An Autonomous Institute
Shree Warana Vibhag Shikshan Mandal's
Tatyasaheb Kore Institute of Engineering And Technology, Warananagar
NBA Accredited Institute

Department of Civil Engineering

T. Y. B. Tech. Civil Engineering
2025-26

B. Tech. In Civil Engineering
Syllabus Structure and Curriculum under Autonomy


TATYASAHEB KORE INSTITUTE OF ENGINEERING & TECHNOLOGY
Autonomous
Warananagar

Third Year B. Tech.
Semester – I

23UGPCC-CE501-SOIL MECHANICS

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To provide a coherent development to the students for the course in the field of soil mechanics & soil improvement techniques
2. To present different soil conditions, their analysis and applications to design field as a foundation.
3. To give a practical experience in the implementation of soil properties and its behavior in the wide field of soil mechanics.
4. To involve the learning methods of soil properties improvisation by compaction, consolidation and ground improvement techniques.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand soil origin, properties, phases, and classification	Remember Understand
CO2	Analyze soil permeability, seepage, and stress in different states	Understand Analyze
CO3	Understand soil compaction, influencing factors, field control, and consolidation for construction	Understand
CO4	Understand Bousinessq and Westergaard theories, load effects, and contact pressure calculations in soils.	Understand Apply
CO5	Analyze shear strength via Mohr-Coulomb and evaluate soil strength under tests and drainage conditions.	Apply Evaluate
CO6	Understand earth pressure and Rankine's theory for cohesive and cohesionless soils with applications.	Understand Apply

Description

Soils mechanics *refers to the art of applying the mechanics of solids to the soil to predict its deformation behavior and strength. Understanding soil mechanics enables engineers and other professionals to create structures with soil and appreciate its interaction with other structures built on it. This course teaches students basic fundamentals of soil, its properties and applications to practical field. Prime focus on permeability and its calculations, fundamentals of soil compaction, methods and consolidation processes, importance of shear strength in design of structures over soil, stress developed in soil, importance of lateral soil pressure, analysis and of design vertical/abutment walls against soil pressure. This course also helps in applying different test on soil for its*

investigation, soil study in deep is essential before beginning of construction activities of any structure over it.

Prerequisites:	1:	Knowledge of different types of soil available in field
	2:	Compaction process and different types of equipment used for compaction
	3:	Calculation of stress and resultant (Engineering Mechanics)
	4.	Knowledge of derivatives and integration (Mathematics)
	5.	Properties of materials (Strength of Material)

Section – I

Unit 1	**SOIL PROPERTIES**	
	Soil phase systems, weight-volume relationship, Index properties of soil – unit weights, water content, specific gravity, void ratio, porosity, air content, degree of saturation, their relationships and significance, particle size distribution by sieve analysis and hydrometer analysis, Atter berg's consistency limits, and consistency indices, Indian standard soil classification system, Casagrande plasticity chart	**6 Hrs**
Unit 2	**PERMEABILITY AND SEEPAGE ANALYSIS**	
	Darcy's law and its validity, one dimensional permeability, factors affecting permeability of soil, determination of permeability of soil by constant head and variable head methods, seepage through soil, seepage pressure, flow net, flow net applications, uplift pressure, piping, quick sand condition, critical hydraulic gradient. concept of total stress, pore pressure and effective stress under different soil conditions.	**6 Hrs**
Unit 3	**COMPACTION AND CONSOLIDATION**	
	Process of compaction, factors affecting compaction, standard proctor test and modified proctor test as per IS 2720, zero air void line and placement water content, field compaction control, field compaction equipment with their suitability in construction work, concept of consolidation, factors affecting consolidation, Terzaghi's piston and spring model, Terzaghi's theory of one-dimensional consolidation, lab consolidation tests to find coefficient of consolidation, coefficient of volume change, compression index, coefficient of compressibility, NCC, UCC and OCC	**6 Hrs**

Section – II		
	STRESS DISTRIBUTION IN SOIL	
Unit 4	Bousinessq theory, assumptions and application to point load, strip load, circular sections, pressure distribution diagrams on horizontal and vertical plane, Radial shear stress, Isobars and pressure bulbs, use of Newmark's charts, Westergaard's theory assumptions and application to uniformly loaded rectangular area, contact pressure for different footings in different soils, equivalent point load method for stress calculation, approximate method OR (2V:1H) method for stress calculations.	**6 Hrs.**
	SHEAR STRENGTH OF SOIL	
Unit 5	Concept of shear stress and shear strength, Mohr-Coulomb's theory and failure envelopes for different types of soils such as cohesive soil, cohesionless soil, and composite soils, Terzaghi's total stress and effective stress approach, factors affecting shear strength of cohesive and cohesionless soils, determination of shear strength of soil by direct shear test, Triaxial compression test, under UU, CU & CD conditions, unconfined compression test and vane shear test.	**6 Hrs.**
	EARTH PRESSURE THEORY	
Unit 6	Concept of earth pressure, earth pressure at rest, active and passive condition, its practical applications, Rankine's earth pressure theory for cohesionless soils under dry, partially and fully submerged condition, horizontal back fill with surcharge, total lateral force on wall, Bell-Rankine's theory for cohesive soils under dry, partially and fully submerged condition, tension cracks in soil	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO1	PSO2	PSO3
CO1	1	2	2	3	2	1	-	1	-	-	-	-	1	-	-
CO2	2	3	1	2	2	2	-	-	-	-	1	-	2	-	1
CO3	2	2	3	2	1	3	1	1	-	-	1	-	2	1	1
CO4	1	3	1	2	1	-	-	-	-	-	2	-	1	-	1
CO5	1	2	3	2	1	-	-	1	-	-	-	-	2	-	-
CO6	1	2	3	2	1	2	-	1	-	-	1	-	1	-	1

REFERENCES

	Text Books
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication, 18th Edition, published in 2023
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher, 7th Edition, with 953 pages, was released as a reprint in 2022
3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker, 1st Edition 2002
4	"*Basic and Applied soil Mechanics*" - A. S. R. Rao and Gopal Ranjan, New age International Publication, 5th Edition, published in August 2023
5	"*Geotechnical Testing and Instrumentation*" - Alam Singh, CBS Publisher, 2nd Edition, 2014
6	"*Geotechnical Engineering*" - C. Venkatramaiah, New age International Publication, 6th Edition, September 1, 2018
7	"*Geotechnical Engineering*" - Purushottam Raj New age International Publication
	Reference Books
1	"*Soil Mechanics*" - Terzaghi and Peak, Jony Willey and Sons, New York, 3rd Edition March 1996
2	"*Soil Testing*" - T. W. Lambe, Willey Eastern Ltd, New Delhi, 1st Edition 1951
3.	"*Principles of Geotechnical Engineering*" – Braja M. Das & Khaled Sobhan, Cengage Learning, 10th Edition (SI edition), published in around 2021–2022
4.	"*Fundamentals of Geotechnical Engineering*" – Braja M. Das & Nagaratnam Sivakugan, Cengage Learning, 5th Edition, published in 2017/2018
5.	"*Soil Mechanics and Foundations*" – Muni Budhu, Wiley, 3rd Edition, published in 2010

23UGPCC-CE502 THEORY OF STRUCTURES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To impart principles of elastic structural analysis and behavior of indeterminate structures.
2. To analyze indeterminate structures by using different methods.
3. To make aware of the limitations of the methods of solution and their outcomes

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Remember the concept of indeterminacy and various methods of analysis	Remember
CO2	Analyze Continuous Beams with Clapeyron's 3 moment theorem	Analyze
CO3	Understand and Apply Strain Energy theorem in Indeterminate Structures	Understand Apply
CO4	Analyze Continuous Beams and Frames Using Slope-Deflection Method	Analyze
CO5	Analyze Continuous Beams and Frames Using Moment Distribution Method	Analyze
CO6	Understand and analyze matrix method for indeterminate beams	Understand Analyze

Description

Theory of Structures teaches the basic difference between statically determinate structures and Indeterminate structures, The creativity and imagination of an architect come to reality by adopting a suitable structural system. Architects should understand the basic principles and concepts of structure in order to apply the structural system suitably but Civil engineers are required to use structural design to ensure the safety and stability of the structure before they add in some creative designs into a structure for visual appeal. This course teaches different methods for analysis of indeterminate structures including frames. The advance software tools for analysis are based on basic fundamentals of these methods. The student is capable to do analysis and design of RCC structures by using fundamentals of theory of structures.

Prerequisites:	1.	Knowledge of matrices and Integration (Mathematic)
	2.	The basics of different types of beams and loadings (Applied Mechanics)
	3.	Knowledge of drawing SFD and BMD (Strength of Material)
	4.	Basic knowledge of Structural analysis methods (Mechanics of Structure)

Section – I		
Unit 1	**Introduction and Consistent Deformation Method**	
	Concept of determinacy and indeterminacy, Degrees of freedom and structural redundancy, Methods of analysis. Consistent deformation method: propped cantilever with uniform section, fixed beams	6 Hrs
Unit 2	**Clapeyron's Theorem**	
	Clapeyron's theorem of three moments, application to Continuous beams, Sinking of supports, Beams with different M.I.	6 Hrs
Unit 3	**Energy Theorems**	
	Introduction to Castiglione's theorem and unit load method (Degree of S.I. ≤ 2), application to statically indeterminate beam	6 Hrs
Section – II		
Unit 4	**Slope Deflection Method**	
	Introduction to Slope deflection equation, Modified slope deflection equation (Degree of K.I. ≤ 2) Application to continuous Beams. Concept of sinking of supports. Portal frames with and without sway.	6 Hrs.
Unit 5	**Moment Distribution Method**	
	Moment distribution method (Degree of S.I. ≤ 2), Application to continuous beam. Sinking of supports. Portal frames with and without sway	6 Hrs.

Unit 6	Matrix Methods	
	Introduction to Flexibility Method and Stiffness Method. Stiffness and flexibility coefficients, Development of stiffness and flexibility matrix, Equilibrium equations, Applications to beams and frames.	6 Hrs.

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO1	PSO2	PSO3
CO1	1	2	2	-	1	-	-	-	-	-	-	-	2	-	-
CO2	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO5	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO6	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-

REFERENCES

	Text Books
1	"Structural Analysis" - Bhavikatti, Vikas Publishing House Pvt, Ltd.
2	"Analysis of Structures" - Vazirani and Ratwani, Vol. I & II, Khanna Publishers.
3	"Mechanics of Structures" - S. B. Junnarkar, H.J. Shah, Vol-I & II, Charotar Publishers.
4	"Structural Analysis: Matrix approach - Pandit and Gupta.
	Reference Books
1	"Basic Structural Analysis" - C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi.
2	"Structural Analysis" - Devdas Menon, Narosa Publishing House.
3	"Matrix analysis of structures" - Gere & Weave.
4	"Indeterminate structural analysis" - C.K. Wang.

23UGPCC-CE503 Water Resource Engineering

Lectures	:	3* Hrs./Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To impart the basic knowledge of importance of Hydrology & irrigation in water resources development.
2. To know various hydrometeorological parameters and their estimation.
3. To create awareness about floods, their estimation using various methods.
4. To understand the importance of irrigation in Indian agricultural industry considering cropping patterns.
5. To understand the principles of watershed management and water harvesting.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Analyze hydrometrological processes and utilize advanced measurement techniques of the same	Analyze
CO2	Analyze and apply principles of evaporation, transpiration, infiltration, and runoff, including their measurement and influencing factors.	Apply, Analyze
CO3	Evaluate hydrograph parameters and flood estimation techniques for peak flow and design floods.	Evaluate
CO4	Interpret and relate groundwater occurrence and distribution in aquifers.	Apply, Analyze
CO5	Organize different methods of irrigation and water conservation.	Analyze
CO6	Understand various crops and their water requirement to estimate reservoir capacity.	Understand

Description

Water resources engineering has its roots in the tasks of supplying water for human use, removing water when humans are finished using it and developing methods of avoiding damage from excess water (floods). Much of the work of water resource engineers involves the planning and management of constructed facilities that address these tasks. Water resources engineering is the quantitative study of the hydrologic cycle -the distribution and circulation of water linking the earth's atmosphere land and oceans.

Prerequisites:	1:	Basics of Fluid Mechanics
	2:	Basic knowledge of water cycle of earth
	3:	Basic knowledge of soil water relationship

	4. Knowledge of flow of Water through open channel	
Section – I		
Unit 1	**HYDROLOGY AND PRECIPITATION:**	
	Introduction of Hydrology: Definition, Importance and scope of hydrology, Hydrologic Precipitation: Forms and types of precipitation, Methods of measurement, Rain-gauge Network, Determination of average precipitation over the catchment & its numerical Estimation of missing rainfall data, Graphical representation of rainfall - Mass rainfall curves, Rainfall hyetograph.	**6 Hrs**
Unit 2	**EVAPORATION AND RUNOFF:**	
	Evaporation: Process, Factors affecting, Measurement and control of evaporation Evaporation Transpiration: Process, factors affecting, Measurement. Infiltration: Process, Factors affecting and measurement of infiltration, Infiltration indices & its numerical. Runoff: Classification, Factors affecting runoff, Determination of runoff-empirical equations.	**6 Hrs**
Unit 3	**HYDROGRAPH AND FLOODS:**	
	Hydrograph: Components of Storm hydrograph, Base flow and Separation of base flow, Direct runoff hydrograph, Unit hydrograph – theory, assumptions and limitations, Derivation and use of unit hydrograph, Conversion of UH of different durations using Principle of Superposition. Introduction to S-curve hydrograph. Floods: Introduction of river gauging, Area velocity method. Estimation of peak flow - empirical equations, rational method. Importance of - Design flood, Standard project flood, Maximum probable flood. Introduction to Flood routing	**6 Hrs**
Section – II		
Unit 4	**GROUND WATER HYDROLOGY:**	
	Ground Water Hydrology: Classification of ground water, Darcy's law, Types of aquifers, Aquifer parameters- Porosity, Transmissibility. Hydraulics of Well: Under steady flow conditions in confined and unconfined aquifers. Introduction to Tube wells and open wells.	**6 Hrs.**

Unit 5	**IRRIGATION AND MINOR IRRIGATION WORKS:**	
	Introduction to Irrigation: Definition and necessity of irrigation, ill-effects of irrigation, Systems of irrigation - Surface, Sub-surface (Drip irrigation), Sprinkler irrigation. Minor Irrigation Works: General layout, main components and functioning of 1. Percolation tanks 2. K. T. Weir, 3. Bandhara irrigation 4. Lift irrigation	**6 Hrs.**
Unit 6	**WATER REQUIREMENTS OF CROPS:**	
	Water Requirement of Crops: Principal crops and crop patterns, Classes and availability of soil water, depth and frequency of watering. Duty, delta, base period and their relationship and numericals, factors affecting duty, methods of improving duty. Numerical on command area calculations and reservoir capacity based on crop water requirement.	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PS O1	PS O2	PS O3
CO1	2	2	-	1	1	1	-	-	-	-	1	-	1	-	-
CO2	1	2	-	2	-	-	-	-	-	-	1	-	2	-	1
CO3	2	2	-	1	1	-	-	-	-	-	1	-	2	-	-
CO4	-	1	1	1	1	-	-	-	-	-	2	-	-	-	-
CO5	-	1	-	1	1	-	-	-	-	-	1	-	1	-	1
CO6	2	2	-	-	-	-	-	-	-	-	-	-	1	-	1

REFERENCES

	Text Books
1	"Irrigation Engineering" – S. K. Garg – Khanna Publishers, Delhi.
2	"Water Resources & Irrigation Engineering" – Dr. K. R. Arora, Standard Publisher.

3	"Irrigation, Water Resources and Water Power Engineering" – Dr P.N. Modi, Standard Brookhouse.
4	"Irrigation and Water Power Engineering" – Dr. Punamia and Dr. Pande – Laxmi Publications, Delhi
5	"Engineering Hydrology" – Dr. K. Subramanya, -Tata McGraw Hill, New Delhi.
	Reference Books
1	"*Soil Mechanics*" - Terzaghi and Peak, Jony Willey and Sons, New York
2	"*Soil Testing*" - T. W. Lambe, Willey Eastern Ltd, New Delhi

23UGPEC1-CE5041 - ENVIRONMENTAL ENGINEERING

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand various sources of water and waste water with respect to the quality and quantity of water and wastewater (Sewage).
2. To understand the concept and working of various water and wastewater treatment units and its design.
3. Understand the analysis of water distribution and sewage transportation system.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Bloom's Taxonomy
CO1	Analyze and design a water supply scheme by estimating water demand, assessing quality standards, and selecting appropriate intake structures	Knowledge Analyze
CO2	Understand and apply the principles of water treatment processes, including aeration, coagulation, sedimentation, filtration, disinfection, and softening techniques, for safe and efficient water purification	Understand Apply
CO3	Analyze and design water transmission and distribution systems, including pipe network analysis, appurtenances, leakage control, and water auditing for efficient water supply management.	Analyze Design
CO4	Analyze wastewater characteristics, flow variations, sewerage system design, and pumping requirements for effective wastewater management	Understand Analyze
CO5	Understand and design primary, secondary, and low-cost wastewater treatment processes, including sludge management and sewage recycling, for sustainable wastewater treatment.	Understand Evaluate
CO6	Understand stream pollution, self-purification mechanisms, and wastewater disposal methods while ensuring compliance with MPCB and CPCB standards	Understand

Description:

Environmental Engineering is focused on analysing and understanding the quality of water and waste water. Knowledge of quality of water and waste water allows for the design of WTP and STP. Life of people is dependent on the quality of water supplied and waste water generated. One should know the transportation of water and waste water. This subject will provide the platform for the students to diversified their interest in environmental needs and their implementation. The quality standards of waste water and drinking water will create awareness among the society through civil engineering students. The awareness about major problem of river pollution will be handled effectively after understanding the environmental engineering.

Prerequisites	1	Knowledge about water quality parameters
	2	The sources of waste water generation and their collection
	3	Systems of water supply
	4	Knowledge of fluid mechanics including discharges

Section – I

Unit 1	**Introduction to water supply**	
	Data collection for water supply scheme, components and layout. Design period, factors affecting design period. Quantity: Rate of water consumption for various purposes like domestic, industrial, institutional, commercial, fire demand and water system losses, factors affecting rate of demand, Population forecasting. Quality: Water quality parameters, characteristics & significance in water treatment, drinking water quality standards- BIS, WHO Standards. Water intake structures: General design considerations, types such as river intake, canal intake and reservoir intake, Concept of rising main and pumping station.	**6 Hrs**
Unit 2	**Water treatment**	
	Principles of water treatment processes. Introduction to different types of water treatment flow sheets. Aeration: Principle and Concept, Necessity, Methods, Design of cascade aerator. concept Coagulation & Flocculation- Theory, factors affecting, destabilisation of colloidal particles, types of dosing of coagulants, selection of coagulants, jar tests, rapid mixer & flocculator, Theory of Clariflocculation. Concept of Sedimentation- Theory, types of settling, types of sedimentation tanks, principles & design steps, concept of tube & plate settler. Filtration- Mechanism, head loss development, negative head loss, Types of filters- Slow sand filter, Rapid sand filter & Pressure filter, operation & design of slow sand & rapid sand filter. Disinfection- Theory, factors affecting disinfection, types of disinfectants, types and methods of chlorination breakpoint chlorination. Water softening processes - lime-soda process, ion exchange Demineralization - Reverse osmosis, electro dialysis	**6 Hrs**
Unit 3	**Concept of Distribution reservoirs & service storages**	
	Necessity, location, head requirement, capacity determination by analytical & graphical method. Transmission of water, pumping & gravity mains, choice of pipe materials, forces acting on pressure pipes, leakage & pressure testing of pipes, thrust block concept, corrosion types & control measures.	

