R23

III-I

DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES

Subject Code: UGCE5T0123 **L T P C**
III Year / I Semester **3 0 0 3**

Prerequisite: Knowledge of Mathematics, Building construction and Strength of materials.

COURSE OBJECTIVES: The course is designed –

- Familiarize Students with different types of design philosophies.
- Equip student with concepts of design of flexural members.
- Understand Concepts of shear, bond and torsion.
- Familiarize students with different types of compressions members and Design.
- Understand different types of footings and their design.

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

CO1: Explain and compare different design philosophies (Working Stress Method and Limit State Method) using IS codes. (L 2)

CO2: Analyze and design singly and doubly reinforced beams, including T-beams, and prepare reinforcement detailing. (L 4)

CO3: Design beams for shear, torsion, and bond requirements with anchorage length and serviceability checks as per IS 456. (L 4)

CO4: Design short and long RC columns under axial, uniaxial and biaxial loading and design isolated footings for axial loads. (L 4)

CO5: Analyze and design one-way, two-way, and continuous RC slabs as per IS codes, including reinforcement detailing for strength and serviceability**.** (L 4)

SYLLABUS:

UNIT –I: **10hrs**

Introduction: Working stress method Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, elastic theory, design constants, modular

ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

UNIT –II: 10hrs

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement-Maximum Flexural Steel- Design of Flanged Sections (T)- Effective width of flange –Behavior- Analysis and Design.

UNIT –III: 10hrs

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion for L Beam – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.

Limit state design for serviceability: Deflection, cracking and code provision.

UNIT –IV: 10hrs

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions.

Footings: Different types of footings – Design of isolated footings, Square footings – Rectangular footings – circular footing – spread & sloped footings - subjected to axial loads.

UNIT –V: 10Hrs

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	2	-	2
CO2	3	3	3	2	2	-	-	-	-	-	2	-	3
CO3	3	3	3	2	2	-	-	-	-	-	2	-	3
CO4	3	3	3	2	2	-	-	-	-	-	2	-	3
CO5	3	3	3	2	2	-	-	-	-	-	2	-	3

TEXTBOOKS:

1. A. K. Jain, Limit State Design of Reinforced Concrete, 9th ed. New Delhi, India: Nem Chand & Bros, 2012.
2. S. Unnikrishna Pillai and D. Menon, Reinforced Concrete Design, 3rd ed. New Delhi, India: Tata McGraw-Hill, 2009.

REFERENCES:

1. N. Krishna Raju, Design of Concrete Structures, 4th ed. New Delhi, India: CBS Publishers & Distributors, 2003.
2. 'R. Park and T. Paulay, Reinforced Concrete Structures, 1st ed. New York, NY: John Wiley & Sons, 1975.

IS Codes:

1) IS -456-2000 (Permitted to use in examination hall)
2) IS – 875
3) SP-16

NOTE: All the designs to be taught in Limit State Method. Drawing classes must be conducted every week and the Following plates should be prepared by the students.

- Reinforcement detailing of T-beams, L-beams and continuous beams and cantilevers.
- Reinforcement detailing of columns and isolated footings.
- Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION 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 and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

ENGINEERING HYDROLOGY

Subject Code: UGCE5T0223	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of fluid mechanics

Course Objectives: Course Objectives: This course aims to provide students with a comprehensive understanding of the hydrologic cycle and its physical processes, including measurement and estimation of its components. Students will also learn about hydrograph analysis, flood frequency analysis, design flood and routing methods, and fundamental concepts of groundwater movement.

Course Outcomes:

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

CO1: Demonstrate a comprehensive understanding of the theories and principles governing hydrological processes, including the hydrologic cycle, precipitation, abstractions, runoff, and groundwater dynamics.

CO2: Quantify key hydrologic components and apply these concepts in the design and analysis of water resources engineering projects

CO3: Develop design storms for specific return periods and perform frequency analysis to evaluate the likelihood and impact of extreme precipitation events.

CO4: Develop synthetic unit hydrographs and apply hydrograph analysis techniques to predict runoff response in ungauged or data-limited basins

CO5: Estimate flood magnitude using statistical methods and carry out flood routing using channel and reservoir routing techniques

SYLLABUS:

UNIT – I (11Hrs)

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

UNIT-II (10Hrs)

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement,

infiltration indices.

UNIT-III (11Hrs)

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

UNIT-IV (11Hrs)

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

UNIT-V (10Hrs)

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of an open well-recuperation test.

CO_PO MAPPING

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

Textbooks

1. Subramanya, K. *Engineering Hydrology*. Tata McGraw-Hill Education Pvt Ltd, 2013. New Delhi.
2. Jayarami Reddy, P. *Engineering Hydrology*. Laxmi Publications Pvt. Ltd., 2013. New Delhi.
3. Chow, V.T., Maidment, D.R., & Mays, L.W. *Applied Hydrology*. Tata McGraw Hill Education Pvt Ltd, 2011. New Delhi.
4. Ojha, C.S.P., Berndtsson, R., & Bhunya, P. *Engineering Hydrology*. Oxford University Press, 2010.

References

1. Mays, L.W. *Water Resources Engineering*. Wiley India Pvt. Ltd, 2013.
2. Raghunath, H.M. *Hydrology*. New Age International Publishers, 2010.
3. Ponce, V.M. *Engineering Hydrology – Principles and Practice*. Prentice Hall

International, 1994.
4. Patra, K.C. *Hydrology and Water Resources Engineering*. Narosa Publications, 2011.

Online Resources

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

GEOTECHNICAL ENGINEERING– I

Subject Code: UGCE5T0323 **L T P C**
III Year / I Semester **3 0 0 3**

Prerequisite: The student should have knowledge in mathematics and physics for determining basic index properties and engineering properties of soil.

COURSE OBJECTIVES: The course is designed –

- To enable the student to determine the index properties of the soil and classify it.
- To impart the concept of seepage of water through soils and determine the discharge of water through soils.
- To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
- To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

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

CO1: Classify soils based on formation, index properties, and classification systems. (L2)

CO2: Interpret soil water characteristics and analyze the flow of water through soils using Darcy's Law and permeability concepts. (L3, L4)

CO3: Apply stress distribution theories to evaluate the influence of surface loads on soils. (L3, L5)

CO4: Analyze the effects of compaction and understand the consolidation behavior of soils using Terzaghi's theory. (L2, L4)

CO5: Determine shear strength of soils under various drainage and loading conditions. (L2, L3)

SYLLABUS:

UNIT – I **8 Hrs**

Introduction: Soil formation – Structure of Soils – Texture of Soils – Three phase system and phase relationships.

Index Properties and Classification Tests of Soils: Index properties – Density Index - Grain size analysis – Sieve and Hydrometer methods – Consistency of Clay Soils – Activity of Clays – Thixotropy of clays - soil Classification – Unified soil classification and I.S. Soil classification.

UNIT – II **8 Hrs**

Soil moisture and Capillarity: Soil moisture and modes of occurrence – Total, Neutral and Effective Pressures – Capillary Rise in soils.

Permeability: Flow of water through soils –- One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems.

UNIT –III **10 Hrs**

Seepage and Flow Nets: Flow net for one-dimensional flow – two-dimensional flow – Basic equation for Seepage – Flow nets & Characteristics and Uses – Quicksand condition –Seepage forces

Stress Distribution in Soils: Stresses induced by applied loads – Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method. – Pressure Blubs.

UNIT – IV **10 Hrs**

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – compaction control.

Consolidation: Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation – Spring Analogy – Terzaghi's theory of one-dimensional **Consolidation** – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (cv) – Over consolidated and normally consolidated clays.

UNIT – V **8 Hrs**

Shear Strength of Soils: Basic mechanism of shear strength – Mohr – Coulomb Failure theories – total and effective shear strength parameters – Stress-Strain behavior of Sands – Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions – stress paths.

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	-	3
CO2	3	3	-	3	2	-	-	-	-	-	-	-	2
CO3	3	3	-	3	2	-	-	-	-	-	-	-	3
CO4	3	3	-	3	2	-	-	-	-	-	-	-	3
CO5	3	3	-	3	2	-	-	-	-	-	-	-	3

TEXTBOOKS:

1. 'Soil Mechanics and Foundation Engineering by Dr. K.R. Arora, Standard Publishers and Distributors, New Delhi.
2. Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
3. 'Soil Mechanics and Foundation Engineering' by V.N.S.Murthy ,CBS publishers
4. 'Geotechnical Engineering' by C. Venkataramaiah, New Age International Publishers.

REFERENCES:

1. 'Fundamentals of Soil Mechanics' by D.W.Taylor., Wiley.
2. 'An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall
3. Principles of Geotechnical Engineering, Braja M.Das, Cengage Learing.

