Third Year B. Tech.

In CIVIL Engineering

Syllabus Under Autonomous Status of
TKIET, Warananagar

SEMESTER - V

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	Able to understand, evaluate index and engineering properties of soil	Knowledge Understand
CO2	Understand the fundamental relationships in properties of soil	Understand
CO3	Evaluate stresses and permeabilities in soil under different environmental conditions	Understand
CO4	Understand the process and importance of compaction and consolidation	Understand
CO5	Knows importance of shear strength of soil and its evaluation	Apply Evaluate
CO6	Analyze lateral earth pressure on retaining walls	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:	Different types of earthen structures, stress and resultant calculations
	4.	Units and conversions

Section – I		
Unit 1	**SOIL PROPERTIES**	
	Origin of soil, soil structure, 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 (Liquid limit, plastic limit, shrinkage limit), consistency indices and activity number, unified and 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, intrinsic permeability, determination of permeability of soil by constant head and variable head methods, permeability of stratified soils, 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**	
	Concept of compaction, factors affecting compaction, standard proctor test and modified proctor test as per IS 2720, dry density and moisture content relationship, 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		
Unit 4	**STRESS DISTRIBUTION IN SOIL**	
	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	**6 Hrs.**

	calculation, approximate method OR (2V:1H) method for stress calculations.	
	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, representation of stress on Mohr's circle, 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, sensitivity, Skempton pore water pressure parameters.	**6 Hrs.**
	EARTH PRESSURE THEORY	
Unit 6	Concept of earth pressure, plastic equilibrium, 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, critical height,	**6 Hrs.**

CO - PO Mapping

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

REFERENCES

Text Books	
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication Sixteenth Edition 2017
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher, 14th Edition, December 2020

3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker, Jan 2010
4	"*Basic and Applied soil Mechanics*" - A. S. R. Rao and Gopal Ranjan, New age International Publication, January 2016
5	"*Geotechnical Testing and Instrumentation*" - Alam Singh, CBS Publisher, January 2019
6	"*Geotechnical Engineering*" - C. Venkatramaiah, New age International Publication, Nov. 2016
7	"*Geotechnical Engineering*" - Purushottam Raj New age International Publication, Jan 2018
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

CE502-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

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	Apply the knowledge of estimation of hydrometeorological parameters.	Apply Evaluate
CO2	Estimate direct runoff and peak discharge using hydrograph technique.	Apply Evaluate
CO3	Understand ground water hydrology	Knowledge Understand
CO4	Apply different methods of efficient irrigation and water conservation.	Apply
CO5	Understand Efficient water Storage techniques	Knowledge Understand
CO6	Estimate reservoir capacity based on crop water requirement	Knowledge 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 including units and conversions
	2	Basic knowledge of soil water relationship including seepage
	3	Knowledge of flow of Water through open channel
	4	Vision of river, channel, flood, farming operation of water application etc

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, Double mass rainfall curve, 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, Rainfall runoff co-relation.	**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 S-curve hydrograph. Floods: Introduction of river gauging, Estimation of peak flow - empirical equations, rational method Importance of - Design flood, Standard project flood, Maximum probable flood.	**6 Hrs.**
Section – II		
Unit 4	**Ground Water Hydrology**	
	Ground Water Hydrology: Occurrence, Distribution and classification of ground water, Darcy's law, Aquifer parameters 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; Water logging and land drainage, 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 seasons, cropping pattern and crop rotation, Classes and availability of soil water, depth and frequency of watering. Duty, delta, base period and their relationship, 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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO1	PSO2	PSO3
CO1	1	--	2	--	1	--	--	---	--	--	--	--	--	--	--
CO2	2	1	2	--	1	--	--	--	--	--	--	--	--	--	--
CO3	--	2	2	--	1	--	--	--	--	--	--	--	--	--	--
CO4	--	2	2	--	2	--	--	--	--	--	--	--	--	--	--
CO5	1	2	2	--	--	--	--	--	--	--	--	--	--	--	--
CO6	1	2	--	2	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 BookHouse.
4	"Irrigation and Water Power Engineering" – Dr. Punmia and Dr. Pande – Laxmi Publications, Delhi
5	"Engineering Hydrology" – Dr. K. Subramanya, -Tata McGraw Hill, New Delhi.
	Reference Books
1	"Hydrology and water resources" - R. K. Sharma, Dhanpatrai and sons, New Delhi.
2	"Theory and design of irrigation structures" - Varshney, Gupta and Gupta, vol. I and II and III, New Chand and Brothers.
3	"Irrigation Theory and practice" - Michael, Vikas Publications House.
4	"Water management" - Jaspal Sing, M. S. Acharya, Arun Sharma, Himanshu Publications.
5	"Design of M.I. and Canal Structure" - Satyanarayana and R. Murthy, Wiley Eastern Ltd, New Delhi.
6	"Irrigation Engineering" - Raghunath, Wiley Eastern Ltd, New Delhi.

CE503-THEORY OF STRUCTURES

Lectures	**:**	4 Hrs./Week	**Evaluation Scheme**		
Credit	**:**	4	**ISE**	**:**	40 Marks
Tutorials	**:**	---	**ESE**	**:**	60 Marks

Course Objectives: The objective of the course is

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.