	Water distribution systems, method of distributing water, layout pattern, basic system requirements for water distribution system, and methods of network analysis: equivalent pipe method, Hardy-Cross method, design problem. Water supply appurtenances- sluice valve, air relief valve, gate valve, non-return valve, scour valve, fire hydrants water metre, service connections, maintenance & leak detection of water distribution system separation and Cavitation concept. Necessity of water audit, water audit in domestic sector, Pre-feasibility report and feasibility report, Concept of preparation of DPR	**6 Hrs**
Section – II		
	Components of wastewater	
Unit 4	Wastewater flows, wastewater sources and flow rate, Variations in flow rates and strength, wastewater constituents, Characteristics of Municipal wastewater, Problems on B.O.D. calculations, Quantity of stormwater. Sewerage system, Types, Layout, Types of sewers, Collection system, Appurtenances, Design of sanitary and storm water sewers, Maintenance of sewerage systems Sewage and Sludge pumping, Location, Capacity, Concept of pumping station.	**6 Hrs**
	Treatment of Wastewater	
Unit 5	Primary & Secondary Treatment-Screening, comminating, Grit removal, Oil and Grease trap Primary settling tank. Secondary Treatment-Activated sludge process, Process, design and operating parameters of ASP, modification of ASP, Operational problems, Concept of trickling filter. Sludge Treatment and disposal, Concept of anaerobic digestion, types of reactors. Low-cost wastewater treatment methods-Principles of waste stabilization pond. Design and operation of oxidation pond, Operation of aerobic & anaerobic Lagoons, Oxidation ditch, Septic tank. Selection of alternative Treatment process flow sheets, Concept of recycling of sewage	**6 Hrs**
	Stream Pollution	
Unit 6	Stream pollution, Self-Purification, DO sag curve, Streeter Philp's Equation, Stream classification, disposal of waste water methods, effluents standards for stream and land disposal as per MPCB and CPCB standards	**6 Hrs**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	2	2	-	1	1	1	3	2	2
CO2	1	3	3	2	2	2	2	2	-	-	2	2	2	2	2
CO3	2	3	3	2	2	3	2	2	-	1	1	1	3	2	2
CO4	3	3	3	2	2	3	1	2	-	1	1	1	3	2	2
CO5	1	3	3	2	2	2	2	2	-	-	2	2	2	2	2
CO6	-	2	2	1	-	2	1	1	-	-	1	-	1	1	1

REFERENCES

	Text Books
1	Environmental Engineering by Peavey, H. S. Rowe, D.R. and Tchobanoglous McGraw Hill Book Company.
2	Water Supply and Pollution Control by Viessman W and Hammer M.J. HarperCollins College Publishers.
3	Water and Waste Water Technology by Hammer M.J. Prentice-Hall of India Private ltd.
4	Water and Wastewater Technology by G.S. Birdie and J.S. Birdie
5	Water Supply by Duggal K. N, S. Chand and Company.
6	Water Supply by Garg S.K., Khanna Publishers.
7	Water Supply and Waste water Disposal by Fair and Gayes, John Wiley Publication.
	Reference Books
1	Manual on Water Supply and Treatment- Government of India Publication. -1993
2	Water and Waste Water Engineering Vol. I & II, John Wiley Publication, 1966. Fair G. M, Geyer J. C, and Okun D. A
3	Water and Wastewater Technology, Prentice Hall of India Private Limited, 1996.Hammer
4	Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development
5	Water and wastewater Technology - Hammer M.J, [Prentice-Hall of India Private ltd.]
6	Masters. G.M. Introduction to Environmental Engineering and Science

23UGMDM3-CE505 SOLID WASTE MANAGEMENT

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	1 hr./week	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand basics of municipal solid waste management generation, storage, collection, transportation, processing and disposal.
2. To study Hazardous waste management concepts storage, collection treatment to waste minimization.
3. To learn various stages from generation to disposal of Biomedical Waste, and E-Waste management.
4. To understand concept of integrated waste management with awareness of regulatory policies and promote sustainable waste management practices

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Learn basic concepts of solid waste management from source generation to waste disposal.	Remember Understand
CO2	State and explain storage, collection system, transport and different processing techniques of solid waste	Remember Understand
CO3	Describe different disposal methods of Municipal Solid Waste and concept of waste to energy.	Remember Understand
CO4	Explain concept from storage, collection treatment to waste minimization and Summarize Salient features of rules for hazardous waste management.	Remember Understand
CO5	Learn basic concepts, various stages from generation to disposal and Summarize Salient features of rules for Biomedical Waste, and E-Waste management.	Remember Understand
CO6	Illustrate concept of Integrated waste management and state features of Regulatory Framework	Remember Understand

Description

Solid waste management is a multidisciplinary field with relevance across all engineering branches. It involves the collection, transportation, processing, and disposal of waste in a manner that minimizes environmental impact and protects public health. . This course addresses conventional municipal solid waste (MSW), hazardous waste, e-waste and integrated waste management with an emphasis on environmental sustainability, regulatory policies, and technological interventions. Students will gain insights into collection, processing, treatment, disposal and sustainable management approaches aligned with current national and global standards.

Prerequisites:	1:	Basics of Environmental science.
	2:	Foundational knowledge in chemistry.
	3:	Basic engineering principles.
	4.	Basic knowledge about wastes and their impact on environment

Section – I		
Unit 1	**Introduction to Solid Waste Management**	
	Definition, scope, importance and objectives of SWM. Classification: Source based and type based. Factors affecting waste generation. Physical and chemical characteristics of municipal solid waste (MSW), Functional elements of SWM system. Public health and environmental effects of improper SWM.	**6 Hrs**
Unit 2	**Storage, Collection, Transport and Processing of Solid waste**	
	Storage-containers/collection vehicles, collection system, Transfer stations, Solid waste processing: Purpose, Different processing techniques	**6 Hrs**
Unit 3	**Disposal of Municipal Solid Waste**	
	Sanitary landfilling, Composting, vermicomposting, Incineration, pyrolysis, concept of waste to energy.	**6 Hrs**
Section – II		
Unit 4	**Hazardous Waste Management**	
	Identification, classification, characteristics and sources of hazardous waste, Storage and collection of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India, Salient features of HWM rules 2016	**6 Hrs.**
Unit 5	**Biomedical Waste, and E-Waste Management**	
	Biomedical Waste: its Sources and Categories, Stages of Medical waste disposal (Collection, Segregation Storage, Treatment, disposal), Salient features of BMW rules 2016 E-Waste: Generation, Recycling process, Disposal, Health and environmental effects, Salient features of e-waste rules 2022	**6 Hrs.**
Unit 6	**Integrated waste management and Regulatory Framework**	
	5R concept, Introduction to IWM, it's Characteristics and Benefits, Life cycle assessment-benefits and phases, public education and involvement, Salient features of SWM rules 2016.	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	3	2	2	-	-	1	1	1	3
CO2	2	-	-	-	-	1	3	2	2	-	-	1	1	1	3
CO3	2	1	-	-	-	1	3	2	2	-	-	1	1	1	3
CO4	2	-	-	-	-	1	3	2	2	-	-	2	1	1	3
CO5	2	-	-	-	-	1	3	2	2	-	-	2	1	1	3
CO6	2	-	-	-	-	1	3	3	2	2	1	2	1	1	3

REFERENCES

	Text Books
1	"Solid Waste Management" – A.D. Bhide and B.B. Sundaresan, NEERI Publications.
2	"Environmental Engineering Vol. II" – S.K. Garg, Khanna Publishers.
3	"Solid and Hazardous Waste Management" – M.N. Rao and Razia Sultana, Oxford & IBH Publishing Co. Pvt. Ltd.
4	"Environmental Engineering" – H.S. Peavy, D.R. Rowe, and G. Tchobanoglous, McGraw Hill Education.
5	"Environmental Engineering" – G. S. Birdie and J.S. Birdie, Dhanapat Rai Publications.
6	"Solid Waste Management: Principles and Practice" – Ramesha Chandrappa and Das D.B., Springer Publications.
	Reference Books
1	"Manual on Municipal Solid Waste Management" – Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India
2	"Environmental Engineering" – Metcalf & Eddy, McGraw Hill Education.
3	"Environmental Pollution Control Engineering" – C.S. Rao, New Age International Publishers.
4	"Environmental Science and Engineering" – Henry and Heinke, Prentice Hall India.

23UGOE2-CE5061 OPTIMIZATION TECHNIQUES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To introduce the fundamental concepts and significance of optimization techniques in engineering and decision-making processes.
2. To enable students to formulate and solve linear programming problems using graphical and simplex-based methods, including duality and sensitivity analysis.
3. To develop the ability to analyze and solve real-world operational problems such as transportation, assignment, inventory, and queuing systems using mathematical models
4. To familiarize students with advanced topics like simulation, forecasting, and decision theory for effective planning under uncertainty and risk.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the importance of optimization in engineering applications and formulate linear programming problems for graphical solutions.	Remember Understand
CO2	Apply simplex-based techniques such as the Simplex Method and Big M Method, and analyze optimization problems using duality and sensitivity analysis	Understand Apply
CO3	Solve transportation problems using various initial basic feasible solution methods and understand the basics of nonlinear programming.	Understand Analyze
CO4	Develop decision-making models using assignment problems, decision theory, and decision trees to support effective organizational planning	Remember Understand
CO5	Analyze competitive situations using game theory and design inventory models under deterministic and probabilistic conditions	Understand Analyze
CO6	Apply queuing theory and simulation techniques to model and analyze service systems, and use forecasting methods for future demand estimation	Understand Apply

Description

Optimization Technique *introduces students to key optimization techniques used in engineering, operations research, and decision-making. It covers linear programming methods such as graphical, simplex, and Big M techniques, along with duality and sensitivity analysis. Students will learn to solve real-world problems through transportation and assignment models, decision theory, game*

theory, and inventory models. The course also includes topics like queuing theory, simulation, and forecasting methods to handle uncertainty in planning and resource allocation. By the end of the course, students will be able to model and solve various optimization problems and apply appropriate techniques for improved efficiency and decision-making in engineering systems.		
Prerequisites:	1:	Basic knowledge of matrices, calculus, and differential equations to understand optimization formulations
	2:	Understanding of vector spaces, linear transformations, and matrix operations used in linear programming models
	3:	Familiarity with basic probability, distributions, and statistical analysis for modeling uncertainty in decision-making

Section – I		
Unit 1	**Basics of Optimization & LP**	
	Introduction: Importance of optimization techniques, Linear programming: Formulation, graphical solution	**6 Hrs**
Unit 2	**Simplex, Duality & Sensitivity**	
	Simplex method, Big M Method (Only theory), Duality, Sensitivity analysis.	**6 Hrs**
Unit 3	**Transportation & Nonlinear Programming**	
	Transportation problems: Finding IBFS by N-W corner rule, Least Cost method and VAM method, Optimization, Introduction to nonlinear programming.	**6 Hrs**
Section – II		
Unit 4	**Assignment & Decision Theory**	
	Assignment problems, Decision theory, decision tree.	**6 Hrs.**
Unit 5	**Game Theory & Inventory Models**	
	Game theory, Inventory models -deterministic model, probabilistic model.	**6 Hrs.**
Unit 6	**Queuing, Simulation & Forecasting**	
	Queuing theory, simulation applications, Forecasting techniques	**6 Hrs.**

Term Work:

At least one assignment based on each unit.

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	3	2	2	1	2	1	1	1	1	1	1	2	2	1	2
CO2	3	2	3	2	2	1	1	1	1	1	1	2	2	1	2
CO3	3	2	2	2	2	1	1	1	1	1	1	2	2	2	2
CO4	2	2	2	2	2	2	1	2	2	2	2	3	1	3	3
CO5	3	2	2	2	2	2	2	1	2	2	2	3	2	3	3
CO6	3	2	2	2	3	1	2	1	2	2	2	3	2	3	3

REFERENCES

	Text Books
1	"Operations Research" – S.D. Sharma, Kedarnath Ramnath Publishers
2	"Operations Research" – Kanti Swarup, P.K. Gupta & Man Mohan, Sultan Chand & Sons
3	"Optimization Techniques" – C. Ranganathan, SCITECH Publications
4	"Engineering Optimization" – S.S. Rao, New Age International Publishers
5	"Operations Research: An Introduction" – Hamdy A. Taha, Pearson Education
	Reference Books
1	"Introduction to Optimization" – Pablo Pedregal, Springer
2	"Operations Research: Theory and Practice" – A. Ravindran, D.T. Phillips & J.J. Solberg, Wiley
3	"Quantitative Techniques in Management" – N.D. Vohra, McGraw Hill Education
4	"Operations Research" – J.K. Sharma, Macmillan Publishers

23UGPCC-CE501P – SOIL MECHANICS (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 50 Marks

Course Objectives: The objective of the course is to
1) To introduces different types of soils and their properties 2) To familiar different types of tests to be conducted on soil to study their behavior. 3) To understand difference between field tests and lab tests on soil. 4) To evaluate and study significance of soil testing

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Understand various equipment's used for evaluation of soil properties	Knowledge, Apply
CO2	Apply the testing on field soil in both disturbed and undisturbed conditions	Apply
CO3	Analysis of soil properties such as Index Properties, Engineering properties, permeability, compaction, shear strength	Analyze
CO4	Understanding of result specifications for various experiments on soil.	Understand

PRACTICALS

A] Performance of at least eight experiments from the following:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Determination of specific gravity by pycnometer Or density bottle method	2	Knowledge
02	Determination of water content by oven drying method & Pycnometer method	2	Knowledge
03	Particle size distribution by dry sieve analysis	2	Knowledge, Analyze
04	Particle size distribution by hydrometer analysis	2	Knowledge, Analyze

05	Determination of consistency limits (LL, PL, SL)	2	Knowledge
06	Determination of field density by core cutter method	2	Knowledge, Analyze
07	Determination of field density by sand replacement method	2	Analyze
08	Determination of MDD & OMC by standard/Modified proctor test	2	Analyze
09	Determination of coefficient of permeability by variable head method/Constant head method (Any one)	2	Analyze
10	Determination of shear strength parameters of soil by using direct shear test	2	Analyze
11	Determination of shear strength of soil using Triaxial, Unconfined compression test and Vane shear test (Any one)	2	Analyze

B] One assignment on each unit with minimum five numerical in each assignment

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	2	3	1	1	1	1	-	-	-	-	-	-	1	-	1
CO2	1	2	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	1	2	2	3	2	1	-	-	-	-	-	-	1	-	1
CO4	1	1	2	1	2	1	-	-	-	-	-	-	-	-	1

REFERENCES

	Text Books
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher
3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker
	Reference Books
1	"Soil Mechanics in Engineering Practice,', Karl Von Terzaghi, Wiley-Inter science; 3rd edition
2	Geotechnical engineering: principles and practices of soil mechanics and foundation engineering, V. N. S. Murthy
3	"Principles of Geotechnical Engineering", Braja M. Das, California State University, Sacramento, Cengage India Private Limited; Ninth edition

23UGPCC-CE502P – THEORY OF STRUCTURES (Lab)

Practical's: 2 hrs. / week
Credits: 1

Examination Scheme:
ISA: 25 Marks

Course Objectives: The objective of the course is to
1. To impart principles of elastic structural analysis and behavior of indeterminate structures.
2. To analyze indeterminate structures by using different methods.
3. To make aware of the limitations of the methods of solution and their outcomes

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Remember the concept of indeterminacy and various methods of analysis	Remember
CO2	Analyze Continuous Beams with Clapeyron's 3 moment theorem	Analyze
CO3	Understand and Apply Strain Energy theorem in Indeterminate Structures	Understand Apply
CO4	Analyze Continuous Beams and Frames Using Slope-Deflection Method	Analyze
CO5	Analyze Continuous Beams and Frames Using Moment Distribution Method	Analyze
CO6	Understand and analyze matrix method for indeterminate beams	Understand Analyze

PRACTICALS

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Introduction to Statically Indeterminate Structures and Method of Consistent Deformations	2	Remember
02	Practice problems on two span beams using three Moment Equation (Clapeyron's Theorem)	2	Analyze

03	Practice problems on propped cantilever and fixed beams by using principles of Strain Energy method	2	Understand Apply
04	Practice problems on two span beams and frames using Slope Deflection Method	2	Analyze
05	Practice problems on two span beams and frames using Moment Distribution Method	2	Analyze
06	Practice problems on two span beams and frames using Matrix methods	2	Understand Analyze

Term work shall comprise of at least one assignment on each unit with minimum 5 numerical

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	2	2	-	1	-	-	-	-	-	-	-	2	-	-
CO2	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO5	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO6	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-

REFERENCES

	Text Books
1	"Structural Analysis" - Bhavikatti, Vikas Publishing House Pvt, Ltd.
2	"Analysis of Structures" - Vazirani and Ratwani, Vol. I & II, Khanna Publishers.
3	"Mechanics of Structures" - S. B. Junnarkar, H.J. Shah, Vol-I & II, Charotar Publishers.
4	"Structural Analysis: Matrix approach - Pandit and Gupta.
	Reference Books
1	"Basic Structural Analysis" - C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi.
2	"Structural Analysis" - Devdas Menon, Narosa Publishing House.
3	"Matrix analysis of structures" - Gere & Weave.
4	"Indeterminate structural analysis" - C.K. Wang.

23UGPCC-CE503P WATER RESOURCE ENGINEERING (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
1) To familiarize the students with determination of average annual rainfall (AAR) 2) To Introduce the students with different infiltration losses. 3) To familiarize the students with Ground water hydrology 4) To introduce the student with minor irrigation structures.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Determine different infiltration losses like Phi-index, W- Index	Knowledge, Apply
CO2	Understand unit hydrograph using method of superposition and S- curve technique	Analyze
CO3	Understand concept of minor irrigation structures	Understand Analyze
CO4	Determine crop water requirement	Knowledge, Apply

PRACTICALS

Performance of at least eight experiments from the following:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Determination of average annual rainfall using Thiessens polygon & Isohytal map method	2	Apply
02	Consistency of rain gauge station by double mass rainfall curves.	2	Knowledge Apply
03	Determination of evaporation losses, effective rainfall hyetograph infiltration losses – Phi index calculation, Horton's infiltration curve.	2	Apply
04	To develop a unit hydrograph from a total runoff	2	Knowledge,

	hydrograph resulting from isolated storms.		Analyze
05	Alteration of base period of given unit hydrograph using method of superposition and S-curve technique	2	Knowledge
06	Determination of well discharge in a confined and unconfined aquifer.	2	Analyze
07	Layout of Percolation tank, K. T. Weir, Bandhara Irrigation, Lift Irrigation	2	Analyze
08	Estimating depth and frequency of irrigation on the basis on soil moisture regime concept.	2	Knowledge, Analyze
09	Crop water requirement and irrigation command area calculations	2	Knowledge, Analyze
10	Site visit & report on meteorological station	2	Knowledge,
11	Calculation of Total agricultural water requirement of nearby village-Mini project	2	Apply

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	2	1	1	1	-	1	-	-	-	-	-	-	1	-	1
CO2	2	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	1	2	-	1	1	-	-	-	-	-	-	-	-	-	1

REFERENCES

	Text Books
1	"Irrigation Engineering" – S. K. Garg – Khanna Publishers, Delhi.
2	"Water Resources & Irrigation Engineering" – Dr. K. R. Arora, Standard Publisher.
3	"Irrigation, Water Resources and Water Power Engineering" – Dr P.N. Modi, Standard book House.
	Reference Books
1	"Irrigation Engineering" - Raghunath, Wiley Eastern Ltd, New Delhi.
2	"Irrigation Theory and practice" - Michael, Vikas Publications House.
3	"Water management" - Jaspal Sing, M. S. Acharya, Arun Sharma, Himanshu Publications.

23UGPEC1-CE5041 P – ENVIRONMENTAL ENGINEERING (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
1) To familiarize the students with the quality of water and waste water. 2) To familiarize the students design concept of WTP & STP 3) To understand working of WTP & STP

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Determine different properties like pH, Hardness, Acidity, Alkalinity, Chlorides of water and waste water.	Analyze
CO2	Understand distribution of Water and collection of waste water	Analyze
CO3	Visit clarify the working of various units	Analyze
CO4	Explain the Treatment concept of water and wastewater	Understand Analyze

PRACTICALS

A] Performance of at least eight experiments from the following:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
1	Determination of pH of drinking and waste water	2	Analyze
2	Determination of Alkalinity drinking and waste water	2	Analyze
3	Determination of Solids in drinking and waste water	2	Analyze
4	Determination of Chlorides in drinking and waste water	2	Analyze
5	Determination of Dissolved Oxygen (DO) of drinking water	2	Analyze

6	Determination of Biochemical Oxygen Demand (BOD) of waste water	2	Analyze
7	Determination of Chemical Oxygen Demand (COD) of waste water	2	Analyze
8	Determination of Sulphates in waste water	2	Analyze
9	Determination of Oil & grease in waste water	2	Analyze
10	Determination of Volatile acids in waste water	2	Analyze
11	Design/Analysis problems on Water and sewerage system and treatment system,	2	Knowledge Apply
12	Visit to Water Treatment Plant and sewage treatment plant & visit report.	2	Knowledge Apply

B] One assignment on each unit with minimum five numerical in each assignment

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	2	1	1	1	--	--	--	---	--	--	---	--	--	---	--
CO2	2	1	2	2	--	--	--	---	--	--	---	--	--	---	--
CO3	--	2	2	--	--	--	--	---	--	--	---	--	--	---	--
CO4	--	2	--	--	--	--	--	---	--	--	---	--	--	---	--

REFERENCES

	Text Books
1	Water Supply by Garg S.K., Khanna Publishers.
2	Water Supply and Wastewater Disposal by Fair and Gayes, John Wiley Publication.
3	Water Supply Engineering by B.C.Punmia,Ashok Jain,Arun Jain, Laxmi Publications
	Reference Books
1	Manual on Water Supply and Treatment- Government of India Publication. -1993.
2	Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development
3	. "Water and Waste Water Engineering Vol. I & II", John Wiley Publication, 1966. Fair G. M, Geyer J. C, and Okun D. A

Third Year B. Tech.
Semester - II

23UGPCC-CE601 REINFORCED CONCRETE STRUCTURES

Lectures	:	3 Hrs./Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Practical	:	2 Hrs./Weak	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand the concept of RCC structural design.
2. To conceive the elementary, deign of different structural elements.
3. To study the concept of torsion.
4. To impart knowledge of strength determination of different kinds of R.C. elements using I.S. Code.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the basic data (Basic Mechanics, Mathematics, and structural analysis) required for design of flexural concrete members	Understand
CO2	Understand the design process for shear and bond	Understand
CO3	Understand the design of RCC members subjects to torsion	Analyze
CO4	To evaluate loads on slab and design of slabs	Evaluate
CO5	Understand analysis and design of compression members	Apply
CO6	Understand the design process for isolated rectangular footing	Evaluate

Description

Design of reinforced concrete structures *is an introductory design course in civil engineering. In this course, basic elements governed by bending, shear, axial forces or combination of them are identified and are considered as building blocks of the whole structure. Different methods of design will be briefly described before introducing the limit states of collapse and serviceability. The design will be done as per IS 456:2000.*

Prerequisites:	1:	Knowledge of concrete technology and its engineering properties.
	2:	Fundamental concept of stresses, strains, deflections etc.
	3:	Different types geometrical shapes, centroid, center of gravity, moment of inertia calculations.
	4.	Units and conversions

Section – I

FUNDAMENTALS OF RCC STRUCTURES

Unit 1	Introduction to R.C.C., Stress-Strain behavior of concrete, Different design philosophies of RCC structures Various Limits States, Characteristic Strength and Characteristic Load, Load, `Factor, Partial Safety Factors, Limit State of Collapse (Flexure) -Analysis and design of singly reinforced beam and design of doubly reinforced beam	**6 Hrs.**
Unit 2	**ANALYSIS AND DESIGN OF FLANGED BEAMS**	
	Types of flanged beams, stress strain analysis of flanged beams, Criteria to calculate width of flange, analysis and design of symmetrical T and L beams using IS – 456-2000	**6 Hrs.**
Unit 3	**LIMIT STATE OF COLLAPSE (SHEAR AND BOND)**	
	Shear failure, Types of Shear reinforcement, Design of Shear reinforcement, Bond-types, Factors affecting bond Resistance, Check for development length. (No Numerical on bond).	**6 Hrs.**
Section – II		
Unit 4	**DESIGN OF SLABS**	
	Cantilever Slab, Simply Supported One way slab Simply Supported Two-way slab with different support conditions as perIS: 456-2000, Design of Simply Supported single flight Dog-legged staircase.	**6 Hrs.**
Unit 5	**DESIGN OF COLUMNS**	
	General aspects, Effective length of column, loads on column, Slendernessratio for column, Maximum and Minimum eccentricity, Codal provisions,Design of short axially loaded columns, Design of columns subjected combined axial load and uni-axial bending using SP-16.	**6 Hrs.**
Unit 6	**DESIGN OF FOOTING**	
	Design of isolated rectangular column footing with constant depth subjected to axial load and moment.	**6 Hrs.**

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable PSO 1	PSO 2	PSO 3
CO1	2	2	1	-	1	-	-	-	-	-	1	-	1	-	-
CO2	2	2	1	-	1	-	-	-	-	-	1	-	1	-	-
CO3	2	3	1	-	1	-	-	-	-	-	1	-	1	-	-
CO4	2	3	2	-	1	-	-	-	-	-	1	-	1	-	-
CO5	1	2	2	-	1	-	-	-	-	-	1	-	1	-	-
CO6	1	1	2	-	1	-	-	-	-	-	1	-	1	-	-

REFERENCES

	Text Books
1	IS 456-2000, SP-16 & Relevant Special publications of BIS
2	Limit state theory and Design of Reinforced Concrete 8th Edition – Karve and Shah, Structures publications, Pune
3	Reinforced Concrete Limit State Design, 7th Edition — A. K. Jain Nem Chand's brothers, Roorkee
4	Fundamentals of Reinforced Concrete –N C Sinha and S K Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
5	Reinforced Concrete Design - B. C. Punamia Laxmi publications New Delhi
6	Reinforced Concrete Design-M. L. Gambhir Mc Millan India Ltd. New Delhi
	Reference Books
1	Limit State Design of Reinforced Concrete P. C. Varghese, Prentice Hall, New Delhi

23UGPCC-CE602 BUILDING PLANNING AND DESIGN

Lectures	:	3Hrs/Week	**Evaluation Scheme**	
Credit	:	2	**ISE**	: 40Marks
Tutorials	:	--	**ESE**	: 60Marks

Course Objectives: The objective of the course is to

1. Study fundamentals of building and its classification.
2. Understand site selection criteria, Orientation and Principles of building planning.
3. Learn scope and content of NBC India and building bye laws.
4. Understand different units of Residential Buildings, their requirement and Planning of residential Buildings.
5. Study building services such as plumbing, electrification.
6. Learn building finishes as plastering, pointing and painting.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain fundamentals of building and its classification	Remember
CO2	Illustrate site selection criteria, Orientation and Principles of building planning.	Understand
CO3	Describe NBC India and building bye laws	Remember Understand
CO4	Develop layout of different units of Residential Buildings as per requirement.	Understand Apply
CO5	State and explain plumbing and electrification as building services.	Remember Understand
CO6	Discuss building finishes as plastering, pointing and painting.	Remember Understand

Description

Civil engineering deals with development of different Infrastructures. Building Construction is one of the important sectors in Infrastructure development.