ONLINE RESOURCES:

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

ADVANCED STRUCTURAL ANALYSIS

(Professional Elective-I)

Subject Code: UGCE5T0423	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites: The student should have Knowledge of equilibrium, internal force analysis, deflection methods, and indeterminate structures is crucial for understanding structural behavior under various loads.

Course Objectives:

The course is designed to

- To understand the elastic theory of arches and analyze three-hinged and two-hinged arches for horizontal thrust, bending moment, normal thrust, and radial shear under varying load and support conditions, including the effects of temperature.
- To apply approximate analytical methods such as the Portal, Cantilever, and Substitute Frame methods for analyzing multi-storey building frames subjected to gravity and lateral loads, and to interpret shear force and bending moment diagrams.
- To analyze cable structures and suspension bridges for concentrated and distributed loads, including temperature effects and stiffening girder responses in three-hinged and two-hinged configurations.
- To employ advanced techniques such as Moment Distribution, Slope-Deflection, and Kani's Methods for the analysis of continuous beams and portal frames, addressing sway, support settlement, and generating shear force and bending moment diagrams.
- To introduce matrix methods of structural analysis, including the Flexibility and Stiffness methods, and to apply these techniques to continuous beams considering support settlements for solving structural problems efficiently.

Course outcomes

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

CO1**:** Analyze three-hinged and two-hinged arches to determine horizontal thrust, bending moment, normal thrust, and radial shear under various loading and temperature conditions. (L4)

CO2**:** Apply approximate methods such as Portal, Cantilever, and Substitute Frame methods to analyze multi-storey frames subjected to gravity and lateral loads. (L3)

CO3: Analyze cable structures and suspension bridges under concentrated and distributed loads, incorporating temperature stresses and stiffening girder effects. (L4)

CO4**:** Employ advanced methods like Moment Distribution and Kani's Method to analyze beams and portal frames, addressing sway and support settlements. (L3)
CO5**:** Apply the Flexibility and Stiffness Methods to analyze continuous beams with limited unknowns, including support settlements. (L3)

Syllabus

UNIT_I

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question)

UNIT_II

Approximate Methods of Analyses: Application to building frames. (i) Portal Method (ii) Cantilever Method (iii) Substitute frame method for approximate analysis of multi-storey frames subjected to gravity loads and lateral loads. Shear force and bending moment diagrams - Elastic curve.

UNIT_III

Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT_IV

Moment Distribution Method: Analysis of Portal frames – including Sway- Substitute frame analysis by two cycle.

UNIT_IV (Modified)

Moment Distribution Method: Analysis of Portal frames – including Sway- Substitute frame analysis by two cycle.
Kani's Method: Analysis of continuous beams–including settlement of supports and single bay portal frames with and without side sway. Shear force and bending moment diagrams - Elastic curve.

UNIT_V

Introduction to matrix methods:

Flexibility methods: Introduction, application to continuous beams (maximum of two unknowns) including support settlements.

Stiffness method: Introduction, application to continuous beams (maximum of two unknowns) including support settlements

Mapping of CO's and PO's:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	-	-

Text books:

1. Analysis of Structures-Vol I & Vol II by V.N. Vazirani & M.M.Ratwani, Khanna Publications, New Delhi.
2. Structural Analysis by V.D.Prasad Galgotia publications, 2nd Editions.
3. Theory of Structures by M.Ramamrutham, R.Narayan, and Dhanapat Rai Publishing Company (p) Ltd.

References:

1. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi
2. Comprehensive Structural Analysis-Vol.I & 2 by Dr. R. Vaidyanathan & Dr. P.Perumal-Laxmi publications pvt. Ltd., New Delhi
3. Basic structural Analysis by C.S. Reddy, Tata McGraw-Hill, New Delhi.
4. Mechanics of Structures by S.B.Junnarkar, Charotar Publishing House, Anand, Gujarat.
5. Theory of Structures by Gupta, Pandit & Gupta; Tat McGraw – Hill Publishing Co.Ltd. New Delhi.
6. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
7. Structural Analysis: A Matrix Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt Ltd.

Online Resources:

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

ARCHITECTURE AND TOWN PLANNING
(Professional Elective-I)

Subject Code: UGCE5T0523	**L**	**T**	**P**	**C**
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites:Nil.

Course Objectives: The objectives of this course are:

- Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
- The salient features of Egyptian, Greek, Roman, and Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
- Architectural design concepts, principles of planning and composition are imparted.
- Enabling the student to understand town planning from ancient times to modern times.
- To impart the concepts of town planning standards, landscaping and expansion of towns.

Course Outcomes:

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

CO1: Differentiate between the architectural styles of the Eastern and Western world by identifying their historical, cultural, and design characteristics.

CO2: Explain the significance of the classical Orders in Greek and Roman architecture and their influence on historical and contemporary architectural practices.

CO3: Demonstrate planning principles such as site orientation, circulation, and spatial organization in residential planning.

CO4: Examine the development of town planning from ancient to modern periods by studying planning elements of historic cities.

Syllabus:

UNIT I: **(9 Hours)**

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization**.**

Temples of Religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhubaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT II: **(8 Hours)**

Principles of designing and Planning: Principles of planning a residence-site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors**.**

Post-classic Architecture: Introduction of post-classic architecture-contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping**.**

UNIT III: **(12 Hours)**

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjo- Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London. Urban morphology, medieval and colonial planning - Garden City Movement, Chandigarh case study.

UNIT IV: **(8 Hours)**

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning**.**

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations. Smart Cities Mission, AMRUT, RERA - Transit-Oriented Development, sustainable urbanism, planning legislation.

UNIT V: **(8 Hours)**

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns-garden cities, satellite towns-floating towns-skyscrapers-pyramidal cities. Urban heat island, green roofs, urban farming - Smart infrastructure, resilient cities, climate-responsive urban design.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO 2
CO1	2	1	-	-	-	2	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	1	-	-	1	-	-	-	-	-	-	-
CO4	1	2	-	-	-	2	-	-	-	-	-	-	-

TEXT BOOKS:

1. 'The great ages of World Architecture 'by G.K.Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y.S.Sane.
3. 'Professional Practice'by G.K. Krishnamurthy, S.V.Ravindra, PHI Learning,New Delhi.
4. 'Indian Architecture–Vol.I&II'byPercy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' by G.K.Haraskar.

REFERENCE BOOKS:

1. 'Drafting and Design for Architecture'by Hepler, Cengage Learning
2. 'Architect's Portable Hand book' by John Patten Guthrie–McGraw Hill International Publications.
3. 'Modern Ideal Homes for India'by R.S.Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design'by Federik Glbbard, Architectural press,London.

CONSTRUCTION TECHNOLOGY AND MANAGEMENT
(Professional Elective-I)

Subject Code: UGCE5T0623

	L	T	P	C
III Year / I Semester	**3**	**0**	**0**	**3**

Prerequisite: Building materials, Concrete Technology.

Course Learning Objectives:
The objective of this course is to enable the students to:

- Understand modern construction techniques including advanced materials, modular construction, and innovative formwork and scaffolding systems.
- Gain knowledge of construction equipment such as cranes, compactors, batching plants, and their selection criteria based on project type and site conditions.
- Learn the principles of construction project planning, scheduling, resource allocation, and control using tools like bar charts, CPM, and PERT.
- Understand methods of cost estimation, productivity analysis, and equipment performance to optimize time and budget in project execution.
- Familiarize with construction safety standards, quality control, and environmental management practices followed in real-world infrastructure projects

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

CO1: Understand the principles of construction project management and Barcharts & CPM (L 2)

CO2: Apply and Analyze project schedules using PERT and CPM techniques and usage of Primavera (L 4)

CO3: Compare different types of equipment for various site conditions and perform economic analysis. (L 4)

CO4: Identify appropriate concreting methods using relevant machinery on site. (L 1)

CO5: Understand the role of Building Information Modelling (BIM) in construction planning and quality control (L 2)

SYLLABUS:

UNIT –I: **8hrs**

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT –II: **8hrs**

Project evaluation and review technique–cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT –III: **10hrs**

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – In-situ densification- compaction equipment – types of compaction rollers

Hoisting and earth work equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clam shell buckets

UNIT –IV: **8hrs**

Concreting equipment— concrete mixers– Batching plants, mobile using plants like "Ajax"etc. mixing and placing of concrete – consolidating and finishing.

UNIT –V: **10Hrs**

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

Mapping of COs to POs:

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	3	-	-	-
CO2	2	3	-	2	3	-	-	-	-	3	-	-	-
CO3	3	2	2	3	3	2	-	-	-	2	-	-	-
CO4	3	-	2	-	3	-	-	-	-	-	-	-	-
CO5	3	2	2	-	3	2	-	2	3	2	-	-	-

TEXT BOOKS:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar

NeerajJha(2011), Pearson.

