JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., ACT No.30 of 2008)

ANANTHAPURAMU – 515 002 (A.P) INDIA

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B. Tech (Regular-Full Time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

CIVIL ENGINEERING

III & IV YEAR COURSE STRUCTURE

III B.Tech. I Semester

S.No.	Course code	Title	L	T	P	Credits
1.	23A01501	Water Resources Engineering	3	0	0	3
2.	23A01502	Design Of Reinforced Concrete Structures	3	0	0	3
3.	23A01503T	Geotechnical Engineering	3	0	0	3
4.	23A05504	Introduction To Quantum Technologies And Applications	3	0	0	3
5.	23A01504a 23A01504b 23A01504c	**Professional Elective-I** 1. Pre-stressed Concrete 2.Air Pollution and Control 3. Environmental Impact Assessment	3	0	0	3
6.		**Open Elective-I**	3	0	0	3
7.	23A01503P	Geotechnical Engineering Lab	0	0	3	1.5
8.	23A01506	Fluid Mechanics Hydraulic Machines Lab	0	0	3	1.5
9.	23A01507	**Skill oriented course** Estimation, Specifications, Costing & Valuation	0	1	2	2
10.	23A03508	Tinkering Lab	0	0	2	1
11	23A01508	Evaluation of Community Service Internship	-	-	-	2
Total			**18**	**1**	**10**	**26**

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A02505	Electrical Safety Practices and Standards	EEE
2	23A03505	Sustainable Energy Technologies	ME
3	23A04505	Electronic Circuits	ECE
4	23A05506a	Java Programming	CSE& Allied/IT
5	23A05506b	Fundamentals of Artificial Intelligence	
6	23A05506c	Quantum Technologies and Applications	
7	23A54501	Mathematics for Machine Learning and AI	Mathematics
8	23A56501	Materials Characterization Techniques	Physics
9	23A51501	Chemistry of Energy Systems	Chemistry
10	23A52502a	English for Competitive Examinations	Humanities
11	23A52502b	Entrepreneurship and New Venture Creation	

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

III B.Tech. II Semester

S.No.	Course code	Title	L	T	P	Credits
1.	23A01601	Design of Steel Structures	3	0	0	3
2.	23A01602T	Highway Engineering	3	0	0	3
3.	23A01603T	Environmental Engineering	3	0	0	3
4.	23A01604a 23A01604b 23A01604c	**Professional Elective-II** 1. Design of Earthquake Resistant Structures 2. Open Channel Flow 3. Foundation Engineering	3	0	0	3
5.	23A01605a 23A01605b 23A01605c	**Professional Elective-III** 1. Cost effective Housing Techniques 2. Watershed Management 3. Advanced Structural Analysis	3	0	0	3
6.		**Open Elective-II**	3	0	0	3
7.	23A01602P	Highway Engineering Lab	0	0	3	1.5
8.	23A01603P	Environmental Engineering Lab	0	0	3	1.5
9.	23A01607	**Skill oriented course** Building Information Modelling	0	1	2	2
10.	23A52601	**Mandatory noncredit course** Technical paper writing & IPR	2	0	0	-
Total			**20**	**1**	**8**	**23**

Mandatory Industry Internship of 08 weeks duration during summer vacation

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A02605	Renewable Energy Sources	EEE
2	23A03606	Automation and Robotics	ME
3	23A04606	Digital Electronics	ECE
4	23A32502T	Operating Systems	CSE& Allied/IT
5	23A32501T	Introduction of Machine Learning	
6	23A54601a	Optimization Techniques for Engineers	Mathematics
7	23A54601b	Mathematical Foundation Of Quantum Technologies	
8	23A56601	Physics Of Electronic Materials And Devices	Physics
9	23A51601	Chemistry Of Polymers And Applications	Chemistry
10	23A52602	Academic Writing and Public Speaking	Humanities

IV B.Tech I Semester

S.No.	Course code	Title	L	T	P	Credits
1	23A01701	Finite Element Methods	3	0	0	3
2	23A52701a 23A52701b 23A52701c	**Management Course-II** 1.Business Ethics and Corporate Governance 2.E-Business 3.Management Science	2	0	0	2
3	23A01702a 23A01702b 23A01702c	**Professional Elective-IV** 1.Geo-synthetics and Reinforced Earth Structures 2.Railways, Airports, Docks and Harbour Engineering 3. Experimental Stress Analysis	3	0	0	3
4	23A01703a 23A01703b 23A01703c	**Professional Elective-V** 1. Ground Improvement Techniques 2. Subsurface Investigation and Instrumentation 3. Transportation Economics	3	0	0	3
5		**Open Elective-III**	3	0	0	3
6		**Open Elective-IV**	3	0	0	3
7	23A01706	**Skill oriented course** Skills in Civil Engineering software (STAADPRO/CAD/TEKL)	0	1	2	2
8	23A52702	**Audit Course** Gender Sensitization	2	0	0	-
9	23A01707	Evaluation of Industry Internship	-	-	-	2
Total			**19**	**1**	**2**	**21**

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23A02704	Smart Grid Technologies	EEE
2	23A03704	3D Printing Technologies	ME
3	23A04503T	Microprocessors and Microcontrollers	ECE
4	23A05402T	Data Base Management Systems	CSE & Allied/IT
5	23A38502	Cyber Security	
6	23A54701	Wavelet transforms and its Applications	Mathematics
7	23A56701a	Smart Materials And Devices	Physics
8	23A56701b	Introduction to Quantum Mechanics	
9	23A51701	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
10	23A52703	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23A02705	Electric Vehicles	EEE
2	23A03705	Total Quality Management	ME
3	23A04704	Transducers and Sensors	ECE
4	23A05502T	Introduction to Computer Networks	CSE & Allied/IT
5	23A35501T	Internet of Things	
6	23A32603	Introduction to Quantum Computing	
7	23A54702	Financial Mathematics	Mathematics
8	23A56702	Sensors And Actuators For Engineering Applications	Physics
9	23A51702	Chemistry Of Nanomaterials and Applications	Chemistry
10	23A52704	Literary Vibes	Humanities

IV B.Tech. II Semester

S.No.	Course code	Title	Category	L	T	P	Credits
1	23A01801	Internship		-	-	-	4
		Project					8
Total							**12**

COURSES OFFERED FOR HONOURS DEGREE IN CIVIL ENGINEERING

S.No	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1	23A01H01	Soil Dynamics and Machine Foundation	3	0	0	3
2	23A01H02	Industrial Waste and Waste Water Management	3	0	0	3
3	23A01H03	Repair & Rehabilitation of Structures	3	0	0	3
4	23A01H04	Design and Drawing of Irrigation Structures	3	0	0	3
5	23A01H05	Road Safety Engineering	3	0	0	3
6	23A01H06	NDT Lab	0	0	3	1.5
7	23A01H07	ETABS/SAP Lab	0	0	3	1.5
Total						**18**

LIST OF MINORS OFFERED BY THE CIVIL ENGINEERING

BUILDING PLANNING & CONSTRUCTION TECHNOLOGY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A01M01	Construction Materials	3	-	0	3
2	23A01M02	Construction Methods	3	-	0	3
3	23A01M03	Building Planning And Drawing	3	-	0	3
4	23A01M04	Surveying	3	-	0	3
5	23A01M05	Concrete Technology	3	-	0	3
6	23A01M06	Concrete Technology Lab	0	0	3	1.5
7	23A01M07	Surveying Lab	0	0	3	1.5

LIST OF MINORS OFFERED TO CIVIL ENGINEERING

S.No.	Minor Title	Department offering the Minor
1	Micro Grid Technology	EEE
2	Energy Systems	
3	3D Printing	ME
4	Industrial Engineering	
5	Embedded Systems and IoT	ECE & VLSI
6	Electronic Systems	
7	Computer Science and Engineering	CSE & Allied
8	Cyber Security	
9	Internet of Things	
10	Data Science	
11	Artificial Intelligence & Machine Learning	
12	Data Analytics	
13	Data Science and Analytics	
14	Programming & Computational Intelligence	
15	AI Applications & Emerging Technologies	
16	Quantum Computing	
17	Quantum Technologies	

CIVIL ENGINEERING					
III B.Tech – I Semester					
Course Code	**WATER RESOURCES ENGINEERING**	L	T	P	C
23A01501		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental concepts of hydrology, including precipitation, evaporation, infiltration, and runoff, and their significancein water resource management.
2. **Analyze** hydrographs, unit hydrographs, and groundwater characteristics for estimating water availability and flood management.
3. **Evaluate** the necessity, importance, and methods of irrigation, along with soil-water-plant relationships and irrigation efficiencies.
4. **Apply** silt theories and principles of canal design to ensure efficient water conveyance andmanagement in irrigation systems.
5. **Assess** the principles of diversion head works, water logging, canal lining, and the stability of hydraulic structures on permeable foundations.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain the hydrologic cycle, precipitation types, and measurement techniques for rainfall, evaporation, infiltration, and runoff computation.
2. Analyze hydrographs, unit hydrographs, and groundwater flow parameters for flood estimation and water resource planning.
3. Evaluate irrigation requirements, soil-water-plant relationships, duty, delta, and irrigation efficiencies for sustainable agricultural productivity.
4. Apply silt theories and design principles of irrigation canals to ensure effective water conveyance and prevent water logging.
5. Assess the stability of diversion head works, including weirs and barrages, using Bligh's and Khosla's theories for hydraulic structure design.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	**3**	**2**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**2**	**2**
CO -2	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**2**
CO -3	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**3**
CO -4	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**-**	**2**	**-**	**2**	**3**	**3**
CO -5	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**2**	**3**	**3**

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-Coefficient 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; CulturableCommand Area; CulturableCultivated and Uncultivated Area; KorDepth andKorPeriod; 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 ofKennedy's andLacey'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

REFRENCE 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 Learning Resources:

https://nptel.ac.in/courses/105101214

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**DESIGN OF REINFORCED CONCRETE STRUCTURES**	L	T	P	C
23A01502		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental methods of concrete structure design, including elastic, ultimate load, and limit state methods.
2. **Analyze** and**design** reinforced concrete beams, slabs, staircases, columns, and footings using the Limit State Method as per IS codes.
3. **Evaluate** the behavior of reinforced concrete membersin terms of flexure, shear, torsion, bond, and anchorage.
4. **Apply** design principles to ensure serviceability and safety of concrete structures under various loading conditions.
5. **Develop** skills to use design aids and professional software for the analysis and design of RC structures.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Explain** the different methods of concrete structure design and their advantages.
2. **Analyze** and**design** singly and doubly reinforced beams, flanged beams, slabs, and staircases using the Limit State Method.
3. **Evaluate** the behavior of RC members under shear, torsion, and combined loading conditions.
4. **Design** short columns and footings considering axial and eccentric loading conditions.
5. **Utilize** IS code provisions and design aids for efficient structural design.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**2**
CO -2	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**
CO -3	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**
CO -4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**
CO -5	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**2**	**1**	**2**	**2**	**2**

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 andArun 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

REFRENCE BOOKS:

1. N. Krishnaraju, —Structural Design and Drawing, UniversitiesPressPvtltd, Hyderabad.4rdedition 2020.
1. N.C. Sinha and S.K. Roy,—Fundamentals of Reinforced Concrete, S. Chand Publishers
2. N.Subramanian, —Design of Reinforced Concrete Structures, Oxford University Press

Online Learning 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%.

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**GEOTECHNICAL ENGINEERING**	L	T	P	C
23A01503T		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the classification and compaction characteristics of different soil types and their engineering significance.
2. **Analyze** the concepts of effective stress, permeability, and seepage in soils and their impact on soil behavior.
3. **Apply** stress distribution theories and settlement computations to evaluate soil response under loads.
4. **Evaluate** shear strength properties of soil using various testing methods and their applications in geotechnical engineering.
5. **Assess** the stability of slopes using different analytical methods and suggest suitable slope protection measures.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Classify** soils based on their physical and index properties as per BIS and Unified classification systems.
2. **Analyze** soil permeability and seepage problems using Darcy's law and flow net concepts.
3. **Apply** stress distribution theories and settlement analysis to predict soil behavior under loading.
4. **Evaluate** shear strength of soils using experimental methods and interpret test results.
5. **Assess** slope stability and recommend suitable protection measures.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**3**	**2**
CO -2	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**2**
CO -3	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**
CO -4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**	**3**
CO -5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

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.		
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.Venkataramiah, New Age International Pvt. Ltd,(2002).		
REFRENCE 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 Pubilishers, 4th edition. 3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New age International Pvt.Ltd, New Delhi 3rdedition 2016		
Online Learning Resources:		
https://nptel.ac.in/courses/105101201 https://nptel.ac.in/courses/105105185		

23A05504	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (Qualitative Treatment)	L	T	P	C
		3	0	0	3

Course Objectives (COBJ):

- 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 (CO):

- Explain core quantum principles in a non-mathematical manner.
- Compare classical and quantum information systems.
- Identify theoretical issues in building quantum computers.
- Discuss quantum communication and computing concepts.
- Recognize applications, industry trends, and career paths in quantum technology.

Unit 1: 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 2: 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 3: 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, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

Unit 4: 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 5: 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, PsiQuantum,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

Textbooks**:**

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*, Oneworld 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. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, *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*, MeitY/DST Publications, 2020 onward.