Planning and designing of building requires understanding and apply concepts of site selection criterions, principles of building planning, byelaws, rules and regulations etc. For effective working, structure requires different building services and finishes.

Prerequisites:	1.	Components of building.
	2.	Building Construction materials.
	3:	Technical Drawing Concepts.
	4.	Basic requirements of a building.

Section–I		
Unit 1	**Fundamentals of Buildings:** Building, its classification based on 'nature of occupancy, and their scope: Residential, Educational, Institutional, Assembly, Business, Mercantile, Industrial, Storage, Hazardous. Classification of building based on 'Fire resistance': TYPE I, TYPE II, TYPE III, and TYPE IV. Classification of building based on 'Built in Environment and naturality': Natural, Green or Sustainable, Intelligent. Classification of Residential building and their advantages and disadvantages: Detached, Semidetached, Row houses, Block of flats and Duplex type house.	6 Hrs
Unit 2	**Site selection, Orientation, Principles of building planning:** Site selection and factors affecting Orientation, factors affecting, Orientation criteria for Indian conditions, Sun and wind diagram with their significance. Principles of Building planning.	6 Hrs
Unit 3	**NBC of India, Building plan approval, Building Bye Laws:** NBC of India 2016, scope and content Building plans approval as per NBC. Significance of different certificates: Commencement, Plinth completion, Building completion and occupancy certificate. Building Bye Laws: Introduction, objectives, principles underlying, different building bye laws	6 Hrs
Section–II		
Unit 4	**Planning of Residential Building:** Introduction to residential buildings and considerations in planning. Different units for various activities in residential building, their purpose, dimension and other requirement, develop general layout of different units considering principles of planning.	6 Hrs.
Unit 5	**Building Services:** Introduction: Plumbing services, water distribution systems and considerations, material and sizes for service pipes, service connection, storage tank. House drainage, pipes and traps, sanitary fittings, system of plumbing for vertical drainage, septic tank, and House drainage plan. Electrification: Types – Open and Concealed, requirements and location of points, Concept and types of earthing.	6 Hrs.
Unit 6	**Building Finishes:** Plastering: objectives and requirements, types of mortar for plastering, Terminology, procedure of plastering, defects in plastering. Pointing: Mortar requirements, preparation of surface, method and types of pointing. Paints and Painting: Characteristics of ideal paint, constituents of paint, Classification and types of paints, defects in painting.	6 Hrs.

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	1	1	-	-	1	-	1	1	-	1
CO2	2	-	1	-	-	2	1	-	-	1	-	1	1	-	1
CO3	2	-	1	-	-	1	1	-	-	1	-	2	1	-	1
CO4	3	1	1	-	-	2	1	-	1	1	-	1	1	-	1
CO5	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO6	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-

REFERENCES

	Text Books
1.	"Building Planning and Drawing" – Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publications.
2.	"Building Construction" - B. C. Punamia, Laxmi Publications.
3.	"A Text Book of Building Construction" - S.P. Arora, S.P. Bindra, Dhanapat Rai Publications.
4.	"A to Z of Practical Building Construction and Its Management"- Sandeep Mantri, Satya Prakashan, New Delhi.
	Reference Books
1.	"Building Drawing with an integrated approach to Built-Environment" - Shah, Kale and Patki, Tata McGraw Hill publication
2.	"Basic Civil Engineering" - G. K. Hiraskar, Dhanpat Rai Publications.
3.	"Practical Handbook – Buiding baandhkam Va dekhrekh Part I and II", Pramod Beri, DIT publication, third edition. (Marathi Language).
	Codes of standard
1.	SP 7- National Building Code of India, 2016, Group 1 to 5 - B.I.S., New Delhi.
2.	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.

23UGPCC-CE603 DESIGN OF STEEL STRUCTURES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand the behavior of elements of steel structure.
2. To understand the design concept of steel structure.
3. To have sense of design of professional ethics

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand different types of welded and bolted connections by using necessary elements for analyzing steel structures.	Remember
CO2	Evaluate axially loaded tension member along with its end connection	Evaluate
CO3	List and describe essential elements necessary to analyze and design of compression member.	Remember
CO4	Analyze and design axially and eccentrically loaded columns along with its different types of column bases.	Analyze
CO5	Analyze and design laterally supported and unsupported beams with their end connections.	Analyze
CO6	Calculate forces acting on gantry girder and its design as laterally unsupported beam.	Apply

Description:

The course deals with design of steel structures using "Limit State Design Method". The design methodology is based on the latest Indian Standard Code of Practice for general construction (IS 800:2007). The subject covers all the necessary components such as material specifications, connections and elementary design of structural members for designing industrial steel structures. The course provides material specifications and design considerations. It provides relevant material properties of different types of steel. This course teaches the design of trusses for small and long scale for industrial structures.

Prerequisites	1	Students should locate centroid and find MI of any cross-section.
	2	Students must be able to find effective length and slenderness ratio
	3	Students must be able to draw SFD and BMD for given loading
	4	Capable to evaluate bending moments, axial forces and shear forces
	5	Knowledge of welding and bolting process

Section – I		
Unit 1	**Introduction & Connections**	
	Design Philosophy, comparison of LSM &WSM, advantages and disadvantages of steel structures, types of steel structures, grades of structural steel, various rolled steel sections, Types of bolts & welds, analysis and Design of axially and eccentrically loaded bolted and welded connections (subjected to bending and torsion). Loads and load combinations, partial safety factors for load and materials, load calculation for roof trusses.	**6 Hrs**
Unit 2	**Tension Member based on IS: 800-2007**	
	Common sections, Net area, modes of failure, load carrying capacity, Design of axially loaded tension members, Design of end connections (Bolted and welded).	**6 Hrs**
Unit 3	**Design of Compression Member based on IS: 800-2007**	
	Common sections, economical sections, effective length, slenderness ratio, modes of failure, Classification of cross section, behavior of compression member, Load carrying capacity & Design of compression members	**6 Hrs**
Section – II		
Unit 4	**Column & Footing**	
	Design of column subjected to Axial load Design of lacing system, battening system and column splices Design of slab bases & gusseted base subjected to axial load Design of slab bases & gusseted base subjected to eccentric load	**6 Hrs**
Unit 5	**Design of Beams**	
	Types of sections, behavior of beam in flexure, Design of laterally supported, unsupported beams and built-up beam using flange plates, curtailment of flange plates Check for deflection, shear, web buckling & web crippling, Secondary and main beam arrangement, beam to beam connections	**6 Hrs**
Unit 6	**Gantry Girder**	
	Forces acting on gantry girder, commonly used sections, design of gantry girder as laterally unsupported beam, connection details	**6 Hrs**

:

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	1	2	2	-	1	-	-	-	-	-	-	-	2	-	-
CO2	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO4	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO5	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-
CO6	2	2	3	-	1	-	-	-	-	-	-	-	3	-	-

REFERENCES

	Text Books
1	IS 800:2007-BIS
2	"Handbook on steel-SP6" BIS
3	"IS – 875, Part - III" -BIS.
4	"Design of Steel Structures (By Limit State Method As Per Is 800—2007" – S.S.Bhavikatti, I K International Publishing House, New Delhi
5	Limit State Design of Steel Structures: *V. L. Shah and* Veena Gore, Stuctures Publication, Pune
	Reference Books
1	Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi
2	Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House
3	Design of Steel Structures: K.S. Sairam, Pearson
4	Limit state design in structural steel: Dr. M. R. Shiyekar, PHI publications
5	Vajrani V. N., Ratwani M. M. and Mehra H. Design and Analysis of Steel Structures, Oscar Publications

PROFESSIONAL ELECTIVE - II

23UGPEC2-CE6041-ADVANCE FOUNDATION ENGINEERING

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Practical	:	2 Hrs./Weak	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to
1. Understand the importance and basics of foundations in the civil engineering projects
2. Evaluate the load bearing capacity and settlement of foundations by classical theories.
3. Analyze the geotechnical aspects of deep foundations
4. To learn dynamic analysis of foundations for industrial machines
5. Understand the concepts of the stability of slopes and study various methods of evaluating the of slopes stability
6. To study the types & analysis process for earth & water retaining structures

Course Outcomes (CO):

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand and analyze shallow and raft foundations with emphasis on settlement, bending moments, and IS Code methods.	Understand Analyze
CO2	Understand the principles of bearing capacity evaluation, foundation design in weak soils, and various soil stabilization techniques and their applications.	Remember Evaluate
CO3	Analyze and design pile foundations, focusing on capacity, group behavior, and installation techniques.	Analyze
CO4	Understand and design machine foundations, focusing on dynamic loadings, vibration analysis, and IS code design criteria for various machine types.	Analyze Design
CO5	Analyze slope stability, failure modes, and design sheet pile foundations using various methods to evaluate safety factors and prevent landslides	Understand Analyze
CO6	Understand and apply design methods for well foundations, caissons, cofferdams, stone columns, and geosynthetics.	Remember Understand

Description

Advanced Foundation Engineering *focuses on the design and analysis of various foundation systems, including shallow foundations, piles, machine foundations, and specialized structures like rafts and cofferdams. The subject covers key topics such as bearing capacity, soil stabilization, slope stability, and dynamic load considerations. It also delves into advanced techniques for evaluating soil behavior, foundation performance, and the application of relevant IS Code standards. Practical aspects like construction methods, installation techniques, and safety measures for foundations in challenging soils are also discussed.*

Prerequisites:	1:	Knowledge of soil properties and their analysis
	2:	Concept of foundations and its constructions
	3:	Different types of earthen structures, stress and resultant calculations

Section – I		
Unit 1	**SHALLOW AND RAFT FOUNDATIONS**	
	Types & shapes of shallow foundation, minimum depth of foundation, Concept of proportioning of footings (Isolated), calculation of immediate and consolidation settlement, foundation on slopping ground etc. Dimensional analysis of rectangular & Trapezoidal combined footings, Introduction to raft or mat foundation, necessity & types of rafts, floating foundation & problems associated with floating foundation,	**6 Hrs**
Unit 2	**BEARING CAPACITY AND SOIL STABILIZATION**	
	Definitions, Modes of failure, Terzaghi's bearing capacity theory, I.S. Code method of bearing capacity evaluation & computation (IS 6403), effect of various factors on bearing capacity (Size & Shape, Depth, WT), Bearing capacity evaluation from plate load test, S.P.T. (By I.S. Code method) and Menards pressure meter tests. Introduction to soil stabilization, methods of stabilization & their applications - mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization & stabilization by grouting	**6 Hrs**
Unit 3	**PILE FOUNDATIONS**	
	Introduction, necessity, advantages and detail classification of piles, Single pile capacity evaluation by static and dynamic methods for cohesive and cohesion less soil, pile load test. negative skin friction, Group action of files, efficiency of group of piles, Feld's rule, Seiler-Keeney formula, Converse-Labarre formula etc. calculation of group capacity of pile in cohesive soil, under reamed pile – its application and installation techniques	**6 Hrs**
Section – II		
Unit 4	**MACHINE FOUNDATIONS**	
	Introduction to machine foundation, types of machine foundations, terms related to dynamic loadings, static and dynamic design criteria, SDOF System etc., Permissible amplitude of vibrations for different types of machines, calculation of probable amplitude, amplitude ratio, maximum amplitude, coefficient of uniform compression index etc. criteria for design of machine foundations, design criteria for foundations of reciprocating machines (IS2974-Part-I), design criteria for foundations of impact type machines (IS2974-Part-II), Vibration Isolation & Its methods, vibration effects on soil etc.	**6 Hrs.**

Unit 5	**SLOPES AND STABILITY ANALYSIS**	
	Slope classification, forces responsible for slope failure, modes of failure. infinite slope in cohesive and cohesion less soil, Taylor's stability number, Swedish slip method, method of slices and concept of friction circle method to evaluate factor of safety for slope, concept of land slide and its preventive measures.	**6 Hrs.**
Unit 6	**WELL FOUNDATIONS AND COFFER DAMS**	
	Element of wells, Types of well foundations, methods of construction, Tilt and shift, Remedial measures, Pneumatic Caissons: Sinking method - Sand Island method, Caisson disease, cofferdam and common types of cofferdams, Braced cofferdam, Stone columns, Vibroflotation, Preloading technique, Civil engineering application of geo synthetics, Geo textile & geomembrane	**6 Hrs.**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	3	2	2	-	3	-	1	-	-	1	-	3	-	-
CO2	2	3	3	3	1	1	-	1	-	-	-	-	2	-	-
CO3	1	3	3	2	-	3	-	-	-	-	-	-	3	-	-
CO4	2	3	2	1	2	1	2	-	-	-	1	-	2	-	-
CO5	1	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO6	1	3	1	1	2	1	1	-	-	-	1	-	1	1	2

REFERENCES

	Text Books
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher
3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker
4	"*Basic and Applied soil Mechanics*" - A. S. R. Rao and Gopal Ranjan, New age International Publication
5	"*Foundation Engineering Handbook- I*", Van Nostrand Reinhold Company, 1975 by Winterkorn H.F. and Fang H. Y
6	*"Foundation Analysis & Design"*, by Joseph Bowles, McGraw-Hill Education; 5th edition
7	"*Advance Foundation Engineering*", by T. G. Sitharam, CRC Press, 1st Edition 2019
8	*"Soil Mechanics & Foundation Engineering"*, by V. N. S. Murthy, CBS Publishers & Distributors.
	Reference Books
1	*"Soil Mechanics"* - Terzaghi and Peak, Jony Willey and Sons, New York
2	*"Soil Testing"* - T. W. Lambe, Willey Eastern Ltd, New Delhi
3	Dynamics and Vibrations, A. K. Chopra,

PROFESSIONAL ELECTIVE - III

23UGPEC3-CE6051 CONSTRUCTION MANAGEMENT

Lectures	:	3* Hrs./Week	**Evaluation Scheme**		
Credit	:	2	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is..

1. To provide basic knowledge on management of construction work.
2. To make able to plan and schedule of resources required in construction projects.
3. To provide basic knowledge of contract management, equipment management and economics in construction project management.
4. To understand and apply safety measures on construction project site.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand project management concept, identify roles of different agencies in construction industry.	Knowledge Understand
CO2	Draw the network and compute activity times and event times for the given construction project.	Understand Apply
CO3	Understand analyze and apply construction resources and quality management in construction project management.	Understand Apply
CO4	Understand the basics of contracts, tenders and E-tendering.	Knowledge Apply
CO5	Understand equipment management and various costs associated with construction equipments.	Knowledge Apply
CO6	Acquainted with construction safety, identify causes of accidents and apply relevant labour laws in construction industry.	Understand Apply

Description

Civil engineering projects are costly and involve various resources like men, materials, machinery, time and money. Construction management is a versatile subject which deals with understanding of various aspects of engineering projects. Students learn construction management skills including planning, scheduling, monitoring, construction resource and quality management, contract management, construction equipments and safety aspects on construction project sites. The valuable insights and awareness about work behavior parameters like safety, health hazards are created during construction project management.

Prerequisites:	1:	Basic knowledge of project management concept, including planning, scheduling.
	2:	Understanding how to manage construction resources, negotiate contracts and tenders with client and suppliers.
	3:	Understanding basics of legal enforcements and legal things in general activities.

	4.	Ability to identify safety hazards and implement solution to avoid accidents, in construction. Also, too familiar with safety practices and procedures.	
Section – I			
Unit 1	**CONSTRUCTION MANAGEMENT FRAME WORK**		
	Construction project management- Objectives, Phases, Agencies, Project life cycle, Relation between Client, Consultant and Contractor. Work Break down structure.		**6 Hrs**
Unit 2	**CONSTRUCTION PLANNING AND SCHEDULING**		
	Introduction to construction planning scheduling, Identifying broad activities in construction work and allotting time, Development of Bar charts, Activity cost and time estimation in CPM and PERT, Precedence network diagrams, Control of schedule- Earn value management.		**6 Hrs**
Unit 3	**CONSTRUCTION RESOURCE AND QUALITY MANAGEMENT**		
	Objectives, Inventory control techniques – EOQ, ABC, SED, VED analysis. Statistical quality control charts, Sampling techniques, Quality management Quality circle, ISO: 9000 and ISO: 21500.		**6 Hrs**
Section – II			
Unit 4	**CONTRACT MANAGEMENT**		
	Contracting, Basic elements of contracts, Types of contracts, Conditions of contracts, Tendering process- Preparation of tender notice, Tender documents, Submission-Scrutiny and acceptance two envelop method, Invitation of tenders, Types of tenders, E-tendering.		**6 Hrs.**
Unit 5	**EQUIPMENT MANAGEMENT AND ECONOMICS IN CONSTRUCTION**		
	Extent of Mechanization, Forecasting equipment requirement Selection of construction equipments, Hourly work rate, Owing cost –Investment, Depreciation and major repair costs, Operating costs- cost of fuel, lubrication, Servicing and maintenance, Replacement of equipment.		**6 Hrs.**
Unit 6	**SAFETY IN CONSTRUCTION**		
	Importance of safety in construction industry- Causes of accidents, Remedial and preventive measures, Safety policy, Safety organization, Various safety equipments (PPEs) used on construction sites, Labor laws related to construction industry.		**6 Hrs.**

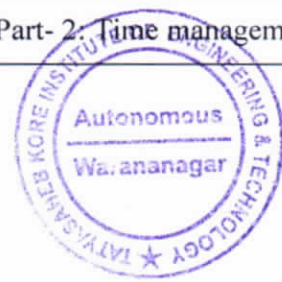
CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	1	-	1	-	2	1	-	-	1	-	1	-	1	2	-
CO2	1	2	-	-	2	2	-	-	-	-	1	1	1	1	-
CO3	1	2	-	-	1	2	-	-	-	-	1	1	1	1	-
CO4	1	-	-	-	-	2	1	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-
CO6	1	-	1	-	-	2	-	2	-	2	1	-	-	-	-

REFERENCES

	Text Books
1	"Construction planning and management" – P. S. Gahlot, B.M. Dhir New age International Pvt. Ltd. 3Rd edition.2024.
2	"Industrial engineering and management" – S.C. Sharma, T.R. Banga, Khanna book publication. Cop. Ltd. Edition.2017.
3	"Construction engineering and management" – Dr. S. Seetharaman Umesh publication 5Th edition.
4	"Project planning and control with PERT and CPM" – B. C. Punamia Laxmi publication.
5	"PERT and CPM principles and applications" – L.S. Shrinath affiliated by east – west pvt. Ltd
6	"Building and engineering contracts. Patil, S.P Woolhouse, 7Th edition Taylor and Francis group Pune (India) May. 2019
7	"Contract-I" Dr. R. K. Bangias, Allahabad law agency, 8Th edition.2021
8	"Estimation costing specification and valuation in civil engineering" – M. Chakrabarti, M.K. Publishers and distrubutres.24Th edition.2010.
9	"Construction equipment and its management" – S. C. Sharma Khanna publishers 7Th edition 2014.