3. 'Construction Technology' by Subir K.Sarkar and Subhajit Sarasvati, Oxford University press

REFERENCES:

1. Construction ProjectManagement-An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trendsand Technologies' by TreforWilliams , Cengage learning

COURSE LAYOUT

Week 1 : Introduction, Course Context, Construction Project Management Week 2 : Time Management, Work Breakdown Structure (WBS), Gantt Charts Week 3 : Duration Estimation, Network Representation & Analysis -1

Week 4 : Network Representation & Analysis -2; Two-Span Bridge: Scheduling, Network Analysis and Application

Week 5 : Time-Cost Trade-off (Crashing)

Week 6 : Resource Scheduling

Week 7 : Precedence Diagramming Method (PDM), Project Monitoring & Control

Week 8 : Project Monitoring & Control (Earned Value Concepts), Uncertainty in Project Schedules (PERT), Course Summary

GEOTECHNICAL ENGINEERING LAB

Subject Code: UGCE5P0723 **L T P C**
III Year / I Semester **0 0 3 1.5**

Prerequisite: Geotechnical Engineering, Mathematics

COURSE OBJECTIVES: The course is designed –

- To determine the index properties for soil classification– Grain size distribution & Atterberg's limits.
- To determine the engineering properties–Permeability, Compaction, consolidation, shear strength parameters & CBR value.
- To find the degree of swelling by DFS test.
- To impart knowledge of determination of index properties required for classification of soils.
- To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
- To teach how to determines hear parameters of soil through different laboratory tests.

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

CO1: Determine basic index and engineering properties of soils through laboratory testing methods. (L3)

CO2: Conduct field and laboratory tests to assess soil compaction and density characteristics. (L3, L4)

CO4: Evaluate the permeability, shear strength, and compressibility behavior of soils using standard test procedures. (L4, L5)

CO5: Interpret the results of laboratory and field tests to assess the suitability of soil for engineering applications. (L2, L5)

SYLLABUS:

LISTOFEXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.

3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soils - Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	3	2	-	-	-	-	-	-	-	3
CO2	3	3	-	3	2	-	-	-	-	-	-	-	3
CO3	3	3	-	3	3	-	-	-	-	-	-	-	3
CO4	3	3	-	3	3	-	-	2	2	2	-	-	3

TEXTBOOKS:

1. 'Soil Mechanics and Foundation Engineering by Dr. K.R. Arora, Standard Publishers and Distributors, New Delhi.
2. Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
3. 'Soil Mechanics and Foundation Engineering' by V.N.S.Murthy ,CBS publishers
4. 'Geotechnical Engineering' by C. Venkataramaiah, New Age International Publishers.

References:

1. 'Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
2. 'Soil Mechanics and Foundation Engineering' by V.N.S.Murthy , CBS publishers.

FLUID MECHANICS & HYDRAULIC MACHINES LAB

Subject Code: UGCE5P0823	**L**	**T**	**P**	**C**
III Year / I Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Knowledge of fluid mechanics and hydraulic machines

Course Objectives: This course aims to enable students to apply fundamental fluid mechanics principles through practical laboratory activities, verify theoretical concepts, develop skills in calibrating and using flow measurement devices, and analyze energy losses in pipelines.

Course Outcomes:

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

CO1: Apply fluid mechanics principles to analyze and solve practical problems involving flow measurement and energy loss in pipes and channels

CO2: Calibrate and operate standard flow measurement instruments and interpret their measurements for real-world applications.

CO3: Determine the coefficients of discharge for orifices and mouthpieces under various flow conditions, and compare results with theoretical expectation

CO4**:** Measure and evaluate head loss due to friction and pipe fittings, and analyze the factors influencing energy dissipation in fluid systems

Syllabus:

LIST OF EXPERIMENTS

1. Verification of Bernoullis' equation.
2. Calibration of Venturimeter.
3. Calibration of orificemeter.
4. Determination of coefficient of discharge of a small orifice by constant head method
5. Determination of coefficient of discharge of an external cylindrical mouth piece by variable head method.
6. Calibration of a contracted rectangular notch.
7. Calibration of a triangular notch.
8. Determination of friction factor of the pipe material.
9. Determination of coefficient of head loss due to a sudden expansion/ contraction in a pipeline.
10. Determination of head loss coefficient due to a bend in pipe line.

CO_PO MAPPING

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

Textbooks

1. Rajput, R.K. A Textbook of Fluid Mechanics and Hydraulic Machines. S. Chand Publishing, 2024, New Delhi.
2. Bansal, R.K. A Textbook of Fluid Mechanics and Hydraulic Machines. Laxmi Publications, 2024, New Delhi.

Reference Books

1. Kumara Swamy, N. Fluid Mechanics and Machinery Laboratory Manual. 2nd ed. Charotar Publication, Anand, Gujarat.
2. Panigrahi, S.K., & Mohanty, L. Fluid Mechanics and Hydraulic Machines Laboratory Manual. 1st ed. S.K. Kataria & Sons, 2023. New Delhi.

ESTIMATION, SPECIFICATIONS & CONTRACTS

Subject Code: UGCE5K0923

	L	T	P	C
III Year / I Semester	**0**	**1**	**2**	**2**

Prerequisite: Basic civil engineering, Building planning & Drawing, Basics of Surveying, Basics of RCC and Steel structures, Unit conversions and Maths

Course Learning Objectives:

The objective of this course is to enable the students to:

- Understand the quantity calculations of different components of the buildings.
- Understand the rate analysis of different quantities of the buildings components.
- Learn various specifications and components of the buildings.

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

CO1: Identify and explain different types of contracts and standard specifications. (L 1 & 2)

CO2: Apply methods to estimate the quantities of various components of buildings (L 3)

CO3: Perform rate analysis for various items of construction work including earthwork and bar bending schedules. (L 3 & 4)

CO4: Analyze and prepare abstract and detailed estimates for various building works using standard procedures. (L 4)

SYLLABUS:

UNIT –I: **8hrs**

Contracts–Types of contracts–Contract Documents–Conditions of contract, Valuation of buildings- concepts of e-procurement and reverse auctions. Standard specifications for different items of building construction.

UNIT –II: **8hrs**

General items of work in Building–Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT –III: **8hrs**

Rate Analysis– Working out data for various items of work over head and contingent charges. Earthwork for roads and canals, Reinforcement bar bending and bar

requirement schedules.

UNIT –IV: **10hrs**

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

UNIT –V: **10Hrs**

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

Mapping of COs to POs:

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2					3	3		3	3	2		
CO2	3	2			2								
CO3	3	3	2		2								2
CO4	3	3	3	2	3						2		3

TEXT BOOKS:

1. 'Estimating and Costing' by B.N.Dutta,UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. 'Estimating and Costing'by G.S. Birdie.

REFERENCES:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works–B.I.S.)
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications.
4. National Building Code.

TINKERING LAB

Subject Code: UGCE5P1023	**L T P C**
III Year / I Semester	**0 0 2 1**

Prerequisite: Nil.

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives :

The course is designed to

- Encourage Innovation and Creativity
- Provide Hands-on Learning
- Impart Skill Development
- Foster Collaboration and Teamwork
- Enable Interdisciplinary Learning
- Impart Problem-Solving mind-set
- Prepare for Industry and Entrepreneurship

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

Course Outcomes:

CO1 Design and implement foundational electronic and IoT projects using breadboards, Arduino, ESP32, and sensors to solve context-specific problems. (L3)

CO2 Fabricate 3D models and mechanical prototypes (e.g., robots, rockets) using digital tools and printers to address defined design challenges. (L3)

CO3 Apply design thinking methodology to evaluate and redesign existing products by documenting empathy, ideation, prototyping, and testing phases. (L4)

CO4 Work collaboratively in multidisciplinary teams to develop and present working solutions, demonstrating effective communication, task coordination, and feedback incorporation. (L4)

CO5 Integrate technical knowledge with innovation and entrepreneurial thinking to identify real-world needs and propose feasible, market-oriented solutions. (L4)

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.
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.

Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/

3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf
5) https://aim.gov.in/pdf/Level-3.pdf

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	3	-	-	-	-
CO2	3	-	3	-	3	-	-	-	3	-	-	-	-
CO3	-	3	3	3	-	-	-	-	3	-	-	-	-
CO4	-	3	-	-	-	-	-	-	3	3	-	-	-
CO5	-	3	-	-	-	3	3	-	3	-	3	-	-

Text Books

1. Programming Arduino: Getting Started with Sketches by Simon Monk

2. Building Arduino Projects for the Internet of Things: Experiments with Real-World Applications by Adeel Javed

Reference Book

1. 3D Printing for Product Designers: Innovative Strategies Using Additive Manufacturing by Jennifer Loy, James Novak, and Olaf Diegel

R23

III-II

DESIGN AND DRAWING OF STEEL STRUCTURES

Subject Code: UGCE6T0123 **L T P C**
III Year / II Semester **3 0 0 3**

Prerequisite: Basics of Design and drawing of reinforced concrete structures

COURSE OBJECTIVES: The course is designed –

- Identify different types of structural connections and interpret relevant IS codes
- Apply the design concepts to flexural members as per relevant standards.
- Analyze the behavior and design principles of tension and compression members in trusses.
- Classify different types of columns and column bases and design them for given conditions.
- Design Plate girders for structural requirements as per standard practices.