Online Learning Resources**:**

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

CIVIL ENGINEERING

III B.Tech – I Semester

Course Code	**PRESTRESSED**	L	T	P	C
23A01504a	**CONCRETE (PE – I)**	3	0	0	3

Course Objectives:-

The objectives of this course are to make the student to:

1. Understand the principles, methods, and materials used in prestressed concrete.
2. Analyze various losses of prestress in both pre-tensioned and post-tensioned members.
3. Design prestressed concrete beams considering flexure and shear forces.
4. Evaluate deflections in prestressed concrete structures and their controlling factors.
5. Analyze the behavior of composite beams under different loading conditions.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain the principles and methods of prestressing and the need for high-strength materials.
2. Analyze the different types of prestress losses and their impact on structural performance.
3. Design prestressed concrete beams considering flexural and shear stresses.
4. Evaluate deflections in prestressed beams and suggest control measures.
5. Analyze the stress distribution and differential shrinkage in composite beams.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	2	1	1	-	-	1	-	-	-	1	-	1	1	1
CO -2	2	2	1	1	2	-	-	-	-	-	-	1	1	1
CO -3	2	2	3	2	2	-	1	-	-	-	-	1	2	2
CO -4	2	1	2	2	3	1	-	-	-	-	-	1	2	1
CO -5	2	2	2	1	2	1	-	-	-	-	-	1	2	1

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 ofUncracked Beams- Prediction of Long Time Deflections

UNIT – V		

Composite beams

Different Types- Propped and Un-Propped- 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 N.Rajagopalan, Narosa Publishing House 2nd edition 2017

REFRENCE 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 Learning Resources:

https://archive.nptel.ac.in/courses/105/106/105106118/
https://nptel.ac.in/courses/105106117

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**AIR POLLUTION AND CONTROL (PE – I)**	L	T	P	C
23A01504b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the sources, classification, and effects of air pollution on humans and the environment.
2. Analyze meteorological factors influencing air pollution and dispersion modeling.
3. Design and evaluate control measures for particulate pollutants.
4. Apply techniques for controlling gaseous pollutants through chemical and physical processes.
5. Assess vehicular and indoor air pollution and propose control strategies.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain the sources, classification, and global effects of air pollution.
2. Analyze meteorological parameters affecting air pollution dispersion.
3. Design control systems for particulate matter using appropriate removal techniques.
4. Apply suitable technologies for gaseous pollutant removal through adsorption, absorption, and combustion.
5. Evaluate vehicular and indoor air pollution sources and suggest mitigation strategies.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	2	1	-	-	-	2	3	-	-	1	-	1	1	1
CO -2	2	2	-	2	2	3	3	-	-	-	-	1	2	2
CO -3	2	2	3	2	2	3	3	-	-	-	-	1	2	2
CO -4	2	1	2	2	3	3	3	-	-	-	-	1	2	2
CO -5	2	2	2	2	2	3	3	2	-	-	-	1	2	2

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.

REFRENCE 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. andTchobanoglous G., Environmental Engineering, McGraw Hill, New York, 1985.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/107/105107213/

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**ENVIRONMENTAL IMPACT ASSESSMENT (PE – I)**	L	T	P	C
23A01504c		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworksin EIA studies.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	2	3	-	-	-	-	-	1	2	2
CO -2	3	3	3	2	2	3	-	-	-	-	-	1	3	2
CO -3	3	3	3	2	2	3	3	-	-	-	-	1	3	3
CO -4	3	3	3	3	2	3	3	-	-	-	-	1	3	3
CO -5	2	2	2	2	2	3	3	3	-	-	-	1	2	2

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 andMethodology for The Assessment of Soil and Ground Water, Delineation

ofStudy 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.

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 ofAudit 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)

REFRENCE 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 Learning Resources:

https://archive.nptel.ac.in/courses/124/107/124107160/

CIVIL ENGINEERING

III B.Tech – I Semester

Course Code		L	T	P	C
23A01503P	**GEOTECHNICAL ENGINEERING LAB**	0	0	0	1.5

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental index properties of soils and their significancein geotechnical engineering.
2. **Perform** field and laboratory tests to determine in-situ density and compaction characteristics of soils.
3. **Evaluate** the engineering properties of soil, including permeability, shear strength, and consolidation.
4. **Analyze** the strength and deformation characteristics of soils through shear and compression tests.
5. Interpret test results and relate engineering properties of soils to real-world geotechnical problems and design considerations.

Upon successful completion of this course, students will be able to:

1. **Determine** index properties of soil, including specific gravity, grain size distribution, and consistency limits.
2. **Conduct** field and laboratory compaction tests to evaluate the moisture-density relationship of soil.
3. **Evaluate** permeability and consolidation characteristics of soil using appropriate laboratory techniques.
4. **Analyze** the shear strength and compressibility of soil through direct shear, unconfined compression, and tri-axial tests.
5. **Integrate test results and engineering judgment** to interpret soil behavior and make informed decisionsin geotechnical engineering applications.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
CO -2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
CO -3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
CO -4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO -5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

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)
    b. Determination of Moisture–Density Relationship Using Standard Proctor Compaction Test.

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.

REFRENCE BOOKS:

1. "Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
2. G.VenkatappaRao andGoutham .K. Potable, "Geosynthetics Testing – A laboratory Manual", Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition 2008.
3. BrajaM.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012

Online Learning Resources:

https://nptel.ac.in/courses/105101160

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**FLUID MECHANICS**	L	T	P	C
23A01506	**HYDRAULIC MACHINES LAB**	0	0	0	1.5

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the principles of fluid mechanics and validate fundamental concepts through experiments.
2. **Determine** discharge coefficients for various flow measurement devices and analyze flow behavior.
3. **Evaluate** energy lossesin pipes, open channels, and hydraulic jumps to improve flow efficiency.
4. **Analyze** the impact of jet forces on vanes and their applicationsin hydraulic machinery.
5. **Assess** the performance characteristics of hydraulic turbines and pumps under different operating conditions.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Verify** Bernoulli's equation and apply it to real-life fluid flow problems.
2. **Determine** the coefficient of discharge for orifices, notches, and flow meters.
3. **Evaluate** head losses due to friction and minor lossesin pipe flow systems.
4. **Analyze** the impact of jets on vanes and its significancein hydraulic machinery.
5. **Assess** the performance of turbines and pumps under different conditions and recommend optimal operating parameters.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
CO -2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
CO -3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
CO -4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO -5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

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 Venturimeter/ 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 andChezy's Constants for Open Channel Flow.

9. Impact of Jet On Vanes
10. Performance Characteristics ofPelton 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.

REFRENCE 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 Learning Resources:

https://archive.nptel.ac.in/courses/112/106/112106311/

CIVIL ENGINEERING
III B.Tech – I Semester

Course Code	**ESTIMATION, SPECIFICATIONS, COSTING AND VALUATION**	L	T	P	C
23A01507		0	1	2	2

Course Objectives:
The objectives of this course are to make the student to:

1. **Understand** the various methods and types of estimates usedin civil engineering projects.
2. **Develop** detailed estimates for single and multi-storey buildings using standard estimation methods.
3. **Analyze** rate analysis, abstract estimation, and bill preparation as per standard procedures.
4. **Prepare** detailed specifications and tender documents for construction works.
5. **Evaluate** the valuation, cost escalation, and value analysis of buildings.

Course Outcomes:
Upon successful completion of this course, students will be able to:

1. **Apply** estimation techniques to prepare detailed estimates for various construction projects.
2. **Develop** abstract estimates and rate analysis for different civil engineering works.
3. **Analyze** the preparation of measurement books and bill preparation as per AP State Government procedures.
4. **Create** detailed specifications and tender documents for construction projects.
5. **Assess** building valuation, cost escalation, and value analysis techniques.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	1	-	-	-	-	-	1	-	2	3	2
CO -2	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO -3	3	3	3	2	2	-	2	1	-	-	-	1	3	3
CO -4	3	3	3	2	2	-	2	1	-	-	-	1	3	3
CO -5	2	2	2	1	3	-	3	1	-	1	1	2	2	2

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 - A Textbook of Estimating and Costing (Civil), S. Chand Publishing, 2011.

REFRENCE BOOKS:

1. M. Chakraborti - Estimating, Costing, Specification &Valuationin 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 Learning Resources:

https://onlinecourses.swayam2.ac.in/nou20_cs11/preview
https://www.coursera.org/learn/construction-cost-estimating

III B.Tech – I semester

		L	T	P	C
23A03508	**TINKERING LAB**	**2**	**0**	**0**	**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: The objectives of the course are to
1	**Encourage Innovation and Creativity**
2	**Provide Hands-on Learning and Impart Skill Development**
3	**Foster Collaboration and Teamwork**
4	**Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship**
5	**Impart Problem-Solving mind-set**

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

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

- **Note:** The students can also design and implement their own ideas, apart from the list of experiments mentioned above.
- **Note:** A minimum of 8 to 10 experiments must be completed by the students.

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**DESIGN OF STEEL STRUCTURES**	L	T	P	C
23A01601		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the properties, types, and applications of structural steelin construction.
2. **Analyze** the behavior and design of bolted and welded connections for steel structures.
3. **Design** tension and compression members, including built-up members and column bases.
4. **Develop** steel structural elements such as beams, plate girders, roof trusses, and gantry girders.
5. **Apply** plastic analysis concepts to the design of continuous beams and portal frames.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Explain** the properties of structural steel, types of sections, and the concept of limit state design.
2. **Analyze and design** bolted and welded connections for structural steel members.
3. **Design** tension and compression members, including built-up sections and column bases.
4. **Develop** design solutions for beams, plate girders, roof trusses, and gantry girders.
5. **Perform** plastic analysis and design of continuous beams and portal frames.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**2**	**2**
CO -2	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
CO -3	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**1**
CO -4	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**1**
CO -5	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**2**	**2**

UNIT – I

INTRODUCTION to STRUCTURAL STEEL and DESIGN of CONNECTIONS

General -Types ofSteel -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.

REFRENCE BOOKS:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac& Stephen F. Csernak - Structural Steel Design, Pearson, 7th Edition, 2023.
3. William T. Segui&FaridSoleimani - Steel Design, Cengage, 7th Edition, 2023.
4. SarwarAlamRaz, Structural Design in Steel, New Age International Publishers, 2014
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

Online Learning Resources:

https://nptel.ac.in/courses/105105162

CIVIL ENGINEERING					
III B.Tech – II Semester					
Course Code	**HIGHWAY ENGINEERING**	L	T	P	C
23A01602T		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the history, importance, and planning aspects of highway developmentin India.
2. **Apply** geometric design principles for highway alignment, sight distance, and curves.
3. **Analyze** traffic characteristics, capacity, level of service, and road safety measures.
4. **Design** flexible and rigid pavements using IRC guidelines.
5. **Evaluate** highway construction materials, testing methods, and maintenance techniques.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Explain** the significance, planning, and alignment of highways.
2. **Design** geometric elements of highways, including curves, gradients, and sight distances.
3. **Analyze** traffic flow, capacity, level of service, and implement road safety measures.
4. **Design** flexible and rigid pavements as per IRC guidelines.
5. **Assess** construction practices, highway materials, and pavement maintenance techniques.

CO – PO Articulation Matrix:-

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO -1	3	2	2	1	-	-	-	-	-	1	-	2	3	2
CO -2	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO -3	3	3	3	2	2	-	2	1	-	-	-	1	3	3
CO -4	3	3	3	2	2	-	2	1	-	-	-	1	3	3
CO -5	2	2	2	1	3	-	3	1	-	1	1	2	2	2

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-DesignofVertical 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 ofDowel Bars and Tie Bars.

TEXT BOOKS:

1. Highway Engineering – S.K.Khanna&C.E.G.Justo, Nemchand& Bros., 9th edition (2011).
2. Transportation Engineering, Volume I, C Venkatramaiah, Universities Press, 2015

REFRENCE BOOKS:

1. Principles of Highway Engineering by L.R.Kadiyali, Khanna Publishers
2. Traffic Engineering and Transportation Planning by L.R.Kadiyali andLal- Khanna Publications 9th edition
3. Highway Engineering – Dr. S.K.Sharma, S.Chand Publishers 2014 edition

Online Learning Resources:

https://nptel.ac.in/courses/105101087

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**ENVIRONMENTAL ENGINEERING**	L	T	P	C
23A01603T		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the sources, demand estimation, and quality parameters of water.
2. **Apply** water treatment processes for purification and supply.
3. **Analyze** storage, distribution, and operation of water supply systems.
4. **Design** sewerage systems, stormwater drainage, and plumbing networks.
5. **Evaluate** sewage treatment, sludge management, and water reuse methods.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Explain** water sources, quality standards, and waterborne diseases.
2. **Design** unit processes of water treatment plants.
3. **Analyze** water distribution networks and pumping stations.
4. **Design** sewerage systems, including stormwater and sanitary sewers.
5. **Assess** sewage treatment methods and advanced wastewater management techniques.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	1	-	3	3	1	-	1	-	2	3	3
CO -2	3	3	3	2	2	2	2	1	-	-	-	1	3	3
CO -3	3	3	3	2	2	2	3	1	-	-	-	1	3	3
CO -4	3	3	3	2	2	2	3	1	-	-	-	1	3	3
CO -5	2	2	2	1	3	3	3	1	-	1	1	2	2	2

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 - PulsatorClarifier - 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.		
REFRENCE 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. HammarJr.Wiley, 2007.		
Online Learning Resources:		
https://nptel.ac.in/courses/103107084		

CIVIL ENGINEERING					
III B.Tech – II Semester					
Course Code	**DESIGN OF EARTHQUAKE RESISTANT STRUCTURES** **Professional Elective-II**	L	T	P	C
23A01604a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental concepts of engineering seismology, including earthquake phenomena, seismic waves, and measuring instruments.
2. **Analyze** the principles of structural vibrations, degrees of freedom, and dynamic response of structures to earthquake ground motions.
3. **Evaluate** conceptual design strategies, seismic design principles, and methods for improving earthquake resistancein structures.
4. **Apply** earthquake-resistant design principles to reinforced concrete and masonry buildings using IS codes and lateral force methods.
5. **Assess** the role of structural walls, non-structural elements, and ductility considerationsin enhancing earthquake resistance.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. **Explain** earthquake mechanisms, seismic waves, and seismic zones, including measuring techniques and instruments.
2. **Analyze** vibratory systems, single-degree-of-freedom (SDOF) models, damping effects, and earthquake-induced dynamic forces.
3. **Evaluate** conceptual design strategies, ductility factors, and seismic design methods for ensuring structural resilience.
4. **Apply**IS code provisions and lateral force methods for seismic design of reinforced concrete and masonry buildings.
5. **Assess** the significance of structural walls, non-structural elements, and ductile detailingin enhancing earthquake resistance.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	-	-	1	-	3	1	-	2	-	2	2	2
CO -2	3	-	-	-	2	-	3	1	-	2	-	-	-	2
CO -3	3	-	-	3	-	-	3	2	-	2	-	-	-	3
CO -4	3	2	-	3	-	-	3	2	-	2	2	2	3	3
CO -5	3	3	-	3	-	-	3	2	-	2	2	2	3	3

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-Factorsin 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- Behaviour of Unreinforced and Reinforced Masonry Walls- Behavior of Walls- Box Action and Bands- Behaviour of Infill Walls- Improving Seismic Behaviour 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 - Behaviour 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 – PankajAgarwal and Manish Shrikhande, PrenticeHall of India Pvt. Ltd.