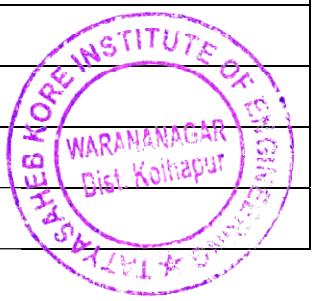
Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand the concept of determinacy and indeterminacy.	Knowledge
CO2	Apply various techniques of structural mechanics to solve indeterminate structures.	Apply Evaluate
CO3	Analyze indeterminate structures by using various approaches.	Knowledge Understand
CO4	Know the limitations of the methods of solution and their outcomes	Knowledge Understand

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	Basic knowledge of Structural mechanics
	2	Conceptual knowledge of statically determinate structures
	3	The basics of different types of beams and loadings
	4	Knowledge of matrices from Mathematics
	5	Basics of analysis and design
	6	Different types of analsis methods



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	**6 Hrs.**
Unit 3	**Energy Theorems**	
	Introduction to Castiglione's theorem and unit load method. 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 Application to continuous Beams. Concept of sinking of supports. Portal frame without sway.	**6 Hrs.**
Unit 5	**Moment Distribution Method**	
	Moment distribution method (Degree of S.I. ≤ 2), application to Application to continuous beam. Sinking of supports. Portal frames without sway.	**6 Hrs.**
Unit 6	**Matrix Methods**	
	Introduction to Flexibility Method and Stiffness Method. Stiffness coefficients, Development of stiffness matrix, Equilibrium equations, Applications to beams.	**6 Hrs.**

CO - PO Mapping

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

REFERENCES

	Text Books
1	"Structural Analysis" – S. S. Bhavikatti, Vikas Publishing House Pvt, Ltd, January 2021
2	"Analysis of Structures" - Vazirani and Ratwani, Vol. I & II, Khanna Publishers, January 1999
3	"Mechanics of Structures" - S. B. Junnarkar, H.J. Shah, Vol-I & II, Charotar Publishing house, January 2012
4	"Structural Analysis: Matrix approach - Pandit and Gupta. McGraw Hill Education, April 2008
5	"Structural Analysis" - L.S. Negi and R.S. Jangid, Tata Mc-Graw Hills Publishing House, New Delhi
	Reference Books
1	"Basic Structural Analysis" - C.S. Reddy, Tata McGraw Hill Publishing House, New Delhi, April 2017
2	"Structural Analysis" - Devdas Menon, Narosa Publishing House.
3	"Matrix analysis of structures" - Gere & Weave. CBS Publishers & Distributors
4	"Indeterminate structural analysis" - C.K. Wang, McGraw Hill Education, July 2017

CE-503P

Term work shall comprise of

At least one assignment on each unit with minimum six questions

CE504 - 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	Describe the various sources of water and wastewater with respect to quality and quantity of water.	Knowledge Understand
CO2	Describe and design the various water and wastewater treatment units.	Understand
CO3	Illustrate the special water and wastewater treatments and sequencing of treatment for various qualities of surface & ground water.	Understand
CO4	Design the various components related to transmission water and wastewater.	Understand
CO5	Summarize the different water and wastewater appurtenances.	Apply Evaluate

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	
	5	River water lift and pollution of river	
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 exchangeDemineralization - Reverse osmosis, electro dialysis	**6 Hrs**	
Unit3	**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, StreeterPhilp'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		
													PSO 1	PSO 2	PSO 3
CO 1	1	2			1	--	--	---	--	--	--	--	--	--	--
CO 2	1	2	1	2		--	--	--	--	--	--	--	--	--	--
CO 3	1	2				--	--	--	--	--	--	--	--	--	--
CO 4			2	2	2	--	--	--	--	--	--	--	--	--	--
CO 5	1	2	2			--	--	--	--	--	--	--	--	--	--
CO 6	1	2			1	--	--	--	--	--	--	--	--	--	--

REFERENCES

Text Books	
1	Environmental Engineering by Peavey, H.S.Rowe, D.R. and Tchobanoglous McGraw Hill Book Company, Indian Edition, July 2017
2	Water Supply and Pollution Control by Viessman W.and Hammer M.J. HarperCollins College Publishers.
3	Water and WasteWater Technology by Hammer M.J. Prentice-Hall of India Private ltd., January 2012, 14th Edition
4	Water and Wastewater Technology by G.S. Birdie and J.S. Birdie, Dhanpat Rai Publishing Company (p) Ltd, January 2010
5	Elements of Environmental Engineering by Duggal K.N Published by S. S Chand & Co Ltd
6	Water Supply by Garg S.K., Published by Khanna Publishers, 33rd edition
7	Water Supply and Waste water Disposal by Fair and Gayes, John Wiley Publication, Nov 2010
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.], Sep 2015

CE505 - PROJECT MANAGEMENT

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

Course Objectives: The objective of the course is to

1. To learn project management tools.
2. To understand Resource management.
3. To get acquainted with financial management.

Course Outcomes:

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Use the Project planning and management tools in Construction	Knowledge Understand
CO2	Evaluate and draw project network for estimating time and Cost	Understand
CO3	Know the techniques of Material Management	Apply
CO4	Understand the economic comparison of alternatives	Apply
CO5	Evaluate feasibility of alternatives using investment criteria.	Apply Evaluate
CO6	To get acquainted with occupational ethics.	Apply

Description:

Project Management is versatile subject which deals with understanding various aspects of engineering Projects.it covers application of tools of handling project in scientific way. Also, it explores material management techniques along with Economic and Financial analysis of projects.it adds insights into work behavior parameters like safety, health hazards.

