

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: RAJAMPET
An Autonomous Institution

Department of Civil Engineering

Course Structure and Syllabi

B.Tech.– III Year I Semester

S.No.	Category	Course Code	Title	L	T	P	Credits
1	PC	23A0151T	Water Resources Engineering	3	0	0	3
2	PC	23A0152T	Design of Reinforced Concrete Structures	2	1	0	3
3	PC	23A0153T	Geotechnical Engineering	3	0	0	3
4	MC	23A0554T	Introduction to Quantum Technologies and Applications	3	0	0	3
5	PE-I	23A015AT	Design of Pre-stressed Concrete Members Air Pollution and Control Environmental Impact Assessment	3	0	0	3
6		23A015BT					
7		23A015CT					
8	OE-1	23A015DT 23A015ET	Green Buildings Construction Technology and Management	3	0	0	3
9	PC	23A0153L	Geotechnical Engineering Laboratory	3	0	0	3
10	PC	23A0154L	Fluid Mechanics and Hydraulic Machines Laboratory	3	0	0	3
11	MC	23A0155L	Estimation, Specifications, Costing & Valuation	0	0	3	1.5
12	SEC	23A0156L	Tinkering Laboratory for Civil Engineers	0	0	3	1.5
13	INTERN	23A0157I	Evaluation of Community Service Internship	0	1	2	2
Total				20	02	08	29

Open Elective-I

S.No.	Course Code	Title	Branch
1	23A025ET	Electrical Safety Practices and Standards	EEE
2	23A035FT	Sustainable Energy Technologies	ME
3	23A045DT	Electronic Circuits	ECE
4	23A045ET	Communication Systems	
5	23A055ET	Java Programming	CSE & Allied/IT
6	23A055FT	Fundamentals of Artificial Intelligence	
7	23A055GT	Quantum Technologies and Applications	
8	23AHS51T	Mathematics for Machine Learning and AI	Mathematics
9	23AHS52T	Materials Characterization Techniques	Physics
10	23AHS53T	Chemistry of Energy Systems	Chemistry
11	23AHS56T	Entrepreneurship and New Venture Creation	Humanities
12	23AHS54T	English for Competitive Examinations	

Note:

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

Department of Civil Engineering

Title of the Course: WATER RESOURCES ENGINEERING
Category: PC
Couse Code: 23A0151T
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	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 significance in 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 and management 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:

At the end of the course, the student 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

Unit 1 Introduction to Hydrology 8

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 2 Hydrograph Analysis 8

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 3 Irrigation & Water Requirement of Crops 8

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.

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Types of Soils, Indian Agricultural Soils, Preparation of Land for Irrigation; Soil Fertility; Soil-Water-Plant Relationship; Vertical Distribution of Soil Moisture; Soil Moisture Tension; Soil Moisture Stress; Various Soil Moisture Constants; Limiting Soil Moisture Conditions; Depth and Frequency of Irrigation; Gross Command Area; Culturable Command Area; Culturable Cultivated and Uncultivated Area; Kor Depth and Kor Period; Crop Seasons and Crop Rotation; Irrigation Efficiencies; Determination of Irrigation Requirements of Crops; Assessment of Irrigation Water. Consumptive Use of Water-Factors Affecting Consumptive Use, Direct Measurement and Determination By Use of Equations

Unit 4

10

Channels – Silt Theories:

Classification; Canal Alignment, Inundation Canals; Cross-Section of an Irrigation Channel; Balancing Depth; Borrow Pit; Spoil Bank; Land Width; Silt Theories–Kennedy’s Theory, Kennedy’s Method of Channel Design; Drawbacks in Kennedy’s Theory; Lacey’s Regime Theory- Lacey’s Theory Applied to Channel Design; Defects in Lacey’s Theory; Comparison of Kennedy’s and Lacey’s Theory.

Water Logging and Canal Lining:

Water Logging; Effects of Water Logging; Causes of Water Logging; Remedial Measures; Saline and Alkaline Soils and their Reclamation; Losses in Canal; Lining of Irrigation Channels – Necessity, Advantages and Disadvantages; Types of Lining; Design of Lined.

Unit 5 Diversion Head Works

10

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.

Prescribed Textbooks:

1. Irrigation and Water Power Engineering By Punmia & Lal, Laxmi Publications Pvt.Ltd., New Delhi 17th Edition 2021
2. Engineering Hydrology By K.Subramanya, The Tata McGraw Hill Company, Delhi 5th Edition 2020

Reference Books:

1. Irrigation Engineering and Hydraulic Structures By S. K. Garg; Khanna Publishers, Delhi 36th Edition
2. Engineering Hydrology By Jayarami Reddy, Laxmi Publications Pvt. Ltd., New Delhi 3rd Edition 2016
3. Engineering Hydrology By Jayarami Reddy, Laxmi Publications Pvt. Ltd., New Delhi 3rd Edition 2016

Online Learning Resources:

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

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0151T.1	3	2	2	1	2	-	-	-	-	2	-	2	2	2
23A0151T.2	3	3	3	3	3	-	-	-	-	2	-	2	3	2
23A0151T.3	3	3	3	3	2	-	-	-	-	2	-	2	3	3
23A0151T.4	3	3	3	3	3	3	3	3	-	2	-	2	3	3
23A0151T.5	3	3	3	3	3	2	2	2	-	2	-	2	3	3

Department of Civil Engineering

Title of the Course: DESIGN OF REINFORCED CONCRETE STRUCTURES
Category: PC
Course Code: 23A0152T
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	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 members in 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:

At the end of the course, the student 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.

