- To Analyze and Design Basic Components of Industrial Structures with Emphasis On Modern Techniques and Materials.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of construction methods and processes to explain site preparation, excavation, and foundation construction techniques. (L3)

CO2: Analyze masonry, concrete, and steel construction methods and their suitability for different structural systems. (L4)

CO3: Evaluate formwork design, scaffolding systems, and temporary structure requirements for safe construction operations. (L5)

CO4: Apply project planning and scheduling techniques including bar charts and CPM for construction project management. (L3)

CO5: Assess construction quality, safety regulations, and environmental compliance requirements for sustainable building projects. (L5)

Unit I: Foundations:

Introduction to Foundations - Importance of Foundations In Construction - Functions of A Foundation -Factors Affecting the Choice of Foundations - Types of Foundations - Shallow Foundations: Strip Footing, Isolated Footing, Combined Footing, Raft Foundation - Deep Foundations: Pile Foundations, Well Foundations - Site Investigation For Foundations - Soil Testing Methods, Bearing Capacity of Soils, Methods of Improving Bearing Capacity.

Unit II: Masonry:

Introduction to Masonry Construction - Definition and Importance of Masonry - Comparison of Different Types of Masonry - Types of Masonry Construction - Brick Masonry: Stretcher, Header, English, Flemish Bonds - Stone Masonry: Random Rubble Masonry, Coursed Rubble Masonry, Ashlar Masonry -Concrete Block

Masonry: Hollow Blocks, Solid Blocks, Interlocking Blocks - Composite Masonry: Brick-Stone Composite Masonry - Lintels, Arches, and Copings - Construction Techniques and Materials Used.

Unit III: Plastering:

Introduction to Plastering - Purpose and Importance of Plastering - Materials Used In Plastering (Cement, Lime, Gypsum) - Types of Plastering - Lime Plaster, Cement Plaster, Gypsum Plaster, Stucco Plaster -Methods of Plastering -Single Coat, Double Coat, and Three-Coat Plastering - Defects In Plastering and Remedies -Cracking, Peeling, Efflorescence, Blistering - Special Plastering Techniques -Waterproof Plastering, Decorative Plastering.

Unit IV: Flooring:

Introduction To Flooring - Importance and Requirements of Good Flooring - Types of Flooring - Hard Flooring: Stone (Marble, Granite, Kota), Concrete Flooring , Ceramic and Vitrified Tiles - Resilient Flooring: PVC, Linoleum, Rubber Flooring - Wooden Flooring: Solid Wood, Laminated Wood, Parquet Flooring -Special Flooring: Epoxy Flooring, Mosaic Flooring, Terrazzo Flooring - Construction Methods of Flooring -Laying of Different Floor Materials - Sub-Base Preparation and Finishing - Defects In Flooring and Repair Techniques - Cracking, Dampness, Uneven Settlement.

Unit V: Industrial Structures:

Introduction To Industrial Structures - Requirements of Industrial Buildings - Structural Components - Types of Industrial Structures - Steel Structures: Components of Steel Buildings (Trusses, Columns, Girders)

Pre-Engineered Buildings (PEB): Concept, Advantages, and Applications - Portal Frames and Space Frames: Design and Construction Considerations - Roofing Systems In Industrial Buildings - Trusses, Shell Roofs, Domes, Vaults - Construction of Warehouses and Sheds : Material Selection, Structural Stability Considerations - Factories and Large-Span Structures, Construction Techniques For Long-Span Structures , Fire Resistance and Safety Measures - Special Considerations For Industrial Buildings - Ventilation and Lighting Requirements, Vibration Control and Noise Reduction Techniques.

Text Books:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Construction, Laxmi Publications (P) Ltd., New Delhi, 2008.
2. P.C. Varghese, Building Construction, PHI Learning Pvt. Ltd., 2nd Edition, 2017.

Reference Books:

1. Sushil Kumar, Building Construction, Standard Publishers Distributors, New Delhi, 2013
2. S. S. Bhavikatti, Building Construction, Vikas Publishing House Pvt. Ltd., 2nd Edition, 2016.
3. Dr. S. C. Rangwala, Building Construction, Charotar Publishing House, 26th Edition, 2014.
4. R. L. Peurifoy, Construction Planning, Equipment and Methods, McGraw Hill Education, 8th Edition, 2010

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0103T	Building Planning and Drawing	3	0	0	3

Pre-Requisites: Fundamental knowledge of engineering drawing, building construction, and architectural planning concepts.