Prerequisites:	1	Basic knowledge of working of Business organization.
	2	Strong ability to do mathematical calculations with logic.
	3	Financial knowledge of how and money transactions.
	4.	Basic idea about planning and execution

Section – I

Unit 1	**Project Management Concept**	
	Principles of Management(H.Fayols), Functions of management, Decision tree,Work Break down structure, Phases &Agencies of Construction Project.	**4 Hrs**
Unit 2	**Network Analysis: CPM**	
	Bar Chart, Gantt Chart, CPM Network: Time estimate, Floats, Critical path, Network compression, Network updating. PERT (only introduction.)	**9 Hrs**
Unit 3	**Resource Management**	
	Objectives, Functions, Resource Smoothening and levelling, Inventory Control methods: ABC, EOQ, HML, VED, SDE. *(Numerical on ABC&EOQ).*	**5 Hrs**
Section – II		
Unit 4	**Financial Management**	
	Time value of money, Equivalence, Demand and supply theory, Types of interests, Uniform series factors. *Economic Comparison Methods***:** Present worth method, EUAC method, Capitalized cost method.	**8 Hrs**
Unit 5	**Economic Analysis**	
	*Discounting and No discounting investment Criteria's***: -** Net present value, Rate of return, Benefit cost ratio, Payback period method, Breakeven analysis	**6 Hrs**
Unit 6	**Miscellaneous**	
	ISO 9000, Site layout & factors affecting, Safety in construction - Injury sources and causes, occupational health hazards, Personal protective equipment.	**4 Hrs**

CO - PO Mapping

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

REFERENCES

Text Books	
1	"Project planning and Control with PERT and CPM" - B. C. Punmia, K. K. Khandelwal, Laxmi Publication,edi.2002.
2	"PERT &CPM: Principles and Application" - Srinath L.S, Affiliated East-West Press (Pvt.) Ltd.(1 January 2001).
3	"Construction Engineering and Management" - Dr. S. Seetharaman, Umesh Publications,2017.
4	Financial Management" – Prasanna Chandra, TATA McGraw Hill.2011
Reference Books	
1	Engineering Management" – Stoner, Pearson Publication.; Sixth edition (19 January 2018)
2	. "Construction Project Management" – K.K.Chitkara, TATA McGraw Hill, 1998.
3	"Project Cost Control in Construction" - Roy Pilcher, Blackwell Scientific Publications.1994
4	"Engineering Economics" - Layland Blanck and Torquin, TATA McGraw Hill.1998

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	Able to understand evaluation of basic properties of soil in laboratory	Knowledge, Apply
CO2	Analyze the density, specific gravity, water content and permeability of soil	Analyze
CO3	Understand and able to evaluate shear strength of soil	Analyze
CO4	Understand the fundamental relationships in properties of soil	Understand Analyze

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	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

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

REFERENCES

Text Books

1. "*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication Sixteenth Edition 2017

2. "*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher, 14th Edition, December 2020

3. "*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker, Jan 2010

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

CE502P – 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 familiarize 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:		
COs	**At the end of successful completion of the course the student will be able to**	**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

Assignments on following topics (at least 6):

Sr. No.	**Practical/ Assignments/Tutorial Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Determination of average annual rainfall using Thiessens polygon & Isohyet map method	2	Apply
2	Consistency of rain gauge station by double mass rainfall curves.	2	Knowledge Apply
3	Determination of evaporation losses, effective rainfall hyetograph infiltration losses – Phi index calculation, Horton's infiltration curve.	2	Apply
4	To develop a unit hydrograph from a total runoff hydrograph resulting from isolated storms.	2	Knowledge, Analyze
5	Alteration of base period of given unit hydrograph using method of superposition and S -curve technique	2	Knowledge
6	Determination of well discharge in a confined/unconfined aquifer.	2	Analyze
7	Layout of Percolation tank, K. T. Weir, Bandhara Irrigation, Lift Irrigation	2	Analyze

8	Estimating depth and frequency of irrigation on the basis on soil moisture regime concept.	2	Knowledge, Analyze
9	Crop water requirement and irrigation command area calculations	2	Knowledge, Analyze
10	Site visit & report on meteorological station	2	Knowledge,

CO - PO Mapping

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

CE504P - 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 course the student will be able to**	**Blooms Taxonomy**
CO1	Determine different properties like pH, Hardness, Acidity, Alkalinity, Chlorides of water and waste water.	Analyse
CO2	Understand distribution of Water and collection of waste water	Analyse
CO3	Visit clarify the working of various units	Analyse
CO4	Explain the Treatment concept of water and wastewater	Understand Analyse

PRACTICALS

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		Analyze
9	Oil & grease		Analyze

10	Volatile acids		Analyze
11	Design/Analysis problems on Water and sewerage system and treatment system,		Knowledge Apply
12	Visit to Water Treatment Plant and sewage treatment plant & visit report.		Knowledge Apply

CO - PO Mapping

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

REFERENCES

Text Books	
1	Environmental Engineering by Peavey, H.S.Rowe, D.R. and Tchobanoglous McGraw Hill Book Company, Indian Edition, July 2017
2	Water Supply and Pollution Control by Viessman W.and Hammer M.J. HarperCollins College Publishers.
3	Water and WasteWater Technology by Hammer M.J. Prentice-Hall of India Private ltd., January 2012, 14th Edition
4	Water and Wastewater Technology by G.S. Birdie and J.S. Birdie, Dhanpat Rai Publishing Company (p) Ltd, January 2010
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

CE505P – PROJECT MANAGEMENT (Lab)

Practicals: 2 hrs. / week
Credits: 1

Examination Scheme:
ISA: 50 Marks

Course Objectives: The objective of the course is to
1. To familiarize the students with Project flow and various tools of Project planning, scheduling and controlling. 2. To inculcate in students the knowledge of Material management, Finance and economics.