Unit 1 Methods of Design of Concrete Structures 8

Behaviour of Plain and RC Beams under Flexure, Design Concept: Elastic Method, Ultimate Load Method and Limit State Method, – Working Stress Method as per 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 2 Limit State Method - Flanged Beam, Shear & Torsion 8

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 3 Limit State Design of Slabs 8

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 4 Limit State Design of Columns & Footings 10

Classification of Columns – Design of Short Rectangular and Circular Columns for Axial, Uniaxial and Biaxial Bending. 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 5 Limit State of Serviceability and Miscellaneous 10
Deflection and Cracking, Staircases – Classification, Design of Dog-Legged Staircase

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Prescribed Textbooks:

1. N. Krishnaraju —Structural Design and Drawing, Universities Press Pvt ltd, Hyderabad. 4th edition 2020.
2. P. C. Varghese, Limit State—Designed of Reinforced Concrete, P r e n t i c e Hall of India, New Delhi

Reference Books:

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Limit State Design, Laxmi Publications Pvt. Ltd., New Delhi.
2. N.C. Sinha and S.K. Roy— Fundamentals of Reinforced Concrete, S.ChandPublishers
3. 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%.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0152T.1	3	2	2	1	-	-	-	-	-	2	-	2	3	2
23A0152T.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0152T.3	3	2	2	2	2	-	-	-	-	-	-	1	2	2
23A0152T.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0152T.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

Department of Civil Engineering

Title of the Course: **GEOTECHNICAL ENGINEERING**
Category: PC
Couse Code: 23A0153T
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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:

At the end of the course, the student 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.

Unit 1 Soil Classification and Compaction 8

Formation of Soil - Soil Description – Particle – Size Shape and Colour – Composition of Gravel, Sand, Silt, Clay Particles – Particle Behavior – Soil Structure – Phase Relationship – Index Properties – Significance – BIS Classification System – Unified Classification System – Compaction of Soils Theory, Laboratory and Field Tests – Field Compaction Methods – Factors Influencing Compaction of Soils.

Unit 2 Effective Stress and Permeability 8

Soil - Water – Static Pressure in Water - Effective Stress Concepts in Soils – Capillary Phenomena– Permeability Interaction – Hydraulic Conductivity – Darcy's Law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant Head and Falling Head Methods) and Field Measurement Pumping Out in Unconfined and Confined Aquifer – Factors Influencing Permeability of Soils – Seepage - Two Dimensional Flow – Laplace's Equation – Introduction to Flow Nets – Simple Problems. (Sheet Pile and Weir).

Unit 3 Stress Distribution and Settlement 8

Stress Distribution in Homogeneous and Isotropic Medium – Boussinesq Theory – (Point Load, Line Load and UDL) Use of New Marks Influence Chart –Components of Settlement – Immediate and Consolidation Settlement – Terzaghi's One Dimensional Consolidation Theory – Computation of Rate of Settlement. - $\sqrt{t}$ and Log t Methods– E-Log p Relationship.

Unit 4 Shear Strength 10

Shear Strength of Cohesive and Cohesion Less Soils – Mohr-Coulomb Failure Theory
Measurement of Shear Strength - Direct Shear, Tri-axial Compression, UCC and Vane Shear Tests – Pore Pressure Parameters – Cyclic Mobility – Liquefaction.

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Unit 5 Stability of Slopes

10

Stability Analysis - Infinite Slopes and Finite Slopes – total Stress Analysis for Saturated Clay
Friction Circle Method – Use of Stability Number – Method of Slices – Fellenious and Bishop's Method -
Slope Protection Measures.

Prescribed Textbooks:

1. Soil Mechanics and Foundation Engg by K.R.Arora, Standard Publishers and Distributors Delhi 7th edition 2009.
2. Geotechnical Engineering by C.Venkataramiah, New Age International Pvt. Ltd, (2002).