REFRENCE BOOKS:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly,John Wiley & Sons.
2. Eartquake Resistant Design ofBuidling structures by VinodHosur, 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 –AnandS.Arya, Nemchand& 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 Learning Resources:

https://nptel.ac.in/courses/105107204

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**OPEN CHANNEL FLOW**	L	T	P	C
23A01604b	**Professional Elective-II**	3	0	0	3

Course Objectives (COs):

The objectives of this course are to make the student to:

1. Explain the principles governing fluid flowin pipelines and networks, including steady and unsteady flow conditions.
2. Apply fundamental concepts of uniform and varied flowin open channels for analyzing hydraulic structures and networks.
3. Analyze the behavior of unsteady flowsin open channels, including wave motion and dam break scenarios.
4. Evaluate sediment transport mechanisms and their impact on hydraulic structures, reservoirs, and river morphology.
5. Design and assess hydraulic models, flow measurement devices, and physical models for hydraulic applications.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Describe the fundamental principles of fluid flowin pipelines and networks under steady and unsteady conditions.
2. Solve problems related to uniform and varied flowin open channels using theoretical and computational approaches.
3. Analyze the impact of unsteady flow phenomena such as surges and dam breaksin open channels.
4. Evaluate sediment transport processes and their influence on river morphology and hydraulic structures.
5. Develop and validate hydraulic models for flow measurement and physical modeling applicationsin fluid mechanics.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO -2	3	2	2	1	2	-	-	-	-	-	-	-	2	1
CO -3	2	3	2	2	2	-	-	-	-	-	-	-	3	2
CO -4	2	3	3	3	2	-	-	-	-	-	-	-	3	3
CO -5	2	2	3	3	3	2	-	-	-	-	-	-	3	3

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. IntroductiontoHec-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 Advancementin Open Channel Flow Measurements. Physical Modelingin Hydraulics. Dimensional Analysis. Modeling 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. OpenChannelHydraulics,Chow,V.T.,McGrawHillInc.NYork,1979		
REFRENCE BOOKS:		
1. Open Channel Hydraulics, French, R.H., McGraw Hill PubCo.,NYork,1986 2. Open Channel Hydraulics, Terry Sturm, Tata McGraw Hill Pub. N Delhi,2011		
Online Learning Resources:		
https://nptel.ac.in/courses/105/106/105106114/		

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**FOUNDATION ENGINEERING (PE – II)**	L	T	P	C
23A01604c		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the need for soil exploration and various methods used in site investigations.
2. Analyze the stability of slopes under different conditions using various stability methods.
3. Apply earth pressure theories to analyze retaining walls and soil pressures.
4. Evaluate the bearing capacity and settlement characteristics of shallow foundations.
5. Assess the load-carrying capacity and settlement of deep foundations, including pile and well foundations.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain the principles of soil exploration, field testing, and soil investigation reporting.
2. Analyze slope stability using different failure theories and numerical methods.
3. Apply earth pressure theories to determine the stability of retaining walls.
4. Evaluate the bearing capacity and settlement of shallow foundations using theoretical and field methods.
5. Analyze deep foundations, including pile and well foundations, for their load-carrying capacity and settlement.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	2	1	1	-	-	1	-	-	-	1	-	1	1	1
CO -2	2	2	1	1	2	-	-	-	-	-	-	1	1	1
CO -3	2	2	3	2	2	-	1	-	-	-	-	1	2	2
CO -4	2	1	2	2	3	1	-	-	-	-	-	1	2	1
CO -5	2	2	2	1	2	1	-	-	-	-	-	1	2	1

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, Meyerhoffs 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 Pubilications(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.

REFRENCE BOOKS:

1. Soil Mechanics and Foundation Engineering by Purushtoma Raj, Pearson Pubilications 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 Learning Resources:

https://nptel.ac.in/courses/105105176

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**COST EFFECTIVE HOUSING TECHNIQUES** **Professional Elective-III**	L	T	P	C
23A01605a		3	0	0	3

Course Objectives (COs):

The objectives of this course are to make the student to:

1. Analyze the housing scenarioin urban and rural areas, including challengesin housing finance and urban planning.
2. Explore and evaluate innovative low-cost housing technologies for sustainable construction.
3. Investigate alternative building materials and infrastructure services for cost-effective housing solutions.
4. Assess rural housing techniques, including traditional mud housing, soil stabilization, and fire treatment for roofing.
5. Develop strategies forhousingin disaster-prone areas, with a focus on earthquake, cyclone, and flood-resistant construction.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Examine the current status of urban and rural housing and analyze the role of finance and planningin housing development.
2. Evaluate and recommend cost-effective construction techniques, including prefabrication and innovative roofing/flooring systems.
3. Assess the feasibility of alternative building materials and infrastructure solutions for low-cost housing.
4. Analyze traditional rural housing methods and propose modern techniques for improving rural housing quality.
5. Design housing solutions for disaster-prone areas by incorporating earthquake, cyclone, and flood-resistant strategies.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	1	2	-	2	2	-	-	1	-	1	2	2
CO -2	3	3	2	3	2	-	3	-	-	-	-	2	3	2
CO -3	3	2	3	3	2	-	3	-	-	-	-	2	3	3
CO -4	2	3	3	3	2	2	2	-	-	-	-	2	3	3
CO -5	2	3	3	3	3	3	3	-	-	-	-	2	3	3

UNIT – I

a) **Housing Scenario :**Introducing - Status of Urban Housing - Status of Rural Housing
b) **Housing Finance**: Introducing - Existing Finance System in India - Government Role as Facilitator - Status At Rural Housing Finance – ImpedimentlyIn Housing Finance and Related Issues
c) **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
d) **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. Requirement'sOf 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

REFRENCE 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 trendsin housing in developing countries – A.G. MadhavaRao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon Publishers

Online Learning Resources:

https://nptel.ac.in/courses/124107001

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**WATERSHED MANAGEMENT Professional Elective-III**	L	T	P	C
23A01605b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the concept of watershed management, stakeholder roles, pollution sources, and environmental guidelines for water quality.
2. **Analyze** soil erosion processes, sediment yield, and wetland hydrology, including the role ofwaterin wetland ecosystems.
3. **Evaluate** surface water and groundwater interactions, wetland water quality, and hydrological models for effective watershed planning.
4. **Apply** principles of wetland hydrologic assessment, water harvesting, and watershed treatment system design to real-world scenarios.
5. **Assess** irrigation planning, participatory water management, and water footprint concepts to ensure sustainable water resource utilization.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. **Explain** watershed management concepts, pollution control strategies, and environmental policies related to water quality.
2. **Analyze** erosion processes, wetland water budgets, and sediment transport models to assess land degradation and conservation needs.
3. **Evaluate** surface and groundwater interactions, wetland treatment efficiency, and hydrological models for integrated water resource management.
4. **Apply** water harvesting techniques, hydrologic modeling, and wetland design methods for sustainable watershed management.
5. **Assess** irrigation water management strategies, drought mitigation policies, and the role of water footprintin agricultural sustainability.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	1	2	3	1	-	2	-	2	2	2
CO -2	3	3	2	3	2	2	3	1	-	2	-	2	2	2
CO -3	3	3	3	3	3	2	3	2	-	2	-	2	3	3
CO -4	3	2	3	3	3	3	3	2	-	2	2	2	3	3
CO -5	3	3	3	3	3	3	3	2	-	2	2	2	3	3

UNIT – I

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

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 Flows: Structures and Channels, Groundwater-Surface Water Exchange inWetlands, 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 andCstrs in Series; Intro to Method of Moments.

UNIT – IV

Wetland Hydrologic Assessment: Physical and Biological Processes, Anthropogenic and Climate Change Impacts On Wetland Hydrology, Modeling 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

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

REFRENCE 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 Learning Resources:

https://nptel.ac.in/courses/105101010
https://nptel.ac.in/courses/126105334

CIVIL ENGINEERING

III B.Tech – II Semester

Course Code	**ADVANCED STRUCTURAL ANALYSIS** **Professional Elective-III**	L	T	P	C
23A01605c		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental concepts of arches, including three-hinged and two-hinged arches, and analyze the effects of horizontal thrust, bending moment, normal thrust, and radial shear.
2. **Apply** the moment distribution method to analyze single-bay, single-story portal frames with and without side sway.
3. **Analyze** continuous beams and portal frames using Kani's Method, including cases with and without settlement of supports.
4. **Solve** structural problems using the flexibility method for continuous beams and single-bay portal frames, considering support settlements and side sway effects.
5. **Evaluate** the stiffness method for analyzing continuous beams and single-bay portal frames with and without side sway, ensuring structural stability and performance.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. **Explain** the behavior of three-hinged and two-hinged arches and**analyze** the effects of horizontal thrust, bending moment, normal thrust, and radial shear. (Bloom's Level: Understand - L2, Analyze - L4)
2. **Apply** the moment distribution method to**analyze** single-bay, single-story portal frames with and without side sway. (Bloom's Level: Apply - L3, Analyze - L4)
3. **Analyze** continuous beams and portal frames using Kani's Method, including cases with and without settlement of supports.
4. **Solve** structural problems using the flexibility method for continuous beams and single-bay portal frames, considering support settlements and side sway effects.
5. **Evaluate** the stiffness method for analyzing continuous beams and single-bay portal frames with and without side sway, ensuring structural stability and performance.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	1	-	-	-	-	2	-	1	2	2
CO -2	3	3	2	2	2	-	-	-	-	2	-	2	2	2
CO -3	3	3	3	2	2	-	-	-	-	2	-	2	3	2
CO -4	3	2	3	3	3	-	-	-	-	2	1	2	3	3
CO -5	3	3	3	3	3	-	-	-	-	2	1	2	3	3

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.

REFRENCE BOOKS:

1. Structural analysis by R.S.Khurmi, S.Chand Publications, NewDelhi.
2. Basic Structural Analysis by K.U.Muthuetal .,I.K. International PublishingHousePvt.Ltd
3. Theoryof Structures by Gupta SP, GSPundit and R Gupta,Vol II, Tata McGraw Hill Publications Company td.
4. D. S. PrakashRao,"StructuralAnalysis:AUnifiedApproach",UniversitiesPress

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/106/105106050/

CIVIL ENGINEERING					
III B.Tech – II Semester					
Course Code	**HIGHWAY**	L	T	P	C

23A01602P	ENGINEERINGLAB	0	0	3	1.5

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the properties and behavior of aggregates and bitumen usedin highway construction.
2. **Perform** standard laboratory tests on aggregates and bitumen to evaluate their suitability for road construction.
3. **Analyze** the strength, durability, and performance characteristics of pavement materials.
4. **Assess** the quality and compliance of highway materials with standard specifications.
5. **Develop** hands-on skills for material testing and interpretation of test results.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Determine** the physical properties of coarse aggregates, such as specific gravity, water absorption, and shape characteristics.
2. **Evaluate** the mechanical properties of aggregates, including abrasion resistance, impact strength, and crushing value.
3. **Analyze** the physical and chemical properties of bituminous materials through standard tests.
4. **Perform** Marshall stability tests and assess the optimum binder content for bituminous mixes.
5. **Interpret** test results to assess the suitability of aggregates and bitumen for pavement construction.

CO – PO Articulation Matrix:-

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO -1	3	2	2	2	1	3	3	1	-	1	-	2	3	3
CO -2	3	3	3	2	2	2	2	1	-	-	-	1	3	3
CO -3	3	3	3	2	2	2	3	1	-	-	-	1	3	3
CO -4	3	3	3	2	2	2	3	1	-	-	-	1	3	3
CO -5	2	2	2	1	3	3	3	1	-	1	1	2	2	2

List of Experiments:-

I. TEST ON AGGREGATES

1. Specific Gravity Determination ofthe Coarse Aggregate Sample
2. Determination of Abrasion Value ofthe 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
1. Determination of Aggregate Crushing Value of Coarse Aggregate
2. Determination of Water Absorption Capacity ofthe Coarse Aggregate Sample.

II. TEST ON BITUMEN

1. Specific Gravity Determination ofThe Bitumen/Asphalt Sample.
2. Penetration Test OnBitumen.
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, Nemchand Brothers

REFRENCE 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"
4. MS-2 Manual for Marshalls Mix design 2002

Online Learning Resources:

https://ts-nitk.vlabs.ac.in/

CIVIL ENGINEERING					
III B.Tech – II Semester					
Course Code	**ENVIRONMENTAL**	L	T	P	C

23A01603P	ENGINEERING LAB	0	0	3	1.5

Course Objectives:
The objectives of this course are to make the student to:

1. **Understand** the principles and methods of water and wastewater sampling and preservation.
2. **Perform** standard laboratory tests to determine water quality parameters.
3. **Analyze** wastewater characteristics and assess pollution levels.
4. **Evaluate** the effectiveness of treatment processes using chemical and biological tests.
5. **Develop** hands-on skillsin advanced laboratory techniques for environmental monitoring.

Course Outcomes:
Upon successful completion of this course, students will be able to:

2. **Apply** appropriate sampling and preservation techniques for water and wastewater.
3. **Measure** physical and chemical parameters such as turbidity, conductivity, and chlorine content.
4. **Analyze** key water and wastewater quality indicators like BOD, COD, and TKN.
5. **Assess** the efficiency of water treatment processes through laboratory tests.
6. **Perform** microbiological analysis forcoli form detection and sludge characterization.

CO – PO Articulation Matrix:-

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO -1	3	1	1	-	-	2	2	-	-	-	1	1	1	1
CO -2	2	2	1	-	-	1	1	-	-	-	1	1	2	2
CO -3	2	1	2	-	1	1	2	-	-	-	2	1	1	1
CO -4	1	1	1	1	-	1	1	-	-	-	1	1	2	2
CO -5	2	1	2	-	-	1	2	1	-	-	1	1	1	1

LIST OF EXPERIEMENTS:-

II. 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 ofSulphate 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

III. ANALYSIS of WASTEWATER 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 andfaecal 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.
REFRENCE BOOKS:
1. Environmental Engineering Laboratory Manual by Dr. S.K. Panigrahi, L. Mohanty, S.K. Kataria& Sons
Online Learning Resources:
https://ee1-nitk.vlabs.ac.in/ **https://ee2-nitk.vlabs.ac.in/**

CIVIL ENGINEERING
III B.Tech – II Semester

Course Code	**BUILDING INFORMATION MODELING**	L	T	P	C
23A01607		0	1	2	2

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamentals of Building Information Modeling (BIM) and Autodesk Revit.
2. **Develop** proficiency in Revit's basic drawing and editing tools for structural and architectural modeling.
3. **Create** 3D models of buildings, including walls, floors, ceilings, roofs, stairs, and railings.
4. **Analyze** different components such as curtain walls, doors, windows, and structural elements.
5. **Apply** various visualization and detailing techniques to generate callouts, elevations, and sections.