Course Objectives:

- To Understand the Principles of Building Planning and Regulatory Requirements for Residential and Public Structures.
- To Apply Functional Planning Skills for Residential, Public, and Commercial Buildings Including Vaastu and Barrier-Free Concepts.
- To Analyze and Prepare Building Plans and Elevations for Industrial and Special-Purpose Structures.
- To Utilize Computer-Aided Drafting Tools to Develop Architectural and Working Drawings.
- To Evaluate Planning Strategies in Compliance with National Codes and Sustainability Standards.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply architectural design principles to explain building planning concepts, bye-laws, and space functional requirements. (L3)

CO2: Analyze building planning requirements for residential, commercial, and institutional buildings based on NBC guidelines. (L4)

CO3: Develop plans, elevations, sections, and details of buildings using standard drawing conventions and AutoCAD tools. (L5)

CO4: Apply knowledge of building systems including staircases, ventilation, and lighting in the preparation of architectural drawings. (L3)

CO5: Evaluate building designs for functional efficiency, structural feasibility, and compliance with planning regulations. (L5)

Unit I: Building Planning Principles & Regulations:

Introduction To Building Planning - Objectives of Planning - Principles of Planning - Orientation of Buildings
- Building Bye-Laws and Regulations - Necessity of Building Bye-Laws - National Building Code (NBC) Provisions - Local Municipal and Development Authority Regulations - Setbacks and Open Space Requirements - Floor Area Ratio (FAR) and Floor Space Index (FSI) , Height Regulations and Ground Coverage - Lighting, Ventilation, and Fire Safety Regulations - Natural Lighting and Ventilation Standards -Fire-Resistant Construction and Safety Measures - Concepts of Green Building and Sustainable Planning -Energy-Efficient Building Design - Passive Solar Architecture.

Unit II: Residential Buildings:

Classification of Residential Buildings - Individual Houses, Duplex Houses, Apartments, Row Houses, Villas Functional Requirements of A Residential Building - Zoning and Space Requirements For Different Rooms Circulation and Connectivity - Types of Residential Plans - Single-Bedroom, Double-Bedroom, and Multi-Storey Residential Plans - Preparation of Building Plans - Plan, Elevation, and Section of A Simple Residential Building - Vaastu Considerations In Residential Planning - Orientation of Rooms as Per Traditional Indian Architectural Practices.

Unit III: Public and Commercial Buildings:

Classification of Public Buildings - Educational Buildings (Schools, Colleges, Universities) - Institutional Buildings (Hospitals, offices, Banks) - Recreational Buildings (Theatres, Auditoriums, Stadiums) - Functional Requirements and Planning of Public Buildings - Planning of Commercial Buildings - Shopping Malls, Hotels, office Buildings - Preparation of Drawings for Public Buildings - Plan, Elevation, and Section of A Public/Commercial Building - Universal Design and Barrier-Free

Planning - Provision for Differently-Abled Individuals - Ramps, Lifts, Tactile Paving, and Accessible Washrooms

Unit IV: Industrial and Special Structures:
Introduction To Industrial Buildings - Functional Planning of Industries - Layout of Factory Buildings - Types of Industrial Structures - Warehouses, Godowns, Cold Storage Facilities - Special Purpose Buildings - Parking Structures, Bus Terminals, Railway Stations, Airports - Planning of Multi-Storied Buildings - Structural Aspects and Service Provisions - Vertical Circulation (Lifts, Escalators, Staircases) - Preparation of Drawings For Industrial Buildings – Plan, Elevation, and Section of An Industrial Shed Or Warehouse.

Unit V: Computer-Aided Drawing (CAD) and Working Drawings:
Introduction To CAD In Building Drawing - Importance of CAD In Modern Construction - Software Used (AutoCAD, Revit, Sketchup) - Preparation of Working Drawings - Detailed Plans, Elevations, and Sections –Site Plan, Key Plan, and Service Plans - Structural Drawings and Detailing - Footing Details, Column Layouts, Slab Reinforcement - Preparation of Submission Drawings - Sanction Drawings as Per Municipal Regulations Approval Process and Documentation - Service Drawings - Electrical, Plumbing, and HVAC (Heating, Ventilation, and Air Conditioning) Drawings.