Reference Books:

1. Soil Mechanics and Foundation by B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt.Ltd., New Delhi 17th edition 2017
2. Geotechnical Engineering by Iqbal H.Khan, PHI Publishers, 4th edition.
3. Basic and Applied Soil Mechanics by Gopal Ranjan & ASR Rao, New Age International Pvt. Ltd, New Delhi 3rd edition 2016

Online Learning Resources:

1. <https://nptel.ac.in/courses/105101201>
2. <https://nptel.ac.in/courses/105105185>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0153T.1	3	2	2	1	-	-	-	-	-	2	-	2	3	2
23A0153T.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0153T.3	3	2	2	2	2	-	-	-	-	-	-	1	2	2
23A0153T.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0153T.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

Department of Civil Engineering

Title of the Course: INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS
Category: MC
Couse Code: 23A0554T
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies

Course Outcomes:

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

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

Unit 1 Introduction to Quantum Theory and Technologies 8

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 8

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 8

What is required to build a quantum computer (conceptual overview)?, Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit 4 Quantum Communication and Computing – Theoretical Perspective 10

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

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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

10

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

Prescribed 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

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](#)

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0554T.1	3	2	2	1	-	-	-	-	-	2	-	2	3	2
23A0554T.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0554T.3	3	2	2	2	2	-	-	-	-	-	-	1	2	2
23A0554T.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0554T.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

Department of Civil Engineering

Title of the Course: DESIGN OF PRESTRESSED CONCRETE MEMBERS
Category: PE-1
Couse Code: 23A015AT
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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:

At the end of the course, the student 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.

Unit 1 Introduction

8

Principles of Pre-Stressing – Prestressing Systems - Pre-Tensioning and Post Tensioning- Advantages and Limitations of PreStressed 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 2 Losses of Pre-Stress

8

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 3 Flexural And Shear

8

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 4 Deflections

10

Control of Deflections- Factors Influencing Deflections - Short Term Deflections of Uncracked Beams- Prediction of Long Time Deflections

Unit 5 Composite Beams

10

Different Types- Propped and Un-Propped- Stress Distribution- Differential Shrinkage- Analysis of Composite Beams.

Prescribed Textbooks:

1. Prestressed Concrete by N. Krishna Raju, Tata McGraw Hill Publications, New Delhi, 6th edition 2018
2. Design of Prestressed Concrete Structures by T.Y. Lin & Ned H. Burns, John Wiley & Sons 3rd edition 2010

Reference Books:

1. Prestressed concrete by N. Rajagopalan, Narosa Publishing House 2nd edition 2017
2. Prestressed Concrete Design by Praveen Nagrajan, Pearson publications, 2013
3. IS: 1343, BIS code on –prestressed concrete, to be permitted into the examination Hall

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Online Learning Resources:

1. <https://archive.nptel.ac.in/courses/105/106/105106118/>
2. <https://nptel.ac.in/courses/105106117>

CO-PO Mapping:

	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A015AT.1	2	1	1	-	-	1	-	-	-	1	-	1	1	1
23A015AT.2	2	2	1	1	2	-	-	-	-	-	-	1	1	1
23A015AT.3	2	2	3	2	2	-	1	-	-	-	-	1	2	2
23A015AT.4	2	1	2	2	3	1	-	-	-	-	-	1	2	1
23A015AT.5	2	2	2	1	2	1	-	-	-	-	-	1	2	1

Department of Civil Engineering

Title of the Course: AIR POLLUTION AND CONTROL
Category: PE-1
Couse Code: 23A015BT
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. Understand the sources, classification, and effects of air pollution on humans and the environment.
2. Analyze meteorological factors influencing air pollution and dispersion modelling.
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:

At the end of the course, the student 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

Unit 1 Introduction 8

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 2 Meteorology And Air Pollution 8

Factors Influencing Air Pollution, Wind Rose, Mixing Depths, Lapse Rates and Dispersion - Atmospheric Stability, Plume Rise and Dispersion, Plume behaviour Prediction of Air Quality, Box Model - Gaussian Model - Dispersion Coefficient - Application of Tall Chimney for Pollutant Dispersion.

Unit 3 Control of Particulate Pollutants 8

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 4 Control Of Gaseous Pollutants 10

Process and Equipment for The Removal by Chemical Methods - Design and Operation of Absorption and Adsorption Equipment - Combustion and Condensation Equipment.

Unit 5 Automobile And Indoor Pollution 10

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

Prescribed Textbooks:

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.

Reference Books:

1. Fundamentals of Air Pollution by Dr. B.S.N. Raju, Oxford & I.B.H

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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.

Online Learning Resources:

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

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A015BT.1	2	1	-	-	-	2	3	-	-	1	-	1	1	1
23A015BT.2	2	2	-	2	2	3	3	-	-	-	-	1	2	2
23A015BT.3	2	2	3	2	2	3	3	-	-	-	-	1	2	2
23A015BT.4	2	1	2	2	3	3	3	-	-	-	-	1	2	2
23A015BT.5	2	2	2	2	2	3	3	2	-	-	-	1	2	2

Department of Civil Engineering

Title of the Course: ENVIRONMENTAL IMPACT ASSESSMENT
Category: PE-1
Couse Code: 23A015CT
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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 frameworks in EIA studies

Course Outcomes:

At the end of the course, the student 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.

Unit 1 Concepts and Methodologies of EIA 8

Initial Environmental Examination, Elements of EIA, - Factors 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 2 Impact of Developmental Activities and Land Use 8

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I A in Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts on Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

Unit 3 Assessment of Impact on Vegetation, Wildlife and Risk Assessment 8

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 4 Environmental Audit 10

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 5 Environmental Acts and Notifications 10

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention & Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report- Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, Concept of ISO and ISO 14000.