Course Outcomes (CO):		
COs	**At the end of successful completion of the course the student will be able to**	**Blooms Taxonomy**
CO1	Interpret the Project parameters and Build decision making abilities	Knowledge, Apply
CO2	Draw and Solve the Project Network to find out project duration. Also will able to use advance project planning and Management software like MSP, Primavera.	Analyze
CO3	Plan material required for Project and ordering techniques.	Analyze
CO4	Analyze and select best alternative from available. Also, can understand feasibility of project alternative.	Understand Analyze

PRACTICALS

Sr. No.	**Practical/ Experiment/Tutorial Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Phases and Agencies of Project. Decision tree,	2	Apply
2	Network drawing and solving with CPM technique.	2	Knowledge Apply
3	Use of Software like MSP for Project planning.	2	Apply
4	Finding out Economic Order quantity and studying inventory control techniques.	2	Knowledge, Analyze
5	Problems on Economic comparison methods of project alternatives.	2	Knowledge
6	Occupational Health Hazards, Site Layout.	2	Analyze

CO - PO Mapping

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

REFERENCES

	Text Books
1	"Project planning and Control with PERT and CPM" - B.C.Punmia,K.K.Khandelwal, Laxmi Publication,edi.2002.
2	"PERT &CPM: Principles and Application" - Srinath L.S, Affiliated East-West Press (Pvt.) Ltd.(1 January 2001).
3	"Construction Engineering and Management" - Dr. S. Seetharaman, Umesh Publications,2017.
4	Financial Management" – Prasanna Chandra, TATA McGraw Hill.2011
	Reference Books
1	Engineering Management" – Stoner, Pearson Publication.; Sixth edition (19 January 2018)
2	. "Construction Project Management" – K.K.Chitkara, TATA McGraw Hill, 1998.
3	"Project Cost Control in Construction" - Roy Pilcher, Blackwell Scientific Publications.1994
4	"Engineering Economics" - Layland Blanck and Torquin, TATA McGraw Hill.1998

CE506A- SEMINAR

Lectures	**:**	---	**Evaluation Scheme**		
Credit	**:**	---	**ISE**	**:**	---
Practical's	**:**	2 Hrs/Week	**ESE**	**:**	---

Course Objectives: The objective of the course is to
1. To understand, develop research ability & present the knowledge gained from curriculum/field etc. 2. To study the recent trends, technological innovations in civil engineering & interdisciplinary areas. 3. To enhance presentation skills.

Course Outcomes:		
COs	**At the end of successful completion of the course, the student will be able to**	**Blooms Taxonomy**
CO1	Summarize the present status and make literature review on the selected topic with current issues to give a state of an art of technological progress in the past through technical report.	Knowledge Understand
CO2	Deliver seminar presentation using modern tools highlighting the distinguishing features of the studies conducted.	Understand & Apply Evaluate
CO3	Prepare the technical report of seminar work in given format.	Apply

Description:		
Graduate Student is expected to learn, investigation, methodologies, study relevant research papers, correlate work of various authors/researchers critically, study the concepts techniques & prevailing results, analyze those and prepare a seminar report (25-30 pages of A4 size sheets and submit it in IEEE format) on all these aspects.		
Prerequisites:	1:	Knowledge of English
	2:	Study & understand about research papers
	3:	Study the concepts techniques & prevailing results
Section – I & II		
Term Work		
1	Selection of topic from curriculum / field in civil engineering / interdisciplinary areas on current issue.	
2	Minimum three presentations as follows, a. Synopsis presentation b. Literature review presentation c. Final presentation	
3	Preparation of final report in hard and soft format	

4	Student has to deliver seminar presentation in front of the faculty of the department and his classm The concerned faculty should assess the candidates based on quality of seminar work carried out, preparation and understanding of candidates. Some marks should be reserved for the candidate's attendance.

Mapping of POs & COs:

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

References:

	Text Books
1	Relevant text books on selected topic of seminar.
	Reference Books
1	Relevant reference books, journal publications, conferences publications, magazines, open web site sources on selected topic of seminar.