Text Books:
1. M. G. Shah, C. M. Kale, Building Drawing, Tata McGraw Hill Publishing Co. Ltd., 2nd Edition, 2012.
2. Gurucharan Singh, Building Drawing, Standard Publishers Distributors, 9th Edition, 2015.

Reference Books:
1. K. R. Karnan, Building Planning and Drawing, Scitech Publications (India) Pvt. Ltd., 2016.
2. S. P. Bindra, Building Drawing and Detailing, Dhanpat Rai Publishing Co., 2014.
3. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Building Planning and Drawing, Laxmi Publications Pvt. Ltd., 2011.

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0104T	Surveying	2	1	0	3

Pre-Requisites: Basic understanding of mathematics, geometry, and civil engineering measurement principles.

Course Objectives:

- Understand the Principles, Classifications, and Fundamental Techniques of Surveying Including Chain, Compass, Levelling, and Plane Table Surveys.
- Apply Basic Surveying Instruments and Techniques for Measurement of Distances, Angles, Levels, Areas, and Volumes.
- Analyze and Compute Traverse Data, Horizontal and Vertical Angles Using theodolites and Trigonometric Levelling Methods.
- Evaluate the Use of Modern Surveying Instruments Like Total Stations, GPS, and Remote Sensing Tools for Spatial Data Acquisition.
- Interpret Photogrammetric Data for Topographic Mapping, Aerial Triangulation, and Preparation of Maps Using Stereoscopy.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply principles of surveying to explain basic concepts, types of surveys, and linear measurement techniques. (L3)

CO2: Analyze angular and levelling measurements using theodolite, dumpy level, and total station instruments for survey work. (L4)

CO3: Apply traversing and plane table survey methods to determine land areas and prepare contour maps. (L3)

CO4: Evaluate horizontal and vertical curve design for road and railway alignment using standard surveying calculations. (L5)

CO5: Assess modern surveying technologies including GPS, remote sensing, and GIS for large-scale mapping applications. (L5)

Unit I: Introduction and Basic Concepts:

Introduction, Objectives, Classification and Principles of Surveying, Surveying Accessories. Introduction to Compass, Leveling and Plane Table Surveying.

Linear Distances: Approximate Methods, Direct Methods- Chains- Tapes, Ranging, Tape Corrections.

Prismatic Compass: Bearings, Included Angles, Local Attraction, Magnetic Declination, and Dip – Systems and W.C.B and Q.B Systems of Locating Bearings.

Unit II: Leveling:

Leveling- Types of Levels, Methods of Levelling, and Determination of Levels, Effect of Curvature of Earth and Refraction.

Contouring: Characteristics and Uses of Contours, Methods of Contour Surveying.

Areas: Determination of Areas Consisting of Irregular Boundary and Regular Boundary.

Volumes: Determination of Volume of Earth Work in Cutting and Embankments for Level Section, Capacity of Reservoirs.

Unit III: Theodolite Surveying:

Types of theodolites, Temporary Adjustments, Measurement of Horizontal Angle by Repetition Method and Reiteration Method, Measurement of Vertical Angle, Trigonometrical Leveling When Base Is Accessible and Inaccessible.

Traversing: Methods of Traversing, Traverse Computations and Adjustments, Introduction to Omitted Measurements.

Unit IV: Curves:

Types of Curves and their Necessity, Elements of Simple, Compound, Reverse Curves. Introduction To Tacheometric Surveying.

Modern Surveying Methods: Principle and Types of E.D.M. Instruments, Total Station- Advantages and Applications. Introduction to Global Positioning System. Introduction to Drone Survey and Lidar survey (Light Detection and Ranging).

Unit V: Photogrammetry Surveying:

Introduction, Basic Concepts, Perspective Geometry of Aerial Photograph, Relief and Tilt Displacements, Terrestrial Photogrammetry, Flight Planning; Stereoscopy, Ground Control Extension for Photographic Mapping- Aerial Triangulation, Radial Triangulation, Methods; Photographic Mapping- Mapping Using Paper Prints, Mapping Using Stereo-Plotting Instruments, Mosaics, Map Substitutes.

Text Books:

1. S. K. Duggal, Surveying (Vol. 1 & 2), Tata McGraw Hill Publishing Co. Ltd., New Delhi, 5th Edition, 2019.
2. C. Venkatramaiah, Textbook of Surveying, Universities Press, 1st Edition, 2011.