Course Outcomes:

Upon successful completion of this course, students will be able to:

1. **Explain** the fundamentals of BIM and Autodesk Revit's interface and workflow.
2. **Use** basic drawing, editing, and modificationtoolsin Revit for creating and modifying models.
3. **Model** various architectural elements such as walls, doors, windows, floors, ceilings, and roofs.
4. **Construct** structural elements including grids, columns, stairs, railings, and ramps.
5. **Generate** 3D views, sections, and elevations for visualization and detailing purposes.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	3	1	-	-	-	1	-	2	3	3
CO -2	3	3	3	3	3	2	-	-	-	-	-	2	3	3
CO -3	3	3	3	3	3	3	1	-	-	-	-	2	3	3
CO -4	3	3	3	3	3	3	1	-	-	-	-	2	3	3
CO -5	2	2	2	2	3	3	1	-	-	1	1	2	2	2

List of Experiments: -

1. INTRODUCTION to BIM & AUTODESK REVIT - About AutodeskandAutocad, Workflow and BIM, Revit Terms, Overview of The Interface, Starting Projects, Viewing Commands.
2. BASIC DRAWING and EDITINGtoOLS - 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 ModellingWalls, 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.
8. ADDING COMPONENTS Adding Component, Modifying Component, Working

With Elements.

9. MODELING FLOORS Modelling& Modifying Floors, Joining Geometry, Creating Shaft Openings, Creating Sloped Floors
10. MODELING CEILINGS & ROOFS ModellingCeilings, 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, 2nd Edition, 2011
2. Wing, Eric. Autodesk Revit Architecture 2017: No Experience Required. Indianapolis: John Wiley & Sons, 2016

REFRENCE BOOKS:

1. Kim, Marcus, Lance Kirby, and Eddy Krygiel. Mastering Autodesk Revit 2017 for architecture. 1st ed. INpolis, 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., "BIMin 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: BIMin Current and Future Practice, Karen Kensek and Douglas Noble, Wiley, 2014, First Edition.

Online Learning Resources:

https://minnodillc.com/building-information-modeling-bim/
https://www.skyfilabs.com/online-courses/building-information-modelling-course

23A52601	**TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

Course Code: **L T P C :2 0 0 0**

Course Objectives:·

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

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

COURSE OUTCOMES: At the end of the course, students will be able to		**Blooms Level**
CO1	Identify key secondary literature related to their proposed technical pape writing	L1, L2
CO2	Explain various principles and styles in technical writing	L1, L2
CO3	Use the acquired knowledge in writing a research/technical paper	L3
CO4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.	L4
CO5	Evaluate different forms of IPR available at national & nternational level	L5
CO6	Develop skill of making search of various forms of IPR by using modern tools and techniques.	L3, L6

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence andlogical 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: Abstract- Objectives-Limitations-Review of Literature-Problemsand Framing Research Questions- Synopsis.

UNUNIT – III:

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, 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 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.

Textbooks:

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 Papers*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

CIVIL ENGINEERING

IV B.Tech – I Semester

Course Code	**FINITE ELEMENT METHODS**	L	T	P	C
23A01701		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental principles of the Finite Element Method (FEM) and its applicationsin structural analysis.
2. **Apply** the concepts of elasticity, stress-strain relationships, and displacement functionsin FEM.
3. **Develop** finite element formulations for1D, 2D, and 3D elements.
4. **Analyze** bar, beam, and plane stress/strain problems using shape functions and stiffness matrices.
5. **Implement** solution techniques such as numerical integration, static condensation, and element assembly.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. **Explain** the basic principles, advantages, and limitations ofFEMin engineering applications.
2. **Derive** shape functions and stiffness matrices for 1D bar and beam elements.
3. **Analyze** continuous beams and plane stress/strain problems using FEM.
4. **Develop**isoparametric formulation for 2D elements such as CST and LST.
5. **Implement** solution techniques for assembling elements and solving FEM equations.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	2	-	-	-	-	-	-	2	3	3
CO -2	3	3	3	3	3	-	-	-	-	-	-	2	3	3
CO -3	3	3	3	3	3	-	-	-	-	-	-	2	3	3
CO -4	3	3	3	3	3	-	-	-	-	-	-	2	3	3
CO -5	2	2	2	2	3	-	-	-	-	1	-	2	2	2

UNIT – I

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

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

FEA Beam Elements – Stiffness Matrix - Shape Function– Analysis of Continuous Beams.

UNIT – IV

FEA Two-Dimensional Problem – CST – LST Element – Shape Function – Stress – Strain. Isoparametric formulation – Concepts of, Isoparametric 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 coursein Finite Element Method by Daryl L. Logan, 5th Edition, Cengage Learning India Pvt. Ltd.
2. Introduction to finite Elements in Engineering by Tirupathi R. Chandrupatla, and Ashok D. Belegundu, Prentice Hall of India

REFRENCE 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 Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105041/#
https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-me43/

23A52701a	**BUSINESS ETHICS AND CORPORATE GOVERNANCE Management Course- II**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

COURSE OBJECTIVES : The objectives of this course are	
1	To make the student understand the principles of business ethics
2	To enable them in knowing about the ethics in management
3	To facilitate the student' role in corporate culture
4	To impart knowledge about the fair-trade practices
5	To encourage the student in knowing about the corporate governance

UNIT-I: Ethics

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior..Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management -Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crisis of 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.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand the meaning of Ethics in various areas of management
- Compare and contrast professional ethics and technical ethics
- Develop ethical values in self and organization

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.

LEARNING OUTCOMES:-After completion of this unit student will

- Define corporate culture
- Understand the key elements of corporate culture
- Analyze organization leadership and corporate culture

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.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair trade practices
- Make use of Environmental Protection and Fair Trade Practices

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.

LEARNING OUTCOMES:-After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders in corporate governance
- Implementing corporate social responsibility in India.

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, KarunakaraReaddy. *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*

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Understand the Ethics and different types of Ethics.	L2
CO2	Understand business ethics and ethical practices in management	L2
CO3	Understand the role of ethics in management	L2
CO4	Apply the knowledge of professional ethics & technical ethics	L3
CO5	Analyze corporate law, ethics, codes & principles	L4
CO6	Evaluate corporate governance & corporate scams	L5

BTL = Bloom's Taxonomy Level

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/

23A52701b	**E-BUSINESS (Management Course-II)**	**L**	**T**	**P**	**C**
		2	0	0	2

Course Objectives: The Objectives of this course are	
1	To provide knowledge on emerging concept on E-Business related aspect.
2	To understand various electronic markets & business models.
3	To impart the information about electronic payment systems & banking.
4	To create awareness on security risks and challenges in E-commerce.
5	To the students aware on different e-marketing channels & strategies.

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.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

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

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze the B2B,B2C and B2G model

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

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards
- Analyze debit card and credit cards

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.

Learning Outcomes: -After completion of this unit student will

- Understand E-Security
- Contrast and compare security protocols and public network
- Evaluate on Digital signature

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, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- Understand the concept of online marketing
- Apply the knowledge of online marketing
- Compare e-CRM and 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

References:

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*, RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.

COURSE OUTCOMES: At the end of the course student will be able to		**BTL**
CO1	Remember E-Business & its nature, scope and functions.	L1
CO2	Understand E-market-Models which are practicing by the organizations	L2
CO3	Apply the concepts of E-Commerce in the present globalized world.	L3
CO4	Analyze the various E-payment systems & importance of net banking.	L4
CO5	Evaluate market research strategies & E-advertisements.	L5
CO6	Understand importance of E-security & control	L2

BTL = Bloom's Taxonomy Level

Online Resources:

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
https://www.slideshare.net/VikramNani/e-commerce-business-models
https://www.slideshare.net/RiteshGoyal/electronic-payment-system
https://www.slideshare.net/WelingkarDLP/electronic-security
https://www.slideshare.net/Ankitha2404/emarketing-ppt

23A52701c	**MANAGEMENT SCIENCE**	**L**	**T**	**P**	**C**

		2	0	0	2

COURSE OBJECTIVES : The objectives of this course are	
1	To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2	To make the students understand the role of management in Production
3	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in modern management

UNIT- IINTRODUCTION 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.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure of an enterprise.

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.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the core concepts of Operations Management
- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

UNIT - IIIHUMAN 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

LEARNING OUTCOMES: At the end if the Unit, the students will be able to

- Understand the concepts of HRM, Recruitment, Selection, Training & Development
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

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).

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques

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.

LEARNING OUTCOMES At the end if the Unit, the students will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in TQM, SCM
- Analyze CRM, BPR
- Evaluate change management & sustainability

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. ***Introduction to Management Science,*** October 26, 2023

2. A.R Aryasri, *Management Science*, TMH, 2019

References:

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

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Remember the concepts & principles of management and designs of organization in a practical world	**L1**
CO2	Understand the knowledge of Work-study principles & Quality Control techniques in industry	**L2**
CO3	Apply the process of Recruitment & Selection in organization.	**L3**
CO4	Analyze the concepts of HRM & different training methods.	**L4**
CO5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.	**L5**
CO6	Create awareness on contemporary issues in modern management & technology.	**L3**

BTL = Blooms Taxonomy Level

ONLINE RESOUECES:

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/

CIVIL ENGINEERING

IV B.Tech – I Semester

Course Code	**GEO SYNTHETICS AND REINFORCED EARTH STRUCTURES** **Professional Elective-IV**	L	T	P	C
23A01702a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the concept and applications of reinforced earth, including friction coefficient determination.
2. Analyze the classification, functions, and durability aspects ofgeosynthetics and their advantages over conventional materials.
3. Design reinforced earth retaining walls considering stability mechanisms and material selection.
4. Evaluate the performance of reinforced embankments and their foundation mattresses for settlement and stability control.
5. Develop reinforced soil beds and analyze reinforced pavements using standard design approaches.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain the fundamentals of reinforced earth and analyze the effects of reinforcement on soil properties.
2. Compare different types ofgeosynthetics, their functions, and durability aspectsin geotechnical applications.
3. Design reinforced earth retaining walls considering stability mechanisms and reinforcement layouts.
4. Evaluate reinforced embankments and foundation mattresses with respect to settlement and load-bearing capacity.
5. Design and analyze reinforced pavements and soil beds using standard methodologies.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	2	1	1	1	-	1	1	-	-	1	-	1	1	1
CO -2	2	1	2	1	1	-	1	-	-	-	-	1	1	1
CO -3	2	1	2	1	1	-	1	-	-	-	-	1	1	1
CO -4	2	1	2	1	1	1	1	-	-	-	-	1	1	1
CO -5	2	1	2	1	1	1	2	-	-	-	-	1	2	1

UNIT – I

Reinforced Earth: Concept, Effects of Reinforcement On Soils – Equal Confining andPsuedo Cohesion Concepts, Materials, Friction Coefficient – Definition, Laboratory Determination, Factors Affecting Fiction Coefficient; Application of Reinforced Earth

UNIT – II

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 Embankments: 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 Behaviour of Reinforced Soil Beds, Analysis and Design Reinforced Pavements: Benefits of Placing Reinforcementin Flexible Pavement Layers, Design of Reinforced Pavements By Giroud andNoiray 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 andJian-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.

REFRENCE 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 Learning Resources:

https://archive.nptel.ac.in/courses/105/106/105106052/
https://onlinecourses.nptel.ac.in/noc20_ce06/preview

CIVIL ENGINEERING

IV B.Tech – I Semester

Course Code	**RAILWAYS, AIRPORTS, DOCKS AND HARBOR ENGINEERING** **Professional Elective-IV**	L	T	P	C
23A01702b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the components and geometric design principles of railway tracks.
2. Analyze the principles of railway track design, signaling, and interlocking.
3. Evaluate airport site selection, runway orientation, and terminal area planning.
4. Design runways and taxiways based on aircraft characteristics and geometric elements.
5. Assess the requirements and classification of ports, harbors, docks, and navigation aids.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. Explain railway track components, functions, and requirements.
2. Apply geometric design principles to railway track layout and interlocking systems.
3. Evaluate airport planning aspects, including site selection, runway design, and terminal planning.
4. Design runways and taxiways based on geometric standards and safety regulations.
5. Analyze ports and harbor structures, including docks, breakwaters, and navigation aids.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	1	1	-	-	1	-	-	-	1	-	1	1	1
CO -2	3	2	2	1	2	-	-	-	-	-	-	1	2	1
CO -3	3	2	3	2	2	-	1	-	-	-	-	1	2	2
CO -4	3	1	2	2	3	1	-	-	-	-	-	1	2	2
CO -5	3	2	2	1	2	1	-	-	-	-	-	1	2	1

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 – Cant and Negative Super Elevation – Cant 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

Harbours - 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 andS.Arora, Dhanpatrai and Sons, New Delhi 2010
2. Highway, railway, Airport andHarbour Engineering – K.P. Subramanian, Scitech Publishers

REFRENCE BOOKS:

1. Harbour, Dock and Tunnel Engineering – R. Srinivasan, Charotar Publishing House Pvt. Limited, 200
2. Railway Track Engineering by J.S.MundreyMcGraw Hill Education 5th edition 2017
3. A Text book of Transportation Engineering – S.P.Chandola – S.Chand& Co. Ltd. – (2001)

Online Learning Resources:

https://nptel.ac.in/courses/105107123
https://archive.nptel.ac.in/courses/114/106/114106025/
https://www.mkube.co.in/product-detail/railways-airports-docks-and-harbour-engineering

CIVIL ENGINEERING					
IV B.Tech – I Semester					
Course Code	**EXPERIMENTAL STRESS ANALYSIS Professional Elective-IV**	L	T	P	C
23A01702c		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles and advantages of experimental stress analysis.
2. Explain strain measurement techniques using strain gauges and their applications.
3. Analyze strain rosettes and apply non-destructive testing methods for concrete.
4. Understand the fundamental principles of photoelasticity and its applications.
5. Apply two-dimensional photoelasticity methods for stress analysisin materials.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Explain the principles and merits of experimental stress analysis.
2. Demonstrate strain measurement using various strain gauge techniques.
3. Analyze strain rosette data and evaluate concrete structures using NDT methods.
4. Apply the theory of photoelasticity to determine stress distributionsin materials.
5. Utilize two-dimensional photoelasticity techniques for experimental stress analysis.