APPROVED BY

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Board of Studies

Academic Dean
T.K.I.E.T.Warananagar

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In CIVIL Engineering

Syllabus Under Autonomous Status of
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SEMESTER - VI

CE601 – 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	Analyze and design different types of welded and bolted connections by using necessary elements for analyzing steel structures.	Remember
CO2	Analyze and design axially loaded tension member along with its end connections.	Apply, Evaluate
CO3	List and describe essential elements necessary to analyze and design of compression member.	Apply, Evaluate
CO4	Analyze and design axially and eccentrically loaded columns along with its different types of column bases.	Apply, Evaluate
CO5	Analyze and design laterally supported and unsupported beams with their end connections.	Apply
CO6	Calculate forces acting on gantry girder and its design as laterally unsupported beam.	Remember, 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 Beam based on IS: 800-2007**	
	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**

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CO - PO Mapping

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

REFERENCES

	Text Books
1	"Design of Steel Structures (By Limit State Method As Per Is 800—2007" – S.S.Bhavikatti, I K International Publishing House, New Delhi,2009
2	Limit State Design of Steel Structures: *V. L. Shah and* Veena Gore, Stuctures Publication, Pune,2009
3	IS 800:2007-BIS
4	"Handbook on steel-SP6" BIS
5	"IS – 875, Part - III" -BIS.
	Reference Books
1	Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi,2008
2	Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House,2010
3	Design of Steel Structures: K.S. Sairam, Pearson Education India, 2010
4	Limit state design in structural steel: Dr. M. R. Shiyekar, PHI Learning Pvt. Ltd.,2013
5	Design and Analysis of Steel Structures:Vajrani V. N., Ratwani M. M. and Mehra H., Oscar Publications,1988

CE602: REINFORCED CONCRETE STRUCTURES

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Practical's	**:**	2 Hrs/Week	**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 concrete structures	Knowledge Understand
CO2	Understand the design process of concrete structure	Understand
CO3	Design the Sections subjected to torsion	Understand
CO4	Understand the application of limit state method for structural element such as footing, column, beam slab, staircase etc.	Understand
CO5	Design the individual members and hence building.	Apply 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.

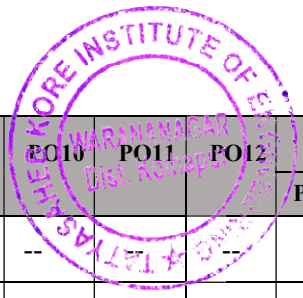
Prerequisites:	1:	Knowledge of concrete technology and its engineering properties.
	2:	Fundamental concept of stresses, strains, deflections etc.
	3:	Different types geometrical shapes, centroid, centre of gravity, moment of inertia calculations.
	4.	Units and conversions

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, Analysis and design of symmetrical T and L beams.	**6 Hrs**
Unit 2	**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**
Unit 3	**LIMIT STATE OF COLLAPSE IN TORSION**	
	Behavior of R.C. rectangular sections subjected to torsion, Design of sections subjected to combined bending and torsion, combined shear and torsion.	**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 per IS: 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, Slenderness ratio 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



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

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 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. Punmia 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

CE-603: LEGAL ASPECTS AND CONSTRUCTION PRACTICES

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

Course Objectives: The objective of the course is to

1. To aware the students about Indian Contract and Arbitration act.
2. To provide knowledge about contract administration.
3. To understand working of various excavating, hauling, conveying, and hoisting equipment.
4. To compute cycle time of operations, rating and output of equipment.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Understand basics of contracts, tenders and e- tendering.	Knowledge Understand
CO2	Understand the concepts of contract administration and RERA	Understand apply
CO3	Study the Indian Arbitration Act	Understand
CO4	Understand the different types of excavating equipment used for construction work	Knowledge
CO5	Study of different types of Conveying and Hoisting Equipment and their operations	Understand
CO6	Compute cycle time of operations, rating and output of equipment	Apply and Analyze

Description

Legal Aspects & Construction Practices deals with important laws in relation with Indian construction industry which helps students to run construction projects efficiently without any litigations. Also it enables students better understanding of various machineries useful for mechanization of construction industry in order to control time and cost of projects

Prerequisites:	1:	Professional etiquettes.
	2:	Ethical behavioral knowledge.
	3:	Basic enforcements and legal things in general activities.
	4.	Basics about use of machineries in construction.

Section – I

Contract and Tenders

Unit 1	Contracts, Types of Contracts, Tender document- invitation of tenders, Tender notice, tenderdocuments, Submission. Scrutiny and acceptance two envelop method. Award of jobs. Various conditions to contracts, Rights and responsibilities of parties of contracts, E-Tendering, Introduction to Non-Conventional Contracts.	**6 Hrs**
Unit 2	**Contract administration**	
	Essentials of legally void and avoidable contracts, contract for engineer and architecture services, contract between owner and contractor, BOT system, Introduction to RERA.	**6 Hrs**
Unit 3	**Arbitration**	
	Introduction to Indian Arbitration Act, Arbitration Agreement, Power and Duties of Arbitration, Different types of arbitration, Qualification of arbitrator.	**6 Hrs**
Section – II		
Unit 4	**Excavating Equipment**	
	Excavator, Shovels, different types – back hoe, draglines, clamshell, Cycles of operations, Their use in different soil conditions. Output criteria, Rippers, Trenchers, Hauling Equipment: Tractor Dumpers, Bulldozer, Scrapers, Operation cycles times.	**6 Hrs.**
Unit 5	**Conveying and Hoisting Equipment**	
	Different types of conveyors, Power requirement, Damages during operations, Economy of transportations, Cableways and Ropeways, Different types of hosting equipment - derricks and cranes.	**6 Hrs.**
Unit 6	**Equipment Management**	
	Selection of equipment, Advantages and limitations of using machines, planning of equipment – buying Vs hiring, Cost analysis, Economic life and Replacement, Problems of Equipment Management.	**6 Hrs.**