Reference Books	
1	"Engineering management" – Stoner Pearson publication.
2	"Construction project management" K. K. Chitkara, TATA McGraw hill Publication Pvt Ltd.
3	"Industrial engineering and management" O. P. Khanna, Dhanapat Rai Publication.
4	Indian Contract Act, https://www.indiacode.nic.in/
5	Dr. Roshan Namavati, Professional Practice: With Elements of Estimating, Valuation, Contract and Arbitration, Lakhani Book Depot, 1January2016.
6	F.H.Kellogg, Construction Methods & Machinery, Prentice-HallInc. NewYork, January1,1955
7	Philippe Pire and Benoît Legrand, Building Construction Manual, Nov2013.
8	IS 15883-1:2009 Construction project management – Guidelines, Part- 1: General
9	IS 15883-2:2013 Construction project management – Guidelines, Part- 2: Time management



23UGMDM4-CE606 TOWN PLANNING

Lectures : 2 Hrs./Week
Credit : 2

Evaluation Scheme
ISA : 50 Marks

Course Objectives: The objective of the course is to,
1)Understand basics of town planning. 2)Knowledge regarding development pattern of town. 3)Learn development control rules. 4)Meaning of village planning.

Course Outcomes (CO):

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	To understand necessity, scope & principles of town planning.	Remember Understand
CO2	To get knowledge regarding various development pattern of town.	Understand Remember
CO3	To learn development control rules of town planning.	Understand Apply
CO4	To understand methods of village planning	Understand Apply

Description

Students learn about the planning and design of all the new buildings, roads, and parks in a place in order to make them attractive and convenient for the people who live there, Also formulate master plans to ensure sustainable urban development in notified urban areas.

Prerequisites:	1:	Basics of town planning.
	2:	Development control rules,

Unit 1	**INTRODUCTION TO TOWN PLANNING**	
	a) Necessity, scope & principles of town planning. Brief history, Greek & Roman towns, planning in ancient India – Indus valley civilization, Pre-independence & post-independence period. Present status of town planning in India. b) Contribution of town planner in modern rea such as Sir Patric Geddes, Sir Ebenezer Howard, Clarene stein, Sir Patric Abercrombie.	**6 Hrs**

Unit 2	**DEVELOPMENTS IN TOWN PLANNING**	
	a) Growth pattern of towns- natural & Planned, Elements of town, Types of zoning & importance, Urban roads- traffic problem in cities, various road networks (Grid pattern, Shoe string development, etc.) Surveys of data collection, physical, social, economic, civic, etc. Analysis of data, Town aesthetics, Landscape architecture. b) Layout of residential units, neighborhood unit planning, Rehabilitation of slum & urban renewal.	**6 Hrs**
Unit 3	**DEVELOPMENT CONTROL RULES**	
	a) Development rules with respective of town planning b) M.R.T.P. Act & Land Acquisition Act	**6 Hrs.**
Unit 4	**VILLAGE PLANNING**	
	a) Village planning- Necessity & Principles. b) Village re-development project, Preparation of development plan, General principles of rural housing design.	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	3	-	-	-	-	1	-	-	-	-	-	1	-	-	-
CO2	3	-	-	-	-	1	-	-	1	-	-	1	-	-	-
CO3	2	2	1	-	-	2	2	1	-	1	1	1	1	-	-
CO4	2	2	1	-	-	2	2	1	1	-	-	1	-	-	1

REFERENCES

Text Books	
1	Town and country Planning-G.K. Hiraskar& K. G. Hiraskar, By Dhanpat Rai Publication (p) Ltd.
2	Town Planning- S.C.Rangawala, Charotar Publications, Pune.
Reference Books	
1	MRTP Act 1966
2	Rural development Planning - Design and method: Misra S.N., Satyalian Publications New Delhi.

Vocational and Skill Enhancement Course (VSEC)

23UGVSEC-CE6071 – Civil Software

Lecture: 1 Hr./week
Practical's: 2 hrs. / week
Credits: 2

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
Enhance software skill required for various civil engineering field such as: Structural engineering, Construction management, Surveying, Environmental engineering, Geotechnical engineering, Transportation engineering, etc.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Able to understand industry standard software in professional set up.	Knowledge, Apply
CO2	Understand basic concepts of software.	Knowledge
CO3	Understand applications in field.	Knowledge
CO4	Performing analysis for design.	Analyze
CO5	Interpret result for final output.	Analyze
CO6	Develop customized design automation tool.	Apply

Student should select & perform any one software course from the following:

SOFTWARES

Sr. No.	Name of Software	Field
01	BIM	Architecture/ Construction management/Structural engineering
02	STAAD pro	Structural engineering
03	ETABS	Structural engineering

04	Microsoft Project	Construction management
05	Primavera	Construction management
06	Arc GIS	Surveying
07	Q GIS	Surveying
08	MATLAB	Environmental engineering
09	Mir	Geotechnical engineering
10	PLAXIS and FLAC	Geotechnical engineering,
11	PTV Viscum	Transportation engineering

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	1	1	1	1	1	1	1	2	1	---	--
CO2	1	-	-	-	1	-	1	1	1	1	1	2	--	1	--
CO3	1	-	-	-	1	-	1	1	1	1	1	2	--	---	1
CO4	-	2	2	1	1	-	-	-	-	1	-	2	--	1	--
CO5	-	2	1	1	1	-	-	-	-	1	-	2	1	---	--
CO6	1	-	-	-	1	1	1	1	1	1	1	2	1	---	--

EVALUATION SCHEME

1. Student should complete the any one course mention as above individually in semester as per their area of interest.
2. Course conduction facility available in campus OR out of campus.
3. Submit course completion certificate before the term end of semester VI
4. Based on course completion certificate and analysis by experts student will get Satisfactory OR Unsatisfactory remark

23UGPCC-CE602P - REINFORCED CONCRETE STRUCTURES

Practical's: 2 hrs. / week

Credits: 1

Examination Scheme:

ISA: 25 Marks

POE: 25 Marks

Course Objectives: The objective of the course is to

1. To introduces different types of stresses, strains, analysis and design of singly reinforced beams, L and T beams.
2. To calculate the shear reinforcement in beams.
3. To understand the concept of combined bending and torsion.
4. To analysis and design of different types of slabs.
5. To understand the design of column.
6. To calculate the design of footings.

Course Outcomes (CO):

COs	At the end of successful completion of the practical's the student will be	Blooms Taxonomy
CO1	Able to understand basic properties of RCC structures and solve singly, L and T beams design problems.	Analyze
CO2	Analyze and design shear reinforcement in beams.	Analyze
CO3	Understand and able to evaluate combined bending and torsion.	Understand Analyze
CO4	Understand the design of different types of slabs.	Understand Analyze
CO5	Analyze and design of column.	Analyze
CO6	Calculate the design of footings.	Analyze

PRACTICALS

A] At least one assignment on each unit

Sr. No.	Assignment	Hrs.	Bloom's Taxonomy
01	Assignment No. 1: FUNDAMENTALS OF RCC STRUCTURES	2	Knowledge Analyze
02	Assignment No. 2: LIMIT STATE OF COLLAPSE (SHEAR AND BOND)	2	Knowledge Analyze
03	Assignment No. 3: LIMIT STATE OF COLLAPSE IN TORSION	2	Knowledge, Analyze
04	Assignment No. 4: DESIGN OF SLABS	2	Knowledge, Analyze
05	Assignment No. 5: DESIGN OF COLUMNS	2	Knowledge
06	Assignment No. 6: DESIGN OF FOOTING	2	Knowledge, Analyze

B] One assignment on each unit with minimum five numerical in each assignment

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	2	2	1	-	1	-	-	-	-	-	1	-	1	-	-
CO2	2	2	1	-	1	-	-	-	-	-	1	-	1	-	-
CO3	2	3	1	-	1	-	-	-	-	-	1	-	1	-	-
CO4	2	3	2	-	1	-	-	-	-	-	1	-	1	-	-
CO5	1	2	2	-	1	-	-	-	-	-	1	-	1	-	-
CO6	1	1	2	-	1	-	-	-	-	-	1	-	1	-	-

REFERENCES

	Text Books
1	IS 456-2000, SP-16 & Relevant Special publications of BIS
2	Limit state theory and Design of Reinforced Concrete 8th Edition – Karve and Shah, Structures publications, Pune
3	Reinforced Concrete Limit State Design, 7th Edition — A. K. Jain Nem Chand's brothers, Roorkee
4	Fundamentals of Reinforced Concrete –N C Sinha and S K Roy, S. Chand and company Ltd. Ram Nagar, New Delhi
5	Reinforced Concrete Design - B. C. Punamia Laxmi publications New Delhi
6	Reinforced Concrete Design-M. L. Gambhir Mc Millan India Ltd. New Delhi
	Reference Books
1	Limit State Design of Reinforced Concrete P. C. Varghese, Prentice Hall, New Delhi

UGCEPCC602P – BUILDING PLANNING AND DESIGN

Practical: 2 hrs. / week
Credits: 1

Examination Scheme:
ISA: 25 Marks

Course Objectives: The objective of the course is to
1. Study fundamentals of building and its classification.
2. Understand site selection criteria, Orientation and Principles of building planning.
3. Learn scope and content of NBC India and building bye laws.
4. Understand different units of Residential Buildings, their requirement and Planning of residential Buildings.
5. Study building services such as plumbing, electrification.
6. Learn building finishes as plastering, pointing and painting.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Explain fundamentals of building and its classification	Remember
CO2	Illustrate site selection criteria, Orientation and Principles of building planning.	Understand
CO3	Describe NBC India and building bye laws	Remember Understand
CO4	Develop layout of different units of Residential Buildings as per requirement.	Understand Apply
CO5	State and explain plumbing and electrification as building services.	Remember Understand
CO6	Discuss building finishes as plastering, pointing and painting.	Remember Understand

PRACTICALS

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Assignment Based on unit no.1	4	Remember
02	Assignment Based on unit no.2	4	Understand
03	Assignment Based on unit no.3	4	Remember Understand

04	Assignment Based on unit no.4	4	Understand Apply
05	Assignment Based on unit no.5	4	Remember Understand
06	Assignment Based on unit no.6	4	Remember Understand

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	2	-	-	-	-	1	1	-	-	1	-	1	1	-	1
CO2	2	-	1	-	-	2	1	-	-	1	-	1	1	-	1
CO3	2	-	1	-	-	1	1	-	-	1	-	2	1	-	1
CO4	3	1	1	-	-	2	1	-	1	1	-	1	1	-	1
CO5	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO6	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-

REFERENCES

	Text Books
1.	"Building Planning and Drawing" – Dr. N. Kumara Swamy, A. Kameswara Rao, Charotar Publications.
2.	"Building Construction" - B.C.Punmia, Laxmi Publications.
3.	"A Text Book of Building Construction" - S.P. Arora, S.P. Bindra, Dhanpat Rai Publications.
4.	"A to Z of Practical Building Construction and Its Management"- Sandeep Mantri, SatyaPrakashan, New Delhi.
	Reference Books
1.	"Building Drawing with an integrated approach to Built-Environment" - Shah, Kale and Patki, Tata Mcgraw Hill publication
2.	"Basic Civil Engineering" - G. K. Hiraskar, DhanpatRai Publications.
3.	"Practical Handbook – Buiding baandhkam Va dekhrekh Part I and II" - Pramod Beri, DIT publication, third edition. (Marathi Language).

Codes of standard	
1.	SP 7- National Building Code of India, 2016, Group 1 to 5 - B.I.S., New Delhi.
2.	I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.

23UGPEC2-CE6041 P ADVANCE FOUNDATION ENGINEERING (Tutorial)

Lectures	:	0	**Evaluation Scheme**	
Credit	:	1	**ISA**	: 25 Marks
Practical	:	2 Hrs./Week	**POE**	: 25 Marks

A] Minimum one Assignment on each CO by considering understanding of concepts and skills to solve engineering problems wherever applicable.

No of Assignment	CO	Description
Assignment No-01	CO-01	Concepts and Problems on shallow foundations
Assignment No-02	CO-02	Concepts and Problems on Bearing capacity
Assignment No-03	CO-03	Concepts and Problems on Pile foundations
Assignment No-04	CO-04	Concepts and Problems on Machine foundations
Assignment No-05	CO-05	Concepts and Problems on Slope Stability
Assignment No-06	CO-06	Concepts on Well Foundations

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	3	2	2	-	3	-	1	-	-	1	-	3	-	-
CO2	2	3	3	3	1	1	-	1	-	-	-	-	2	-	-
CO3	1	3	3	2	-	3	-	-	-	-	-	-	3	-	-
CO4	2	3	2	1	2	1	2	-	-	-	1	-	2	-	-
CO5	1	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO6	1	3	1	1	2	1	1	-	-	-	1	-	1	1	2

B] Seminar on any topic with advances in foundation Engineering OR Site visit to foundation site

23UGPEC3-CE6051 P – CONSTRUCTION MANAGEMENT (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme
ISA: 25 Marks
POE: ---

Course Objectives: The objective of the course is
1) To familiarize students with construction management framework, project management tools i.e planning, scheduling in construction project management. 2) To understand analyze and apply construction resources and quality management. 3) To know the basics of contracts, tenders and E- tendering. 4) To understand and apply equipment management and safety on construction project management

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be able to**	**Blooms Taxonomy**
CO1	Understand project management framework, project management tools , draw and evaluate network for estimating time and cost.	Knowledge Understand
CO2	Analyze and apply construction resources and quality in construction project management.	Understand Apply
CO3	Understand the basics of contracts, tenders and E-tendering.	Understand Apply
CO4	Understand equipment management and get acquainted with safety in construction.	Understand Apply

ASSIGNMENTS/PRACTICALS

A] Write six assignments/practicals mentioned below:

Sr. No.	Assignments/ Practical's/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Construction Project management concept, Objectives, Phases, Agencies, Project life cycle, Relation between client, consultant and contractor WBS.	4	Knowledge Understand
02	Introduction to construction planning, scheduling, Bar chart, CPM Network: Elements of network development, CPM time estimates, Forward & Backward pass, CPM and PERT concept and numerical. Precedence network and earn value management.	4	Understand Apply
03	Construction resource and quality management: Objectives, inventory control techniques EOQ, ABC,	4	Understand Apply

	SDE, VED analysis, SQC, sampling techniques, Quality management, ISO: 9000, ISO:21500.		
04	Contracting, basic elements of contracts, types of contracts, conditions of contracts, tendering process, tender notice preparation, tender documents, types of tenders, invitation of tender, Submission- scrutiny & acceptance two envelop method, E-tendering.	4	Knowledge Apply
05	Equipment management, mechanization, equipment requirement, selection of construction equipments, hourly work rate, cost associates with construction equipments, Depreciation calculation : Straight line and Diminishing balance method, Replacement of equipments	4	Knowledge Apply
06	Safety in construction: Importance, causes of accidents, Remedial and preventive measures, Safety policy, Safety organization, PPEs, Labour laws related to construction industry.	4	Understand Apply

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	3	-	-	2	1	-	-	-	-	2	-	2	1	-
CO2	1	3	-	-	1	2	-	-	-	-	1	-	1	2	-
CO3	1	-	-	-	-	2	-	-	-	-	-	-	2	-	-
CO4	1	-	-	-	1	2	-	1	-	-	2	1	-	-	-

REFERENCES

	Text Books
1	"Construction planning and management" – P. S. Gahlot, B.M. Dhir New age International Pvt. Ltd. 3Rd edition.2024.
2	"Industrial engineering and management" – S.C. Sharma, T.R. Banga, Khanna book publication. Cop. Ltd. Edition.2017.
3	"Project planning and control with PERT and CPM" – B. C. Punmia Laxmi publication.
4	"Contract-I" Dr. R. K. Bangias, Allahabad law agency, 8Th edition.2021
	Reference Books
1	"Engineering management" – Stoner Pearson publication.
2	"Construction project management" K. K. Chitkara, TATA McGraw hill Publication Pvt Ltd.

23UGPCC-CE608P – STRUCTURAL DESIGN AND DRAWING-I (Lab)

Practical's: 2 hrs. / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
1. To analyze and design steel structures. 2. To prepare the working drawing for various structural elements.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Analyse and design various types of bolted and welded structural connections in accordance with relevant codes and standards.	Analyze
CO2	Explain the behavior of structural sections under axial tension and compression, and design tension and compression members.	Explain, Design
CO3	Analyze and design steel columns, flexural members, and their individual elements for structural performance.	Analyze, design
CO4	Apply structural analysis and design software tools to simulate and solve practical engineering problems.	Apply
CO5	Develop detailed working drawings and structural layouts in compliance with project specifications and execution requirements.	Develop

Term Work

Term work shall comprise of Detailed structural design and drawing of the following steel structure along with necessary drawings by limit state method analysis. (Max group size should not exceed four students)

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Design of industrial building and Preparation of all working drawings.	2	Design
02	Analysis and design of Purlin	2	Analyze, Design

03	Analysis and design of Bracings	2	Analyze, Design
04	Analysis and design of Gantry Girder	2	Analyze, Design
05	Analysis and design of Column	2	Analyze, Design
06	Analysis and design of Column bases and connections	2	Analyze, Design
07	Analysis of building frame manually with drawings	2	Analyze
08	Design of building frame manually with drawings	2	Design
09	Analysis of building frame and by using any FEM based software with drawings	2	Analyze
10	Design of building frame and by using any FEM based software with drawings	2	Design

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	2	2	2	1	1	-	-	-	-	-	-	2	-	-
CO2	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO3	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO4	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO5	-	-	3	2	1	1	-	-	-	-	-	-	3	-	-

REFERENCES

Text Books	
1	"Limit State Design of Steel Structures" - Duggal S.K., Tata McGraw-Hill Education private Ltd., New Delhi, 2nd Edition 2014
2	"Design of Steel Structures: By Limit State Method as Per IS: 800 – 2007" - Bhavikatti S. S., I K International Publishing House.
3	"Limit State Design in Structural Steel" - Shiyekar M. R, 2nd Edition, PHI Publisher
4	"Design of Steel Structures" - Dayaratnam, Wheeler Publications, New Delhi.
5	"Design of Steel Structures" – B. C. Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication

Reference Books	
1	"LRFD Steel Design" - William T. Segui, PWS Publishing
2	"Design of Steel Structures" - Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, Mc-Graw Hill
3	"Design of Steel Structures" - Mac. Ginely T.
4	"Design of Steel Structures" - Kazimi S. M. and Jindal R. S., Prentice Hall India.
5	"Design of Steel Structures" - Breslar, Lin Scalzi, John Willey, New York
6	"Steel Structure" - Controlling Behaviour Through Design, Englekirk, WILEY.
I.S. Codes	
1	IS: 800 – 2007
2	IS: 875 (part I, II and III)
3	SP6 (1) & SP 6 (6),
4	IS: 816
5	IS: 808.

Dr. R. V. Kajave
Member Secretary
Board of Studies

Dr. D. M. Patil
Chairman
Board of Studies

Dr. K. I. Patil
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KORE INSTITUTE OF ENGINEERING & TECHNOLOGY ★ TATYASAHEB
Autonomous
Warananagar

Dr. D. N. Mane
Principal
T.K.I.E.T Warananagar

COURSE OFFERED
BUCKET LIST

Multidisciplinary Courses (MDM)

Semester – V

Solid Waste Management

(23UGMDM3-CE505)

Semester – VI

Town Planning

(23UGMDM4-CE606)

23UGMDM3-CE505 SOLID WASTE MANAGEMENT

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	1 hr./week	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

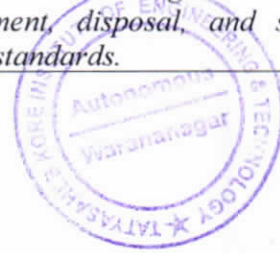
1. To understand basics of municipal solid waste management generation, storage, collection, transportation, processing and disposal.
2. To study Hazardous waste management concepts storage, collection treatment to waste minimization.
3. To learn various stages from generation to disposal of Biomedical Waste, and E-Waste management.
4. To understand concept of integrated waste management with awareness of regulatory policies and promote sustainable waste management practices

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Learn basic concepts of solid waste management from source generation to waste disposal.	Remember Understand
CO2	State and explain storage, collection system, transport and different processing techniques of solid waste	Remember Understand
CO3	Describe different disposal methods of Municipal Solid Waste and concept of waste to energy.	Remember Understand
CO4	Explain concept from storage, collection treatment to waste minimization and Summarize Salient features of rules for hazardous waste management.	Remember Understand
CO5	Learn basic concepts, various stages from generation to disposal and Summarize Salient features of rules for Biomedical Waste, and E-Waste management.	Remember Understand
CO6	Illustrate concept of Integrated waste management and state features of Regulatory Framework	Remember Understand

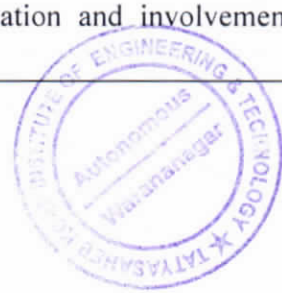
Description

Solid waste management is a multidisciplinary field with relevance across all engineering branches. It involves the collection, transportation, processing, and disposal of waste in a manner that minimizes environmental impact and protects public health. . This course addresses conventional municipal solid waste (MSW), hazardous waste, e-waste and integrated waste management with an emphasis on environmental sustainability, regulatory policies, and technological interventions. Students will gain insights into collection, processing, treatment, disposal, and sustainable management approaches aligned with current national and global standards.