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Prescribed Textbooks:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011.
2. Environmental Impact Assessment, by Canter Larry W McGraw-Hill education Edi (1996)

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G. McGraw 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:

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

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A015CT.1	3	2	2	2	2	3	-	-	-	-	-	1	2	2
23A015CT.2	3	3	3	2	2	3	-	-	-	-	-	1	3	2
23A015CT.3	3	3	3	2	2	3	3	-	-	-	-	1	3	3
23A015CT.4	3	3	3	3	2	3	3	-	-	-	-	1	3	3
23A015CT.5	2	2	2	2	2	3	3	3	-	-	-	1	2	2

Department of Civil Engineering

Title of the Course:	ELECTRICAL SAFETY PRACTICES AND STANDARDS
Category:	OE-I
Course Code:	23A025ET
Branch/es:	CSE/ECE/ME/Civil
Year:	III
Semester:	I

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	0	0	3

Course Objectives:

1. Explain the physiological effects of electric shock and identify various hazards of electricity including arc and blast based on safety requirements.
2. Classify conductors, insulators, and voltage types, and evaluate the use of appropriate electrical safety equipment and fire extinguishers.
3. Interpret grounding and bonding requirements, and determine safe approach distances and arc hazard categories based on earthing practices.
4. Demonstrate appropriate safety practices in handling electrical appliances and installations across various environments through real-life case studies.
5. Analyze national and international electrical safety standards (e.g., NFPA 70E, OSHA, NEC, NESC) and apply statutory compliance as per the Electricity Act and regulations.

Course Outcomes:

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

1. Analyze national and international electrical safety standards and apply statutory compliance as per the Electricity Act and regulations.
2. Classify various electrical safety components including conductors, insulators, voltage levels, and select suitable protection methods for overvoltage and static electricity.
3. Explain grounding and bonding principles, and calculate safe approach distances and arc hazard levels using earthing system standards.
4. Demonstrate appropriate electrical safety practices in domestic, industrial, and public environments, and evaluate real-world case studies for safety effectiveness.
5. Compare various electrical safety standards and interpret statutory compliance requirements from governing authorities.

Unit 1 Introduction To Electrical Safety 9

Fundamentals of Electrical safety - Electric Shock- physiological effects of electric current - Safety requirements - Hazards of electricity - Arc - Blast - Causes for electrical failure.

Unit 2 Safety Components 9

Introduction to conductors and insulators - voltage classification - safety against over voltages - safety against static electricity - Electrical safety equipment - Fire extinguishers for electrical safety.

Unit 3 Grounding 9

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

Unit 4 Safety Practices 9

General first aid - Safety in handling hand held electrical appliances tools - Electrical safety in train stations- swimming pools, external lighting installations, medical locations - Case studies.

Unit 5 Standards For Electrical Safety 9

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

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Prescribed Textbooks:

1. Massimo A. G. Mitolo - Electrical Safety of Low-Voltage Systems, McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi - Electric Safety - Practice and Standards, CRC Press, USA, 2014.

Reference Books:

1. Kenneth G. Mastrullo, Ray A. Jones - The Electrical Safety Program Book, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman - Electrical Safety - Related Work Practices, Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W. - Electrical Safety Engineering, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli - Schellpfeffer, Dennis K. Neitzel - Electrical Safety Hand book, McGraw - Hill, New York, USA, 4th edition, 2012.

Web Resources:

1. <https://www.youtube.com/watch?v=s24Gn43mVs>
2. <https://www.youtube.com/@NOUCS-ey8iq>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering Tool Usage	The Engineer and The World	Ethics	Individual and Collaborative Team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A025ET.1	3	2	-	-	2	-	-	-	-	-	-	3	2
23A025ET.2	3	3	-	-	2	-	-	-	-	-	-	3	2
23A025ET.3	3	2	-	-	2	-	-	-	-	-	-	3	3
23A025ET.4	3	2	-	-	3	-	-	-	-	-	-	3	3
23A025ET.5	3	2	-	-	3	-	-	-	-	-	-	3	2

Department of Civil Engineering

Title of the Course: SUSTAINBLE ENERGY TECHNOLOGIES
Category: OE-I
Couse Code: 23A035FT
Branch/es: Civil/EEE/ME/CSE & Allied
Year: III
Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. Demonstrate the importance the impact of solar radiation, solar pvmodules
2. Understand the principles of storage in PV systems
3. Discuss solar energy storage systems and their applications.
4. Get knowledge in wind energy and bio-mass
5. Gain insights in geothermal energy, ocean energy and fuel cells.

Course Outcomes:

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

1. Illustrate the importance of solar radiation and solar PV modules.
2. Discuss the storage methods in PV systems
3. Explain the solar energy storage for different applications.
4. Understand the principles of wind energy, and bio-mass energy.
5. Attain knowledge in geothermal energy, ocean energy and fuel cells.