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

CO1: Apply relevant IS codes to design steel structural members(L3)

CO2: Analyze and design flexural members and prepare detailed connection drawings(L4)

CO3: Design different types of compression members with complete connection detailing. (L5)

CO4: Design Plate Girders with appropriate connection detailing, adhering to standards(L5)

CO5: Produce detailed working drawings for various components of steel structures.(L5)

SYLLABUS:

UNIT – I : Steel structures and its connections **8hrs**

Introduction to Steel structures: Advantages and disadvantages of steel structures, Types of steel sections.

Connections: Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints. Bolted connections: Failure of bolted joints, strength of bolted joints, Problems

UNIT –II: Beams **8hrs**

Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported

beams and Laterally supported beams

UNIT –III: Tension Members and compression members 8hrs

Effective length of members, slenderness ratio-permissible stresses. Design compression members subjected to axial and eccentric loading. Design of members subjected to direct tension and bending. **Roof Trusses:** Different types of roof trusses – Design loads – Load combinations as per IS Code recommendations –Design of purlins, members and joints.

UNIT –IV: Columns and columns foundations 8hrs

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected to moment.

Unit-V: Plate girder and Gantry girder 8hrs

Design of Plate Girder: Design consideration – IS Code Recommendations

Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Gantry Girder: impact factors - longitudinal forces

NOTE: Drawing classes must be conducted every week and the students should prepare the following plates.

Plate 1 Detailing of simple beams
Plate 2 Detailing of Compound beams including curtailment of flange plates.
Plate 3 Detailing of Column including lacing and battens.
Plate 4 Detailing of Column bases – slab base and gusseted base
Plate 5 Detailing of tension members and compression members.
Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

IS Codes:

1) IS 800 (Permitted to use in examination hall)
2) Steel Tables (Permitted to use in examination hall)

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	3	3	-	-	-	-	-	-	-	3	-	-
CO3	2	3	3	-	-	-	-	-	-	-	3	-	-
CO4	2	3	3	-	-	-	-	-	-	-	3	-	-
CO5	3	2	2	-	-	-	-	-	-	-	3	-	-

TEXTBOOKS

1. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
2. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
3. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

REFERENCES

1. 'Structural Design in Steel' by SarwarAlamRaz, New Age International Publishers, New Delhi
2. 'Design of Steel Structures' by P. Dayaratnam; S. Chand Publishers
3. 'Design of Steel Structures' by M. Raghupathi, Tata Mc. Graw-Hill
4. 'Structural Design and Drawing' by N. Krishna Raju; University Press

ONLINE RESOURCES

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

HIGHWAY ENGINEERING

Subject Code: UGCE6T0223 **L T P C**
III Year / II Semester **3 0 0 3**

Prerequisite: Concepts of surveying and basic construction materials are required.

COURSE OBJECTIVES: The objectives of this course are:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

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

CO1: Conduct aggregate tests to evaluate material properties for pavement construction under standard testing conditions.
CO2: Perform bituminous material tests to assess characteristics like penetration, ductility, and viscosity for road construction.
CO3: Analyze traffic survey data (volume, speed, and parking studies) to assess road capacity and safety.
CO4: Perform Marshall Stability tests to design optimal bituminous mixes for road durability and stability.
CO5: Design road cross-sections, rotary intersections, and calculate earthworks for accurate road construction and alignment.

SYLLABUS:

UNIT – I Highway Planning and Alignment **8hrs**

Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, Road development vision 2021,Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

UNIT – II Highway Geometric Design **8hrs**

Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical Alignment-Gradients- Vertical curves.

UNIT – III Traffic Engineering **10hrs**

Basic Parameters of Traffic - Volume, Speed and Density-Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.

UNIT –IV Highway Materials **8hrs**

Sub grade soil: classification –Group Index–Subgrade soil strength –California Bearing Ratio–Modulus of Subgrade Reaction. Stone aggregates: Desirable properties– Tests for Road Aggregates–Bituminous Materials: Types–Desirable properties––Tests on Bitumen - Bituminous paving mixes: Requirements – Marshall Method of Mix Design.

UNIT–V Design of Pavements **10hrs**

Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements: Design factors–Flexible Pavement Design Methods–CBR method–IRC method–Burmister method–Mechanistic method–IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses –Frictional stresses–Combination of stresses–Design of slabs–Design of Joints–IRC method–Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

Mapping of COs to POs:

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

TEXTBOOKS:

- Highway Engineering, Khanna S.K., Justo C.E.G and Veeraragavan A,Nem Chand Bros., Roorkee.
- Traffic Engineering and Transportation Planning, KadiyaliL. R,Khanna Publishers, New Delhi.

REFERENCES:

- Principles of Highway Engineering, KadiyaliL .R,Khanna Publishers, NewDelhi

- Principles of Transportation Engineering, Partha Chakraborty and Animesh Das,PHI Learning Private Limited, Delhi

ONLINE RESOURCES:
https://onlinecourses.nptel.ac.in/

ENVIRONMENTAL ENGINEERING

Subject Code: UGCE6T0323	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of engineering chemistry and fluid mechanics

Course Objectives: This course aims to outline the planning and design of water supply systems, including water quality requirements and distribution networks, and the selection of valves. It also covers the planning and design of sewerage systems, and imparts knowledge on wastewater treatment and disposal .

Course Outcomes:

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

CO1: Develop plans and designs for water distribution networks and sewerage systems tailored to community needs

CO2: Evaluate potential water sources by assessing both quality and quantity requirements for intended uses

CO3: Recommend appropriate treatment processes for raw water and sewage, considering technical, environmental, and regulatory criteria

CO4: Assess options for the disposal of wastewater, ensuring compliance with environmental and regulatory standards

CO5: Analyze physical, chemical, and biological characteristics of water to evaluate its quality against established standards for various uses

SYLLABUS:

UNIT–I (11Hrs)

Introduction: Importance and Necessity of Protected Water Supply systems. Water borne diseases. Planning of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison- Capacity of storage reservoirs, Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes and Pipe joints.

UNIT-II (12Hrs)

Quality and Analysis of Water: Physical, Chemical and Biological characteristics of water. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system–Laying and testing of pipe lines.

UNIT-III **(12Hrs)**

Treatment of Water: Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation, flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odors – Removal of Iron and manganese – Fluoridation and De-fluoridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

UNIT-IV **(12Hrs)**

Planning and Design of Sewerage System

Characteristics and composition of sewage — population equivalent -Sanitary sewage flow estimation — Sewer materials — Hydraulics of flow in sanitary sewers — Sewer design — Storm drainage-Storm runoff estimation — sewer appurtenances — corrosion in sewers — prevention and control — sewage pumping-drainage in buildings-plumbing systems for drainage **Primary Treatment of Sewage**

Objectives — Unit Operations and Processes — Selection of treatment processes — Onsite sanitation — Septic tank- Grey water harvesting — Primary treatment — Principles, functions and design of sewage treatment units — screens — grit chamber-primary sedimentation tanks — Construction, Operation and Maintenance aspects.

UNIT–V **(12Hrs)**

Secondary Treatment of Sewage

Objectives — Selection of Treatment Methods — Principles, Functions, — Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor (SBR) — Membrane Bioreactor — UASB — Waste Stabilization Ponds — Other treatment methods -Reclamation and Reuse of sewage — Recent Advances in Sewage Treatment — Construction, Operation and Maintenance aspects.

Disposal of Sewage

Standards for– Disposal — Methods — dilution — Mass balance principle — Self purification of river - Oxygen sag curve — de-oxygenation and re-aeration — Streeter–Phelps model — Land disposal — Sewage farming — sodium hazards — Soil dispersion system.

CO_PO MAPPING

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

TEXTBOOKS

1. Peavy, Howard S., Rowe, Donald R., & Tchobanoglus, George. Environmental Engineering. McGraw-Hill Book Company, 1985, New Delhi.
2. Modi, Dr. P.N. Water Supply Engineering. Standard Book House, Delhi.

REFERENCES

1. Duggal, K.N. Elements of Environmental Engineering. S. Chand & Company Ltd., New Delhi.
2. Punmia, Dr. B.C., Jain, A.K., & Jain, A.K. Water Supply Engineering. Laxmi Publications (P) Ltd., New Delhi.
3. Birdie, G.S., & Birdie, J.S. Water Supply and Sanitary Engineering.