Prerequisites:	1:	Basics of Environmental science.
	2:	Foundational knowledge in chemistry.
	3:	Basic engineering principles.
	4.	Basic knowledge about wastes and their impact on environment

Section – I		
Unit 1	**Introduction to Solid Waste Management**	
	Definition, scope, importance and objectives of SWM. Classification: Source based and type based. Factors affecting waste generation. Physical and chemical characteristics of municipal solid waste (MSW), Functional elements of SWM system. Public health and environmental effects of improper SWM.	**6 Hrs**
Unit 2	**Storage, Collection, Transport and Processing of Solid waste**	
	Storage-containers/collection vehicles, collection system, Transfer stations, Solid waste processing: Purpose, Different processing techniques	**6 Hrs**
Unit 3	**Disposal of Municipal Solid Waste**	
	Sanitary landfilling, Composting, vermicomposting, Incineration, pyrolysis, concept of waste to energy.	**6 Hrs**
Section – II		
Unit 4	**Hazardous Waste Management**	
	Identification, classification, characteristics and sources of hazardous waste, Storage and collection of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India, Salient features of HWM rules 2016	**6 Hrs.**
Unit 5	**Biomedical Waste, and E-Waste Management**	
	Biomedical Waste: its Sources and Categories, Stages of Medical waste disposal (Collection, Segregation Storage, Treatment, disposal), Salient features of BMW rules 2016 E-Waste: Generation, Recycling process, Disposal, Health and environmental effects, Salient features of e-waste rules 2022	**6 Hrs.**
Unit 6	**Integrated waste management and Regulatory Framework**	
	5R concept, Introduction to IWM, it's Characteristics and Benefits, Life cycle assessment-benefits and phases, public education and involvement, Salient features of SWM rules 2016.	**6 Hrs.**



CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO1	PSO2	PSO3
CO1	2	1	-	-	-	1	3	2	2	-	-	1	1	1	3
CO2	2	-	-	-	-	1	3	2	2	-	-	1	1	1	3
CO3	2	1	-	-	-	1	3	2	2	-	-	1	1	1	3
CO4	2	-	-	-	-	1	3	2	2	-	-	2	1	1	3
CO5	2	-	-	-	-	1	3	2	2	-	-	2	1	1	3
CO6	2	-	-	-	-	1	3	3	2	2	1	2	1	1	3

REFERENCES

	Text Books
1	"Solid Waste Management" – A.D. Bhide and B.B. Sundaresan, NEERI Publications.
2	"Environmental Engineering Vol. II" – S.K. Garg, Khanna Publishers.
3	"Solid and Hazardous Waste Management" – M.N. Rao and Razia Sultana, Oxford & IBH Publishing Co. Pvt. Ltd.
4	"Environmental Engineering" – H.S. Peavy, D.R. Rowe, and G. Tchobanoglous, McGraw Hill Education.
5	"Environmental Engineering" – G. S. Birdie and J.S. Birdie, Dhanapat Rai Publications.
6	"Solid Waste Management: Principles and Practice" – Ramesha Chandrappa and Das D.B., Springer Publications.
	Reference Books
1	"Manual on Municipal Solid Waste Management" – Central Public Health & Environmental Engineering Organization (CPHEEO), Ministry of Urban Development, Government of India
2	"Environmental Engineering" – Metcalf & Eddy, McGraw Hill Education.
3	"Environmental Pollution Control Engineering" – C.S. Rao, New Age International Publishers.
4	"Environmental Science and Engineering" – Henry and Heinke, Prentice Hall India.

23UGMDM4-CE606 TOWN PLANNING

Lectures : 2 Hrs./Week
Credit : 2

Evaluation Scheme
ISA : 50 Marks

Course Objectives: The objective of the course is to,
1)Understand basics of town planning. 2)Knowledge regarding development pattern of town. 3)Learn development control rules. 4)Meaning of village planning.

Course Outcomes (CO):

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	To understand necessity, scope & principles of town planning.	Remember Understand
CO2	To get knowledge regarding various development pattern of town.	Understand Remember
CO3	To learn development control rules of town planning.	Understand Apply
CO4	To understand methods of village planning	Understand Apply

Description

Students learn about the planning and design of all the new buildings, roads, and parks in a place in order to make them attractive and convenient for the people who live there, Also formulate master plans to ensure sustainable urban development in notified urban areas.

Prerequisites:	1:	Basics of town planning.
	2:	Development control rules,

Unit 1	**INTRODUCTION TO TOWN PLANNING**	
	a) Necessity, scope & principles of town planning. Brief history, Greek & Roman towns, planning in ancient India – Indus valley civilization, Pre-independence & post-independence period. Present status of town planning in India. b) Contribution of town planner in modern rea such as Sir Patric Geddes, Sir Ebenezer Howard, Clarene stein, Sir Patric Abercrombie.	**6 Hrs**

Unit 2	**DEVELOPMENTS IN TOWN PLANNING**	
	a) Growth pattern of towns- natural & Planned, Elements of town, Types of zoning & importance, Urban roads- traffic problem in cities, various road networks (Grid pattern, Shoe string development, etc.) Surveys of data collection, physical, social, economic, civic, etc. Analysis of data, Town aesthetics, Landscape architecture. b) Layout of residential units, neighborhood unit planning, Rehabilitation of slum & urban renewal.	**6 Hrs**
Unit 3	**DEVELOPMENT CONTROL RULES**	
	a) Development rules with respective of town planning b) M.R.T.P. Act & Land Acquisition Act	**6 Hrs.**
Unit 4	**VILLAGE PLANNING**	
	a) Village planning- Necessity & Principles. b) Village re-development project, Preparation of development plan, General principles of rural housing design.	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO1	PSO2	PSO3
CO1	3	-	-	-	-	1	-	-	-	-	-	1	-	-	-
CO2	3	-	-	-	-	1	-	-	1	-	-	1	-	-	-
CO3	2	2	1	-	-	2	2	1	-	1	1	1	1	-	-
CO4	2	2	1	-	-	2	2	1	1	-	-	1	-	-	1

REFERENCES

	Text Books
1	Town and country Planning-G.K. Hiraskar& K. G. Hiraskar, By Dhanpat Rai Publication (p) Ltd.
2	Town Planning- S.C.Rangawala, Charotar Publications, Pune.
	Reference Books
1	MRTP Act 1966
2	Rural development Planning - Design and method: Misra S.N., Satvahan Publications New Delhi.

Multidisciplinary Courses

Open Elective - II

Semester – V

1. Optimization Techniques

(23UGOE2-CE5061)

2. Maintenance, Retrofitting, Rehabilitation of Structure

(23UGOE2-CE5062)

23UGOE2-CE5061 OPTIMIZATION TECHNIQUES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To introduce the fundamental concepts and significance of optimization techniques in engineering and decision-making processes.
2. To enable students to formulate and solve linear programming problems using graphical and simplex-based methods, including duality and sensitivity analysis.
3. To develop the ability to analyze and solve real-world operational problems such as transportation, assignment, inventory, and queuing systems using mathematical models
4. To familiarize students with advanced topics like simulation, forecasting, and decision theory for effective planning under uncertainty and risk.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the importance of optimization in engineering applications and formulate linear programming problems for graphical solutions.	Remember Understand
CO2	Apply simplex-based techniques such as the Simplex Method and Big M Method, and analyze optimization problems using duality and sensitivity analysis	Understand Apply
CO3	Solve transportation problems using various initial basic feasible solution methods and understand the basics of nonlinear programming.	Understand Analyze
CO4	Develop decision-making models using assignment problems, decision theory, and decision trees to support effective organizational planning	Remember Understand
CO5	Analyze competitive situations using game theory and design inventory models under deterministic and probabilistic conditions	Understand Analyze
CO6	Apply queuing theory and simulation techniques to model and analyze service systems, and use forecasting methods for future demand estimation	Understand Apply

Description

Optimization Technique *introduces students to key optimization techniques used in engineering, operations research, and decision-making. It covers linear programming methods such as graphical, simplex, and Big M techniques, along with duality and sensitivity analysis. Students will learn to solve real-world problems through transportation and assignment models, decision theory, game*

theory, and inventory models. The course also includes topics like queuing theory, simulation, and forecasting methods to handle uncertainty in planning and resource allocation. By the end of the course, students will be able to model and solve various optimization problems and apply appropriate techniques for improved efficiency and decision-making in engineering systems.		
Prerequisites:	1:	Basic knowledge of matrices, calculus, and differential equations to understand optimization formulations
	2:	Understanding of vector spaces, linear transformations, and matrix operations used in linear programming models
	3:	Familiarity with basic probability, distributions, and statistical analysis for modeling uncertainty in decision-making

Section – I		
Unit 1	**Basics of Optimization & LP**	
	Introduction: Importance of optimization techniques, Linear programming: Formulation, graphical solution	**6 Hrs**
Unit 2	**Simplex, Duality & Sensitivity**	
	Simplex method, Big M Method (Only theory), Duality, Sensitivity analysis.	**6 Hrs**
Unit 3	**Transportation & Nonlinear Programming**	
	Transportation problems: Finding IBFS by N-W corner rule, Least Cost method and VAM method, Optimization, Introduction to nonlinear programming.	**6 Hrs**
Section – II		
Unit 4	**Assignment & Decision Theory**	
	Assignment problems, Decision theory, decision tree.	**6 Hrs.**
Unit 5	**Game Theory & Inventory Models**	
	Game theory, Inventory models -deterministic model, probabilistic model.	**6 Hrs.**
Unit 6	**Queuing, Simulation & Forecasting**	
	Queuing theory, simulation applications, Forecasting techniques	**6 Hrs.**

Term Work:

At least one assignment based on each unit.

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	3	2	2	1	2	1	1	1	1	1	1	2	2	1	2
CO2	3	2	3	2	2	1	1	1	1	1	1	2	2	1	2
CO3	3	2	2	2	2	1	1	1	1	1	1	2	2	2	2
CO4	2	2	2	2	2	2	1	2	2	2	2	3	1	3	3
CO5	3	2	2	2	2	2	2	1	2	2	2	3	2	3	3
CO6	3	2	2	2	3	1	2	1	2	2	2	3	2	3	3

REFERENCES

	Text Books
1	"Operations Research" – S.D. Sharma, Kedarnath Ramnath Publishers
2	"Operations Research" – Kanti Swarup, P.K. Gupta & Man Mohan, Sultan Chand & Sons
3	"Optimization Techniques" – C. Ranganathan, SCITECH Publications
4	"Engineering Optimization" – S.S. Rao, New Age International Publishers
5	"Operations Research: An Introduction" – Hamdy A. Taha, Pearson Education
	Reference Books
1	"Introduction to Optimization" – Pablo Pedregal, Springer
2	"Operations Research: Theory and Practice" – A. Ravindran, D.T. Phillips & J.J. Solberg, Wiley
3	"Quantitative Techniques in Management" – N.D. Vohra, McGraw Hill Education
4	"Operations Research" – J.K. Sharma, Macmillan Publishers

23UGOE2-CE5062 MAINTENANCE, RETROFITTING, REHABILITATION OF STRUCTURE

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To introduce students to the causes and types of structural deterioration, and develop awareness of the need for timely maintenance and rehabilitation.
2. To familiarize students with modern inspection methods, including visual and non-destructive techniques, for evaluating structural health.
3. To equip students with knowledge of repair materials and retrofitting strategies, focusing on practical, field-applicable techniques.
4. To encourage sustainable rehabilitation planning, considering cost-effectiveness, environmental impact, and safety standards.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the causes of structural deterioration and the importance of preventive maintenance.	Understand
CO2	Identify and interpret various inspection and non-destructive testing (NDT) techniques used in structural assessment.	Remember Understand
CO3	Select appropriate repair materials and apply suitable repair techniques based on damage type and severity.	Apply
CO4	Analyze different retrofitting strategies such as jacketing, FRP wrapping, and their applications to structural elements	Analyze
CO5	Explain the principles and methods used in seismic retrofitting and disaster-resilient construction.	Understand Apply
CO6	Develop a sustainable rehabilitation plan considering economic and environmental factors.	Understand Create

Description

Maintenance, Retrofitting, and Rehabilitation of Structures *is an interdisciplinary course designed to provide students with a comprehensive understanding of how to assess, preserve, and extend the life of civil engineering structures. The subject explores the causes and mechanisms of structural deterioration and presents modern techniques for condition assessment through visual inspection and non-destructive testing (NDT). Students are introduced to various repair materials, retrofitting*

strategies such as jacketing and FRP wrapping, and rehabilitation planning methodologies. The course emphasizes sustainable practices, disaster resilience, and adherence to IS codes, enabling students to contribute effectively to structural safety, environmental protection, and resource optimization in both new and existing constructions		
Prerequisites:	1:	Introductory knowledge of civil infrastructure – Familiarity with types of structures like buildings, bridges, tanks, etc.
	2:	Basic knowledge of construction materials – Understanding properties and behavior of concrete, steel, and masonry.
	3:	Interest in interdisciplinary applications and infrastructure- Willingness to explore structural safety, sustainability, and maintenance beyond core discipline boundaries.
	4.	Fundamentals of structural behavior – Awareness of how loads are transferred and resisted in simple structural systems.

Section – I

Unit 1	**Introduction to Maintenance and Deterioration**	
	Need for maintenance, retrofitting, and rehabilitation, Types of structural deterioration, Causes of damage: physical, chemical, environmental, and human-induced, Life expectancy and serviceability of structures, Preventive vs corrective maintenance	**6 Hrs**
Unit 2	**Condition Assessment and Inspection Techniques**	
	Visual inspection: checklist and documentation, Non-destructive testing (NDT): Rebound hammer, UPV, core cutting, carbonation test, etc., Load testing and health monitoring systems, Damage classification and severity levels, Basics of structural audit and report preparation	**6 Hrs**
Unit 3	**Repair Materials and Techniques**	
	Types of repair materials: cement-based, polymer-based, chemical admixtures, Bonding agents, grouts, and sealants, Surface repair methods: crack filling, patching, overlaying, Anti-corrosion methods and coatings, Selection of materials based on cause and extent of damage	**6 Hrs**

Section – II

Unit 4	**Retrofitting Techniques and Strategies**	
	Definition and need for retrofitting, strengthening techniques: jacketing, steel plate bonding, fibre-reinforced polymer (FRP) wrapping, Foundation retrofitting and soil stabilization, Retrofitting of beams, columns, slabs, and joints, Case studies of retrofitted structures	**6 Hrs.**

Unit 5	**Seismic Retrofitting and Disaster-Resilient Structures**	
	Seismic behaviour of structures, retrofitting strategies for earthquake resistance, Base isolation, energy dissipation devices, Disaster management principles for existing buildings, Government guidelines and IS codes related to seismic retrofitting	**6 Hrs.**
Unit 6	**Rehabilitation Planning and Sustainable Practices**	
	Difference between repair, retrofitting, and rehabilitation, Integrated approach to rehabilitation planning, Cost estimation and budgeting, Sustainable repair technologies and environmental concerns, Lifecycle assessment of rehabilitation solutions	**6 Hrs.**

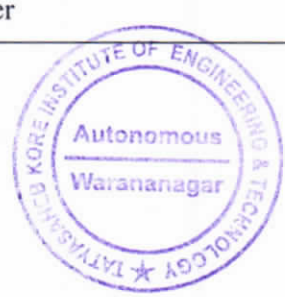
CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	1	-	-	-	-	1	2	1	2
CO2	2	2	-	3	2	-	-	-	-	-	-	1	2	2	1
CO3	2	2	2	2	2	-	2	-	-	-	-	2	3	3	2
CO4	3	2	3	2	2	-	-	-	-	-	-	2	3	3	2
CO5	2	2	2	1	-	3	3	2	-	1	-	2	2	2	2
CO6	2	2	3	-	-	3	3	2	2	2	2	3	2	2	2

REFERENCES

	Text Books
1	"Repair and Rehabilitation of Concrete Structures" – P. I. Modi & C. N. Patel, PHI Learning
2	"Concrete Structures: Repair, Rehabilitation and Retrofitting" – Bhattacharjee B., CBS Publishers
3	"Maintenance and Repair of Civil Structures" – B. L. Gupta & Amit Gupta, Standard Publishers
4	"Retrofitting of Structures" – R. Srinivasan, Oxford University Press

5	"Concrete Technology" – M. S. Shetty, S. Chand Publishing
6	"Building Materials and Construction" – G. C. Sahu & Joygopal Jena, McGraw Hill
	Reference Books
1	"Rehabilitation of Concrete Structures with Fiber-Reinforced Polymer" – Riadh Al-Mahaidi & Thuy Nga Pham, Elsevier
2	"Handbook on Repair and Rehabilitation of RCC Buildings" – CPWD & Indian Building Congress
3	"Structural Renovation of Buildings: Methods, Details, and Design Examples" – Alexander Newman, McGraw Hill
4	"Guide to Concrete Repair" – U.S. Bureau of Reclamation, Denver



Vocational and Skill Enhancement Course (VSEC)

Semester – VI

1. **Civil Software Course**
   (23UGVSEC-CE6071)

2. **Aptitude & Competitive Examinations (ACE)**
   (23UGVSEC-CE6072)

Vocational and Skill Enhancement Course (VSEC)

23UGVSEC-CE6071 P – Civil Software

Lecture: 1 Hr./week
Practical's: 2 hrs. / week
Credits: 2

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
Enhance software skill required for various civil engineering field such as: Structural engineering, Construction management, Surveying, Environmental engineering, Geotechnical engineering, Transportation engineering, etc.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Able to understand industry standard software in professional set up.	Knowledge, Apply
CO2	Understand basic concepts of software.	Knowledge
CO3	Understand applications in field.	Knowledge
CO4	Performing analysis for design.	Analyze
CO5	Interpret result for final output.	Analyze
CO6	Develop customized design automation tool.	Apply

Student should select & perform any one software course from the following:

SOFTWARES

Sr. No.	Name of Software	Field
01	BIM	Architecture/ Construction management/Structural engineering
02	STAAD pro	Structural engineering
03	ETABS	Structural engineering

04	Microsoft Project	Construction management
05	Primavera	Construction management
06	Arc GIS	Surveying
07	Q GIS	Surveying
08	MATLAB	Environmental engineering
09	Mir	Geotechnical engineering
10	PLAXIS and FLAC	Geotechnical engineering,
11	PTV Viscum	Transportation engineering

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	1	-	-	-	1	1	1	1	1	1	1	2	1	---	--
CO2	1	-	-	-	1	-	1	1	1	1	1	2	--	1	--
CO3	1	-	-	-	1	-	1	1	1	1	1	2	--	---	1
CO4	-	2	2	1	1	-	-	-	-	1	-	2	--	1	--
CO5	-	2	1	1	1	-	-	-	-	1	-	2	1	---	--
CO6	1	-	-	-	1	1	1	1	1	1	1	2	1	---	--

EVALUATION SCHEME

1. Student should complete the any one course mention as above individually in semester as per their area of interest.
2. Course conduction facility available in campus OR out of campus.
3. Submit course completion certificate before the term end of semester VI
4. Based on course completion certificate and analysis by experts student will get Satisfactory OR Unsatisfactory remark

Vocational and Skill Enhancement Course (VSEC)

23UGVSEC-CE6072 P Aptitude & Competitive Examinations (ACE)

Lectures	:	1 Hrs./Week	**Evaluation Scheme**		
Credit	:	2	**ISA**	:	50 Marks
Practical	:	1 Hrs./Week			

Course Objectives: The objective of the course is to

1. To strengthen students' understanding of core civil engineering subjects important for competitive exams.
2. To develop quantitative aptitude, logical reasoning, and numerical problem-solving abilities.
3. To enhance students' skills in technical MCQ-solving with speed and accuracy.
4. To familiarize students with exam patterns, tricks, and strategies for success in aptitude-based tests.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the scope and pattern of competitive exams relevant to civil engineers.	Understand
CO2	Solve basic arithmetic and quantitative aptitude problems accurately and efficiently.	Remember Evaluate
CO3	Apply logical reasoning and interpret data effectively in exam settings.	Understand
CO4	Answer core technical questions related to structural and material subjects with accuracy.	Remember Apply
CO5	Demonstrate conceptual clarity in geotechnical, surveying, and environmental topics through MCQs.	Apply Evaluate
CO6	Develop exam-taking strategies through practice tests and analytical review of performance.	Understand

Description

This subject is designed to prepare students for competitive exams such as GATE, SSC-JE, RRB, and other government sector/PSU recruitment exams in the field of Civil Engineering. It focuses on developing core technical knowledge, quantitative aptitude, logical reasoning, and problem-solving skills. Through a structured approach to both technical and non-technical topics, the subject enhances exam readiness, boosts confidence, and sharpens time-management and decision-making abilities under pressure.

Prerequisites:		
	1:	Basic knowledge of core civil engineering subjects studied in earlier semesters.
	2:	Familiarity with high school-level mathematics and general science.
	3:	A basic understanding of logical reasoning and numerical operations.
	4.	Enthusiasm for competitive exam preparation and self-assessment.

Section – I		
	Engineering Aptitude & General Awareness	
Unit 1	Overview of competitive exams (GATE, SSC, RRB, PSU, etc.), Importance of engineering aptitude in exams, Basic civil engineering facts, IS codes, standards, and inventions, Indian infrastructure projects and civil engineering milestones	**6 Hrs**
	Quantitative Aptitude	
Unit 2	Percentages, ratios, profit & loss, averages, Time, speed, and distance, Time and work, pipes and cisterns, Number systems and simplifications	**6 Hrs**
	Logical Reasoning & Data Interpretation	
Unit 3	Blood relations, coding-decoding, direction test, Syllogism, analogy, odd one out, Bar graphs, pie charts, line graphs, Logical sequence and puzzles	**6 Hrs**
Section – II		
	Technical MCQs – Core Civil Subjects – Part I	
Unit 4	Strength of Materials, Structural Analysis, Concrete Technology, Building Materials, Surveying, Construction Planning and Management, Fluid mechanics,	**6 Hrs.**
	Technical MCQs – Core Civil Subjects – Part II	
Unit 5	Soil Mechanics, Environmental Engineering, Transportation Engineering, Hydraulics and Irrigation Engineering, Reinforced concrete structures, Foundation Engineering etc	**6 Hrs.**
	Test Practice & Exam Strategies	
Unit 6	Previous year question analysis, Mock tests, online test series discussions, Shortcut techniques and time-saving tricks, Error analysis and performance improvement strategies	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	-	-	-	-	2	-	-	-	2	-	2	2	3	2
CO2	2	3	-	-	2	-	-	-	-	-	-	2	-	3	2
CO3	-	3	-	-	2	-	-	-	-	-	-	2	-	3	2
CO4	3	3	2	2	2	-	-	-	-	-	-	3	3	3	3
CO5	3	3	2	2	2	-	-	-	-	-	-	3	3	3	3
CO6	-	3	-	2	3	-	-	-	2	3	2	3	2	3	3

REFERENCES

	Text Books
1	"Quantitative Aptitude for Competitive Examinations" – R. S. Aggarwal, S. Chand Publications
2	"A Modern Approach to Verbal and Non-Verbal Reasoning" – R. S. Aggarwal, S. Chand Publications
3	"Objective Civil Engineering" – P. K. Mishra, S. Chand Publishing
4	"GATE Civil Engineering: Chapter wise Solved Papers" – GKP Publications
5	"Civil Engineering Through Objective Type Questions" – S. P. Gupta & S. S. Gupta, CBS Publishers
6	"Logical and Analytical Reasoning" – A. K. Gupta, Ramesh Publishing House
7	"Made Easy: Civil Engineering – GATE Guide" – Made Easy Editorial Board, Made Easy Publications
8	"SSC-JE Civil Engineering Previous Year Papers with Solutions" – Engineers Academy Publications

9	"Practice Book on Quicker Math's" – M. Tyra, BSC Publishing
10	"Reasoning Book for Competitive Examinations" – Nishit K. Sinha, Pearson Education

EVALUATION

Component	Marks	Description
1. Unit Tests / Class Tests (2 Tests)	20 (10+10)	Two tests conducted during the semester covering syllabus proportionally.
2. Assignments / Worksheets	10	Unit-wise assignments, worksheets, or MCQ-based tasks.
3. Practical / Mock Test Performance	10	Based on student performance in mock exams or technical aptitude drills.
4. Attendance & Class Participation	5	75–80% = 3 marks, 80–90% = 4 marks, above 90% = 5 marks.
5. Viva / Interview Readiness / GD	5	Assesses communication, confidence, and aptitude application in oral form.