Unit 1

12

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:

10

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

12

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

12

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.

10

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.

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

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Kreith & John F Kreider / Taylor & Francis
2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd
3. Renewable Energy Technologies -Ramesh & Kumar /Narosa

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Title of the Course: ELECTRONIC CIRCUITS
Category: OE-I
Couse Code: 23A045DT
Branch/es: Civil/EEE/ME/CSE & Allied
Year: III
Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To comprehend 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 the course, the student 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 1 Semiconductor Diode and Applications: 12

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 2 Bipolar Junction Transistor (BJT) 10

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 3 12

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 4 12

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 5 10

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.

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Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

Prescribed Textbooks:

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, LouisNashelsky 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

CO-PO Mapping:

[illegible]

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Title of the Course: **JAVA PROGRAMMING**

Category: Open Elective-1

Couse Code: 23A055ET

Year: III B. Tech

Semester: I Semester

Branch: CE, EEE, ME, ECE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

This course will be able to

1. Identify Java language components and how they work together in applications
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and dynamic binding and how to use exception
4. Understand how to design applications with threads in Java
5. Understand how to use Java apis for program development

Course Outcomes:

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

1. Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
2. Design and implement classes to model real-world entities, with a focus on attributes, behaviours, and relationships between objects
3. Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
4. Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
5. 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 1:

10

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 2

9

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.

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Unit 3

11

Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance. **Interfaces:** Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Unit 4

10

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 Auto un boxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java..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 Throw able, Unchecked Exceptions, Checked Exceptions. **Java I/O and File:** Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java

Unit 5

11

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 My SQL and My SQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, Result Set Interface **Java FX GUI:** Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L. Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11th edition, Herbert Schildt, TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105191/>

Department of Civil Engineering

Title of the Course: **FUNDAMENTALS TO ARTIFICIAL INTELLIGENCE**
Category: Open Elective-1
Course Code: 23A055FT
Year: III B. Tech
Semester: I Semester
Branch: CE, EEE, ME, ECE

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

This course will be able to

1. To learn the distinction between optimal reasoning Vs. human like reasoning.
2. To understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
3. To learn different knowledge representation techniques.
4. To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

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

1. 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
2. Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
3. Learn different knowledge representation techniques.
4. Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
5. Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.

Unit 1

8

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 2

8

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 3

10

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.

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10

Planning – Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

8

Probabilistic Reasoning: Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

Text Books:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.
2. Artificial Intelligence, Shivani Goel, 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 and Expert systems – Patterson, Pearson Education.

CO-PO Mapping:

[illegible]

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Title of the Course	QUANTUM TECHNOLOGIES AND APPLICATIONS		
Category	OE-I		
Couse Code	23A055GT		
Branch/es	All Branches		
Year	III		
Semester	I		
Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. Introduce fundamental quantum concepts like superposition and entanglement.
2. Understand theoretical structure of qubits and quantum information.
3. Explore conceptual challenges in building quantum computers.
4. Explain principles of quantum communication and computing.
5. Examine real-world applications and the future of quantum technologies

Course Outcomes:

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

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

Unit 1 Introduction to Quantum Theory and Technologies 10

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 10

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 10

What is required to build a quantum computer (conceptual overview)?, Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit 4 Quantum Communication and Computing – Theoretical Perspective 10

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Measurement of strain, Displacement, Velocity, Angular Velocity (DC Tachometer generator, Photoelectric tachometer), acceleration (LVDT), Force (Strain-guage, load cells and LVDT), Torque (Magneto-Strictive), Temperature (Thermocouples and Thermistor), Pressure (Resistive, Inductive, LVDT and capacitive), Flow (electromagnetic flow meter, hot wire anemometer), Liquid level (ultrasonic level gauging, resistive and inductive methods).

Unit 5 Applications, Use Cases, and the Quantum Future

8

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

Prescribed Text Books:

1. Michael A. Nielsen, Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction*, MIT Press, 2011.

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. edX – The Quantum Internet and Quantum Computers
2. YouTube – Quantum Computing for the Determined by Michael Nielsen
3. Qiskit Textbook – IBM Quantum

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Engineering tool usage	The engineer and the world	Ethics	Individual and collaborative teamwork	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A055GT.1	3	2	-	-	-	-	-	-	1	-	-	3	-
23A055GT.2	3	2	-	-	2	-	-	-	1	-	-	3	-
23A055GT.3	3	3	2	2	3	-	-	-	1	-	-	3	2
23A055GT.4	3	3	2	2	3	-	-	-	1	-	-	3	2
23A055GT.5	3	2	3	2	3	2	2	2	2	2	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Civil Engineering

Title of the Course: MATHEMATICS FOR MACHINE LEARNING AND AI
Category: OE
Couse Code: 23AHS51T
Branch/es: Common to All Branches
Year III year
Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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

Course Outcomes:

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

1. Apply linear algebra concepts to ML techniques like PCA and regression.
2. Analyze probabilistic models and statistical methods for AI applications.
3. Implement optimization techniques for machine learning algorithms.
4. Utilize vector calculus and transformations in AI-based models.
5. Develop graph-based AI models using mathematical representations.