GROUND IMPROVEMENT TECHNIQUES

(Professional Elective – II)

Subject Code: UGCE6T0423

	L	T	P	C
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisite: Geotechnical Engineering

COURSE OBJECTIVES: The course is designed –

- Understand the principles and applications of in-situ densification methods for different soil types.
- Explore various dewatering techniques and assess their suitability for different site conditions.
- Learn soil stabilization methods and grouting techniques for improving soil performance and safety.
- Understand the concept, design, and construction principles of reinforced earth structures and soil nailing.
- Gain knowledge of geosynthetics, their classifications, properties, and applications in civil engineering projects.

COURSE OUTCOMES:

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

CO1: Explain in-situ densification techniques for both granular and cohesive soils and evaluate their suitability for various field conditions. (L2, L5)

CO2: Analyze different dewatering systems including well points, sumps, and electro-osmosis, and select appropriate methods for ground improvement. (L4)

CO3: Classify and compare various soil stabilization methods and grouting techniques; apply appropriate methods based on soil type and project needs. (L3, L4)

CO4: Design reinforced earth structures and perform stability checks using principles of reinforced earth and soil nailing. (L5)

CO5: Identify and evaluate types, functions, and applications of geosynthetics including geotextiles, geogrids, geomembranes, and gabions in ground improvement. (L2, L5)

SYLLABUS:

UNIT-I **8 hrs**

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in-situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT-II **8 hrs**

Dewatering–sumps and interceptor ditches –single and multi-stage well points–vacuum well points, horizontal wells – criteria for choice of filler material around drains – electro osmosis

UNIT- III **8 hrs**

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization–use of industrial wastes like fly ash and granulated blast furnace slag.

Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting–hydraulic fracturing in soils and rocks –post grout tests. Introduction to Liquefaction & its effects & applications.

UNIT-IV **8 hrs**

Reinforced earth–principles–components of reinforced earth–design principles of reinforced earth walls – stability checks – soil nailing.

UNIT-V **8 hrs**

Geosynthetics–geotextiles–types–functions, properties and applications – geogrids, geomembranes and gabions - properties and applications.

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	-	-	-	3
CO2	3	3	-	-	2	-	-	-	-	-	-	-	3
CO3	3	3	2	-	3	-	-	-	-	-	-	-	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3
CO5	3	2	2	-	3	-	-	-	-	-	-	-	3

TEXT BOOKS:

1. Purushothama Raj, 'Ground Improvement Techniques,' Laxmi Publications, New Delhi.
2. Nihar Ranjan Patro, 'Ground Improvement Techniques', Vikas Publishing

House(p) limited, New Delhi.
3. G L Siva Kumar Babu, 'An introduction to Soil Reinforcement and Geosynthetics,', Universities Press.

REFERENC EBOOKS:

1. MP Moseley, 'Ground Improvement,' Blackie Academic and Professional, USA.
2. RM Koerner, 'Designing with Geo Synthetics,' Prentice Hall.

ONLINE RESOURCES:

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

REPAIR AND REHABILITATION OF STRUCTURES

(Professional Elective – II)

Subject Code: UGCE6T0523

	L	T	P	C
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisite: Building Materials, Concrete Technology, Design of Concrete Structures

Course Learning Objectives:

The objective of this course is to enable the students to:

- Familiarize Students with deterioration of concrete in structures
- Equip student with concepts of NDT and evaluation
- Understand failures and causes for failures in structures
- Familiarize different materials and techniques for repairs
- Understand procedure to carryout Physical evaluation of buildings and prepare report.

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

CO1: Explain the functions and applications of various repair materials and non-destructive evaluation methods. (L2)

CO2: Apply suitable strengthening and stabilization techniques for distressed structural members. (L3)

CO3: Analyze the effectiveness of bonded installation methods and fiber reinforcement in structural repair. (L4)

CO4: Analyze the mechanical and durability properties of special concretes like fiber reinforced, lightweight, and fly ash concretes. (L4)

CO5: Design appropriate repair and rehabilitation strategies using high-performance concretes and advanced materials. (L3)

SYLLABUS:

UNIT –I: 10hrs

Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation- Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.

UNIT –II: 8hrs

Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT –III: 8hrs

Bonded installation techniques-Externally bonded FRP-Wetlay upsheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDC debonding-plate end de bonding-strengthening of floor of structures post grout tests. Introduction to Liquefaction & its effects & applications

UNIT –IV: 10hrs

Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes

UNIT –V: 8Hrs

High performance concretes-Introduction-Development of high performance concretes-Materials of high performance concretes-Properties of high performance concretes-Self Consolidating concrete-properties-qualifications.

Mapping of COs to POs:

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	2	2	-	-	-	-	-	-	-
CO2	3	3	3	-	2	-	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	2	-
CO4	3	2	-	-	-	2	-	-	-	-	-	-	2
CO5	3	2	3	2	3	2	-	-	-	-	2	-	2

TEXT BOOKS:

1. Maintenance Repair Rehabilitation & Minor works of Buildings -P.C.Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures–P.I.Modi,C.N.Patel,PHI Publications
3. Rehabilitation of Concrete Structures-B.Vidivelli,Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice-M.S.Shetty,SChandand Company
2. Concrete Repair and Maintenance illustrated- PeterHEmmons
3. Concrete Chemical Theory and Applications-Santa Kumar A.R.,Indian Society for Construction Engineering and Technology, Madras
4. Hand book on Repair and Rehabilitation of RC Buildings published by CPWD, De

VALUATION AND QUANTITY SURVEY

(Professional Elective – II)

Subject Code: UGCE6T0623

	L	T	P	C
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisite: Basic civil engineering, Building planning & Drawing, asics of Surveying, Basics of RCC and Steel structures, Unit conversions and Maths

Course Learning Objectives:

The objective of this course is to enable the students to:

- Understand the fundamental concepts of valuation, including types of value, purpose of valuation, and influencing factors such as depreciation and obsolescence.
- Learn methods of property valuation, including rental, capital, and land valuation techniques, and apply them to real-world scenarios.
- Gain knowledge of the roles and responsibilities of a quantity surveyor, including cost estimation, budgeting, financial planning, and project control.
- Understand and perform detailed quantity surveying for civil engineering projects using standard methods of measurement and abstracting techniques.

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

CO1: Define and describe the basic principles, terminology, and roles in quantity surveying and estimation. (L1 & L2)

CO2: Apply CPWD-DAR/DSR data to compute unit rates for various construction works. (L3)

CO3: Prepare detailed estimates and Bills of Quantities (BOQ) for buildings, works using standard methods. (L3 & L4)

CO4: Analyze bar bending schedules (BBS) for structural elements such as beams, slabs, columns and retaining walls, sanitary and water supply work. (L4)

CO5: Evaluate the value of buildings and land using different methods of valuation and depreciation. L5)

SYLLABUS:

UNIT –I: 10hrs

Introduction- Quantity Surveying- Basic principles, Role/responsibility of Quantity surveyor at various stages of construction. Estimate-Details required, Type of estimate, purposes. Contingencies, Work-charge establishment, Tools and Plant, centage charge, Day work, Prime cost, Provisional sum & provisional Quantity, Overhead charges, Cost index, Contract documents (Brief description only)Bill of Quantity-Typical format-use Item of works- Identify various item of work from the drawings- units of measurement of various materials and works (focus may give to RCC residential building) General rule & method of measurement with reference to Indian Standard Specifications- IS1200.

UNIT –II: 8hrs

Introduction to the use of CPWD schedule of rates as per latest DSR and Analysis of rate as per latest DAR.

Specifications-Generalspecificationofallitemsofaresidentialbuilding.Detailed specification (CPWD specifications) of major item of work like Earth work excavation in foundation, masonry, Reinforced cement concrete, finishing of building work Analysis of rates for Earth work in excavation for foundation, mortars, reinforced cement concrete Works, finishing work, masonry work, stone works, flooring with reference to latest DSR and latest DAR (Data should be given).

UNIT –III: 8hrs

Detailed Estimate- Preparation of detailed measurement using Centre line method & Short wall long wall (separate wall) method for RCC single storied building (Flat roof) including stair cabin- Residential/office/school building. BOQ preparation of a single storied RCC building work. Material quantity calculation of the items of work (Rubble, Brick work, Concrete work, Plastering) in detailed estimate prepared for building work. (Data for unit quantity should be provided from DAR)

UNIT –IV: 10hrs

Bar Bending Schedule- Preparation of BBS of RCC beams, slabs, Column footings, Retaining wall. Road estimation-Estimation of earthwork from longitudinal section-metaled road. Estimation of sanitary and water supply work -Water tank, Septic tank, Manhole (No Detailed estimate needed-concept of item of work, its general specification and unit of measurement).(Valuation – purpose, factor affecting, introduction to terms-Value, Cost, Price, kinds of values Income- Gross income, net income, outgoings, annuity, sinking fund, Year's purchase, Depreciation, obsolescence - Free hold and leasehold properties.)