Program Electives Courses (PEC)

Semester – V

Program Electives-I

1. **Environmental Engineering**

(23UGPEC1-CE5041)

2. **Industrial Waste Treatment**

(23UGPEC1-CE5042)

23UGPEC1-CE5041 - ENVIRONMENTAL ENGINEERING

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand various sources of water and waste water with respect to the quality and quantity of water and wastewater (Sewage).
2. To understand the concept and working of various water and wastewater treatment units and its design.
3. Understand the analysis of water distribution and sewage transportation system.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Bloom's Taxonomy
CO1	Analyze and design a water supply scheme by estimating water demand, assessing quality standards, and selecting appropriate intake structures	Knowledge Analyze
CO2	Understand and apply the principles of water treatment processes, including aeration, coagulation, sedimentation, filtration, disinfection, and softening techniques, for safe and efficient water purification	Understand Apply
CO3	Analyze and design water transmission and distribution systems, including pipe network analysis, appurtenances, leakage control, and water auditing for efficient water supply management.	Analyze Design
CO4	Analyze wastewater characteristics, flow variations, sewerage system design, and pumping requirements for effective wastewater management	Understand Analyze
CO5	Understand and design primary, secondary, and low-cost wastewater treatment processes, including sludge management and sewage recycling, for sustainable wastewater treatment.	Understand Evaluate
CO6	Understand stream pollution, self-purification mechanisms, and wastewater disposal methods while ensuring compliance with MPCB and CPCB standards	Understand

Description:

Environmental Engineering is focused on analysing and understanding the quality of water and waste water. Knowledge of quality of water and waste water allows for the design of WTP and STP. Life of people is dependent on the quality of water supplied and waste water generated. One should know the transportation of water and waste water. This subject will provide the platform for the students to diversified their interest in environmental needs and their implementation. The quality standards of waste water and drinking water will create awareness among the society through civil engineering students. The awareness about major problem of river pollution will be handled effectively after understanding the environmental engineering.

Prerequisites	1	Knowledge about water quality parameters
	2	The sources of waste water generation and their collection
	3	Systems of water supply
	4	Knowledge of fluid mechanics including discharges

Section – I

Unit 1	**Introduction to water supply**	
	Data collection for water supply scheme, components and layout. Design period, factors affecting design period. Quantity: Rate of water consumption for various purposes like domestic, industrial, institutional, commercial, fire demand and water system losses, factors affecting rate of demand, Population forecasting. Quality: Water quality parameters, characteristics & significance in water treatment, drinking water quality standards- BIS, WHO Standards. Water intake structures: General design considerations, types such as river intake, canal intake and reservoir intake, Concept of rising main and pumping station.	**6 Hrs**
Unit 2	**Water treatment**	
	Principles of water treatment processes. Introduction to different types of water treatment flow sheets. Aeration: Principle and Concept, Necessity, Methods, Design of cascade aerator. concept Coagulation & Flocculation- Theory, factors affecting, destabilisation of colloidal particles, types of dosing of coagulants, selection of coagulants, jar tests, rapid mixer & flocculator, Theory of Clariflocculation. Concept of Sedimentation- Theory, types of settling, types of sedimentation tanks, principles & design steps, concept of tube & plate settler. Filtration- Mechanism, head loss development, negative head loss, Types of filters- Slow sand filter, Rapid sand filter & Pressure filter, operation & design of slow sand & rapid sand filter. Disinfection- Theory, factors affecting disinfection, types of disinfectants, types and methods of chlorination breakpoint chlorination. Water softening processes - lime-soda process, ion exchange Demineralization - Reverse osmosis, electro dialysis	**6 Hrs**
Unit 3	**Concept of Distribution reservoirs & service storages**	
	Necessity, location, head requirement, capacity determination by analytical & graphical method. Transmission of water, pumping & gravity mains, choice of pipe materials, forces acting on pressure pipes, leakage & pressure testing of pipes, thrust block concept, corrosion types & control measures.	

	Water distribution systems, method of distributing water, layout pattern, basic system requirements for water distribution system, and methods of network analysis: equivalent pipe method, Hardy-Cross method, design problem. Water supply appurtenances- sluice valve, air relief valve, gate valve, non-return valve, scour valve, fire hydrants water metre, service connections, maintenance & leak detection of water distribution system. Necessity of water audit, water audit in domestic sector, Pre-feasibility report and feasibility report, Concept of preparation of DPR	**6 Hrs**
Section – II		
Unit 4	**Components of wastewater**	
	Wastewater flows, wastewater sources and flow rate, Variations in flow rates and strength, wastewater constituents, Characteristics of Municipal wastewater, Problems on B.O.D. calculations, Quantity of stormwater. Sewerage system, Types, Layout, Types of sewers, Collection system, Appurtenances, Design of sanitary and storm water sewers, Maintenance of sewerage systems Sewage and Sludge pumping, Location, Capacity, Concept of pumping station.	**6 Hrs**
Unit 5	**Treatment of Wastewater**	
	Primary & Secondary Treatment-Screening, comminating, Grit removal, Oil and Grease trap Primary settling tank. Secondary Treatment-Activated sludge process, Process, design and operating parameters of ASP, modification of ASP, Operational problems, Concept of trickling filter. Sludge Treatment and disposal, Concept of anaerobic digestion, types of reactors. Low-cost wastewater treatment methods-Principles of waste stabilization pond. Design and operation of oxidation pond, Operation of aerobic & anaerobic Lagoons, Oxidation ditch, Septic tank. Selection of alternative Treatment process flow sheets, Concept of recycling of sewage	**6 Hrs**
Unit 6	**Stream Pollution**	
	Stream pollution, Self-Purification, DO sag curve, Streeter Philp's Equation, Stream classification, disposal of waste water methods, effluents standards for stream and land disposal as per MPCB and CPCB standards	**6 Hrs**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	2	3	3	2	2	3	2	2	-	1	1	1	3	2	2
CO2	1	3	3	2	2	2	2	2	-	-	2	2	2	2	2
CO3	2	3	3	2	2	3	2	2	-	1	1	1	3	2	2
CO4	3	3	3	2	2	3	1	2	-	1	1	1	3	2	2
CO5	1	3	3	2	2	2	2	2	-	-	2	2	2	2	2
CO6	-	2	2	1	-	2	1	1	-	-	1	-	1	1	1

REFERENCES

	Text Books
1	Environmental Engineering by Peavey, H. S. Rowe, D.R. and Tchobanoglous McGraw Hill Book Company.
2	Water Supply and Pollution Control by Viessman W and Hammer M.J. HarperCollins College Publishers.
3	Water and Waste Water Technology by Hammer M.J. Prentice-Hall of India Private ltd.
4	Water and Wastewater Technology by G.S. Birdie and J.S. Birdie
5	Water Supply by Duggal K. N, S. Chand and Company.
6	Water Supply by Garg S.K., Khanna Publishers.
7	Water Supply and Waste water Disposal by Fair and Gayes, John Wiley Publication.
	Reference Books
1	Manual on Water Supply and Treatment- Government of India Publication. -1993
2	Water and Waste Water Engineering Vol. I & II, John Wiley Publication, 1966. Fair G. M, Geyer J. C, and Okun D. A
3	Water and Wastewater Technology, Prentice Hall of India Private Limited, 1996.Hammer
4	Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development
5	Water and wastewater Technology - Hammer M.J, [Prentice-Hall of India Private ltd.]
6	Masters. G.M. Introduction to Environmental Engineering and Science

23UGPEC1-CE5041 P – ENVIRONMENTAL ENGINEERING (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
1) To familiarize the students with the quality of water and waste water. 2) To familiarize the students design concept of WTP & STP 3) To understand working of WTP & STP

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Determine different properties like pH, Hardness, Acidity, Alkalinity, Chlorides of water and waste water.	Analyze
CO2	Understand distribution of Water and collection of waste water	Analyze
CO3	Visit clarify the working of various units	Analyze
CO4	Explain the Treatment concept of water and wastewater	Understand Analyze

PRACTICALS

A] Performance of at least eight experiments from the following:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
1	pH	2	Analyze
2	Alkalinity	2	Analyze
3	Solids	2	Analyze
4	Chlorides	2	Analyze
5	DO	2	Analyze

6	BOD	2	Analyze
7	COD	2	Analyze
8	Sulphates	2	Analyze
9	Oil & grease	2	Analyze
10	Volatile acids	2	Analyze
11	Design/Analysis problems on Water and sewerage system and treatment system,	2	Knowledge Apply
12	Visit to Water Treatment Plant and sewage treatment plant & visit report.	2	Knowledge Apply

B] One assignment on each unit with minimum five numerical in each assignment

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	2	1	1	1	--	--	--	---	--	--	---	--	--	---	--
CO2	2	1	2	2	--	--	--	---	--	--	---	--	--	---	--
CO3	--	2	2	--	--	--	--	---	--	--	---	--	--	---	--
CO4	--	2	--	--	--	--	--	---	--	--	---	--	--	---	--

REFERENCES

	Text Books
1	Water Supply by Garg S.K., Khanna Publishers.
2	Water Supply and Wastewater Disposal by Fair and Gayes, John Wiley Publication.
3	Water Supply Engineering by B.C.Punmia,Ashok Jain,Arun Jain, Laxmi Publications
	Reference Books
1	Manual on Water Supply and Treatment- Government of India Publication. -1993.
2	Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development
3	. "Water and Waste Water Engineering Vol. I & II", John Wiley Publication, 1966. Fair G. M. Geyer J. C, and Okun D. A

23UGOE2-CE5042 INDUSTRIAL WASTE TREATMENT

Lectures	:	3* Hrs./Week	**Evaluation Scheme**		
Credit	:	2	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To understand the characteristics and impacts of industrial wastes.
2. To study the principles and practices of industrial waste treatment and disposal.
3. To design and evaluate treatment processes for various types of industrial waste.
4. To familiarize with legal, environmental, and sustainable aspects of industrial waste management.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Identify different types and sources of industrial waste and explain their impacts on human health and the environment.	Remember Understand
CO2	Analyze the physical, chemical, and biological characteristics of industrial wastewater and interpret regulatory standards.	Understand Analyze
CO3	Apply appropriate treatment methods for industrial effluent including pre-treatment, biological, and tertiary systems.	Understand Apply
CO4	Classify industrial solid and hazardous wastes and suggest suitable handling, treatment, and disposal methods.	Remember Understand
CO5	Evaluate sector-specific industrial waste management practices and propose pollution prevention measures.	Understand Evaluate
CO6	Illustrate sustainable industrial waste management techniques including ZLD, resource recovery, and LCA.	Remember Understand

Description

Industrial Waste Treatment *focuses on the identification, characterization, treatment, and management of various industrial wastes, including liquid, solid, and hazardous categories. The subject introduces students to the environmental impacts of industrial waste and the regulatory frameworks governing its control. It covers the principles and practices of industrial wastewater treatment—ranging from basic pre-treatment to advanced processes—as well as solid and hazardous waste disposal techniques such as incineration, landfilling, and co-processing. Through sector-wise case studies and exposure to emerging technologies like Zero Liquid Discharge (ZLD),*

resource recovery, and circular economy models, students gain practical insight into sustainable industrial waste management. The course empowers learners to propose environmentally sound, economically viable, and technically feasible waste treatment solutions in real-world industrial context

Prerequisites:	1:	Students should have basic knowledge of environmental engineering concepts related to water and wastewater.
	2:	Understanding of fundamental chemistry is essential to grasp pollutant behavior and treatment reactions.
	3:	Familiarity with fluid mechanics is required to analyze flow and design aspects of treatment units.
	4.	Basic understanding of microbiology helps in learning biological treatment processes effectively.

Section – I

Unit 1	**Introduction to Industrial Waste Management**	
	Definition and types of industrial waste: liquid, solid, hazardous, Sources of industrial waste: sector-wise classification (chemical, textile, dairy, paper, etc.), Effects of industrial waste on environment and human health, Waste management hierarchy: prevention, minimization, reuse, recycling, disposal	**6 Hrs**
Unit 2	**Industrial Wastewater Characteristics and Regulations**	
	Physical, chemical, and biological characteristics of industrial wastewater, BOD, COD, TSS, TDS, pH, heavy metals, Sampling and analysis techniques, Overview of CPCB/SPCB regulations and standards, Environmental (Protection) Act, 1986; Water (Prevention and Control of Pollution) Act, 1974	**6 Hrs**
Unit 3	**Treatment of Industrial Wastewater**	
	Pre-treatment methods: screening, equalization, neutralization, Primary treatment: sedimentation, flotation, Secondary treatment: biological methods (aerobic/anaerobic), Tertiary/advanced treatment: filtration, carbon adsorption, membrane processes, Sludge management and disposal	**6 Hrs**

Section – II

Unit 4	**Industrial Solid and Hazardous Waste Management**	
	Classification of industrial solid wastes, Collection, storage, transportation, and disposal methods, Hazardous waste: definition, characteristics, toxicity, Incineration, landfilling, pyrolysis, and other thermal methods, Co-processing and secured landfills	**6 Hrs.**

Unit 5	**Case Studies of Industrial Sectors**	
	Waste management practices in: Textile industry, Food and dairy processing, Pulp and paper industry, Electroplating and metal finishing, Pharmaceutical and chemical industries, In-plant control measures and pollution prevention techniques	**6 Hrs.**
Unit 6	**Emerging Technologies and Sustainable Practices**	
	Cleaner production techniques, Zero Liquid Discharge (ZLD), Resource Recovery and Circular Economy, Industrial symbiosis, Life Cycle Assessment (LCA) for industrial waste	**6 Hrs.**

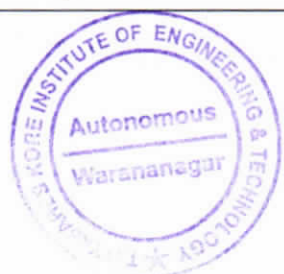
CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO1	PSO2	PSO3
CO1	2	2	-	-	-	2	3	-	-	-	-	1	2	2	3
CO2	3	3	-	2	2	-	2	-	-	-	-	2	2	3	3
CO3	3	3	3	2	2	-	3	-	-	-	-	2	3	3	3
CO4	2	2	2	2	-	2	3	-	-	-	-	2	2	3	3
CO5	2	2	3	1	-	2	2	2	2	2	2	2	2	2	3
CO6	2	2	3	2	2	3	3	2	2	2	2	3	3	2	3

REFERENCES

	Text Books
1	"Wastewater Engineering: Treatment and Reuse" – Metcalf & Eddy, Tata McGraw Hill
2	"Industrial Wastewater Treatment" – N. L. Nemerov, McGraw Hill
3	"Industrial Waste Management" – M. N. Rao & A. K. Dutta, Oxford and IBH Publishing
4	"Environmental Engineering: Vol. II" – S. K. Garg, Khanna Publishers

5	"Pollution Control in Process Industries" – S. P. Mahajan, Tata McGraw Hill
6	"Industrial Pollution Control" – H. C. Dubey, Kataria Publications
7	"Introduction to Environmental Engineering and Science" – Gilbert M. Masters & Wendell P. Ela, Pearson
8	"Industrial Wastewater Management, Treatment & Disposal" – Water Environment Federation, WEF Manual of Practice
	Reference Books
1	"Handbook of Industrial and Hazardous Wastes Treatment" – Lawrence K. Wang, Yung-Tse Hung, Howard H. Lo
2	"Advanced Physicochemical Treatment Processes" – Lawrence K. Wang et al., Springer
3	"Industrial Water Pollution Control" – E. D. Schroeder, McGraw Hill
4	"Environmental Management for Industries" – G. N. Pandey, Vikas Publishing House



23UGPEC1-CE5042 P – INDUSTRIAL WASTE TREATMENT (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
1) To familiarize the students with the quality of water and waste water. 2) To familiarize the students design concept of WTP & STP 3) To understand working of WTP & STP

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Determine different properties like pH, Hardness, Acidity, Alkalinity, Chlorides of water and waste water.	Analyze
CO2	Understand distribution of Water and collection of waste water	Analyze
CO3	Visit clarify the working of various units	Analyze
CO4	Explain the Treatment concept of water and wastewater	Understand Analyze

PRACTICALS

A] Performance of at least eight experiments from the following:

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
1	pH	2	Analyze
2	Alkalinity	2	Analyze
3	Solids	2	Analyze
4	Chlorides	2	Analyze
5	DO	2	Analyze

6	BOD	2	Analyze
7	COD	2	Analyze
8	Sulphates	2	Analyze
9	Oil & grease	2	Analyze
10	Volatile acids	2	Analyze
11	Design/Analysis problems on Water and sewerage system and treatment system,	2	Knowledge Apply
12	Visit to Water Treatment Plant and sewage treatment plant & visit report.	2	Knowledge Apply

B] One assignment on each unit with minimum five numerical in each assignment

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	2	1	1	1	--	--	--	---	--	--	---	--	1	2	-
CO2	2	1	2	2	--	--	--	---	--	--	---	--	-	1	-
CO3	--	2	2	--	--	--	--	---	--	--	---	--	1	-	-
CO4	--	2	--	--	--	--	--	---	--	--	---	--	1	-	-

REFERENCES

	Text Books
1	Water Supply by Garg S.K., Khanna Publishers.
2	Water Supply and Wastewater Disposal by Fair and Gayes, John Wiley Publication.
3	Water Supply Engineering by B. C. Punamia, Ashok Jain, Arun Jain, Laxmi Publications
	Reference Books
1	Manual on Water Supply and Treatment- Government of India Publication. -1993.
2	Manual on sewerage & sewage Treatment published by Ministry of Urban Development Govt. of India Msy-2000. 35 PDOP-4-59-85-97, Ministry of Urban development
3	. "Water and Waste Water Engineering Vol. I & II", John Wiley Publication, 1966. Fair G. M. Geyer J. C, and Okun D. A

Program Electives Courses (PEC)

Semester – VI

Program Electives-II

1. **Advance Foundation Engineering**
   (23UGPEC2-CE6041)

2. **Advance Design of Concrete Structures**
   (23UGPEC2-CE6042)

PROFESSIONAL ELECTIVE - II

23UGPEC2-CE6041-ADVANCE FOUNDATION ENGINEERING

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Practical	:	2 Hrs./Weak	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to
1. Understand the importance and basics of foundations in the civil engineering projects
2. Evaluate the load bearing capacity and settlement of foundations by classical theories.
3. Analyze the geotechnical aspects of deep foundations
4. To learn dynamic analysis of foundations for industrial machines
5. Understand the concepts of the stability of slopes and study various methods of evaluating the of slopes stability
6. To study the types & analysis process for earth & water retaining structures

Course Outcomes (CO):

COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Understand and analyze shallow and raft foundations with emphasis on settlement, bending moments, and IS Code methods.	Understand Analyze
CO2	Understand the principles of bearing capacity evaluation, foundation design in weak soils, and various soil stabilization techniques and their applications.	Remember Evaluate
CO3	Analyze and design pile foundations, focusing on capacity, group behavior, and installation techniques.	Analyze
CO4	Understand and design machine foundations, focusing on dynamic loadings, vibration analysis, and IS code design criteria for various machine types.	Analyze Design
CO5	Analyze slope stability, failure modes, and design sheet pile foundations using various methods to evaluate safety factors and prevent landslides	Understand Analyze
CO6	Understand and apply design methods for well foundations, caissons, cofferdams, stone columns, and geosynthetics.	Remember Understand

Description

Advanced Foundation Engineering *focuses on the design and analysis of various foundation systems, including shallow foundations, piles, machine foundations, and specialized structures like rafts and cofferdams. The subject covers key topics such as bearing capacity, soil stabilization, slope stability, and dynamic load considerations. It also delves into advanced techniques for evaluating soil behavior, foundation performance, and the application of relevant IS Code standards. Practical aspects like construction methods, installation techniques, and safety measures for foundations in challenging soils are also discussed.*

Prerequisites:		
	1:	Knowledge of soil properties and their analysis
	2:	Concept of foundations and its constructions
	3:	Different types of earthen structures, stress and resultant calculations