CO – PO Articulation Matrix:-

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	-	-	-	2	-	-	-	1	-	1	1	1
CO -2	3	2	2	2	2	3	-	-	-	-	-	1	2	2
CO -3	2	2	3	2	2	3	2	-	-	-	-	1	2	2
CO -4	3	2	2	2	2	3	2	-	-	-	-	1	2	2
CO -5	2	2	2	2	2	3	2	-	-	-	-	1	2	2

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 ROSSETTES 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 PHOTOELASTICITY Introduction –Temporary Double Refraction – The Stress Optic Law –Effects of Stressed Modelin A Polar Scope for Various Arrangements – Fringe Sharpening. Brewster's Stress Optic Law		
UNIT – V		
TWO DIMENSIONAL PHOTOELASTICITY 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 Photoelastic Materials.		
TEXT BOOKS:		
1. Experimental stress analysis by J.W.Dally andW.F.Riley, College House Enterprises2005 2. Experimental stress analysis by Dr.SadhuSingh.khanna Publishers 4th edition		
REFRENCE BOOKS:		
1. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications 2012 edition 2. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers		
Online Learning Resources:		
https://archive.nptel.ac.in/courses/112/106/112106068/# **https://archive.nptel.ac.in/courses/112/106/112106198/#**		

CIVIL ENGINEERING					
IV B.Tech – I Semester					
Course Code	**GROUND IMPROVEMENT TECHNIQUES Professional Elective-V**	L	T	P	C
23A01703a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** various dewatering methods, including sumps, well points, and electro-osmosis, for effective groundwater control.
2. **Analyze** the properties and applications of grouts, grouting techniques, and post-grouting tests for soil and rock stabilization.
3. **Evaluate** different densification techniques for granular and cohesive soils, such as vibro-compaction, preloading, and thermal methods.
4. **Apply** stabilization techniques, including mechanical, chemical, and bituminous stabilization, to improve soil properties.
5. **Assess** the design principles of reinforced earth walls and the roleofgeosyntheticsin soil improvement and slope stability. (Bloom's Level: **Evaluate - L5**

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. **Explain** the methods of dewatering and grouting and their importancein foundation engineering.
2. **Analyze** densification techniques for granular and cohesive soils to enhance soil strength.
3. **Evaluate** the effectiveness of soil stabilization methods for different ground conditions.
4. **Apply** reinforced earth principles andgeosynthetics for soil retention and foundation stability.
5. **Assess** expansive soil problems, their identification methods, and suitable foundation techniques like under-reamed piles.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	1	-	-	-	-	2	-	1	2	2
CO -2	3	3	2	2	2	-	-	-	-	2	-	2	2	2
CO -3	3	3	3	2	2	-	-	-	-	2	-	2	3	2
CO -4	3	2	3	3	3	-	-	-	-	2	1	2	3	3
CO -5	3	3	3	3	3	-	-	-	-	2	1	2	3	3

UNIT – I

EXPANSIVE SOILS: Problems of Expansive Soils – Tests for Identification – Methods of Determination of Swell Pressure. Improvement of Expansive Soils – Foundation Techniquesin Expansive Soils – Under Reamed Piles.

UNIT – II

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

DENSIFICATION METHODS in GRANULAR SOILS:-

In – Situ Densification Methodsin 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 Geodrains – Stone and Lime Columns – Thermal Methods

UNIT – IV

STABILISATION: 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.Purushotham Raj. Laxmi Publications, New Delhi University science press, New Delhi 2nd edition 2016

REFRENCE BOOKS:

1. Ground Improvement, Moseley M.P. Blackie Academic and Professional, Boca Taton, Florida, USA(1993).
2. Ground Improvement Techniques, NiharRanajanPatraVikas Publications, New Delhi
3. Ground Control and Improvement, Xanthakos P.P, Abramson, L.W andBrucwe, D.A (1994) John Wiley and Sons, New York, USA.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/108/105108075/
https://archive.nptel.ac.in/courses/105/105/105105210/

CIVIL ENGINEERING

IV B.Tech – I Semester

Course Code		L	T	P	C
23A01703b	**SUBSURFACE INVESTIGATION AND INSTRUMENTATION** **Professional Elective-V**	3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. **Understand** the fundamental concepts of soil formation, classification, and stratification processes.
2. **Analyze** various soil exploration methods, including boring, drilling, and sampling techniques.
3. **Evaluate** borehole logging methods and groundwater observations for site investigation.
4. **Apply** field testing techniques such as SPT, PLT, PMT, CPT, and geophysical methods to assess soil properties.
5. **Assess** soil exploration report preparation, including instrumentation and data interpretation.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

1. **Explain** soil formation processes, classification methods, and stratification phenomena.
2. **Analyze** soil exploration methods and sampling techniques for various geotechnical applications.
3. **Evaluate** borehole logging, groundwater observations, and their influence on soil properties.
4. **Apply** field testing procedures, including penetration tests and geophysical methods, to assess subsurface conditions.
5. **Assess** soil exploration report writing and field instrumentation techniques for site investigations.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	1	2	1	2	2	1	-	2	-	2	2	2
CO -2	3	3	2	3	2	2	3	1	-	2	-	2	2	2
CO -3	3	3	3	3	3	2	3	2	-	2	-	2	3	3
CO -4	3	2	3	3	3	3	3	2	-	2	2	2	3	3
CO -5	3	3	3	3	3	3	3	2	-	2	2	2	3	3

UNIT – I

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, WileyInterscience, 2008		
REFRENCE BOOKS:		
1. Basic and Applied Soil Mechanics- A.S. Rao andGopalRanjan, 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 Learning Resources:		
https://archive.nptel.ac.in/courses/105/103/105103182/ **https://onlinecourses.nptel.ac.in/noc25_ce27/preview** **https://onlinecourses.nptel.ac.in/noc22_ce81/preview**		

CIVIL ENGINEERING					
IV B.Tech – I Semester					
Course Code	**TRANSPORTATION ECONOMICS** **Professional Elective-V**	L	T	P	C
23A01703c		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the fundamentals of transportation project development and decision-making.
2. Analyze transportation costs, including agency and user costs.
3. Evaluate vehicle operating costs and traffic congestion economics.
4. Apply economic evaluation methods for transportation projects.
5. Assess financing methods and risk analysisin transportation projects.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Describe the overall process of transportation project development and financial planning.
2. Analyze transportation cost structures, including demand and supply elasticity.
3. Evaluate vehicle operating costs and traffic congestion pricing strategies.
4. Apply economic analysis techniques to assess the feasibility of transportation projects.
5. Assess financial models, PPP strategies, and risk analysis for road projects.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	1	2	-	-	-	-	2	-	2	2	2
CO -2	3	3	3	3	3	-	-	-	-	2	-	2	3	2
CO -3	3	3	3	3	2	-	-	-	-	2	-	2	3	3
CO -4	3	3	3	3	2	-	-	-	-	2	-	2	3	3
CO -5	3	3	3	3	3	3	3	3	-	2	-	2	3	3

UNIT – I

Introductory Conceptsin 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 - 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 - 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 - 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., andMaitri, V., Economicsin Highway and Transportation Planning, Standard Publisher, New Delhi, 2010.

REFRENCE 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., andVickerman, R., Principles of Transport Economics, Edward Elgar Pub, 2005
4. Button, K. J., Transport Economics, Elgar, 2010

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/104/105104098/
https://archive.nptel.ac.in/content/storage2/courses/105101087/01-Ltexhtml/p2/p.html

CIVIL ENGINEERING					
IV B.Tech – I Semester					
Course Code	**Skills in Civil Engineering software. (STAADPRO/CAD/TEKLA)**	L	T	P	C
23A01706		0	1	2	2

Course Objectives

The objectives of this course are to:

1. Provide fundamental knowledge of **Auto CAD** and **Tekla** for 2D drafting and 3D modeling.
2. Train students in **structural analysis and design** using **STAAD.Pro**
3. Develop skills in **reinforcement detailing and structural component modeling**.
4. Introduce **seismic and nonlinear analysis** for structural safety evaluation.
5. Enable students to apply **civil engineering software tools** for real-world projects.

Course Outcomes (COs):

Upon successful completion of this course, students will be able to:

1. Create **2D drawings and structural detailing** using **AutoCAD**.
2. Develop **3D building models** and analyze site to **pography** in **Revit**.
3. Perform **structural analysis and design** of **multi-story buildings** using **STAAD.Pro and ETABS**.
4. Conduct **seismic and performance-based analysis** for high-rise structures.
5. Apply **SAP2000** for**bridge modeling, water tank design, and advanced structural systems**.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	**3**	**1**	**1**	**-**	**2**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**2**	**1**
CO -2	**3**	**1**	**2**	**-**	**3**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**1**	**1**
CO -3	**3**	**1**	**2**	**-**	**3**	**-**	**-**	**2**	**-**	**2**	**2**	**2**	**2**	**2**
CO -4	**3**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**1**	**2**
CO -5	**3**	**1**	**1**	**-**	**3**	**-**	**-**	**1**	**-**	**1**	**1**	**1**	**1**	**1**

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

REFRENCE 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. NighatYasmin Ph.D.**,** ***Introduction to AutoCAD 2025 for Civil Engineering Applications,*** SDC Publications**,** 2024 Edition**.**

23A52702	**GENDER SENSITIZATION (Common to All Branches of Engineering)**	**L**	**T**	**P**	**C**
		0	**0**	**2**	**0**

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 (CO):

COs	**Statements**	**Blooms level**
CO1	Understand the basic concepts of gender and its related terminology	L1, L2,
CO2	Identify the biological, sociological, psychological and legal aspects of gender.	L1, L2
CO3	Use the knowledge in understanding how gender discrimination works in our society and how to counter it.	L3
CO4	Analyzethe gendered division of labour and its relation to politics and economics.	L4
CO5	Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups	L5
CO6	Develop students' sensibility with regard to issues of gender in contemporary India	L3

Unit-1 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-2 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-3 GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "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-4 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-5 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

Prescribed 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, *Gender Sensitization: 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: //kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf
https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2. Gender Roles and Relations
https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes

https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour
https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. **GENDER-BASED VIOLENCE**
https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls

https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **GENDER AND CULTURE**
https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/

https://archive.nptel.ac.in/courses/109/106/109106136/

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/

		L	T	P	C
23A01707	**EVALUATION OF INDUSTRY INTERNSHIP**	**0**	**0**	**2**	**0**

OPEN ELECTIVES

IIIB.Tech I Semester

23A02505	**ELECTRICALSAFETYPRACTICESANDSTANDARDS (Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Outcomes:

CO1: Understanding the Fundamentals of Electrical Safety -L2
CO2: Identifying and Applying Safety Components -L3
CO3: Analyzing Grounding Practices and Electrical Bonding
CO4: Applying Safety Practices in Electrical Installations and Environments- L4
CO5: Evaluating Electrical Safety Standards and Regulatory Compliance -L5

UNIT I

Introduction To Electrical Safety:

Fundamentals of Electrical safety-Electric Shock-physiological effects of electric current-Safetyrequirements–Hazardsofelectricity-Arc-Blast-Causesforelectricalfailure.

UNIT II

Safety Components:

Introduction to conductors and insulators- voltage classification -safety against over voltages-safety againststaticelectricity-Electricalsafetyequipment's-Fireextinguishersforelectricalsafety.

UNIT III

Grounding:

General requirements for grounding and bonding- Definitions- System grounding-Equipment grounding - The Earth – Earthing practices – Determining safe approach distance-Determining sarchazard category.

UNIT IV

Safety Practices:

Generalfirstaid-Safetyinhandlinghandheldelectricalappliancestools-Electricalsafetyintrain stations-swimmingpools,externallightinginstallations,medicallocations-Casestudies.

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

TEXTBOOKS:

1. MassimoA.G.Mitolo,"ElectricalSafetyofLow-VoltageSystems",McGrawHill,USA,2009.
2. MohamedEl-Sharkawi,"ElectricSafety-PracticeandStandards",CRCPress,USA,2014

REFERENCES:

1. KennethG.Mastrullo, RayA.Jones,"TheElectricalSafetyProgramBook",Jones andBartlettPublishers,London, 2nd Edition, 2011.
2. PalmerHickman,"ElectricalSafety-RelatedWorkPractices",Jones&BartlettPublishers,London,2009.
3. FordhamCooper,W.,"ElectricalSafetyEngineering",ButterworthandCompany,London,1986.
4. JohnCadick,MaryCapelli-Schellpfeffer,DennisK.Neitzel,"ElectricalSafetyHandbook,McGraw-Hill,NewYork,USA, 4th edition, 2012.

III B.Tech – I Sem

23A03505	**SUSTAINBLE ENERGY TECHNOLOGIES (Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	To demonstrate the importance the impact of solar radiation, solar PVmodules
2	To understand the principles of storage in PV systems
3	To discuss solar energy storage systems and their applications.
4	To get knowledge in wind energy and bio-mass
5	To gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES On successful completion of this course the student will be able to		
CO1	Illustrate the importance of solar radiation and solar PV modules.	L1, L2
CO2	Discuss the storage methods in PV systems	L2,L3
CO3	Explain the solar energy storage for different applications	L2,L3
CO4	Understand the principles of wind energy, and bio-mass energy.	L2, L3
CO5	Attain knowledge in geothermal energy, ocean energy and fuel cells.	L1, L2,L3, L4

UNIT – 1

SOLAR RADIATION: 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 – 2

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 – 3

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 – 4

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 – 5

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

References:

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 Learning Resources:

https://nptel.ac.in/courses/112106318

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3

https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

III B.Tech – I Sem

		L	T	P	C
23A04505	**ELECTRONIC CIRCUITS** **(Open Elective-I)**	**3**	**0**	**0**	**3**

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes:
At the end of this course, the students will be able to

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

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, LousisNashelsky 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.

III B.Tech I Sem

23A05506a	**JAVA PROGRAMMING (Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The main objective of the course is to Identify Java language components and how they work together in applications

- 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 apisfor program development

Course Outcomes: After completion of the course, students will be able to
CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

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 printf() 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 ClassObject 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 Autounboxing, 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(Text Book 2)

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, ResultSet 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)

Learning Resources:
Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, 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 Learning Resources:

1. https://nptel.ac.in/courses/106/105/106105191/
2. *https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347 _shared/overv*iew

III B.Tech I Sem

		L	T	P	C
23A05506b	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (Open Elective-I)**	**3**	**0**	**0**	**3**

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:

- Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
- Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
- Learn different knowledge representation techniques.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
- Analyze Supervised Learning Vs. Learning Decision Trees

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

ProbabilisticReasoning:

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 BOOK:

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.

23A05506c	**QUANTUM TECHNOLOGIES AND APPLICATIONS** **Open Elective – I**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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.