UNIT –V: **8Hrs**

Methods of calculating depreciation – straight line method – constant percentage method, sinking fund method and quantity survey method.

Methods of valuation–rental method, direct comparison of capital cost, valuation based on profit, depreciation method. Various method of valuation of land (Brief description only)

Mapping of COs to POs:

CO \ PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	-	-	-
CO2	3	3	2	-	3	-	-	-	-	-	-	-	-
CO3	3	3	3	2	3	-	-	-	-	-	-	-	-
CO4	3	2	3	2		2	-	-	-	-	-	-	-
CO5	3	3	3	2	3	2	-	-	-	-	2	-	2

TEXT BOOKS:

1. B.N.Dutta, Estimation and costing in civil engineering, UBS publishers
2. Rangwala, Estimation Costing and Valuation, Charotar publishing house pvt.ltd
3. Dr. S. Seetha Raman, M.Chinna swami, Estimation and quantity surveying, Anuradha publications Chennai.
4. M Chakraborthy, Estimating, Costing, Specification and valuation, published by the author, 21 B, Babanda Road, Calcutta 26

References:

1. BS Patil, Civil Engineering contracts and estimates, university press
2. VNVazirani & SPChandola, Civil Engineering Estimation and Costing, Khanna Publishers
3. IS1200-1968; Methods of measurement of building & civil engineering works
4. CPWDDAR2018andDSR2018orlatest
5. CPWDSpecificationsVol1&2(2019orlatestedition)

FINITE ELEMENT METHOD

(Professional Elective – III)

Subject Code: UGCE6T0723	**L T P C**
III Year / II Semester	**3 0 0 3**

Prerequisite: Structural Analysis, Advanced Structural Analysis

Course Objectives

The course is designed to:

- Introduce the foundational principles of finite element analysis, including the formulation of basic one-degree-of-freedom problems.
- Familiarize students with finite element software environments, enabling interpretation and simulation of stress, thermal, and modal responses.
- Equip students with mathematical tools to derive and assemble stiffness matrices for various structural elements and systems.
- Enable students to interpret mechanical responses, such as displacements, strains, and stresses, based on computational outputs.
- Develop analytical skills for modeling planar structural systems, using appropriate finite element techniques and convergence methods.

COURSE OUTCOMES

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

CO1: Formulate and solve finite element models for one-dimensional systems using energy principles and approximation methods. (L3)

CO2: Utilize finite element software tools to perform stress, thermal, and modal analyses across diverse structural applications. (L3)

CO3: Derive and assemble stiffness matrices for various structural elements such as bars, beams, and 2D elements, applying appropriate boundary conditions. (L4)

CO4: Interpret displacement, strain, and stress results obtained through FEM software simulations for mechanical components. (L4)

CO5: Develop and implement isoparametric formulations using numerical methods and assess mesh quality through tests like patch testing. (L4)

Syllabus

UNIT I **9 hrs**

Introduction: Review of stiffness method - Principle of Stationary potential energy- Potential energy of anelastic body - Rayleigh-Ritz method of functional approximation - variational approaches - weighted residual methods

UNIT II **9 hrs**

Finite Element formulation of truss element: Stiffness matrix-properties of stiffness matrix – Selection of approximate displacement functions-solution of a planetruss-transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin's methodfor1-Dtruss– Computation of stress in a truss element.

UNIT III **9 hrs**

Finite element formulation of Beam elements: Beam stiffness-assemble age of beam stiffen matrix - Examples of beam analysis for concentrated and distributed loading - Galerkin's method – 2 Darbitrarily oriented beam element–inclined and skewed supports – rigid plane frame examples

UNIT IV **9 hrs**

Finite element formulation for plane stress, plane strain and axi symmetric problems- Derivation of CST and LST stiffness matrix and equations - treatment of body and surface forces - Finite Element solution for plane stress and axi- symmetric problems - comparison of CST and LST elements – convergence of solution-interpretation of stresses

UNIT V **9 hrs**

Iso-parametric Formulation: Iso - parametric bar element - plane bilinear Iso-parametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent modalload vector - Gauss quadrature-appropriate order of quadrature – element and mesh instabilities – spurious zero energy modes, stress computation - patch test.

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	-	3	3	-	-	-	-	-	-	-	-
CO2	3	3	3	-	3	-	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-	-
CO4	-	3	-	3	3	-	-	-	-	3	-	-	-
CO5	3	3	3	3	3	-	-	-	-	3	3	-	-

TEXTBOOKS

1. A first course in the Finite Element Method – Daryl L.Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis – Robert D.Cook, Michael E Plesha, John Wiley & Sons Publications

REFERENCES:

1. Introduction to Finite Elements in Engineering - Tirupati R.Chandrupatla, Ashok D. Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers) Wail N Rifaie, Ashok K Govil, New Age International (P) Limited

BRIDGE ENGINEERING

(Professional Elective-III)

Subject Code: UGCE6T0823	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: The student should have Knowledge of following.

- **Structural Analysis**: Understanding forces in determinate and indeterminate structures, bending moment, and shear force diagrams.
- **Design of Structures**: Knowledge of RCC, steel design, and basics of pre stressed concrete.
- **Geotechnical and Fluid Mechanics**: Soil bearing capacity, foundation design, and hydrodynamic forces on structures.
- **Transportation and Surveying**: Basics of traffic loads, route alignment, and site selection for bridges.

Course Objectives:

The course is designed to

- To familiarize students with the types of bridges, site selection criteria, economical span, foundations, and loading standards as per IRC and railway codes.
- To analyze and design slab bridges using effective width methods and advanced theories like Guyon's and Courbon's for load dispersion and slab behavior under wheel loads.
- To analyze and design T-beam bridge components, including deck slabs, longitudinal girders, and secondary beams, with proper reinforcement detailing.
- To design the components of plate girder bridges, including webs, flanges, stiffeners, and splices, and to prepare detailed reinforcement layouts.
- To design box culverts and develop knowledge on inspection, testing, and maintenance of bridge substructures, superstructures, and bearings.

Course outcomes

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

CO1: Understand the types, components, and selection criteria for bridges, along with the standards for railway and IRC loading. (L2)

CO2: Analyze and design slab bridges using effective width methods and advanced techniques like Guyon's and Massonet's methods. (L4)

CO3: Design and detail T-beam bridge elements, including deck slabs, longitudinal girders, and secondary beams. (L3)

CO4: Design plate girder bridges, including key elements like webs, flanges, stiffeners, and splices, with appropriate reinforcement detailing. (L4)

CO5**:** Analyze, design, and detail box culverts, and apply inspection and maintenance strategies for bridges, including substructures, superstructures, and bearings. (L5)

Syllabus

UNIT-I

General Introduction to types of Bridges- (Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, pre stressed concrete bridges, Truss Bridges, Culverts) - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT-II

Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs-dispersion Length-Design of interior panel of slab-Guyon's–Massonet Method–Hendry-Jaegar Methods- Courbon's theory- Pigeaud's method

UNIT-III

T-Beam bridges- Analysis and design of various elements of bridge–Design of deck slab, longitudinal girders, Secondary beams- Reinforcement detailing

UNIT-IV

Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

UNIT-V

Box Culverts: Loading–Analysis and Design-Reinforcement detailing.
Inspection and Maintenance of Bridges: Procedures and methods for inspection–Testing of bridges- Maintenance of Sub Structures and Super Structures-Maintenance of bearings- Maintenance Schedules.

CO-PO and CO-PSO Mapping Table

CO/ PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2
CO1	3	2	-	-	2	-	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	2	-	-	-	-	-	-	-	2

CO4	3	3	3	-	2	-	-	-	-	2	2	-	-
CO5	3	3	3	2	3	2	2	-	-	1	1	-	2

TEXTBOOKS:

1. Essentials of Bridge Engineering 'by Johnson Victor D
2. Design of Bridge Structures' by T.R. Jagadeesh, M.A. Jayaram, PHI
3. Design of RC Structures' by B. C.Punmai, Jain & Jain, Lakshmi Publications

REFERENCES:

1. Design of Concrete Bridges' by Aswini, Vazirani,Ratwani
2. Design of Steel Structures' by B.C.Punmai, Jain & Jain, Lakshmi Publications
3. Design of Bridges' by Krishna Raju

ONLINE RESOURCES:

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

WATER RESOURCE ENGINEERING

(Professional Elective – III)

Subject Code: UGCE6T0923	**L**	**T**	**P**	**C**
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of fluid mechanics and engineering hydrology

Course Objectives: This course aims to educate students on types of irrigation systems, planning and design concepts for irrigation, relationships among soil, water, and plants, and design principles for canals, weirs, and canal structures. It also covers analysis and design of storage headworks

Course Outcomes:

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

CO1: Estimate the irrigation water requirements for different crops and regions based on climate, soil, and crop characteristics

CO2: Design irrigation canals to efficiently convey water from the source to the fields, considering hydraulic and topographic conditions

CO3: Design irrigation canal structures such as regulators, drops, and escapes to control and manage water flow within the canal system

CO4: Plan and design diversion headworks to ensure effective water intake from rivers or reservoirs for irrigation purposes

CO5: Analyze the stability of gravity and earth dams under various loading conditions to ensure their safety and functionality

SYLLABUS:

UNIT-I (11Hrs)

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II (10Hrs)

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

UNIT- III (12Hrs)

Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall. (Description only)

Regulators: Head and cross regulators, design principles (Description only)
Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. (Description only)

Outlets: Types, proportionality, sensitivity and flexibility
River Training: Objectives and approaches

UNIT-IV (10Hrs)

Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-V (12Hrs)

Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.
Dams: Types of dams, selection of type of dam, selection of site for a dam.
Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.
Earth Dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters.
Spillways: Types, design principles of Ogee spillways, types of spillways crest gates.