Unit 1 Linear Algebra for Machine Learning **8**

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 2 Probability and Statistics for AI **8**

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 3 Optimization Techniques for ML **8**

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT(Karush-Kuhn-Tucker) conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS(Broyden-Fletcher-Goldfarb-Shanno) method.

Unit Vector Calculus & Transformations **8**
4

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

Unit 5 Graph Theory for AI **8**

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

Prescribed 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 Learning by Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.

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2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Online Learning Resources:

3. MIT– Mathematics for Machine Learning <https://ocw.mit.edu>
4. Stanford CS229 – Machine Learning Course <https://cs229.stanford.edu/>
5. DeepAI – Mathematical Foundations for AI <https://deepai.org>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2	PSO3
23AHS51T.1	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
23AHS51T.2	3	3	2	3	2	-	-	-	-	-	-	2	-	-	-
23AHS51T.3	3	3	3	3	2	1	-	-	-	-	-	2	-	-	-
23AHS51T.4	3	3	2	2	1	-	-	-	-	-	-	1	-	-	-
23AHS51T.5	3	3	3	3	2	-	-	-	-	-	-	2	-	-	-

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Title of the Course: MATERIALS CHARACTERIZATION TECHNIQUES
Category: OE
Couse Code: 23AHS52T
Branch/es: Common to all branches
Year III Year
Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	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.

Course Outcomes:

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

1. Analyze the crystal structure and crystallite size by various methods
2. Analyze the morphology of the sample by using a Scanning Electron Microscope
3. Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope
4. Explain the principle and experimental arrangement of various spectroscopic techniques
5. Identify the construction and working principle of various Electrical & Magnetic Characterization technique

Unit 1 Structure analysis by Powder X-Ray Diffraction **9**

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 2 Microscopy technique -1 –Scanning Electron Microscopy (SEM) **9**

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 3 Microscopy Technique -2 - Transmission Electron Microscopy (TEM) **9**

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 4 Spectroscopy techniques **9**

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 5 Electrical & Magnetic Characterization techniques **9**

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.

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23AHS52T.1	3	3	2	2	1	-	-	-	-	-	-	-	2	1
23AHS52T.2	3	3	2	1	1	-	-	-	-	-	-	-	2	1
23AHS52T.3	3	3	2	1	1	-	-	-	-	-	-	-	2	1
23AHS52T.4	3	2	1	1	-	-	-	-	-	-	-	-	2	1
23AHS52T.5	3	3	1	1	-	-	-	-	-	-	-	-	2	1

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Title of the Course: CHEMISTRY OF ENERGY SYSTEMS

Category: OE

Couse Code: 23AHS53T

Branch/es: Common to all branches

Year III

Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
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. To know the necessity 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:

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

1. Understand electrochemical concepts and battery technologies with their practical applications.
2. Apply the principles of fuel cell technology to explain their design, working, classification, efficiency, and applications, including PEM and SOFC types.
3. Apply the concepts of photochemical cells to understand their working, specificity, advantages in photo electrocatalytic conversions, and practical applications.
4. Analyze the principles of solar energy conversion to differentiate between photovoltaic and concentrated solar power technologies and evaluate the performance and applications of solar cells.
5. Analyze hydrogen storage and delivery methods by comparing their mechanisms, advantages, and limitations.

Unit 1 Electrochemical Systems 9

Introduction to electrodes, concepts, electrochemical reactions, Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries – Introduction, primary battery-Zn/air, secondary battery, Lithium-ion batteries and their applications.

Unit 2 Fuel Cells 9

Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells-Methanol oxygen fuel cell, fuel cell, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

Unit 3 Photo and Photo electrochemical Conversions 9

Photochemical cells-Introduction and application, photochemical reactions- Electricity generation using Dye-Sensitized Solar Cells (DSSCs), specificity of photo electrochemical cell (PEC)- Water Splitting (Hydrogen Generation), advantage of photoelectron catalytic conversions and their applications.

Unit 4 Solar Energy 9

Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells-Types, Construction, working principle of PN junction, and electricity generation through light-induced charge separation and applications.

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Unit 5 Hydrogen Storage

9

Introduction-Hydrogen fuel, 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.

Prescribed Textbooks:

1. Ira N. Levine Physical Chemistry, 6th edition, McGraw-Hill Education, 2011
2. Bahl, A., Bahl, B. S., & Tuli, G. D. Essentials of physical chemistry. New Delhi: S. Chand. 2010.