Syllabus

UNIT I: Fundamentals of Quantum Mechanics (7 Hours)

- 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 (7 Hours)

- 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 Centers
- 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

Textbooks and References

Primary Textbooks:

- "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)

• "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)
Supplementary Reading:
• "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
• "Quantum Physics: A Beginner's Guide" by Alastair I.M. Rae
• "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
• IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)
Course Outcomes
• Understand key quantum mechanical concepts and phenomena.
• Comprehend the structure and function of quantum algorithms and circuits.
• Explore applications in quantum communication and cryptography.
• Appreciate the role of quantum technologies in modern engineering systems.

III B.Tech I Sem

		L	T	P	C
23A54501a	**MATHEMATICS FOR MACHINE LEARNING AND AI (Open Elective-I)**	**3**	**0**	**0**	**3**

Course Objectives:

- To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- To equip students with optimization techniques and graph-based methods used in AI applications.
- To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Apply linear algebra concepts to ML techniques like PCA and regression.	L3 (Apply)
CO2	Analyze probabilistic models and statistical methods for AI applications.	L4 (Analyze)
CO3	Implement optimization techniques for machine learning algorithms.	L3 (Apply)
CO4	Utilize vector calculus and transformations in AI-based models.	L3 (Apply)
CO5	Develop graph-based AI models using mathematical representations.	L5 (Evaluate)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Linear Algebra for Machine Learning(08)

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(08)

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(08)

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(08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI(08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models.Introduction to Graph Neural Networks (GNNs).

Textbooks:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learningby 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.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/

DeepAI – Mathematical Foundations for AI https://deepai.org

III B.Tech – I sem

		L	T	P	C
23A54501b	**MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES** **(Open Elective 1)**	**3**	**0**	**0**	**3**

Course Objectives:

- To provide a strong mathematical foundation for understanding Quantum Mechanics.
- To equip students with fundamental basis of the statistical theory, Conclusions from Experiments, Measurement, and reversibility.
- To enhance the ability to apply the concept in Thermodynamics, Reversibility and equilibrium problems and Macroscopic Measurement.
- To develop critical problem-solving skills for composite system and measuring process.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	**Statements**	**Blooms level**
CO1	Understand the Transformation theory and Hilbert space.	L1 (Understand)
CO2	Analyze the properties and operators of Hilbert space and apply Eigen values to it.	L3, L4 (Apply and Analyze)
CO3	Apply statistics to measure theory, uncertainty relations and radiation theory.	L3 (Apply)
CO4	Evaluate problems on reversibility, equilibrium and macroscopic measurements.	L5 (Evaluate)
CO5	Formulate problems of composite system and measuring process	L6 (Formulation)

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Introductory Considerations(08)

The origin of the Transformation Theory, The Original Formulation of Quantum Mechanics, The Equivalence of the two Theories: (i) The Transformation Theory, (ii) Hilbert Space.

UNIT II: Abstract Hilbert Space(10)

The definition of Hilbert space, The Geometry of Hilbert space, Degression on the Conditions A-E, Closed linear Manifolds, Operators in Hilbert space, The Eigen Value Problem, Continuation, Initial Consideration concerning the Eigenvalue Problem, Degression on the Existence and Uniqueness of solutions of the Eigenvalue Problems, Cumulative operators, The Trace.

UNIT III: The Quantum Statistics(08)

The statistical assertions of quantum mechanics, the statistical interpretation, Simultaneous Measurability and Measurability in General, Uncertainty Relations, Projections as Propositions, Radiation Theory.

UNIT IV: Deductive development of the Theory and general considerations(08)

The fundamental basis of the statistical theory, Conclusions from Experiments.

Measurement and reversibility, Thermodynamics Considerations, Reversibility and equilibrium problems, The Macroscopic Measurement.

UNIT V: The measuring Process(06)

Formulation of the problems, Composite systems, discussion of the Measuring process.

Textbooks:

3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).
4. Srinivas, M. D., Measurements and Quantum Probabilities, University Press, Hyderabad (2001).

Reference Books:

3. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education) (2010).
4. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.
5. Gerad Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009.

III B.Tech I Sem

23A56501	**MATERIALS CHARACTERIZATION TECHNIQUES** (Common to all branches) (Open Elective-Interdisciplinary) **(Open Elective-I)**	Credits 3-0-0:3

COURSE OBJECTIVES	
1	To provide exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4	To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT I Structure analysis by Powder X-Ray Diffraction 9H

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) 9H

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) 9H

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 9H

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 9H

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.

Textbooks:

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 BanwellandElaine 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

NPTEL courses link :

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/**

	Course Outcomes	Blooms Level
CO1	Analyze the crystal structure and crystallite size by various methods	L1,L2, L3, L4
CO2	Analyze the morphology of the sample by using a Scanning Electron Microscope	L1,L2, L4
CO3	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope	L1,L2, L3
CO4	Explain the principle and experimental arrangement of various spectroscopic techniques	L1,L2
CO5	Identify the construction and working principle of various Electrical & Magnetic Characterization technique	L1,L2

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	2	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

III B.Tech I Sem

Course Code		L	T	P	C
23A51501	**CHEMISTRY OF ENERGY SYSTEMS**	3		-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

COURSE OUTCOMES	
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
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
CO3	➢ Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, ➢ Interpret advantages of photoelectron catalytic conversion.
CO4	➢ Apply the photo voltaic technology,Demonstrate about solar energy and prospects ➢ Illustrate the Solar cells,Discuss about concentrated solar power
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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT-1: 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-2: Fuel Cells: 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-3: 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-4: Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications. .

UNIT-5: 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 ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4.Hydrogen storage by Levine Klebonoff

III B.Tech I Sem

Course Code	ENGLISH FOR COMPETITIVE EXAMINATIONS	L	T	P	C
23A52502a	**(Open Elective-I)** (Common to All Branches of Engineering)	3	0	0	3

Course Objectives:

1. To enable the students to learn about the structure of competitive English
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To improve word power to answer competitive challenges
5. To make them ready to crack competitive exams

Course Outcomes (CO): **Blooms Level**

By the end of the program students will be able to

- Identify the basics of English grammar and its importance L1, L2
- Explain the use of grammatical structures in sentences L1, L2
- Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams L3
- Analyze an unknown passage and reach conclusions about it. L4
- Choose the appropriate form of verbs in framing sentences L5
- Develop speed reading and comprehending ability thereby perform better in competitive exams L3

UNIT - I	GRAMMAR-1	Lecture Hrs

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	GRAMMAR-2	Lecture Hrs

Verbs-tenses- structure-usages- negatives- positives- 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	Lecture Hrs

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 VOCUBULARY	Lecture Hrs

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	Lecture Hrs

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

Textbooks:

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**

Course Code	ENTREPRENEURSHIP AND NEW VENTURE CREATION (Open Elective-I)	L	T	P	C
23A52502b		3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
2	To encourage creativity and innovation
3	To enable them to learn pitching and presentation skills
4	To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5	To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

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 – 16industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in Entrepreneurship role in economic development
- Develop a creative mind set and personality in starting a business.

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.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the problem and Customer identification.
- Analyze problem and validating with potential customer
- Evaluate customer segmentation and customer personas

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

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze jobs-to-be-done
- Evaluate customer needs to create a strong value proposition
- Design and draw prototyping and MVP

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 analysing 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.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand lean approach in business models
- Apply business plan, sales plan and financial plan
- Analyze financial planning, marketing channels of distribution.
- Design their own venture and source of funds.

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.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand aspiration for scale
- Analyze venture idea and its key components
- Evaluate and build investors ready pitch

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha . *Entrepreneurship*, McGrawHill, 11th Edition.(2020)
2. Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley & Sons. (2010).

REFERENCES

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.

E-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)

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship	L3
CO2	Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution	L3
CO3	Analyze and refine business models to ensure sustainability and profitability	L3
CO4	Build Prototype for Proof of Concept and validate MVP of their practice venture idea	L4
CO5	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture	L5
CO6	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders	L6

BTL: Bloom's Taxonomy Level

III B.Tech.II Semester

L	T	P	C
3	0	0	3

(23A02605) RENEWABLE ENERGY SOURCES
(Open Elective-II)

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1: Understand principle operation of various renewable energy sources. L1
CO 2: Identify site selection of various renewable energy sources. L2
CO 3: Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomasss, Tidal Wave and Fuel cell energies L3
CO 4: Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems. L5
CO 5: Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power. L4

UNIT ISolar 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 IIPV 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 IIIWind 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 IVGeothermal 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 – VMiscellaneous 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 Learning Resources:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

B. TECH-ME-III-II Sem

L	T	P	C
3	0	0	3

23A03606 AUTOMATION ANDROBOTICS

(Open Elective – II)

Course objectives: Theobjectives of the courseareto	
1	Fundamentals of industrial automation, production types, automation strategies, and hardware

	elements used in modern manufacturing processes.
2	Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
3	Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
4	Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
5	Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production.	*L2,L4,L5*
2	Analyze and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques.	L4,L5,L6
3	Classify robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility.	L2,L3,L4
4	Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems.	L3,L4,L5
5	Design, program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks.	L1,L3,L6

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,ProductionsystemsandCIM,M.P.Groover/PearsonEdu.
2. IndustrialRobotics -M.P.Groover,TMH.
3.

References:

1. Robotics,FuKS, McGrawHill,4thedition,2010.
2. AnIntroductiontoRobotTechnology,P.CoiffetandM.Chaironze,KogamPageLtd. 1983 London.
3. RoboticEngineering,RichardD.Klafter,PrenticeHall
4. Robotics,FundamentalConceptsandanalysis–AshitaveGhosal,OxfordPress,1/e,2006
5. RoboticsandControl, MittalRK&NagrathIJ,TMH.

OnlineLearningResources:

https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl-gt76o

https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3ZJgwEjyE

III B.Tech II Sem

L – T – P – C 3 – 0 – 0 – 3

(23A04606) DIGITAL ELECTRONICS
(Open Elective –II)

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:

At the end of this course, the students will be able to

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design.
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. Gain knowledge about programmable logic devices and digital IC's.

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 1: 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 2: 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.

III B.Tech IISem

23A32502T	**OPERATING SYSTEMS (Open Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The main objectives of the course is to make student

- 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: After completion of the course, students will be able to

CO1: Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication. (L1)

CO2: Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection. (L2)

CO3: Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. (L3)

CO4: Illustrate different conditions for deadlock and their possible solutions. (L2) Analyze the memory management and its allocation policies. (L4)

CO5: Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

UNIT - I Operating Systems Overview, System Structures Lecture 8Hrs

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 Lecture 10Hrs

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 Lecture 8Hrs

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 Lecture 9Hrs

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 Lecture 8Hrs

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.

Textbooks:

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 Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/
http://peterindia.net/OperatingSystems.html

III B.Tech – II Sem

23A32501T	**INTRODUCTION TO MACHINE LEARNING (Open Elective-II)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

***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*:**

After completion of the course, students will be able to:

- Understand and distinguish among different types of learning methods.
- Apply supervised and unsupervised learning algorithms to datasets.
- Analyze model performance using cross-validation and error metrics.
- Build, test, and improve machine learning models for classification and prediction.
- Use Python-based libraries (e.g., Scikit-learn) to implement ML algorithms.

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 XGBoost, 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.

***Textbooks*:**

1. Tom Mitchell, **Machine Learning**, McGraw-Hill Education.
2. Aurélien Géron, **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow**, 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 Learning 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

YouTube – StatQuest with Josh Starmer

L	T	P	C
3	0	0	3

III B.Tech IISem

(23A54601a) OPTIMIZATION TECHNIQUES FOR ENGINEERS
(Open Elective -II)

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.	L2, L3
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems.	L3, L5
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	L2, L3
CO5	Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.	L3,L5

CourseArticulationMatrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Linear programming I (08)

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 (08)

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 (08)

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IVNon-linear programming: Constrained optimization techniques (08)

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 (08)

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 BOOK:

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.

REFERENCES:

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.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

23A54601b	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES Open Elective – II	L	T	P	C
		3	0	0	3

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:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand vector spaces, inner products, and linear operators with applications to quantum systems.	L1, L2 (Understand, Comprehend)
CO2	Apply linear algebra concepts to function spaces and analyze the transition from finite to infinite dimensional systems.	L3, L4 (Apply, Analyze)
CO3	Analyze quantum mechanical formalism including measurement theory, uncertainty relations, and time evolution.	L4 (Analyze)
CO4	Apply quantum mechanical principles to solve problems in simple quantum systems and evaluate statistical interpretations.	L3, L5 (Apply, Evaluate)
CO5	Evaluate advanced concepts in composite systems and synthesize understanding of measurement processes and modern quantum theory.	L5, L6 (Evaluate, Create)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	2
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	3	3	3	2	-	-	-	-	-	-	2
CO5	3	3	3	3	2	1	-	-	-	-	-	3

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Linear Algebra Foundation for Quantum Mechanics (10 hours)

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 (08 hours)

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 (08 hours)

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 (06 hours)

Simple applications (infinite square well, harmonic oscillator), Statistical interpretation (ensembles, pure vs mixed states), Measurement process (von Neumann measurement scheme).

UNIT V: Advanced Topics (08 hours)

Composite systems (tensor products basic introduction), Reversibility and irreversibility (unitary evolution vs measurement), Thermodynamic connections (equilibrium states, entropy), Modern perspectives (decoherence, measurement problem conceptual).

Textbooks:

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).

Web 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

III B.Tech II Sem

23A56601	**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES** (Common to all branches) Open Elective-II	Credits 3-0-0:3

Course Objectives	
1	To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2	To provide insight into various semiconducting materials and their properties.
3	To develop a strong foundation in semiconductor physics and device engineering.
4	To elucidate excitonic and luminescent processes in solid-state materials.
5	To understand the principles, technologies, and applications of modern display systems.

Syllabus:

UNIT-I Fundamentals of Materials Science 9H

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 9H

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 IIIPhysics of Semiconductor Devices: 9H

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence: 9H

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 : 9H

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS(Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4th edition, 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

NPTEL course links:
https://nptel.ac.in/courses/113/106/113106062/

https://onlinecourses.nptel.ac.in/noc20_ph24/preview

	CourseOutcomes	Blooms Level
CO1	Understand crystal growth and thin film preparation	L1,L2
CO2	Summarize the basic concepts of semiconductors	L1,L2
CO3	Illustrate the working of various semiconductor devices	L1,L2, L3
CO4	Analyze various luminescent phenomena and the devices based on these concepts	L1,L2, L3
CO5	Explain the working of different display devices	L1,L2

CourseArticulationMatrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	2	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately,3-Substantially.