Section – I		
	SHALLOW AND RAFT FOUNDATIONS	
Unit 1	Types & shapes of shallow foundation, minimum depth of foundation, Concept of proportioning of footings (Isolated), calculation of immediate and consolidation settlement, foundation on slopping ground etc. Dimensional analysis of rectangular & Trapezoidal combined footings, Introduction to raft or mat foundation, necessity & types of rafts, floating foundation & problems associated with floating foundation,	**6 Hrs**
	BEARING CAPACITY AND SOIL STABILIZATION	
Unit 2	Definitions, Modes of failure, Terzaghi's bearing capacity theory, I.S. Code method of bearing capacity evaluation & computation (IS 6403), effect of various factors on bearing capacity (Size & Shape, Depth, WT), Bearing capacity evaluation from plate load test, S.P.T. (By I.S. Code method) and Menards pressure meter tests. Introduction to soil stabilization, methods of stabilization & their applications - mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization & stabilization by grouting	**6 Hrs**
	PILE FOUNDATIONS	
Unit 3	Introduction, necessity, advantages and detail classification of piles, Single pile capacity evaluation by static and dynamic methods for cohesive and cohesion less soil, pile load test. negative skin friction, Group action of files, efficiency of group of piles, Feld's rule, Seiler-Keeney formula, Converse-Labarre formula etc. calculation of group capacity of pile in cohesive soil, under reamed pile – its application and installation techniques	**6 Hrs**
Section – II		
	MACHINE FOUNDATIONS	
Unit 4	Introduction to machine foundation, types of machine foundations, terms related to dynamic loadings, static and dynamic design criteria, SDOF System etc., Permissible amplitude of vibrations for different types of machines, calculation of probable amplitude, amplitude ratio, maximum amplitude, coefficient of uniform compression index etc. criteria for design of machine foundations, design criteria for foundations of reciprocating machines (IS2974-Part-I), design criteria for foundations of impact type machines (IS2974-Part-II), Vibration Isolation & its methods, vibration effects on soil etc.	**6 Hrs.**

Unit 5	**SLOPES AND STABILITY ANALYSIS**	
	Slope classification, forces responsible for slope failure, modes of failure. infinite slope in cohesive and cohesion less soil, Taylor's stability number, Swedish slip method, method of slices and concept of friction circle method to evaluate factor of safety for slope, concept of land slide and its preventive measures.	**6 Hrs.**
Unit 6	**WELL FOUNDATIONS AND COFFER DAMS**	
	Element of wells, Types of well foundations, methods of construction, Tilt and shift, Remedial measures, Pneumatic Caissons: Sinking method - Sand Island method, Caisson disease, cofferdam and common types of cofferdams, Braced cofferdam, Stone columns, Vibroflotation, Preloading technique, Civil engineering application of geo synthetics, Geo textile & geomembrane	**6 Hrs.**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	3	2	2	-	3	-	1	-	-	1	-	3	-	-
CO2	2	3	3	3	1	1	-	1	-	-	-	-	2	-	-
CO3	1	3	3	2	-	3	-	-	-	-	-	-	3	-	-
CO4	2	3	2	1	2	1	2	-	-	-	1	-	2	-	-
CO5	1	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO6	1	3	1	1	2	1	1	-	-	-	1	-	1	1	2

REFERENCES

	Text Books
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher
3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker
4	"*Basic and Applied soil Mechanics*" - A. S. R. Rao and Gopal Ranjan, New age International Publication
5	"*Foundation Engineering Handbook- I*", Van Nostrand Reinhold Company, 1975 by Winterkorn H.F. and Fang H. Y
6	*"Foundation Analysis & Design"*, by Joseph Bowles, McGraw-Hill Education; 5th edition
7	"*Advance Foundation Engineering*", by T. G. Sitharam, CRC Press, 1st Edition 2019
8	*"Soil Mechanics & Foundation Engineering"*, by V. N. S. Murthy, CBS Publishers & Distributors.
	Reference Books
1	*"Soil Mechanics"* - Terzaghi and Peak, Jony Willey and Sons, New York
2	*"Soil Testing"* - T. W. Lambe, Willey Eastern Ltd, New Delhi
3	Dynamics and Vibrations, A. K. Chopra,

23UGPEC2-CE6041 P ADVANCE FOUNDATION ENGINEERING (Tutorial)

Lectures	:	0	**Evaluation Scheme**	
Credit	:	1	**ISA**	: 25 Marks
Practical	:	2 Hrs./Week	**POE**	: 25 Marks

A] Minimum one Assignment on each CO by considering understanding of concepts and skills to solve engineering problems wherever applicable.

No of Assignment	CO	Description
Assignment No-01	CO-01	Concepts and Problems on shallow foundations
Assignment No-02	CO-02	Concepts and Problems on Bearing capacity
Assignment No-03	CO-03	Concepts and Problems on Pile foundations
Assignment No-04	CO-04	Concepts and Problems on Machine foundations
Assignment No-05	CO-05	Concepts and Problems on Slope Stability
Assignment No-06	CO-06	Concepts on Well Foundations

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	3	2	2	-	3	-	1	-	-	1	-	3	-	-
CO2	2	3	3	3	1	1	-	1	-	-	-	-	2	-	-
CO3	1	3	3	2	-	3	-	-	-	-	-	-	3	-	-
CO4	2	3	2	1	2	1	2	-	-	-	1	-	2	-	-
CO5	1	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO6	1	3	1	1	2	1	1	-	-	-	1	-	1	1	2

B] Seminar on any topic with advances in foundation Engineering OR Site visit to foundation site

PROFESSIONAL ELECTIVE - II

23UGPEC2-CE6042-ADVANCE DESIGN OF CONCRETE SRUCTURES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	3	**ISE**	:	40 Marks
Practical	:	2 Hrs./Weak	**ESE**	:	60 Marks

Course Objectives: The objective of the course is to

1. To develop an in-depth understanding of advanced RCC elements such as flat slabs, deep beams, and grid slabs, and their structural behavior under various loading conditions.
2. To enable students to design specialized structures like retaining walls, water tanks, silos, and chimneys using appropriate IS codes and detailing practices
3. To introduce advanced analytical methods such as strut-and-tie models and capacity design concepts for complex load transfer mechanisms
4. To familiarize students with seismic and prestressed concrete design principles, ensuring structural safety and serviceability under dynamic and long-term effects.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the advanced concepts of reinforced concrete design including serviceability, ductility, and Codal provisions.	Understand
CO2	Analyze and design flat slabs and grid slab systems using direct and equivalent frame methods.	Analyze Design
CO3	Design cantilever and counterfort retaining walls, and water tanks as per IS 3370 with appropriate detailing.	Analyze Design
CO4	Apply design principles to silos, bunkers, and chimneys considering pressure distribution and temperature effects.	Analyze Design
CO5	Design deep beams and corbels using strut-and-tie models and understand their load-transfer mechanisms.	Understand Design
CO6	Demonstrate understanding of earthquake-resistant detailing and fundamentals of prestressed concrete design	Understand Analyze

Description

Advanced Concrete Design *focuses on the analysis and design of complex reinforced and prestressed concrete structures, extending beyond the basics of RCC. The subject covers key topics such as flat slabs, grid floors, retaining structures, water tanks, silos, and chimneys. It emphasizes ductile detailing, deep beam behavior, and strut-and-tie models as per IS code provisions. The course also introduces earthquake-resistant design principles and prestressed concrete elements, addressing load transfer, crack control, and serviceability. Practical aspects like reinforcement detailing, construction techniques, and structural safety under various loading conditions are thoroughly discussed.*

Prerequisites:	1:	Structural Analysis – To understand internal forces, moment distribution, and behavior of indeterminate structures.
	2:	Reinforced Cement Concrete (RCC) Design – Fundamental knowledge of limit state method, beam, slab, and column design.
	3:	Strength of Materials – Basic concepts of stress, strain, bending, shear, and deflection in structural elements.

Section – I		
Unit 1	**INTRODUCTION TO ADVANCED CONCRETE DESIGN CONCEPTS**	
	Limit State Method vs Working Stress Method – Review and Extension, Detailing of Reinforcement: Anchorage, Curtailment, Splicing, Ductility of Concrete Members, Codal Provisions: IS 456, IS 13920, IS 1343, IS 3370, Serviceability Criteria: Deflection, Cracking, Vibration	**6 Hrs**
Unit 2	**DESIGN OF FLAT SLABS AND GRID SLABS**	
	Introduction and Classification, Direct Design Method and Equivalent Frame Method, Design for Bending, Shear (including punching shear), Detailing of Reinforcement, Introduction to Grid Floor Systems and Design Approach	**6 Hrs**
Unit 3	**DESIGN OF RETAINING WALLS AND WATER TANKS**	
	Types and Behaviour of Retaining Walls, Design of Cantilever Retaining Wall with Reinforcement Details, Introduction to Design of Counterfort Wall, Design of Circular and Rectangular Water Tanks (IS 3370 – Part I & II), Joints in Water Tanks and Detailing Considerations	**6 Hrs**
Section – II		
Unit 4	**DESIGN OF SILOS, BUNKERS, AND CHIMNEYS**	
	Classification of Silos and Bunkers, Janssen's Theory for Pressure Distribution, Structural Design of Circular and Rectangular Silos, Design of Chimneys (Stresses due to Wind and Temperature), Reinforcement and Crack Control in Tall Structures	**6 Hrs.**
Unit 5	**DESIGN OF DEEP BEAMS AND CORBELS**	
	Introduction and Behaviour of Deep Beams, IS Code Provisions and Strut-and-Tie Model, Design of Deep Beams using IS 456 and SP 34, Introduction to Corbels – Load Transfer Mechanism, Design and Detailing of Corbels	**6 Hrs.**
Unit 6	**EARTHQUAKE-RESISTANT AND PRESTRESSED CONCRETE DESIGN**	
	Basics of Seismic Design – IS 1893 and IS 13920, Ductile Detailing of Beams, Columns, Joints, Capacity Design Concepts, Introduction to Prestressed Concrete, Design of Prestressed Beams: Concepts, Losses, Anchorage	**6 Hrs.**

CO - PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	If applicable		
													PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	1	-	-	-	-	-	-	1	2	1	1
CO2	3	3	3	2	2	-	-	-	1	1	-	1	3	2	1
CO3	3	3	3	2	2	-	2	-	1	1	-	1	3	3	2
CO4	3	3	3	3	2	-	2	-	1	1	-	1	3	3	3
CO5	3	3	3	2	2	-	-	-	-	1	-	1	3	2	1
CO6	3	3	3	2	2	2	3	2	2	2	2	2	3	2	3

REFERENCES

	Text Books
1	"Advanced Reinforced Concrete Design" – P. C. Varghese, PHI Learning
2	"Reinforced Concrete Design" – S. Unnikrishna Pillai & Devdas Menon, Tata McGraw-Hill
3	"Reinforced Concrete Structures (R.C.C.)" – B. C. Punamia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications
4	"Prestressed Concrete" – N. Krishna Raju, Tata McGraw-Hill
5	"Reinforced Concrete (Vol. 1 & 2)" – H. J. Shah, Charotar Publishing House
6	"Limit State Design of Reinforced Concrete" – A. K. Jain, Nem Chand & Bros
7	"Reinforced Concrete Structures" – Ramamrutham S., Dhanapat Rai Publishing
8	"Design of Concrete Structures" – David Darwin, Charles W. Dolan, Arthur H. Nilson, McGraw-Hill Education
9	"Reinforced Concrete Design" – S. N. Sinha, Tata McGraw-Hill
	Reference Books
1	IS 456:2000 – Plain and Reinforced Concrete – Code of Practice
2	IS 3370 (Parts I to IV) – Code for Concrete Storage Structures
3	IS 13920:2016 – Ductile Detailing of RCC Structures
4	SP 34 – Handbook on Concrete Reinforcement and Detailing
5	IS 1893 – Criteria for Earthquake Resistant Design of Structures

Program Electives Courses (PEC)

Semester – VI

Program Electives-III

1. **Construction Management**
   (23UGPEC3-CE6051)

2. **Advanced Construction Techniques**
   (23UGPEC3-CE6052)

PROFESSIONAL ELECTIVE - III

23UGPEC3-CE6051 CONSTRUCTION MANAGEMENT

Lectures	:	3* Hrs./Week	**Evaluation Scheme**		
Credit	:	2	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is..

1. To provide basic knowledge on management of construction work.
2. To make able to plan and schedule of resources required in construction projects.
3. To provide basic knowledge of contract management, equipment management and economics in construction project management.
4. To understand and apply safety measures on construction project site.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand project management concept, identify roles of different agencies in construction industry.	Knowledge Understand
CO2	Draw the network and compute activity times and event times for the given construction project.	Understand Apply
CO3	Understand analyze and apply construction resources and quality management in construction project management.	Understand Apply
CO4	Understand the basics of contracts, tenders and E-tendering.	Knowledge Apply
CO5	Understand equipment management and various costs associated with construction equipments.	Knowledge Apply
CO6	Acquainted with construction safety, identify causes of accidents and apply relevant labour laws in construction industry.	Understand Apply

Description

Civil engineering projects are costly and involve various resources like men, materials, machinery, time and money. Construction management is a versatile subject which deals with understanding of various aspects of engineering projects. Students learn construction management skills including planning, scheduling, monitoring, construction resource and quality management, contract management, construction equipments and safety aspects on construction project sites. The valuable insights and awareness about work behavior parameters like safety, health hazards are created during construction project management.

Prerequisites:	1:	Basic knowledge of project management concept, including planning, scheduling.
	2:	Understanding how to manage construction resources, negotiate contracts and tenders with client and suppliers.
	3:	Understanding basics of legal enforcements and legal things in general activities.

	4.	Ability to identify safety hazards and implement solution to avoid accidents, in construction. Also, too familiar with safety practices and procedures.	
Section – I			
Unit 1	**CONSTRUCTION MANAGEMENT FRAME WORK**		
	Construction project management- Objectives, Phases, Agencies, Project life cycle, Relation between Client, Consultant and Contractor. Work Break down structure.		**6 Hrs**
Unit 2	**CONSTRUCTION PLANNING AND SCHEDULING**		
	Introduction to construction planning scheduling, Identifying broad activities in construction work and allotting time, Development of Bar charts, Activity cost and time estimation in CPM and PERT, Precedence network diagrams, Control of schedule- Earn value management.		**6 Hrs**
Unit 3	**CONSTRUCTION RESOURCE AND QUALITY MANAGEMENT**		
	Objectives, Inventory control techniques – EOQ, ABC, SED, VED analysis. Statistical quality control charts, Sampling techniques, Quality management Quality circle, ISO: 9000 and ISO: 21500.		**6 Hrs**
Section – II			
Unit 4	**CONTRACT MANAGEMENT**		
	Contracting, Basic elements of contracts, Types of contracts, Conditions of contracts, Tendering process- Preparation of tender notice, Tender documents, Submission-Scrutiny and acceptance two envelop method, Invitation of tenders, Types of tenders, E-tendering.		**6 Hrs.**
Unit 5	**EQUIPMENT MANAGEMENT AND ECONOMICS IN CONSTRUCTION**		
	Extent of Mechanization, Forecasting equipment requirement Selection of construction equipments, Hourly work rate, Owing cost –Investment, Depreciation and major repair costs, Operating costs- cost of fuel, lubrication, Servicing and maintenance, Replacement of equipment.		**6 Hrs.**
Unit 6	**SAFETY IN CONSTRUCTION**		
	Importance of safety in construction industry- Causes of accidents, Remedial and preventive measures, Safety policy, Safety organization, Various safety equipments (PPEs) used on construction sites, Labor laws related to construction industry.		**6 Hrs.**

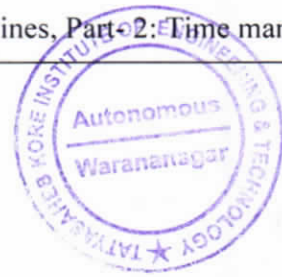
CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	1	-	1	-	2	1	-	-	1	-	1	-	1	2	-
CO2	1	2	-	-	2	2	-	-	-	-	1	1	1	1	-
CO3	1	2	-	-	1	2	-	-	-	-	1	1	1	1	-
CO4	1	-	-	-	-	2	1	-	-	-	-	-	1	-	-
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	1	-
CO6	1	-	1	-	-	2	-	2	-	2	1	-	-	-	-

REFERENCES

	Text Books
1	"Construction planning and management" – P. S. Gahlot, B.M. Dhir New age International Pvt. Ltd. 3Rd edition.2024.
2	"Industrial engineering and management" – S.C. Sharma, T.R. Banga, Khanna book publication. Cop. Ltd. Edition.2017.
3	"Construction engineering and management" – Dr. S. Seetharaman Umesh publication 5Th edition.
4	"Project planning and control with PERT and CPM" – B. C. Punamia Laxmi publication.
5	"PERT and CPM principles and applications" – L.S. Shrinath affiliated by east – west pvt. Ltd
6	"Building and engineering contracts. Patil, S.P Woolhouse, 7Th edition Taylor and Francis group Pune (India) May. 2019
7	"Contract-I" Dr. R. K. Bangias, Allahabad law agency, 8Th edition.2021
8	"Estimation costing specification and valuation in civil engineering" – M. Chakrabarti, M.K. Publishers and distrubutres.24Th edition.2010.
9	"Construction equipment and its management" – S. C. Sharma Khanna publishers 7Th edition 2014.

Reference Books	
1	"Engineering management" – Stoner Pearson publication.
2	"Construction project management" K. K. Chitkara, TATA McGraw hill Publication Pvt Ltd.
3	"Industrial engineering and management" O. P. Khanna, Dhanapat Rai Publication.
4	Indian Contract Act, https://www.indiacode.nic.in/
5	Dr. Roshan Namavati, Professional Practice: With Elements of Estimating, Valuation, Contract and Arbitration, Lakhani Book Depot, 1January2016.
6	F.H.Kellogg, Construction Methods & Machinery, Prentice-HallInc. NewYork, January1,1955
7	Philippe Pire and Benoît Legrand, Building Construction Manual, Nov2013.
8	IS 15883-1:2009 Construction project management – Guidelines, Part- 1: General
9	IS 15883-2:2013 Construction project management – Guidelines, Part- 2: Time management



23UGPEC3-CE6051 P – CONSTRUCTION MANAGEMENT (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme
ISA: 25 Marks
POE: ---

Course Objectives: The objective of the course is
1) To familiarize students with construction management framework, project management tools i.e planning, scheduling in construction project management. 2) To understand analyze and apply construction resources and quality management. 3) To know the basics of contracts, tenders and E- tendering. 4) To understand and apply equipment management and safety on construction project management

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be able to**	**Blooms Taxonomy**
CO1	Understand project management framework, project management tools , draw and evaluate network for estimating time and cost.	Knowledge Understand
CO2	Analyze and apply construction resources and quality in construction project management.	Understand Apply
CO3	Understand the basics of contracts, tenders and E-tendering.	Understand Apply
CO4	Understand equipment management and get acquainted with safety in construction.	Understand Apply

ASSIGNMENTS/PRACTICALS

A] Write six assignments/practicals mentioned below:

Sr. No.	Assignments/ Practical's/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Construction Project management concept, Objectives, Phases, Agencies, Project life cycle, Relation between client, consultant and contractor WBS.	4	Knowledge Understand
02	Introduction to construction planning, scheduling, Bar chart, CPM Network: Elements of network development, CPM time estimates, Forward & Backward pass, CPM and PERT concept and numerical. Precedence network and earn value management.	4	Understand Apply
03	Construction resource and quality management: Objectives, inventory control techniques EOQ, ABC,	4	Understand Apply

	SDE, VED analysis, SQC, sampling techniques, Quality management, ISO: 9000, ISO:21500.		
04	Contracting, basic elements of contracts, types of contracts, conditions of contracts, tendering process, tender notice preparation, tender documents, types of tenders, invitation of tender, Submission- scrutiny & acceptance two envelop method, E-tendering.	4	Knowledge Apply
05	Equipment management, mechanization, equipment requirement, selection of construction equipments, hourly work rate, cost associates with construction equipments, Depreciation calculation : Straight line and Diminishing balance method, Replacement of equipments	4	Knowledge Apply
06	Safety in construction: Importance, causes of accidents, Remedial and preventive measures, Safety policy, Safety organization, PPEs, Labour laws related to construction industry.	4	Understand Apply

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	3	-	-	2	1	-	-	-	-	2	-	2	1	-
CO2	1	3	-	-	1	2	-	-	-	-	1	-	1	2	-
CO3	1	-	-	-	-	2	-	-	-	-	-	-	2	-	-
CO4	1	-	-	-	1	2	-	1	-	-	2	1	-	-	-

REFERENCES

	Text Books
1	"Construction planning and management" – P. S. Gahlot, B.M. Dhir New age International Pvt. Ltd. 3Rd edition.2024.
2	"Industrial engineering and management" – S.C. Sharma, T.R. Banga, Khanna book publication. Cop. Ltd. Edition.2017.
3	"Project planning and control with PERT and CPM" – B. C. Punmia Laxmi publication.
4	"Contract-I" Dr. R. K. Bangias, Allahabad law agency, 8Th edition.2021
	Reference Books
1	"Engineering management" – Stoner Pearson publication.
2	"Construction project management" K. K. Chitkara, TATA McGraw hill Publication Pvt Ltd.

PROFESSIONAL ELECTIVE - III

23UGPEC3-CE6052 ADVANCED CONSTRUCTION TECHNIQUES

Lectures	:	3 Hrs/Week	**Evaluation Scheme**		
Credit	:	2	**ISE**	:	40 Marks
Tutorials	:	---	**ESE**	:	60 Marks

Course Objectives: The objective of the course is..

1. To provide students the necessary knowledge and concepts of advancements/emerging techniques in construction industry.
2. To impart students with the skill of design and operation of various special types of construction based on latest technology.
3. To provide students prerequisite knowledge necessary for higher studies and research in the field of advanced construction techniques.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Estimate and design of formwork materials.	Apply Evaluate
CO2	Apply the knowledge of new construction material.	Apply Evaluate
CO3	Understand land reclamation techniques.	Knowledge Understand
CO4	Apply different advanced methods for efficient construction.	Apply
CO5	Understand various bridge rehabilitation techniques.	Knowledge Understand
CO6	Apply various advanced techniques in concrete pavements.	Apply

Description

Advanced construction techniques has its roots in the tasks of applying various advanced construction techniques to various aspects of construction. Much of the work of civil engineers involves the planning and management of construction facilities that address these tasks. Advanced construction technique is the quantitative study of the various rehabilitation and land reclamation method useful from sustainability point of view.