CO-PO MAPPING

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

Text Books	
1	B. S. Patil, S P Woolhouse, B S Patils Building and Engineering Contracts, 7th edition, Taylor and Francis Group, Pune (India) May 2019.
2	Dr. R. K. Bangia, Contract I, Eighth Edition
3	Chakraborti M, Estimating, Costing, Specification and Valuation in Civil Engineering, 24th edition, M.K. Publishers and Distributors, 2010
4	BN Dutta, Estimation & Costing in Civil Engineering by, 28th Edition, UBS Publishers & Distributor Pvt. Ltd, 2016
5	Avatar singh, Rajesh Kapoor, Law of Contract & Specific Relief, 13th edition, Eastern Book Company, 27th February 2021.
6	Robert Purifoy, Construction Planning, Equipment and methods, Tata McGraw Hill Publication, 2010.
7	Dr. Mahesh Varma, Construction Equipment Planning and Applications, 2nd Edition, Metropolitan Book Company, 1975
8	Roy Chudley and Roger Greene, Construction Technology, 4th Edition, Pearson Prentice Hall, 2005.
Reference Books	
1	Indian Contract Act, https://www.indiacode.nic.in/
2	Dr. Roshan Namavati, Professional Practice: With Elements of Estimating, Valuation, Contract and Arbitration, Lakhani Book Depot, 1 January 2016.
3	F.H. Kellogg , Construction Methods & Machinery, Prentice-Hall Inc. New York, January 1, 1955
4	Philippe Pire and Benoît Legrand, Building Construction Manual, Nov 2013.

CE604 Elective I-ADVANCE FOUNDATION ENGINEERING

Lectures	**:**	3 Hrs/Week	**Evaluation Scheme**		
Credit	**:**	3	**ISE**	**:**	40 Marks
Tutorials	**:**	1	**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 shallow and deep foundations
4. Understand the concepts of the stability of slopes and study various methods of evaluating the stability of slopes.
5. To learn dynamic analysis of foundations for industrial machines
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	Use science principles to develop foundation engineering knowledge.	Understand
CO2	Apply foundation engineering knowledge in the civil engineering projects.	knowledge
CO3	Calculate bearing capacity theoretically as well as practically.	Analyze
CO4	Calculate settlement and design shallow and deep foundation	Analyze
CO5	Design the foundations for Industrial machines under dynamic loadings.	Evaluate
CO6	Analyze the earth and water retaining structures used for special functions	Analyze

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 soil properties and their analysis
	2:	Bridge foundations and their types
	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. Different shapes, bending moment diagrams & Dimensional analysis of rectangular & Trapezoidal combined footings, Introduction to raft or mat foundation, necessity & types of rafts, Design guidelines for raft foundation, types of raft design, floating foundation & problems associated with floating foundation, Analysis of raft or mat foundation by Rigid method (Conventional method) & Elastic plate method (IS Code method)	**6 Hrs**
Unit 2	**BEARING CAPACITY AND SOIL STABILIZATION**	
	Definitions, Modes of failure, Terzaghi's bearing capacity theory, Meyerhof's bearing capacity, 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), Static cone penetration test and Menards pressure meter tests with detailed procedure, Introduction to difficult or weak soils, foundations in expansive soils, foundations in soft & compressible soils, 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 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, Concept of negative skin friction and its estimation, settlement in pile foundation, estimation of load on single pile in a group of pile etc. Under reamed piles – equipment, construction, installation techniques and precautions.	**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 etc., Permissible amplitude of vibrations for different types of machines, calculation of probable amplitude, amplitude ratio & maximum amplitude, criteria for design of machine foundations, Design criteria for foundations of reciprocating machines (IS2974-Part-I), design criteria for foundations of	**6 Hrs.**

	impact type machines (IS2974-Part-II), Vibration Isolation & Its methods, vibration effects on soil etc.	
	SLOPES AND STABILITY ANALYSIS	
Unit 5	Slope classification, 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, Introduction to sheet piles, types and uses of sheet piles, Analysis & design of cantilever sheet pile walls in cohesive & cohesionless (granular) soils,	**6 Hrs.**
	WELL FOUNDATIONS AND COFFER DAMS	
Unit 6	Element of wells, Types of well foundations, methods of construction, Tilt and shift, Remedial measures, Pneumatic Caissons: Sinking method - Sand Island method, Caisson disease, 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	2	--	--	1	--	--	--	--	--	--	--	--	--	--
CO2	1	2	1	2	1	--	--	--	--	--	--	--	--	--	--
CO3	1	2	--	--	--	--	--	--	--	--	--	--	--	--	--
CO4	--	2	2	2	--	--	--	--	--	--	--	--	--	--	--
CO5	1	2	2	--	--	--	--	--	--	--	--	--	--	--	--
CO6	1	1	--	2	1	--	--	--	--	--	--	--	--	--	--

REFERENCES

Text Books	
1	"*Soil Mechanics and Foundation Engineering*" - B. C. Punmia, Laxmi Publication Sixteenth Edition 2017
2	"*Soil Mechanics and Foundation Engineering*" - K. R. Arrora, Standard Publisher, 14th Edition, December 2020
3	"*Soil Mechanics and Foundation Engineering*" - V. N. S. Murthy, Marcell Decker, Jan 2010
4	"*Basic and Applied soil Mechanics*" - A. S. R. Rao and Gopal Ranjan, New age International

	Publication, January 2016
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, Nov 2016
2	"*Soil Testing*" - T. W. Lambe, Willey Eastern Ltd, New Delhi, Dec 2017
3	Dynamics and Vibrations, A. K. Chopra, Pearson, 24 Sept 2019