CO_PO MAPPING

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

Textbooks

1. Punmia, B.C., Lal, P.B.B., Jain, A.K., & Jain, A.K. *Irrigation and Waterpower Engineering*. Laxmi Publications Pvt. Ltd., 2009. New Delhi.
2. Asawa, G.L. *Irrigation and Water Resources Engineering*. New Age International Publishers, 2013.
3. Raghunath, H.M. *Irrigation Engineering*. Wiley India, 2012.
4. Modi, P.N. *Irrigation Water Resources and Waterpower Engineering*. Standard Book House, 2011. New Delhi.

References

1. Mays, L.W. *Water Resources Engineering*. Wiley India Pvt. Ltd, 2013. New Delhi.
2. Sharma, R.K., & Sharma, T.K. *Irrigation Engineering*. S. Chand & Co

Publishers, 2012.
3. Satyanarayana Murthy, Challa. *Water Resources Engineering*. New Age International Publishers, 2008.

DISASTER MANAGEMENT

(Open Elective-II)

Subject Code: UGCE0T0523
III Year II Semester

L	T	P	C
3	0	0	3

Course Objectives:
The objective of this course is to:

1. Understand the Role and Phases of Disaster Management:

Develop a comprehensive understanding of the modern disaster manager's responsibilities in pre- and post-disaster phases, including the chronological stages of natural disaster response and refugee relief operations.

2. Analyze Mitigation and Regulatory Strategies:

Identify and describe effective mitigation planning strategies, hazard management controls, and the role of public awareness and economic incentives in reducing disaster impact.

3. Evaluate Post-Disaster Tools and Victim-Centered Relief Systems:

Understand the structure of relief systems, characteristics of disaster victims, and various tools and methods used in post-disaster recovery and management.

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

CO1: Explain the interdisciplinary aspects of disaster management and illustrate the impacts of natural hazards using real-life case studies. (L2 – Understand)
CO2: Analyze different types of man-made disasters and evaluate suitable disaster management strategies through case-based approaches. (L4 – Analyze)
CO3: Apply the principles of risk and vulnerability assessment in the planning and management of disaster-prone areas. (L3 – Apply)
CO4: Assess the role of advanced technologies such as Remote Sensing, GIS, and multimedia tools in disaster mitigation, response, and training. (L5 – Evaluate)
CO5: Design community-based disaster management plans by integrating educational, social, and institutional preparedness frameworks. (L6 – Create)

SYLLABUS:

UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II

Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III

Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities- electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital- Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers& Distributors Pvt.Ltd.

2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. 'Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., NewDelhi.
4. 'Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

REFERENCE BOOKS:

1. Disaster Management edited by H K Gupta (2003), Universitiespress.
2. Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R R Krishnamurthy (2009), Universitiespress.R. Nishith, Singh AK,
3. "Disaster Management in India: Perspectives, Issues and strategies" New Royal BookCompany."

ONLINE RESOURCES:

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

https://apsdma.ap.gov.in/

https://ndma.gov.in/

SUSTAINABILITY IN ENGINEERING PRACTICES

(Open Elective-II)

Subject Code: UGCE0T0623 **L T P C**
III Year / II Semester **3 0 0 3**

Prerequisite: Basic Knowledge of Engineering Materials

COURSE OBJECTIVES: The course is designed –

- To introduce the concepts and principles of sustainable development and their relevance to engineering practices.
- To create awareness on local and global environmental issues, waste management, and sustainable resource utilization.
- To familiarize students with tools for environmental sustainability such as EMS, LCA, EIA, and carbon accounting.
- To provide insights into sustainable habitat, urbanization, industrialization, and energy-efficient infrastructure.
- To expose students to renewable energy sources and green technologies for sustainable industrial and societal growth.

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

CO1: Describe the principles of sustainable development and critically analyze international environmental agreements, protocols, and legislative frameworks.

CO2: Evaluate contemporary environmental challenges and demonstrate appropriate strategies for the adoption and implementation of renewable energy solutions.

CO3: Examine the causes and consequences of local and global environmental issues, and propose sustainable mitigation measures.

CO4: Compare the environmental performance of conventional and sustainable urban systems, and assess industrial sustainability practices including decarbonization strategies.

CO5: Identify and appraise various renewable energy technologies and apply concepts of green engineering and green business in real-world contexts.

SYLLABUS:

UNIT-I **8 hours**

Introduction to Sustainable Engineering- Sustainable development, concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's

pyramid model, prism model, principles of sustainable development, sustainable engineering, UN Sustainable Development Goals (SDGs) and their integration into engineering practices, threats for sustainability.
Environmental Ethics and Legislations – Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

UNIT-II **8 hours**

Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, Electronic waste (E-waste) and hazardous waste management, waste to energy technology: thermo-chemical conversion, biochemical conversion.
Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

UNIT-III **6 hours**

Tools for Sustainability - Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA), environmental auditing, bio mimicking, case studies, Carbon accounting and carbon neutrality assessments.

UNIT-IV **8 hours**

Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment(GRIHA),leader ship in energy and environmental design (LEED) rating, energy efficient buildings, sustainable cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.
Sustainable Industrialization and Urbanization – Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

UNIT-V **6 hours**

Renewable energy resources- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydroplants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy, Energy storage technologies.
Green technology and Green Business: Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

Mapping of COs to POs:

POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	-	-	3	2	-	-	-	2	-	2
CO2	2	3	3	-	-	3	2	-	-	-	2	2	2
CO3	3	3	2	3	2	3	-	-	-	-	2	2	2
CO4	2	2	3	-	2	3	2	2	2	2	2	-	2
CO5	2	3	3	-	3	3	2	-	-	-	2	-	2

TEXT BOOK:

1. R.L. Ragand Lekshmi Dinachandran Remesh. Introduction to Sustainable Engineering. 2ndEdition, PHI Learning Pvt. Ltd., 2016.
2. Anubha Kaushik and C.P. Kaushik, Perspectives in Environmental Studies, New Age International Publishers, 6th Edition, 2018.
3. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, 3rd Edition, 2016.
4. A. Ravikrishnan, Environmental Science and Engineering, Sri Krishna Publications, 2017.

REFERENCES:

1. D.T.AllenandD.R.Shonnard.SustainabilityEngineering:Concepts,DesignandCaseStudies, 1st Edition, Prentice Hall, 2011.
2. A.S.Bradley,A.O.Adebayo,P.Maria.Engineeringapplicationsinsustainabledesignand development, 1st Edition, Cengage learning, 2016.

ONLINE RESOURCES :

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

WATER SUPPLY SYSTEMS
(Open Elective-II)

	L	T	P	C
Subject Code: UGCE0T0723				
III Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites: Basics of environmental engineering

Course Objectives: This course introduces the necessity and various demands for water, different sources of water including augmentation methods, and explains concepts of dual water supply and related health implications. It also teaches principles of water distribution systems and discusses industrial water requirements, quality standards, and effluent discharge regulations

Course Outcomes:
Upon completion of this course, the students will be able to:
CO1: Classify and explain the main uses of water in daily life and public activities.
CO2: Describe natural water sources and synthesize them for regular use.
CO3: Explain concepts of dual water supply, various water types and water-related health implications.
CO4: Apply principles of water distribution systems, including network design, service reservoirs, and emergency supply.
CO5: Discuss industrial water requirements, quality standards, and effluent discharge regulations.

Syllabus

UNIT-I **(10Hrs)**

WATER AND LIFE:
Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

UNIT-II

SOURCES OF WATER: **(10Hrs)**
Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

UNIT-III

DUAL SUPPLY OF WATER: **(9Hrs)**
Potable and non-potable water – Protected water – Grey water – Black water – Water bornediseases – water related diseases – Sewage Irrigation.

UNIT-IV **(10Hrs)**

DISTRIBUTION OF WATER:
Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks

of distribution– Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

UNIT-V **(10Hrs)**

INDUSTRIAL WATER:

Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water

CO_PO MAPPING

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

TEXT BOOKS:

1. K.N. Duggal, "Elements of Environmental Engineering", 7thEdition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1stEdition Mc Graw –Hill Publications, Civil Engineering Series, 1985.