Prerequisites:	1:	Basics of concrete technology.
	2:	Basic knowledge of various construction materials.
	3:	Knowledge of pavement design and construction.
	4.	Vision of advancements available in construction industry.

Section – I		
Unit 1	**COMPOSITE CONSTRUCTION AND FORMWORK**	
	Composite v/s Non composite action, Composite steel – concrete construction, Materials for formwork, Special types of formworks, Causes of failure of formwork, Design of formwork.	**6 Hrs**
Unit 2	**NEW MATERIAL OF CONSTRUCTION**	
	Use of new materials such as Geosynthetics, Epoxy resins, Adhesive, Medium density fiber (MDF), Fiber reinforced concrete (FRC), Fiber reinforced plastics (FRP), Polymer based composites, Advantages, Disadvantages and Limitations of use.	**6 Hrs**
Unit 3	**LAND RECLAMATION**	
	Necessity, Technical progress of land reclamation, Methods used for land reclamation, Structural improvement of reclaimed land, Methods of improving bearing capacity, Water logging – Causes and preventive measures.	**6 Hrs**
Section – II		
Unit 4	**ADVANCED TECHNIQUES**	
	Vacuum dewatering in concrete slab construction, Reinforced earth construction, Foundation strengthening, vacuum dewatering, Foundation dewatering.	**6 Hrs.**
Unit 5	**REHABILITATION OF BRIDGES**	
	Introduction, Necessity and methods of strengthening, preservation of bridges, Rehabilitation of expansion joints and bearings. Bridge bearings, Retaining structures like Diaphragm walls, Advanced methods of their construction.	**6 Hrs.**
Unit 6	**CONSTRUCTION OF CONCRETE PAVEMENT**	
	Construction of concrete pavement by techniques like vacuum processing, Revibrated concrete, Roller compacted concrete, slip form paving technique.	**6 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	1	-	3	-	2	1	-	-	-	-	1	1	2	1	-
CO2	1	-	2	-	1	1	-	-	1	-	-	-	-	1	-
CO3	1	-	-	-	1	-	-	1	-	-	-	2	-	-	1
CO4	1	2	2	-	2	2	-	-	-	-	-	-	-	-	-
CO5	1	2	2	-	-	-	-	-	-	-	1	-	-	-	-
CO6	1	2	-	2	1	-	-	-	-	-	-	-	-	-	-

REFERENCES

	Text Books
1	Handbook of composite construction Engineering by G. M. Subins. - Van Nostrand Reinhold Company, 1979
2	Formwork design and construction – Wynn. - Concrete publication, 1939
3	Concrete Technology M.S. Shetty S. Chand publication Pvt. Ltd.
4	Bridge Engineering- Raina Shroff Publishers and Distributors Pvt. Ltd.
	Reference Books
1	NPTEL Course on Advanced Construction Technology.
2	Water Power Engineering- Dandekar and Sharama Vikas publishing House.
3	Bridge Engineering by Ponnuswamy.

23UGPEC3-CE6052 P ADVANCED CONSTRUCTION TECHNIQUES (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 25 Marks
POE: ---

Course Objectives: The objective of the course is
1) To provide students necessary knowledge and concept of advancement/emerging techniques in construction industry. 2) To impart students with the skill of design and operation of various special types of construction based on latest technology. 3) To provide students prerequisite knowledge necessary for higher studies and research in the field of advanced construction techniques.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be able to**	**Blooms Taxonomy**
CO1	Apply the knowledge of composite construction, new construction materials and design of formworks materials.	Apply Evaluate
CO2	Understand land reclamation techniques and apply different advanced methods for efficient construction.	Understand Apply
CO3	Understand the various bridge rehabilitation techniques.	Knowledge Understand
CO4	Apply various advanced techniques of construction of concrete pavement.	Apply

ASSIGNMENTS/PRACTICALS

A] Write six assignments/practicals mentioned below:

Sr. No.	Assignments/ Practical's/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Composite v/s non-composite action, Composite steel-concrete construction, Formwork Materials, Special types of formworks, Design of formwork and causes of failures.	4	Understand Apply
02	New construction materials – Geosynthetics, Epoxy resins, Adhesives, Medium density fiber (MDF), Fiber reinforced concrete (FRC), Fiber reinforced plastics (FRP), Polymer based composites, Advantages, disadvantages.	4	Understand Apply

03	Land Reclamation – Necessity, Technical progress, Methods of land reclamation, Structural improvements of reclaimed land, Methods of improving bearing capacity Water logging – causes and preventive measures.	4	Knowledge Understand
04	Advanced techniques – Vaccum dewatering in slab construction, Reinforced earth construction, Foundation strengthening and dewatering.	4	Apply
05	Bridge Rehabilitation- Necessity, methods of strengthening, Preservation, Bridge bearing, Expansion joints and bearings, Retaining structures - Diaphragm walls, Advanced methods of their construction.	4	Knowledge Understand
06	Concrete pavement construction- Techniques: Vaccum processing, Revibrated concrete, Roller compacted concrete and Slip form paving.	4	Apply

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	-	3	-	2	1	-	-	-	-	-	-	2	1	-
CO2	1	2	2	-	2	-	-	1	-	-	-	-	-	-	1
CO3	1	2	2	-	-	-	-	-	-	-	1	-	-	-	-
CO4	1	2	-	2	1	-	-	-	-	-	-	-	-	-	-

REFERENCES

	Text Books
1	Handbook of composite construction Engineering by G. M. Subins.- Van Nostrand Reinhold Company, 1979.
2	Formwork design and construction – Wynn. - Concrete publication, 1939.
3	Concrete Technology M.S. Shetty S. Chand publication Pvt. Ltd
4	Bridge Engineering- Raina Shroff Publishers and Distributors Pvt. Ltd
	Reference Books
1	Water Power Engineering- Dandekar and Sharama Vikas publishing House.
2	Bridge Engineering by Ponnu swamy.

Exit Option to Qualify B Tech Vocational

Sr. No	Category	Sub Category	Course Code	Name of Course	Teaching Scheme			C	CH	Examination & Evaluation Scheme		
					L	T	P			Component	Marks	Min for Passing
1	Program Course (Any One)	PCC	23UGPCC-CE6101E	Structural Design and Drawing	2	--	2	3	4	ISA	50	20
2		PCC	23UGPCC-CE6102E	Quantity Surveying and Valuation	2	--	2	3	4	ISA	50	20
3	Experiential Learning Courses	Project	23UGPW-CE611E	Mini Project (Compulsory)	--	--	6	3	6	ISA	50	20
					2	**0**	**8**	**6**	**10**	**0**	**100**	**40**

Total Credits = 06

Total Marks = 100

23UGPCC-CE6102E (T) Quantity Surveying and Valuation

Lectures	:	2 Hrs./Week	**Evaluation Scheme**		
Credit	:	2	**ISA**	:	50 Marks
Tutorials	:	---	**ESE**	:	

Course Objectives: The objective of the course is to

1. To understand the basic skills in estimation of Civil Works.
2. To prepare specifications & rate analysis of various items.
3. To carry out the estimation for various Civil engineering structures.
4. To understand the valuation of Civil Engineering Structures.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Interpret the various administrative and technical terms before starting construction.	Remember Understand
CO2	Perform rate analysis and Specifications of various items.	Understand Analyze
CO3	Formulate estimate for various construction projects.	Understand
CO4	Assess the valuation of construction projects.	Understand Apply

Description

Quantity Surveying refers to calculating quantities required to execute any work and furthermore calculating cost by multiplying rates with quantities. Also, valuation deals with to acquire knowledge of assessing value of any properties. Both the parts teach students to be fluent in art of estimation of building and other structures. Also, students will know various administrative authorities and technical terms in correlation with executing work. Valuation enables students to workout value of particular structure or Land.

Prerequisites:	1:	Basics of Units of measurement.
	2:	Basic knowledge of market rates of various materials.
	3:	Knowledge of various shapes, areas and volumes .
	4.	Simple Terms in Economics.

Section – I

Unit 1	**Modes of Measurement**	
	Principles in selecting units of measurement for items, various units and modes of measurement for different items. I.S. 1200 (Part 1 to 28). Task Work (Out Turn Work), factors affecting the cost of materials, Standard schedule of rate (SSR).	**3 Hrs**
Unit 2	**Rate Analysis and Specifications**	
	Rate Analysis of Various items of work, Specifications of Works.	**3 Hrs**
Unit 3	**Estimates**	
	Estimates: Meaning, Importance and Purpose, Measurement and abstract sheets, Detailed estimates & Approximate estimates, Provisional sum & provisional quantities. Administrative approval and technical sanction of estimates, Bar Bending Schedule.	**3 Hrs**
Unit 4	**Valuation**	
	Valuation: Purposes, Principles, Factors Affecting, Methods of valuation. Types of Values. Concept of Depreciation and its methods.	**3 Hrs.**

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	3	1	-	-	-	1	-	2	-	3	-	-	-	-	-
CO2	2	3	1	2	3	2	-	-	-	1	-	-	1	-	-
CO3	2	2	1	2	1	2	2	-	1	2	-	-	2	-	1
CO4	2	3	3	2	3	2	-	-	1	2	-	-	3	-	-

REFERENCES

	Text Books
1	Estimating and Costing – B.N.Dutta. Dhanpat Rai & Sons. 1682, NaiSarak, Delhi-110006
2	Estimating, Costing and Specification in civil engineering – Chakroborty M. 21 b, BhabanandaRoad, Kolkata-700026
3	Elements of Estimating and Costing – S. C. Rangwala. Charotar Publishing House - Opp Amul Dairy Court road Anand.388001 (west rly)India
4	Civil Engineering, Contracts and Estimates – B. S. Patil. Universities Press Private Ltd. 3-5-819 Hyderguda, Hyderabad. 500029(A.P),India.
5	Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharashtra.
6	Estimating and Costing – B.N.Dutta. Dhanpat Rai & Sons. 1682, NaiSarak, Delhi-110006
7	Estimating, Costing and Specification in civil engineering – Chakroborty M. 21 b, BhabanandaRoad, Kolkata-700026
	Reference Books
1	Professional Practice (Estimating and Valuation) – Roshan Nanavati (1984 Edition) U.B.S. Publishers, Distributers PVT. Ltd.5 Ansari road, New Delhi.
2	Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharashtra.
3	C.P.W.D. specifications& schedules of rates
4	Valuation of real Properties – S. C. RangwalaCharotar Publishing House, opposite Amul dairy, court Road Anand, 388001.India
5	IS :1200 Part 1 to 28.
6	National Building Code 2005.

23UGPCC-CE6102E (P) Quantity Survey & Valuation (Lab)

Practical's: 2 hrs. / week
Credits: 1

Examination Scheme:
ISA: Marks 50

Course Objectives: The objective of the course is to
1) To know the students basic rates of building Materials and prepare rate analysis. 2) To Prepare Bar Bending Schedule. 3) To Estimate RCC Framed Structure. 4) To understand Valuation report of Building.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Perform rate analysis of various items.	Knowledge, Apply
CO2	Organize specifications for civil engineering items.	Apply
CO3	Formulate estimate for various construction projects.	Analyze
CO4	Assess valuation for construction projects.	Understand

PRACTICALS

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Units of Measurement of construction materials. (Min 50)	4	Knowledge
02	Rate Analysis of ten civil engineering items. (Prepare excel sheet for minimum 5 items of works).	4	Knowledge
03	Detailed specification for minimum eight civil engineering items. (One each from Roads, Irrigation works, Water Supply & Sanitation & five from buildings).	4	Knowledge, Analyze
04	Schedule of reinforcement for the following a) Beams. b) Slab. c) Column & Column footing.	4	Knowledge, Analyze

05	Detailed estimate of G + 1 residential Framed Structure.	8	Knowledge
06	Preparing detailed estimate for any one of the following: a) A stretch of a road about 1 Km. long including earthwork. b) RC Culvert or Bridge.	4	Knowledge, Analyze
07	Read and assess Valuation report for building of residential purpose.	4	Analyze
08	Use of any software for estimation. (Case study)	4	Analyze

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	3	3	2	2	2	--	--	---	--	2	---	1	3	1	--
CO2	3	3	2	2	2	--	--	---	--	2	---	1	2	1	-
CO3	1	3	2	2	2	--	--	---	--	2	---	1	2	1	--
CO4	1	3	1	2	3	--	--	---	--	2	---	1	2	1	1

REFERENCES

	Text Books
1	Estimating and Costing – B.N.Dutta. Dhanpat Rai & Sons. 1682, NaiSarak, Delhi-110006
2	Estimating, Costing and Specification in civil engineering – Chakroborty M. 21 b, BhabanandaRoad, Kolkata-700026.
3	Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharashtra.
	Reference Books
1	Professional Practice (Estimating and Valuation) – Roshan Nanavati (1984 Edition) U.B.S. Publishers, Distributers PVT. Ltd.5 Ansari road, New Delhi.
2	Standard specifications Volumes I & II (P. W. D. Maharashtra) Govt. of Maharashtra.
3	C.P.W.D. specifications& schedules of rates.

23UGPCC-CE6101 E – STRUCTURAL DESIGN AND DRAWING (Lab)

Lecture: 2 Hrs./week
Practical's: 2 hrs. / week
Credits: 3

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
1. To analyze and design steel structures. 2. To prepare the working drawing for various structural elements.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Analyse and design various types of bolted and welded structural connections in accordance with relevant codes and standards.	Analyze
CO2	Explain the behavior of structural sections under axial tension and compression, and design tension and compression members.	Explain, Design
CO3	Analyze and design steel columns, flexural members, and their individual elements for structural performance.	Analyze, design
CO4	Apply structural analysis and design software tools to simulate and solve practical engineering problems.	Apply
CO5	Develop detailed working drawings and structural layouts in compliance with project specifications and execution requirements.	Develop

Term Work

Term work shall comprise of Detailed structural design and drawing of the following steel structure along with necessary drawings by limit state method analysis. (Max group size should not exceed four students)

Sr. No.	Practical/ Experiment/Tutorial Topic	Hrs.	Bloom's Taxonomy
01	Design of industrial building and Preparation of all working drawings.	2	Design

02	Analysis and design of Purlin	2	Analyze, Design
03	Analysis and design of Bracings	2	Analyze, Design
04	Analysis and design of Gantry Girder	2	Analyze, Design
05	Analysis and design of Column	2	Analyze, Design
06	Analysis and design of Column bases and connections	2	Analyze, Design
07	Analysis of building frame manually with drawings	2	Analyze
08	Design of building frame manually with drawings	2	Design
09	Analysis of building frame and by using any FEM based software with drawings	2	Analyze
10	Design of building frame and by using any FEM based software with drawings	2	Design

CO - PO Mapping

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable PSO 01	PSO 02	PSO 03
CO1	1	2	2	2	1	1	-	-	-	-	-	-	2	-	-
CO2	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO3	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO4	2	2	3	2	1	1	-	-	-	-	-	-	3	-	-
CO5	-	-	3	2	1	1	-	-	-	-	-	-	3	-	-

REFERENCES

Text Books	
1	"Limit State Design of Steel Structures" - Duggal S.K., Tata McGraw-Hill Education private Ltd., New Delhi, 2nd Edition 2014
2	"Design of Steel Structures: By Limit State Method as Per IS: 800 – 2007" - Bhavikatti S. S., I K International Publishing House.
3	"Limit State Design in Structural Steel" - Shiyekar M. R, 2nd Edition, PHI Publisher

23UGPW-CE611E Mini Project Work

Practical's: 6 hrs. / week
Credits: 3

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
1) To apply civil engineering concepts to practical problems through project work. 2) To develop teamwork, project management, and communication skills. 3) To gain hands-on experience with engineering tools and software. 4) To encourage innovation and prepare students for final-year projects.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Understand the fundamental principles of civil engineering and their applications in real-world scenarios.	Understand
CO2	Apply civil engineering knowledge and tools to identify, plan, and execute a mini project.	Apply
CO3	Analyze project requirements, constraints, and data to develop practical solutions.	Analyze
CO4	Evaluate different design and implementation approaches for effectiveness and feasibility.	Evaluate

Description
The Mini Project offers third-year civil engineering students hands-on experience in solving practical engineering problems. Students work individually or in teams to plan, design, analyze, and present a project in areas like structural, environmental, or transportation engineering. The course develops technical skills, teamwork, and communication, serving as a foundation for the final year project.

Prerequisites:	1:	Fundamental knowledge of core civil engineering subjects, such as: Structural analysis, Concrete Technology, Soil mechanics, Transportation Engineering.
	2:	Basic proficiency in engineering drawing and design tools, like AutoCAD, STAAD Pro, or Excel.
	3:	Understanding of project planning and estimation concepts.
	4.	Ability to conduct literature reviews and technical report writing.

4	"Design of Steel Structures" - Dayaratnam, Wheeler Publications, New Delhi.
5	"Design of Steel Structures" – B. C. Punmia, A. K. Jain and Arun Kumar Jain, Laxmi Publication
	Reference Books
1	"LRFD Steel Design" - William T. Segui, PWS Publishing
2	"Design of Steel Structures" - Edwin H. Gaylord, Charles N. Gaylord James, Stallmeyer, Mc-Graw Hill
3	"Design of Steel Structures" - Mac. Ginely T.
4	"Design of Steel Structures" - Kazimi S. M. and Jindal R. S., Prentice Hall India.
5	"Design of Steel Structures" - Breslar, Lin Scalzi, John Willey, New York
6	"Steel Structure" - Controlling Behaviour Through Design, Englekirk, WILEY.
	I.S. Codes
1	IS: 800 – 2007
2	IS: 875 (part I, II and III)
3	SP6 (1) & SP 6 (6),
4	IS: 816
5	IS: 808.

23UGPW-CE611E Mini Project Work

Practical's: 6 hrs. / week
Credits: 3

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
1) To apply civil engineering concepts to practical problems through project work. 2) To develop teamwork, project management, and communication skills. 3) To gain hands-on experience with engineering tools and software. 4) To encourage innovation and prepare students for final-year projects.

Course Outcomes (CO):		
COs	**At the end of successful completion of the practical's the student will be**	**Blooms Taxonomy**
CO1	Understand the fundamental principles of civil engineering and their applications in real-world scenarios.	Understand
CO2	Apply civil engineering knowledge and tools to identify, plan, and execute a mini project.	Apply
CO3	Analyze project requirements, constraints, and data to develop practical solutions.	Analyze
CO4	Evaluate different design and implementation approaches for effectiveness and feasibility.	Evaluate

Description
The Mini Project offers third-year civil engineering students hands-on experience in solving practical engineering problems. Students work individually or in teams to plan, design, analyze, and present a project in areas like structural, environmental, or transportation engineering. The course develops technical skills, teamwork, and communication, serving as a foundation for the final year project.

Prerequisites:	1:	Fundamental knowledge of core civil engineering subjects, such as: Structural analysis, Concrete Technology, Soil mechanics, Transportation Engineering.
	2:	Basic proficiency in engineering drawing and design tools, like AutoCAD, STAAD Pro, or Excel.
	3:	Understanding of project planning and estimation concepts
	4.	Ability to conduct literature reviews and technical report writing.

KEY COMPONENTS:

A Mini Project is a short-term, practice-oriented project undertaken by engineering students usually in the third year as part of their academic curriculum. It serves as a bridge between theoretical learning and practical application, helping students gain hands-on experience by working on real-world civil engineering problems.

1. **Topic Selection:**
   Students choose a relevant topic based on interest and feasibility—common domains include structural design, water resources, transportation, environmental systems, and construction management.
2. **Problem Definition & Literature Review:**
   Clearly define the engineering problem and study similar existing work to gain background knowledge.
3. **Project Planning:**
   Use tools like Gantt charts, bar charts, or MS Project for time and task planning.
4. **Data Collection & Analysis:**
   Gather required data through fieldwork, surveys, or secondary sources, and perform necessary calculations or modeling.
5. **Design & Execution:**
   Create drawings, use software (like AutoCAD, STAAD Pro, Revit), or even build physical models depending on the project.
6. **Documentation & Reporting:**
   Prepare a detailed technical report including Introduction, Methodology, Results, Discussion, and Conclusion.
7. **Presentation & Viva:**
   Present the project findings to a faculty panel and answer technical questions during a viva-voce.

EVALUATION CRITERIA:

1. Project Planning & Proposal

This component assesses how well the students have identified and defined the project. It includes:

- Clarity of the problem statement or project objective
- Relevance to civil engineering domains
- Feasibility of completing the project within the given timeline
- Planning tools or initial Gantt charts (if any)

2. Literature Review & Methodology

Evaluates the student's understanding of existing research and the approach taken to solve the problem:

- Quality and depth of literature review
- Relevance of sources cited
- Well-structured and logical methodology
- Justification for selected techniques or tools

3. Project Execution / Work Done

Focuses on the practical efforts put into implementing the project:

- Collection and analysis of data
- Use of appropriate software or engineering tools (e.g., AutoCAD, STAAD Pro, Excel, etc.)
- Accuracy and quality of calculations, models, or simulations
- Regular progress throughout the semester

4. Report & Documentation

Assesses the final project report:

- Proper structure (Introduction, Methodology, Results, Conclusion, References)
- Clarity of writing and formatting
- Quality of drawings, tables, and charts
- Correct use of technical language and referencing style

5. Presentation & Viva-Voce

This component tests the student's ability to communicate their work:

- Clear, well-designed PowerPoint presentation
- Logical flow of ideas and confidence during delivery
- Ability to answer questions during viva
- Depth of understanding reflected in discussion

6. Innovation / Technical Depth

Encourages creative and technical excellence:

- Originality of the idea or solution
- Application of advanced techniques or concepts
- Overall complexity and engineering value of the project

CO - PO Mapping :

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	If applicable		
													PS O1	PS O2	PS O3
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	2	2	-	-	-	-	-	-	-	3	3	-
CO3	2	3	3	3	2	-	-	-	-	-	-	-	3	3	-
CO4	2	2	3	3	3	-	-	-	-	-	-	-	3	2	-

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