III B.Tech –II Sem

23A51601	**CHEMISTRY OF POLYMERS AND APPLICATIONS** (Common to all branches) Open Elective-II	Credits 3-0-0:3

Course Objectives	
1	To understand the basic principles of polymers
2	To understand natural polymers and their applications.
3	To impart knowledge to the students about synthetic polymers,their preparation and importance.
4	To enumerate the applications of hydogel polymers
5	To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Describe the physical and chemical properties of natural polymers and Modified cellulosics.
CO3	DifferentiateBulk, solution, Suspension and emulsion polymerization,Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
CO5	Explain classification and mechanism of conducting and degradable polymers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

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.

III B.Tech –II Sem

23A52602	**ACADEMIC WRITING AND PUBLIC SPEAKING (Common to All Branches of Engineering) OPEN ELECTIVE - II**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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 (CO):	**Blooms Level**
By the end of the program students will be able to	
• Understand various elements of Academic Writing	L1, L2
• Identify sources and avoid plagiarism	L1, L2
• Demonstrate the knowledge in writing a Research paper	L3
• Analyse different types of essays	L4
• Assess the speeches of others and know the positive strengths of speakers	L5
• Build confidence in giving an impactful presentation to the audience	L3

UNIT - I	**Introduction to Academic Writing**	**Lecture Hrs**

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**	**Lecture Hrs**

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**	**Lecture Hrs**

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**	**Lecture Hrs**

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**	**Lecture Hrs**

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics - Paralanguage – Sign

Textbooks:

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 .sserP ytisrevinU drofxO
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 Learning Resources:
1. https://youtu.be/NNhTIT81nH8 2. phttps://www.youtube.com/watch?v=478ccrWKY-A 3. https://www.youtube.com/watch?v=nzGo5ZC1gMw 4. https://www.youtube.com/watch?v=Qve0ZBmJMh4 5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/ 6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview 7. https://archive.nptel.ac.in/courses/109/107/109107172/# 8. https://archive.nptel.ac.in/courses/109/104/109104107/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A02704) SMART GRID TECHNOLOGIES
(Open Elective- III)

Course Outcomes:
CO1: Understanding the Concept and Evolution of Smart Grids. L2
CO2: Analyzing Wide Area Monitoring System and Synchrophasor Technology. L4
CO3: Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3
CO4: Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5
CO5: Designing Smart Grid Applications and Cybersecurity Measures. L6

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 Synchrophasor 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.

REFERENCES:

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, Newyork, 2012.

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A03704) 3D PRINTING TECHNOLOGIES
(Open Elective-III).

Course objectives: Theobjectives of the courseareto	
1	Understand the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2	Demonstrate the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3	Definethe processes and classifications of rapid tooling and reverse engineering techniques.
4	Identify common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5	Familiarize RP-related software and its role in applications such as design, manufacturing, and medical fields.

Course Outcomes: Onsuccessfulcompletionofthecourse, thestudentwillbeable to,		
1	Define and explain the evolution and need for rapid prototyping in modern product development.	L1,L2,L6
2	Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.	L2,L4
3	Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.	L3,L5,L6
4	Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.	L2,L3,L5,
5	Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.	L1,L3,L6

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), Ballastic 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, SurgiGuide, 3-matic, 3D-Doctor, Simplant, 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.

Textbooks:

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. Frank W.Liou, "Rapid Prototyping & Engineering Applications", CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- https://nptel.ac.in/courses/112/104/112104265/
- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-
- %20FDM.pdf
- https://lecturenotes.in/subject/197
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4.

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A04503T) MICROPROCESSORS AND MICROCONTROLLERS

(Open Elective –III)

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:
At the end of this course, the students will be able to

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

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

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V

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

Textbooks:

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.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

IV B.Tech-I Sem

23A05402T	**DATA BASE MANAGEMENT SYSTEM (Open Elective-III)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives: The main objective of the course is to

- 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: After completion of the course, students will be able to

- Understand the basic concepts of database management systems (L2)
- Analyze a given database application scenario to use ER model for conceptual design of the database (L4)
- Utilize SQL proficiently to address diverse query challenges (L3).
- Employ normalization methods to enhance database structure (L3)
- Assess and implement transaction processing, concurrency control and database recovery protocols in databases. (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 for

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:

Textbooks:

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, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012758066672820224 56_shared/overview

IV B.Tech-I Sem

		L	T	P	C
23A38502	**CYBER SECURITY (Open Elective-III)**	**3**	**0**	**0**	**3**

Course Objectives:

1. To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behavior and various classifications of cybercrimes.
2. To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
3. To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.
4. To familiarize students with the tools and techniques used in committing cybercrimes, such as phishing, malware, DoS/DDoS attacks, and code-based exploits.
5. To analyze 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:

After completion of the course, students will be able to

1. Understand the fundamentals of cybercrime and information security, and explain the legal and global perspectives, especially with reference to Indian IT Act 2000.
2. Analyze how cybercriminals plan and execute cyber offenses using techniques like social engineering, cyberstalking, and botnets, including threats posed by cloud computing.
3. Evaluate the security challenges of mobile and wireless devices and formulate measures to secure mobile environments within an organization.
4. Identify and explain various cyberattack tools and methods such as phishing, keyloggers, Trojans, and SQL injection used in committing cybercrimes.
5. Assess the organizational implications of cybercrimes, including IPR issues, social media risks, and formulate strategies to mitigate security and privacy challenges.

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 an 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.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, 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.DavidIrwin.CRC Press T&F Group

Online Learning Resources:

http://nptel.ac.in/courses/106105031/40

http://nptel.ac.in/courses/106105031/39

http://nptel.ac.in/courses/106105031/38

IV B.Tech I Sem

L	T	P	C
3	0	0	3

(23A54701) WAVELET TRANSFORMS AND ITS APPLICATIONS

(Open Elective-III)

Course Outcomes:
After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms	L2, L3
CO2	Illustrate the multi resolution analysis ad scaling functions	L3, 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.	L2, L3
CO5	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields	L3,L5

CourseArticulationMatrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Wavelets (08)

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 (08)

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 (08)

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 (08)

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 (08)

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 BOOK:

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)..

REFERENCES:

1. RaghuveerRao, "Wavelet Transforms", Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

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

23A56701a	**SMART MATERIALS AND DEVICES** (Common to all branches) **Open Elective-III**	Credits 3-0-0:3

	Course Objectives
1	To provide exposure to smart materials and their engineering applications.
2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain the properties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices

Syllabus:

UNIT IIntroduction to Smart Materials 9H
Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II Properties of Smart Materials 9H
Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III Synthesis of Smart Materials 9H
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 9H
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 9H
Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Textbooks:

1. YaserDahman, 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. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014
3. **Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,**Chaudhery MustansarHussain, Paolo Di Sia, Springer,2022.
4.**Fundamentals of Smart Materials,**Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

	Course Outcomes	Blooms Level
CO1	Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.	L1,L2, L3, L4
CO2	Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.	L1,L2, L3
CO3	Summarize various types of synthesis of smart materials	L1,L2, L3
CO4	Analyze various characterization techniques used for smart materials	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	1	1	1							
CO4	3	2	1	1	1							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

23A56701b	INTRODUCTON TO QUANTUM MECHANICS Open Elective – III	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To understand the fundamental differences between classical and quantum mechanics.
2	To study wave-particle duality, uncertainty principle, and their implications.
3	To learn and apply Schrödinger equations to basic quantum systems.
4	To use operator formalism and mathematical tools in quantum mechanics.
5	To explore angular momentum, spin and their quantum mechanical representations.

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 (tunneling 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.

BOOKS FOR STUDY:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-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 PrakashNath& 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.

	CourseOutcomes After completing this course, students will be able to:	**Blooms Level**
CO1	Explain the key principles of quantum mechanics and wave-particle duality	L1, L2
CO2	Apply Schrödinger equations to solve one-dimensional quantum problems	L3, L4
CO3	Solve quantum mechanical problems using operator and matrix methods.	L2, L4
CO4	Evaluate quantum states using Dirac notation and expectation values.	L5
CO5	Analyze angular momentum and spin systems using Pauli matrices and operators.	L4, L5

NPTEL courses link :

4. **https://archive.nptel.ac.in/courses/115/101/115101107/**
5. **https://archive.nptel.ac.in/courses/122/106/122106034/**
6. **https://nptel.ac.in/courses/115106066**

CourseArticulationMatrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2							
CO2	3	2	2	1	1							
CO3	3	3	2	1	1							
CO4	3	3	3	2	3							
CO5	3	3	1	1	1							

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

23A51701	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT** (Common to all branches) **Open Elective-III**	Credits 3-0-0:3

Course Objectives	
1	To understand principle and concepts of green chemistry.
2	To understand the types of catalysis and industrial applications.
3	To apply green solvents in chemical synthesis.
4	To enumerate different sourced of green energy.
5	To apply alternative greener methods foe chemical reactions

Course Outcomes	
CO1	Apply the Green chemistry Principles forday to day life as well as synthesis,describe the sustainable development and green chemistry, Explain economic and un-economic reactions,Demonstrate Polymer recycling.
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 Phasetransfer Catalysis
CO3	Demonstrate Green solvents and importance,Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry,Apply Green Chemistry for Sustainable Development;discuss the importance of Renewable resources, mechanochemical synthesis.
CO5	Discuss Alternative green methods like Photoredox catalysis,single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry,E factor, atom economy, atom economicReactions: 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 2: CATALYSIS AND GREEN CHEMISTRY

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and theBulk 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 3: GREEN SOLVENTS IN CHEMICAL SYNTHESIS

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT 4: 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 5: ALTERNATIVE GREENER METHODS

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions,Microwave-assisted Reactionsand Sonochemical 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

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

IV B.Tech I Sem

Course Code	EMPLOYABILITY SKILLS	L	T	P	C
23A52703	OPEN ELECTIVE-III	3	0	0	3

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 (CO):	**Blooms Level**
CO1: Understand the importance of goals and try to achieve them	L1, L2
CO2: Explain the significance of self-management	L1, L2
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes	L3
CO4: Analyse various forms of Presentation skills	L4
CO5: Judge the group behaviour appropriately	L5
CO6: Develop skills required for employability.	L3, L6

UNIT - I	**Goal Setting and Self-Management**	Lecture Hrs

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**	Lecture Hrs

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**	Lecture Hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation .

UNIT - IV	**Group Presentation Skills**	Lecture Hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation-Group Discussion-Debate –Corporate Etiquette.

UNIT - V	**Job Cracking Skills**	Lecture Hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews.

Textbooks:

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 Montogomery 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 Learning 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/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A02705) ELECTRIC VEHICLES
(Open Elective -IV)

Course Objectives: To make the student
• 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 analyze the various control structures for Electric vehicle.

Course Outcomes (CO): Student will be able to
CO 1: To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. -L2
CO 2: Understand Various dynamics of Electric Vehicles. -L2
CO 3: To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. -L1
CO 4: To analyze fuel cell technologies in EV and HEV systems. -L3
CO 5: To analyze the battery charging and controls required of EVs. -L3

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

Textbooks:

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 Elelctric, Hybrid Elelctric 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 Learning Resources:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A03705) TOTAL QUALITY MANAGEMENT
(Open Elective-IV).

Course objectives: Theobjectives of the courseareto	
1	Familiarize the basic concepts of Total Quality Management.
2	Expose with various quality issues in Inspection.
3	Gain Knowledge on quality control and its applications to real time..
4	Understand the extent of customer satisfaction by the application of various quality concepts.
5	Demonstrate the importance of Quality standards in Production

Course Outcomes: Onsuccessfulcompletionofthecourse, thestudentwillbeable to,		
1	Define and develop on quality Management philosophies and analyze quality costs frameworks.	L1,L3,L4
2	Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.	L2, L3,L6
3	Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.	L2,L4,L5
4	Apply benchmarking and business process reengineering to improve management processes.	L3,L5,L6
5	Demonstrate the set of indications to evaluate performance excellence of an organization	L1,L2,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 Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

IV B.Tech I Sem **L – T – P – C** **3 – 0 – 0 – 3**

(23A04704) TRANSDUCERS AND SENSORS
(Open Elective –IV)

Course Objectives:

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principle and applications of force and sound transducers.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

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 Instrumentation", 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.

IV B.Tech I Sem

23A05502T	**INTRODUCTION TO COMPUTER NETWORKS (Open Elective-IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

The course is designed to:

- 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:

After completion of the course, students will be able to:

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop error, routing, and congestion control algorithms
- Assess critically the existing routing protocols
- Explain the functionality of each layer of a computer network
- Choose the appropriate transport protocol based on the application requirements

UNIT I:

Computer Networks and the Internet **Lecture: 8 Hrs**

What Is the Internet? Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Multimedia Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT II:

The Data Link Layer, Access Networks, and LANs **Lecture: 10 Hrs**

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) 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) (Textbook 2)

UNIT III:

The Network Layer **Lecture: 8 Hrs**

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV:

The Transport Layer **Lecture: 9 Hrs**

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V:

The Application Layer **Lecture: 8 Hrs**

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 Distribution Networks (Textbook 2)

Textbooks:

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 Learning 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/106105183/3

IV B.Tech I Sem

23A35501T	**INTERNET OF THINGS (Open Elective-IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

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:
After completion of the course, students will be able to

- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

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, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

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:

1. 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.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning 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

23A32603	INTRODUCTION TO QUANTUM COMPUTING Open Elective – IV	L	T	P	C
		3	0	0	3

***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*:**
Upon successful completion of this course, students will be able to:

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

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.

Textbooks:

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 Learning 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

IV B.Tech I Sem

L	T	P	C
3	0	0	3

(23A54702) FINANCIAL MATHEMATICS
(Open Elective-IV)

Course Objectives:

1. To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Explain fundamental financial concepts, including arbitrage, valuation, and risk.	L2 (Understand)
CO2	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.	L3 (Apply)
CO3	Analyze mathematical techniques for pricing options and financial derivatives.	L4 (Analyze)
CO4	Evaluate interest rate models and bond pricing methodologies.	L5 (Evaluate)
CO5	Utilize computational techniques such as Monte Carlo simulations for financial modeling.	L3 (Apply)

CourseArticulationMatrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	-	-	-	2	1
CO2	3	3	2	2	2	-	-	-	-	-	1	1
CO3	3	3	3	3	2	1	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	2	1
CO5	3	3	3	3	3	-	-	-	-	-	2	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT-I: Asset Pricing and Risk Management **(08)**

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, CAPModel, Efficient market hypothesis.

UNIT-II: Stochastic Models in Finance (08)

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 (08)

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 (08)

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 (08)

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.