REFERENCES:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rdEdition, Wiley, 2010.
3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

ENVIRONMENTAL ENGINEERING LAB

Subject Code: UGCE6P1023	**L**	**T**	**P**	**C**
III Year / II Semester	**0**	**0**	**3**	**1.5**

Prerequisites: Basics of engineering chemistry

Course Objectives: This course aims to provide practical experience in estimating important characteristics of water and wastewater in the laboratory. It also focuses on understanding the significance of these characteristics for various uses and disposal standards.

Course Outcomes:

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

CO1: Estimate key characteristics of water and wastewater through laboratory experiments

CO2: Conclude whether water is suitable for construction, drinking, or ultimate disposal based on effluent standards

CO3: Determine if a water body is polluted by referring to specified parameters

CO4: Estimate and analyze the strength of raw and treated effluents in terms of BOD, COD, pH, TDS, and chloride

SYLLABUS:

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of Total Solids, Organic Solids and Inorganic Solids and Settleable Solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.
14. Visit a Water Treatment Plant and give a technical report.

NOTE: At least 10 of the above experiments are to be conducted.

List of Equipments

1) pH meter
2) Turbidity meter
3) Conductivity meter
4) Hot air oven
5) Muffle furnace
6) Dissolved Oxygen meter
7) U–V visible spectrophotometer
8) COD Reflux Apparatus
9) Jar Test Apparatus
10) BOD incubator
11) Autoclave
12) Laminar flow chamber
13) Hazen's Apparatus

CO_PO MAPPING

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

Textbooks

1. APHA, "Standard Methods for Analysis of Water and Waste Water"
2. KVSG Murali Krishna, "Chemical Analysis of Water and Soil" Reem Publications, New Delhi

Reference

1. Relevant IS Codes.
2. Sawyer and Mc. Carty, "Chemistry for Environmental Engineering"

HIGHWAY ENGINEERING LAB

Subject Code: UGCE6P1123 **L T P C**
III Year / II Semester **0 0 3 1.5**

Prerequisite: Concepts of highway engineering and properties of materials such as aggregates are required.

COURSE OBJECTIVES: The objectives of this course are:

- To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
- To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
- To test the stability for the given bituminous mix
- To carry out surveys for traffic volume, speed and parking.

Course outcomes

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

CO 1: Conduct aggregate tests to evaluate material properties for pavement construction under standard testing conditions.
CO 2: Perform bituminous material tests to assess characteristics like penetration, ductility, and viscosity for road construction.
CO 3: Analyze traffic survey data (volume, speed, and parking studies) to assess road capacity and safety.
CO 4: Perform Marshall Stability tests to design optimal bituminous mixes for road durability and stability.
CO 5: Design road cross-sections, rotary intersections, and calculate earthworks for accurate road construction and alignment.

SYLLABU LIST OF EXPERIMENTS:

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. Bituminous mix:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

V. DESIGN & DRAWING

1. Earthwork calculations for road works
2. Drawing of road cross sections
3. Rotary intersection design

Note: Any 12 experiments from the above can be performed covering all the sections.

CO-PO MAPPING:

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

TEXTBOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

CAD LAB

(Skill oriented course)

Subject Code: UGCE6K1223 **L T P C**

III Year / II Semester **0 1 2 2**

Prerequisite: Basics of Design and drawing of reinforced concrete structures and Design and detailing of steel structures, structural analysis

COURSE OBJECTIVES: The course is designed –

- Learn the usage of any fundamental software for design
- Create geometries using pre-processor
- Analyze and Interpret the results using post processor
- Design the structural elements

Course Outcomes

After the completion of the course student should be able to

CO1: Model the geometry of real-world structure Represent the physical model of structural element/structure(L3)

CO2: Perform analysis(L4)

CO3: Interpret from the Post processing results(L4)

CO4: Design the structural elements and a system as per IS Codes(L5)

SYLLABUS:

1. Analysis & Design determinate structures using a software
2. Analysis &Design of fixed &continuous beams using a software
3. Analysis & Design of Plane Frames
4. Analysis & Design of space frames subjected to DL & LL
5. Analysis & Design of residential building subjected to all loads (DL, LL,WL,EQL)
6. Analysis & Design of Roof Trusses
7. Analysis and design of steel transmission towers
8. Design and detailing of built up steel beam
9. Developing a design program for foundation using EXCEL Spread Sheet

10. Detailing of RCC beam and RCC slab
11. Detailing of RCC Column and RCC footing

Note: Drafting of all the exercises is to be carried out using commercially available designing software's.

Mapping of COs to POs:

POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	-	-	-	3	-	-	-	-	-	3	-	-
CO2	2	3	-	-	3	-	-	-	-	-	3	-	-
CO3	2	2	2	-	3	-	-	-	-	-	3	-	-
CO4	2	3	2	-	3	-	3	-	-	-	3	-	-

TEXTBOOKS:

1. 'Limit State Design' by A. K. Jain
2. 'Reinforced Concrete Structures' by S. Unnikrishna Pillai &Devdas Menon, Tata Mc.Graw Hill, New Delhi.
3. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
4. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
5. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

REFERENCES:

1. 'Design of concrete structures' by N. Krishna Raju.
2. 'Reinforced Concrete Structures' by Park and Pauley, John Wiley and Sons.
3. 'Structural Design in Steel' by SarwarAlamRaz, New Age International Publishers, New Delhi

IS Codes:

1) IS -456-2000
2) IS – 875
3) IS 800

TECHNICAL PAPER WRITING & IPR
(Audit Course)

Subject Code: UGCE6A1323	**L**	**T**	**P**	**C**
III Year / II Semester	**2**	**0**	**0**	**0**

Prerequisites: -

Course Objectives:

1. To develop a strong foundation in the structure, style, ethics, and formats of technical and scientific writing, enabling students to effectively communicate through research papers, theses, and project reports.

2. To create awareness about intellectual property rights, including patents, copyrights, trademarks, and design rights, while sensitizing students to innovation, commercialization, and the legal aspects of research.

Course Outcomes:

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

CO1: Compose effective technical papers and reports adhering to academic and professional writing standards. (L3 – Apply)

CO2: Present technical information clearly, ethically, and effectively using various communication formats such as papers, posters, and presentations. (L3 – Apply)

CO3: Explain the process of peer review and the steps involved in publishing scholarly work in journals and conferences. (L2 – Understand)

CO4: Identify and differentiate between various types of intellectual property and explain the methods used for their protection. (L3 – Apply)

CO5: Apply knowledge of intellectual property rights to protect and commercialize innovative work in a responsible manner. (L3 – Apply)

Syllabus

UNIT-I **(10Hrs)**

Fundamentals of Technical Writing:

Basics of technical communication, Types of technical documents: research papers, project reports, theses, Structure and components of a technical paper (Abstract, Introduction, Methods, Results, Discussion), Clarity, precision, and language usage in scientific writing, Ethics in writing: plagiarism, data falsification, multiple submissions

UNIT-II

Writing for Publication: **(10Hrs)**

Selection of journal/conference, understanding journal impact factor, indexing, and scope, Manuscript preparation and formatting guidelines, Submission process and peer

review system, Responding to reviewers and revisions.

UNIT-III

Presentation and Dissemination: (9Hrs)

Preparing abstracts, posters, and oral presentations, Tools for formatting and referencing (LaTeX, MS Word, EndNote, Mendeley, Zotero), Best practices for graphical and tabular data representation, Collaboration and authorship ethics, Copyright and open-access publishing

UNIT-IV (10Hrs)

Introduction to IPR:

Definition and need for Intellectual Property, Categories: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Basic principles of patentability: novelty, non-obviousness, utility, National and international IPR organizations (WIPO, IPO, USPTO, EPO), IPR protection mechanisms in India

UNIT-V (10Hrs)

Patent Filing and Innovation Management:

Patent filing process in India and abroad, Patent search using free databases (Google Patents, Espace net, WIPO), Patent drafting basics: claims, specifications, drawings, Technology transfer and commercialization of IP, Role of incubation centers and start-up policy

CO_PO MAPPING

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

TEXT BOOKS:

1. M. Ashok Kumar & R. Murugesan, Research Methodology and IPR, Charulatha Publications.
2. R. N. Khandare, Research Methodology & IPR, S. Chand Publishing.
3. Michael Alley, The Craft of Scientific Writing, Springer.

REFERENCES:

1. B.L. Wadehra, Law Relating to Intellectual Property, Universal Law Publishing Co.
2. Day &Gastel, How to Write and Publish a Scientific Paper, Cambridge University Press.
3. Governmentof India: IPR Policy Documents and Patent Office Guidelines (available on https://ipindia.gov.in)