Reference Books:

1. Fuel Cell Hand Book, 7th Edition, by US Department of Energy (EG&G technical services and corporation)
2. Arvind, & Shyam. (2018). Handbook of Solar Energy: Theory, Analysis and Applications. Springer.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al. (2014) Delft University of Technology, Delft.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23AHS53T.1	3	2	2	1	-	-	2	-	-	-	-	1	2	2
23AHS53T.2	3	2	2	1	-	-	2	-	-	-	-	1	2	2
23AHS53T.3	3	2	2	1	-	-	2	-	-	-	-	1	2	2
23AHS53T.4	3	2	2	1	-	-	2	-	-	-	-	1	2	2
23AHS53T.5	3	2	2	1	-	-	2	-	-	-	-	1	2	2

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Title of the Course: ENTERPRENEURSHIP AND NEW VENTURE CREATION
Category: OE
Couse Code: 23AHS56T
Branch/es: Common to all branches
Year III
Semester: I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

- 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

Course Outcomes:

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

1. Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship.
2. Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution.
3. Analyze and refine business models to ensure sustainability and profitability.
4. Build Prototype for Proof of Concept and validate MVP of their practice venture Idea
5. Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture.

Unit 1 Entrepreneurship Fundamentals and context 9

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, rolemodels 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.

Unit 2 Problem & Customer Identification 9

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities – Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit 3 Solution design, Prototyping & Opportunity Assessment and Sizing 9

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 MinimumViable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit 4 Business & Financial Model, Go-to-Market Plan 9

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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.

Unit 5 Hydrogen Storage

9

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.

Prescribed Textbooks:

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha .
2. Entrepreneurship, McGrawHill, 11th Edition.(2020)

Reference Books:

1. Simon Sinek, Start with Why, Penguin Books limited. (2011)
2. Brown Tim, Change by Design Revised & Updated: How Design Thinking.
3. Transforms Organizations and Inspires Innovation, Harper Business.(2019)

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23AHS56T.1	3	2	2	1	-	-	2	1	-	1	2	1	2	2
23AHS56T.2	3	2	2	1	-	-	2	1	-	1	2	1	2	2
23AHS56T.3	3	2	2	1	-	-	2	1	-	1	2	1	2	2
23AHS56T.4	3	2	2	1	-	-	2	1	-	1	2	1	2	2
23AHS56T.5	3	2	2	1	-	-	2	1	-	1	2	1	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Civil Engineering

Title of the Course: ENGLISH FOR COMPETITIVE EXAMINATIONS
Category: OE
Couse Code: 23AHS54T
Branch/es: Common to all branches
Year III B. Tech
Semester I Semester

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

1. To raise awareness of the importance of English for competitive exams
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To enrich vocabulary to face competitive exams and for effective expression
5. To equip learners with the skills and confidence needed to succeed in competitive exams.

Course Outcomes:

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

1. Identify the basics of English grammar and its importance.
2. Explain the use of grammatical structures in sentences.
3. Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams
4. Analyze an unknown passage and reach conclusions about it.
5. Use correct verb forms and improve speed reading and comprehension to excel in competitive exams

Unit 1 GRAMMAR-1 9

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite -Adverbs-types- errors-Conjunctions-usage

Unit 2 GRAMMAR-2 9

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- -Degrees of Comparison -reported Speech-Agreement-subject and verb-Modals-Spotting Errors-Practices.

Unit 3 VERBAL ABILITY 9

Sentence completion-Verbal analogies-Word Groups-Instructions-Critical reasoning-Verbal deduction- Select appropriate pair-Reading Comprehension-Paragraph-Jumbles

Unit 4 READING COMPREHENSION AND VOCUBULARY 9

Reading Comprehension Skills-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

Unit 5 WRITING FOR COMPETITIVE EXAMINATIONS 9

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

Prescribed 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:

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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 Learning 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>

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23AHS54T-1	-	-	-	-	-	-	-	-	-	3	-	3	3	3
23AHS54T-2	-	-	-	-	-	-	-	-	-	3	-	3	3	3
23AHS54T-3	-	-	-	-	-	-	-	-	-	3	-	3	3	3
23AHS54T-4	-	-	-	-	-	-	-	-	-	3	-	3	3	3
23AHS54T-5	-	-	-	-	-	-	-	-	-	3	-	3	3	3

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Civil Engineering

Title of the Course: GEOTECHNICAL ENGINEERING LABORATORY
Category: PC
Couse Code: 23A0153L
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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

1. Understand the fundamental index properties of soils and their significance in 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.

Course Outcomes:

At the end of the course, the student 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 behaviour and make informed decisions in geotechnical engineering applications.

LIST OF EXPERIMENTS: -

I. Determination of Index Properties

1. Specific Gravity of Soil
2. Grain Size Distribution – Sieve Analysis
3. Grain Size Distribution - Hydrometer Analysis
4. Liquid Limit and Plastic Limit Tests
5. Shrinkage Limit and Differential Free Swell Tests

II. Determination of In-Situ Density and Compaction Characteristics

1. Field Density Test (Sand Replacement Method)
2. Determination of Moisture–Density Relationship Using Standard Proctor Compaction Test.