CE604T – ADVANCE FOUNDATION ENGINEERING (T)

a] Minimum one assignment on each unit with theory and minimum four numerical, (wherever applicable)

b] Any software-based project OR Foundation site visit with report

CE604 - Elective-I-Optimization Techniques

Lectures	: 3 Hrs/Wee	**Evaluation Scheme**		
Credit	: 3	**ISE**	:	40 Marks
Tutorials	: 1	**ESE**	:	60 Marks

Course Objectives: The objective of the course is

1. To provide the students with knowledge on the application of various optimization techniques this can help making decisions for practical problems in industries.
2. To build capabilities in the students for analyzing different situations in the industrial/Business scenario involving limited resources and finding the optimal solution within constraints by using advanced optimization tools.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems	Apply
CO2	Go in research by applying optimization techniques in problems of Engineering	Apply Evaluate
CO3	Analyze the real-life systems with limited constraints.	Analyze
CO4	Understand the process and importance of decision making	Understand
CO5	Knows importance of Problem-solving methods	Apply Evaluate
CO6	Depict the systems in a mathematical model form	Apply

Description

Optimization Techniques refers to the art of applying the various optimization techniques to predict the future performance of various factors like men, material excused in a project. Understanding optimization techniques enables engineers and other professionals to find feasible and optimum solution within constraints by using advanced optimization tools. This course teaches students basic fundamentals of OR and applications to practical field. Students will be able to analyze different situations in the industrial/Business scenario involving limited resources.

Prerequisites:	1	Knowledge of different types of management techniques
	2	Knowledge of different types of mathematical techniques

	3	Units and conversions
Section – I		
Unit 1	**Linear programming**	
	Introduction: Importance of optimization techniques. Linear programming: Formulation, Graphical solution, Simplex method, Big M Method	**6 Hrs**
Unit 2	**Duality, Sensitivity analysis, Transportation problems**	
	Concept of Duality, Sensitivity analysis, Transportation Problem: I.B.F.S. Transportation Problem: Optimization	**6 Hrs**
Unit 3	**NLPP & Assignment Problems**	
	Introduction to assignment problem, Solution of assignment problem, Introduction to N.L.P	**6 Hrs**
Section – II		
Unit 4	**Decision theory**	
	Introduction, decision tree, Game theory.	**6 Hrs.**
Unit 5	**Inventory models**	
	Fundamentals of Inventory, deterministic model, probabilistic model, E.O.Q.	**6 Hrs.**
Unit 6	**Queuing theory**	
	Queuing theory. Simulation applications, Forecasting techniques	**6 Hrs.**

CO - PO Mapping

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

REFERENCES

Text Books	
1	S. S. Rao, Engineering Optimization: Theory and Practice, Wiley & Sons, New Jersey, 2009.
2	H. A. Taha, Operations Research, Pearson Education India,2009.
3	F. H. Hillier and G. J. Liberman, Introduction to Operations Research, Tata McGraw-Hill, 2010.
4	A. Ravindran, D. T. Phillips, and J. J. Solberg, Operations Research: Principles and Practice, John Wiley and Sons, 1987.
Reference Books	
1	W. L. Winston, Operations Research: Applications and Algorithm, 4th Edition, Cengage Learning, 1994.
2	K. Deb, Optimization for Engineering Design, Prentice Hall, 2013.
3	M. C. Joshi and K. M. Moudgalay, Optimization: Theory and Practice, Narosa, 2004.

CE604T Elective I – Optimization Techniques

Credit-1

a] Minimum one assignment on each unit with theory and minimum four numerical, (wherever applicable)

CE605 – ENERGY AND ENVIRONMENT

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 energy with respect to quantity and use
2. To describe and design the various Building and industrial energy efficient units.
3. To learn the special energy requirements and its methods of applications
4. To learn various sources of Air pollution, Noise Pollution and Solid waste its treatment and safe disposal.
5. Measurement of pollution of Air, Noise and solid waste.

Course Outcomes (CO):

COs	At the end of successful completion of the course, the student will be able to	Blooms Taxonomy
CO1	Describe the various sources of energy with respect to quantity.	Knowledge Understand
CO2	Describe and design the various energy efficient units.	Understand
CO3	Illustrate the special energy requirement and its use in residential and industrial buildings	Understand
CO4	Know the various sources of Air pollution, Noise Pollution and Solid waste its treatment and safe disposal.	Understand
CO5	Measurement of strength of Air pollutants, sound pollution and solid waste	Apply Evaluate

Description:

Energy and Environment is focused on analysing and understanding the quality and quantity of Energy required for various types of buildings and its audits. Moreover, the awareness of Air pollution, Noise Pollution and Solid waste generates its pollution intensity, limits laws, and various methods of testing and reduction of pollution. This course will enhance the knowledge about green energy and its applications. The future of globe to reduce use of non-renewable energy and application of green energy is achieved through this course. The environmental pollution impact can be controlled through various techniques and their implementation.