Reference Books:

1. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying (Vol. 1), Laxmi Publications (P) Ltd., New Delhi, 18th Edition, 2024.
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying (Vol. 2), Laxmi Publications (P) Ltd., New Delhi, 17th Edition, 2022.
3. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying (Vol. 3), Laxmi Publications (P) Ltd., New Delhi, 16th Edition, 2023.
4. A. M. Chandra, Plane Surveying and Higher Surveying, New Age International Pvt. Ltd., New Delhi, 3rd Edition, 2015.
5. N. Basak, Surveying and Levelling, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 4th Edition, 2014.
6. K. R. Arora, Surveying (Vol. 1, 2 & 3), Standard Book House, Delhi, 12th Edition, 2015.

Online Resources:

Https://Onlinecourses.Nptel.Ac.In/Noc20_Ce18/Preview

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0105T	Concrete Technology	2	1	0	3

Pre-Requisites: Basic knowledge of construction materials, cement, aggregates, and strength of materials concepts.

Course Objectives:

- Understand the Composition, Properties, Specifications, and Testing Methods for Concrete Materials.
- Learn the Methods of Concrete Production Including Mixing, Transportation, Placing, Compaction, and Curing.
- Acquire Knowledge on the Behaviour of Fresh and Hardened Concrete and Factors Influencing Performance.
- Develop the Ability to Design Concrete Mixes Using Standard Methods for Normal and High Strength Concrete.
- Explore Special Concretes, Quality Control Measures, and Durability Aspects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply knowledge of cement and aggregate properties to explain their role in concrete mix design and quality control. (L3)

CO2: Analyze fresh and hardened concrete properties including workability, strength, durability, and permeability characteristics. (L4)

CO3: Design concrete mixes using IS and ACI methods for various structural applications and exposure conditions. (L5)

CO4: Apply special concrete technologies including high-performance, self-compacting, and fibre-reinforced concrete for advanced applications. (L3)

CO5: Evaluate concrete quality through non-destructive testing and recommend appropriate repairs for deteriorated structures. (L5)

Unit I: Materials for Making Concrete:

Cement - Chemical Composition, Physical Properties; Tests, I.S. Specifications; Different Types – Aggregates - Classification, Mechanical Properties, and Tests, Grading Requirements, Sampling of Aggregate; Water -Quality of Water, Permissible Impurities as Per I.S; – Mineral Admixtures: Fly Ash, GGBS, Silica Fume, Metakaolin, Rice Husk Ash, Etc. Chemical Admixtures - Accelerators, Retarders, Water Reducing Agents, Super Plasticizers, Air Entrainers, Water Proofers.

Unit II: Concrete:

Manufacture of Concrete, Measurement of Materials, Storage and Handling, Batching Plant and Equipment Mixing - Types of Mixers, Transportation of Concrete, Pumping of Concrete, Placing of Concrete, Under Water Concreting, Compaction of Concrete, Curing of Concrete, Ready Mixed Concrete. Mix Design -Nominal Mixes and Design Mixes, Factors Influencing Mix Design; ACI Method and I.S Method, Design for High Strength Mixes.

Unit III: Fresh, Hardened Properties of Concrete:

Fresh Concrete - Workability, Tests for Workability, Cohesion, Segregation, and Bleeding; Hardened Concrete- Factors Affecting Strength of Concrete, Strength of Concrete in Compression, Tension, and Flexure; Stress- Strain Characteristics and Elastic Properties; Introduction to Microstructural Properties of Concrete.

Unit IV: Mix Design:

Mix Design - Factors Influencing Mix Proportion - Mix Design by ACI Method and I.S. Code Method -Design of High Strength Concrete. Strength of Concrete - Shrinkage and Temperature Effects - Creep of Concrete - Permeability of Concrete - Durability of Concrete - Corrosion - Causes and Effects - Remedial Measures- thermal Properties of Concrete - Micro Cracking of Concrete.

Unit V: Special Concrete:

Special Concrete - Lightweight Concrete - Fiber Reinforced Concrete - Polymer-Polymer Modified Concrete -Ferrocement - Mass Concrete - Ready Mix Concrete- Self Compacting Concrete- Quality Control - Sampling and Testing-Acceptance Criteria.

Text Books:

1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5th Edition.
2. Concrete Technology: theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.