Textbooks:

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. IoannisKaratzas& Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.
2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
- National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

IV B.Tech I Sem

		L	T	P	C
23A56702	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS (Open Elective-IV)** (Common to all branches)	**3**	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application

UNIT IIntroduction to Sensors and Actuators9H

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 9H

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 9H

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 9H

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V Chemical and Radiation Sensors 9H

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)

Textbooks:

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.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

	CourseOutcomes	**Blooms Level**
CO1	Classify different types of Sensors and Actuators along withtheir characteristics	L1,L2
CO2	Summarize various types of Temperature and Mechanical sensors	L1,L2
CO3	Illustrates various types of optical and mechanical sensors	L1,L2
CO4	Analyze various types of Optical and Acoustic Sensors	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

CourseArticulationMatrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	1	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

		L	T	P	C
23A51702	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS (Open Elective-IV)** (Common to all branches)	3	0	0	3

Course Objectives	
1	To understand basics and characterization of nanomaterials.
2	To understand synthetic methods of nanomatrials.
3	To apply various techniques for charterization of nanomaterials.
4	To understand Studies of Nano-structured Materials
5	To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes	
CO1	Classify the nanostructure materials; describe scope of nanoscience and importance technology.
CO2	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about highenergy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
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.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Unit – I

Basics and Characterization of Nanomaterials: Introduction**,** Scope of nanoscience and nanotecnology, 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 vapour deposition method, electrodeposition method, highenergy 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: Applicationsof Nano Particle, nanorods, nano wires,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, MaGraw-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 Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures &Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

IV B.Tech I Sem

23A52704	**LITERARY VIBES** **(Open Elective-IV)** (Common to all branches)	**L**	**T**	**P**	**C**

Course Objectives	
1	To inculcate passion for aesthetic sense and reading skills
2	To encourage respecting others' experiences and creative writing
3	To explore emotions, communication skills and critical thinking
4	To educate how books serve as the reflection of history and society
5	To provide practical wisdom and duty of responding to events of the times

Course Outcomes		**Blooms Level**
CO1	Identify genres, literary techniques and creative uses of language in literary texts.	L1, L2
CO2	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces	L1, L2
CO3	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments	L3
CO4	Analyze the underlying meanings of the text by using the elements of literary texts	L4
CO5	Evaluate their own work and that of others critically	L5
CO6	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance	L3

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
1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. 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.

References:

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

https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses
https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis
https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/
https://www.litcharts.com/lit/twelfth-night/themes
https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

HONOURS

Course Code	SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	C
23A01H01		3	0	0	3

Course Objectives :-

The objectives of this course are to:

1. Understand the fundamentals of vibration and response of single/multiple-degree-of-freedom systems. *(L3)*
2. Analyze the wave propagation in soil deposits and evaluate dynamic soil properties. *(L4)*
3. Perform vibration analyses for machine foundations, considering different loading conditions. *(L4)*
4. Design block foundations for reciprocating and impact machines based on codal provisions. *(L5)*
5. Analyze and design machine foundations on piles, considering different modes of vibration. *(L5)*

Course Outcomes :-

Upon successful completion of the course, students will be able to:

1. Explain the fundamentals of vibration and response of SDOF/MDOF systems. (L3)
2. Analyze seismic wave propagation and evaluate dynamic soil properties. (L4)
3. Perform vibration analyses of rigid foundation blocks using different models. (L4)
4. Design machine foundations for reciprocating and impact-type machines. (L5)
5. Analyze the response of pile-supported machine foundations and develop design solutions. (L5)

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO -1	3	2	2	2	2	-	-	-	-	-	-	1	2	2
CO -2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
CO -3	3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO -4	3	3	3	3	2	-	-	-	-	-	-	1	3	3
CO -5	2	2	2	2	2	2	-	-	-	-	-	1	2	2

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 behaviour 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		

Course Code	INDUSTRIAL WASTE AND WASTE WATER MANAGEMENT	L	T	P	C
23A01H02		3	0	0	3

Course Objectives :-

The objectives of this course are to:

1. To understand the various sources and characteristics of industrial wastewater and its impacts on natural water bodies and sewer systems.(L2)
2. To explain and differentiate primary and preliminary treatment methods for industrial effluents.(L2)
3. To illustrate advanced treatment techniques including nutrient and heavy metal removal. (L3)
4. To examine and summarize the characteristics and treatment needs of effluents from major industries like sugar, steel, petroleum, textiles, and tanneries.(L4)
5. To develop awareness of common effluent treatment plants (CETPs), their design considerations, and operational challenges.(L5)

Course Outcomes :-

Upon successful completion of the course, students will be able to:

1. Identify sources and characteristics of industrial wastewaters, compare them with municipal wastewaters, and explain their effects on sewers and water bodies.(L2)
2. Apply suitable preliminary and primary treatment methods such as equalization, neutralization, and oil separation. (L3)
3. Analyze various waste treatment methods like nitrification, phosphorous and heavy metal removal, and evaluate their suitability. (L4)
4. Assess the composition of industrial effluents and recommend suitable treatment strategies. (L5)
5. Design components of CETPs and address operational and maintenance problems considering economic aspects. (L6)

CO – PO Articulation Matrix

CO \ PO/PSO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**
CO1	2	2	–	–	–	2	2	–	–	–	–	1	3	2
CO2	2	3	2	2	2	–	–	–	–	–	–	–	3	2
CO3	2	3	2	3	2	–	2	–	–	–	–	1	3	3
CO4	2	3	3	3	2	–	2	–	–	–	–	1	3	3
CO5	2	2	3	2	3	2	3	–	1	2	2	1	3	3

UNIT – I

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

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		
Manufacturing Process and liquid waste origin, Characteristics and Composition from Textiles, Paper and Pulp industries, Sugar Mills, Tanneries, Dairy and Oil Refineries		
UNIT – IV		
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		
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/noc21_ce25/preview		

Course Code	REPAIR & REHABILITATION OF STRUCTURES	L	T	P	C
23A01H03		3	0	0	3

Course Objectives :-

The objectives of this course are to enable the students to:

1. **Understand** the causes of deterioration and distress in concrete structures and the importance of rehabilitation. (L1)
2. **Familiarize** with condition/damage assessment and evaluation techniques using NDT and field/lab tests. (L2)
3. **Gain knowledge** on the selection and application of suitable materials and techniques for concrete repair. (L2)
4. **Learn** various rehabilitation and retrofitting methods including case studies and demolition techniques. (L3)
5. **Understand** the importance of protection, maintenance, and structural health monitoring (SHM) for ensuring long-term durability. (L1)

Course Outcomes :-

At the end of the course, the student will be able to:

1. **Identify** the causes and types of deterioration in structures and interpret the nature of cracks using IS 456 guidelines. (L1)
2. **Explain** the procedures for condition assessment and damage evaluation using both field and lab-based NDT techniques. (L2)
3. **Select** appropriate repair materials and techniques based on the type and severity of damage in concrete structures. (L3)
4. **Apply** suitable retrofitting and rehabilitation strategies, including engineered demolition methods, with reference to case studies. (L3)
5. **Analyze** the significance of corrosion mitigation, preventive maintenance, and SHM in enhancing the service life of structures. (L4)

CO – PO Articulation Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	–	–	2	2	1	–	–	–	1	3	2
CO2	3	3	2	3	2	1	–	–	–	–	–	2	3	2
CO3	3	2	3	2	2	–	2	2	–	–	1	1	3	3
CO4	2	2	3	2	2	–	1	1	1	2	2	2	2	3
CO5	2	2	2	2	2	2	3	2	–	–	1	3	2	3

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 equipments

UNIT – III

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 Retrofitting, RCC Jacketing, Fibre 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 & 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		

Course Code	DESIGN AND DRAWING OF IRRIGATION STRUCTURES	L	T	P	C
23A01H04		3	0	0	3

Course Objectives :-

The objectives of this course are to:

1. **Impart fundamental knowledge** on various irrigation systems, soil moisture concepts, and canal design principles. (L1)
2. **Provide an understanding** of the design aspects of diversion head works and their components. (L2)
3. **Introduce** the functional and structural design of canal structures and cross-drainage works. (L2)
4. **Develop analytical skills** in assessing the design and safety of storage head works, including gravity and earth dams. (L3)
5. **Explain** the importance and design aspects of spillways and energy dissipation arrangements in hydraulic structures. (L2)

Course Outcomes :-

After successful completion of the course, the student will be able to:

1. **Explain** the principles and practices of various irrigation systems, soil moisture concepts, irrigation efficiencies, and canal design methods including silt and tractive force theories. (L2)
2. **Describe** the components and layout of diversion head works and apply design principles for weirs and silt control systems. (L2)
3. **Design** canal structures such as canal regulators, Sarda-type falls, and cross-drainage works for effective water conveyance. (L3)
4. **Analyze** the structural stability and seepage characteristics of gravity dams and earth dams using appropriate design considerations. (L4)
5. **Apply** the principles of spillway hydraulics and energy dissipation mechanisms in the design of spillway systems. (L3)

CO – PO Articulation Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	2	–	–	2	1	–	–	–	–	1	3	2
CO2	3	2	3	2	–	1	–	–	–	–	–	1	3	2
CO3	3	2	3	2	2	–	–	–	–	–	–	1	3	3
CO4	3	3	2	3	2	–	2	–	–	–	–	2	3	3
CO5	2	2	2	2	2	–	2	–	–	–	–	2	2	3

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.,		
Online Resources :-		
https://www.udemy.com/course/irrigation-structures/?couponCode=LEARNNOWPLANS		

Course Code	ROAD SAFETY ENGINEERING	L	T	P	C
23A01H05		3	0	0	3

Course Objectives :-

The objectives of this course are to:

1. Provide foundational knowledge about the causes and trends of road accidents and the impact of human, vehicle, and roadway factors on highway safety. (L1)
2. Introduce statistical tools and procedures for interpreting and analyzing crash data including black spot and hotspot investigations. (L2)
3. Explain the principles and components of road safety management systems and the role of audits and crash investigations. (L2)
4. Impart understanding of crash reconstruction techniques using physical evidence, kinematic principles, and accident scenarios. (L3)
5. Promote awareness of safety improvement measures in highway planning, design, operation, and enforcement including policy and stakeholder roles. (L2)

Course Outcomes :-

Upon successful completion of this course, the student will be able to:

1. Explain road accident trends, human and vehicle factors affecting highway safety, and the Indian scenario of road safety. (L2)
2. Apply statistical methods for crash data analysis and conduct black spot and hotspot identification with case-based insights. (L3)
3. Describe the structure of a road safety management system, road safety audit process, and the data needs for improving intersection and vehicle safety. (L2)
4. Analyze crash reconstruction cases using physical evidence and calculate speed, drag, and impact forces for different accident types. (L4)
5. Evaluate and recommend mitigation measures such as forgiving road design, road signs, public transport safety strategies, and road safety law enforcement. (L5)

CO – PO Articulation Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	–	–	–	3	2	2	–	–	–	1	2	2
CO2	3	3	2	3	2	–	–	–	–	–	–	2	3	3
CO3	3	2	2	2	2	2	2	2	–	–	–	2	2	3
CO4	3	3	3	3	2	–	–	–	–	–	–	2	3	3
CO5	2	2	3	2	2	3	3	3	2	2	2	3	2	3

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		

Course Code	NDT LAB	L	T	P	C
23A01H06		0	0	4	2

Course Objectives :-

The objectives of this course are to enable the student to:

1. Understand the fundamental principles and significance of non-destructive testing (NDT) in concrete structures. **(L2)**
2. Apply various NDT techniques to evaluate the structural integrity and quality of concrete. **(L3)**
3. Analyze data from NDT methods to detect cracks, voids, rebar position, corrosion, and other defects. **(L4)**
4. Evaluate the durability and in-situ strength characteristics of concrete using advanced testing techniques. **(L5)**
5. Develop competence in interpreting NDT results for effective decision-making in structural health monitoring. **(L5)**

Course Outcomes :-

After successful completion of the course, the student will be able to:

1. Apply Rebound Hammer and Ultrasonic Pulse Velocity tests to assess surface hardness and detect internal concrete defects. **(L3)**
2. Analyze corrosion risk and carbonation depth using Half-Cell Potential and Carbonation Depth tests. **(L4)**
3. Evaluate compressive strength and integrity of concrete using Penetration Resistance and Impact Echo methods. **(L5)**
4. Detect reinforcement layout, cover, and subsurface anomalies using Rebar Locator and Ground Penetrating Radar. **(L4)**
5. Interpret results from advanced methods like Acoustic Emission and core testing for structural damage diagnosis. **(L5)**

CO – PO Articulation Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	2	2	1	2	3	–	–	–	1	1	–	2	3	2
CO2	2	3	1	2	3	3	2	2	–	1	–	1	2	3
CO3	3	3	2	2	3	–	–	–	–	1	–	1	3	2
CO4	3	2	2	3	3	–	2	–	–	1	–	2	3	2
CO5	3	3	2	3	3	2	1	1	1	2	1	3	3	3

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**, **delaminations**, 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**

Course Code	ETABS/SAP LAB	L	T	P	C
23A01H07		0	0	4	2

Course Objectives :-

1. To understand the interface, tools, and modeling environment of ETABS and SAP2000 for structural design.(L2)
2. To develop and analyze multi-storey buildings, shear walls, and frames under various loads using ETABS and SAP2000.(L3)
3. To perform structural modeling, assign loads, and interpret analysis results for real-world building and infrastructure systems.(L4)
4. To evaluate performance-based seismic behavior and nonlinear analysis techniques using advanced structural software.(L5)
5. To design and optimize structural components like water tanks and bridges using advanced modeling tools.(L6)

Course Outcomes :-

Upon successful completion of the course, the student will be able to:

1. Understand and operate the ETABS and SAP2000 interface for modeling structural systems.(L2)
2. Apply ETABS for analysis of multi-story buildings and shear wall systems under lateral and gravity loads.(L3)
3. Analyze and interpret the behavior of structural models including performance-based and nonlinear seismic analysis.(L4)
4. Evaluate the design of structural elements such as frames, water tanks, and bridges using SAP2000.(L5)
5. Create detailed structural models and conduct advanced simulations to support safe and economical design decisions.(L6)

CO – PO Articulation Matrix

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	–	–	2	–	–	–	–	–	–	2	3	2
CO2	3	3	2	2	3	–	–	–	–	–	–	2	3	3
CO3	3	3	3	2	3	–	–	–	–	–	–	2	3	3
CO4	3	3	3	3	3	–	–	–	–	–	–	3	3	3
CO5	3	2	3	3	3	–	–	–	–	–	–	3	3	3

1. Determination of ETABS Interface and Structural Modeling 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