III. Determination of Engineering Properties

1. Permeability Determination (Constant Head Method)
2. Permeability Determination (Falling Head Methods)
3. Determination of Co-Efficient of Consolidation
4. Direct Shear Test in Cohesion Less Soil
5. Unconfined Compression Test in Cohesive Soil
6. Laboratory Vane Shear Test in Cohesive Soil

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7. Tri-Axial Compression Test in Cohesion Less Soil
8. California Bearing Ratio Test

Note-80% of the Experiments are to be completed mandatorily

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0153L.1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
23A0153L.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0153L.3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
23A0153L.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0153L.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Civil Engineering

Title of the Course: FLUID MECHANICS AND HYDRAULIC MACHINES LABORATORY
Category: PC
Couse Code: 23A0154L
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

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 losses in pipes, open channels, and hydraulic jumps to improve flow efficiency.
4. Analyze the impact of jet forces on vanes and their applications in hydraulic machinery.
5. Assess the performance characteristics of hydraulic turbines and pumps under different operating conditions.

Course Outcomes:

At the end of the course, the student 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 losses in pipe flow systems.
4. Analyze the impact of jets on vanes and its significance in hydraulic machinery.
5. Assess the performance of turbines and pumps under different conditions and recommend optimal operating parameters.

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. Determination of Coefficient of Discharge through Venturimeter/ Orifice Meter
4. Determination of Coefficient of Discharge through Triangular / Rectangular/Trapezoidal Notch
5. Determination of Minor Losses in Pipe Flow
6. Determination of Friction Factor of a Pipeline
7. Determination of Energy Loss in Hydraulic Jump
8. Determination of Manning's and Chezy's Constants for Open Channel Flow
9. Impact of Jet On Vanes
10. Performance Characteristics of Pelton Wheel Turbine
11. Performance Characteristics of Francis Turbine
12. Performance Characteristics of Kaplan Turbine
13. Performance Characteristics of A Single Stage / Multistage Centrifugal Pump

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Note-80% of the Experiments are to be completed mandatorily

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0154L.1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
23A0154L.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0154L.3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
23A0154L.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0154L.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
(An Autonomous Institution)
Department of Civil Engineering

Title of the Course: ESTIMATION, SPECIFICATIONS, COSTING AND VALUATION
Category: MC
Couse Code: 23A0155L
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course Objectives:

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

1. Understand the various methods and types of estimates used in 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:

At the end of the course, the student 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.

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

Note-80% of the Experiments are to be completed mandatorily

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TEXT BOOKS:

1. B.N. Dutta - Estimating and Costing in Civil Engineering, CBS Publishers & Distributors, 28th Revised Edition (2020).
2. M. Chakraborti - Estimating, Costing, Specification & Valuation in Civil Engineering, 29th Edition (2021).

REFERENCE BOOKS:

1. Rangwala - Estimating, Costing and Valuation, Charotar Publishing House, 2023.
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).
4. D.D. Kohli & R.C. Kohli - A Textbook of Estimating and Costing (Civil), S. Chand Publishing, 2011.

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0155L.1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
23A0155L .2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0155L.3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
23A0155L.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0155L.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2

ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES RAJAMPET
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Department of Civil Engineering

Title of the Course: TINKERING LABORATORY FOR CIVIL ENGINEERS
Category: SEC
Couse Code: 23A0156L
Branch/es: Civil Engineering
Semester: V

Lecture Hours	Tutorial Hours	Practice Hours	Credits
3	-	-	3

Course objectives:

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

Course Outcomes:

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

1. Construct basic electronic circuits on a breadboard to demonstrate practical applications involving series and parallel connections.
2. Develop and simulate embedded system projects using Arduino and ESP32 platforms for sensor-based automation.
3. Interface sensors and actuators with microcontrollers to implement real-time monitoring and control applications.
4. Design and fabricate simple electromechanical prototypes using 3D modeling and printing tools.
5. Apply design thinking methodology to creatively redesign existing products with a user-centered approach.

List of Experiments

- 1) Make your own parallel and series circuits using breadboard for any application of your choice.
- 2) Demonstrate a traffic light circuit using breadboard.
- 3) Build and demonstrate automatic Street Light using LDR.
- 4) Simulate the Arduino LED blinking activity in Tinkercad.
- 5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
- 6) Interfacing IR Sensor and Servo Motor with Arduino.
- 7) Blink LED using ESP32.
- 8) LDR Interfacing with ESP32.
- 9) Control an LED using Mobile App.
- 10) Design and 3D print a Walking Robot
- 11) Design and 3D Print a Rocket.

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12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.

13) Demonstrate all the steps in design thinking to redesign a motor bike.

Note-80% of the Experiments are to be completed mandatorily

CO-PO Mapping:

Course Outcomes	Engineering Knowledge	Problem Analysis	Design/Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	PSO1	PSO2
23A0156L.1	3	2	2	2	-	-	-	-	-	2	-	2	3	2
23A0156L.2	3	3	3	2	2	-	-	-	-	-	-	1	3	2
23A0156L.3	3	3	2	2	2	-	-	-	-	-	-	1	3	3
23A0156L.4	3	3	3	2	2	-	-	-	-	-	-	1	3	3
23A0156L.5	2	2	2	1	3	-	-	-	-	2	1	2	2	2