Reference Books:

1. P. Kumar Mehta, Paulo J.M. Monteiro, Concrete: Microstructure, Properties, and Materials, Mcgraw Hill Education,2014
2. Concrete Technology: theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers, 2018.
3. Concrete Technology, J.J. Brooks and A. M. Neville, Pearson, 2019, 2nd Edition.
4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.

Minor Degree - Building Planning & Construction Technology

Course Code	Name of the Course	L	T	P	C
24MBC0106P	Concrete Technology Lab	0	0	3	1.5

Pre-Requisites: Fundamental understanding of concrete materials, laboratory testing procedures, and mix design principles.

Course Objectives:

- Understand the Physical Properties and Behavior of Cement and Aggregates.
- Gain Hands-On Experience in Determining the Fresh and Hardened Properties of Concrete.
- Conduct Standard Laboratory Procedures for Assessing the Quality of Concrete Materials.
- Familiarize with Concrete Mix Design Using IS Method.
- Interpret Experimental Data for Evaluating the Performance of Concrete.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply standard test procedures to determine properties of cement including consistency, setting time, soundness, and strength. (L3)

CO2: Analyze aggregate properties such as specific gravity, water absorption, gradation, and fineness modulus for mix design. (L4)

CO3: Evaluate fresh and hardened concrete properties through slump, compaction factor, cube strength, and durability tests. (L5)

List of Experiments:

1. Determination of Fineness and Specific Gravity of Cement.
2. Determination of Consistency of Standard Cement Paste.
3. Determination of Initial and Final Setting Times of Cement.
4. Determination of Compressive Strength of Cement.
5. Determination of Soundness of Cement by La-Chatalier's Apparatus.
6. Determination of Fineness Modulus of Coarse and Fine Aggregates.
7. Determination of Percentage of Voids, Bulk Density, Specific Gravity of Course and Fine Aggregates.
8. Workability Tests: Slump Cone Test, Compaction Factor Test, Vee-Bee Consistometer, Flow Test.
9. Preparing and Curing Concrete Specimens for Tests & Determination of Compressive Strength of Concrete Cubes.
10. Study of Stress - Strain Characteristics of Concrete and Tests for Tensile Strength of Concrete.
11. Experiments to Demonstrate the Use of Non-Destructive Test Equipment.
12. Mix Design: IS Code Method.

Text Books:

13. Concrete Technology: theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.

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Course Code	Name of the Course	L	T	P	C
24MBC0107P	Surveying Lab	0	0	3	1.5

Pre-Requisites: Basic knowledge of surveying principles, field measurements, and use of surveying instruments.

Course Objectives:

- Understand and perform different types of surveying techniques including chain, compass, plane table, and Theodolite surveying.
- Apply methods of levelling and contouring for field measurements and building layouts.
- Interpret and plot survey data accurately to prepare maps and plans.
- Use modern surveying instruments like Total Station for precise measurements.
- Develop skills to set out curves and perform traversing for practical civil engineering projects.

Course Outcomes (COs):

On successful completion of the course, Student will be able to

CO1: Apply chain surveying and plane table methods to conduct field surveys and prepare accurate site plans. (L3)

CO2: Analyze levelling operations and traverse surveys using dumpy level and theodolite instruments for engineering applications. (L4)

CO3: Evaluate topographic data and generate contour maps and longitudinal/cross-sectional profiles for design purposes. (L5)

List of Experiments:

1. Chain Survey - Traversing and Plotting of Details
2. Compass Survey - Traversing with Compass and Plotting
3. Plane Table Survey - Method of Radiation and Intersection
4. Levelling - Fly Leveling - Plane of Collimation Method
5. Levelling - Fly Leveling - Rise and Fall Method
6. Levelling - Longitudinal and Cross Sectioning
7. Levelling - Contour Surveying 8. Layout of Buildings
8. Profile Levelling and Cross Sectioning.
9. Grid Contouring
10. Theodolite Surveying - Measurement of Horizontal Angle by Method of Repetition and Reiteration
11. Setting Out of Simple Curves - Linear Methods
12. Description of Total Station.

Text Books:

1. Surveying and Levelling By N.N.Basak, TMH Publication 2. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 1, Laxmi Publications (P) Ltd., New Delhi

Online Resources:

1. Https://Nptel.Ac.In/Courses/105/107/105107122/
2. Https://Nptel.Ac.In/Courses/105/104/105104101/
3. sHttp://Sl-Iitr.Vlabs.Ac.In/Sl-Iitr/