Prerequisites	1	Energy requirements for human activities
	2	Effects of Air pollution and noise pollution on Human and his environment
	3	Solid wastes and its nuisance
	4	MPCB, CPCB and its standards

Section – I		
Unit 1	**Air Pollution**	
	Definition, Sources and classification of pollutants, Effects. Measurement of Air Pollutants, Control of industrial air pollution- Settling Chamber, Bag filter, Cyclone separator, Scrubbers, Electrostatic precipitators. Air quality standards	**7 Hrs**
Unit 2	**Noise Pollution**	
	Noise characteristics and measurements, Levels of noise and standards, control.	**4 Hrs**
Unit 3	**Solid Waste Management**	
	Solid wastes Definition, Types, Sources, Characteristics, Functional outlines-storage, Collection, Processing techniques, Methods of treatment of solid waste-Composting, Incineration, Pyrolysis and Sanitary land filling.	**7Hrs**
Section – II		
Unit 4	**Green Energy and Environment:**	
	Introduction to Green Buildings, Aspects of green energy and the environment, such as bio-fuel and bio-energy, energy storage and networks, Catalysis of sustainable development	**6 Hrs**
Unit 5	**Clean Energy and its uses**	
	Reduced air pollution and greenhouse gas emissions, Lower consumer energy bills, Enhanced state and local economic development and job creation, Improved energy system reliability and security. Energy audits and green building rating	**5 Hrs**
Unit 6	**Environmental Problems and Energy:**	
	Different types of Energy – Conventional and non-conventional, The environmental problems directly related to energy production and consumption include air pollution, climate change, water pollution, thermal pollution, and solid waste disposal. The emission of air pollutants from fossil fuel combustion is the major cause of urban air pollution.	**7 Hrs**

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	If applicable		
													PSO 1	PSO 2	PSO 3
CO 1	1	2	-	-	1	--	--	---	--	--	--	--	--	--	--
CO 2	1	2	1	2	-	--	--	--	--	--	--	--	--	--	--
CO 3	1	2	-	-	-	--	--	--	--	--	--	--	--	--	--
CO 4	-	-	2	2	2	--	--	--	--	--	--	--	--	--	--
CO 5	1	2	2	-	-	--	--	--	--	--	--	--	--		--
CO 6	1	2	-	-	1	--	--	--	--	--	--	--		--	

REFERENCES

Text Books	
1	Sewage Disposal and Air Pollution Engineering - Garg S.K., [Khanna Publishers], 39th edition
2	Solid Waste Management in Developing countries - Bhide A.D. and Sundersen B.B.[Indian National Scientific Documentation Centre, New Delhi]
3	Air Pollution- Rao M.N. and Rao H.V.N. [Tata Mcgraw Hill]
4	Environmental Noise Pollution: Noise Mapping, Public Health, and Policy Paperback – Import by Enda Murphy (Author), Eoin A King (Author)
Reference Books	
1	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
2	Manual on Municipal Solid Waste Management- Ministry of Urban Development Govt. of India

CE601P – DESIGN OF STEEL STRUCTURES (Lab)

Practical's: 2 hrs / week
Credits: 1

Examination Scheme:
ISA: 50 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	Analyze and design different types of welded and bolted connections by using necessary elements for analyzing steel structures.	Remember
CO2	Analyze and design axially loaded tension member along with its end connections.	Apply, Evaluate
CO3	List and describe essential elements necessary to analyze and design of compression member.	Apply, Evaluate
CO4	Analyze and design axially and eccentrically loaded columns along with its different types of column bases.	Apply, Evaluate
CO5	Analyze and design laterally supported and unsupported beams with their end connections.	Apply
CO6	Calculate forces acting on gantry girder and its design as laterally unsupported beam.	Remember, Apply

TUTORIALS

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

Sr. No.	**Practical/ Experiment/Tutorial Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Design of bolted Connections	2	Remember
2	Design of Welded Connections	2	Apply, Evaluate
3	Design of Tension Member	2	Apply, Evaluate
4	Design of Compression Member	2	Apply, Evaluate
5	Design of Column & Footing	2	Apply

6	Design of Footing	2	Remember, Apply
7	Design of Beam	2	Apply, Evaluate
8	Design of Gantry Girder	2	Apply, Evaluate

CO - PO Mapping

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

REFERENCES

Text Books	
1	"Design of Steel Structures (By Limit State Method As Per Is 800—2007" – S. S. Bhavikatti, I K International Publishing House, New Delhi,2009
2	Limit State Design of Steel Structures: *V. L. Shah and* Veena Gore, Stuctures Publication, Pune,2009
3	IS 800:2007-BIS
4	"Handbook on steel-SP6" BIS
5	"IS – 875, Part - III" -BIS.
Reference Books	
1	Design of Steel Structures, by Dr. N. Subramanian, Oxford University Press, New Delhi,2008
2	Limit State Design of Steel Structures: S.K. Duggal, Tata Mc-Graw Hill India Publishing House,2010
3	Design of Steel Structures: K.S. Sairam, Pearson Education India, 2010
4	Design and Analysis of Steel Structures:Vajrani V. N., Ratwani M. M. and Mehra H., Oscar Publications,1988

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

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

CE605P – ENERGY AND ENVIRONMENT (Lab)

Practical's: 2 hrs / week **Examination Scheme:**
Credits: 1 **ISA: 25 Marks**

Course Objectives: The objective of the course is to
1) To familiarize the students with the quality and quantity of Air, sound and solid waste 2) To familiarize the students Concept and Design of green Building 3) To understand Location and development of sound and its measurement

Course Outcomes (CO):		
COs	**At the end of successful completion of the course the student will be able to**	**Blooms Taxonomy**
CO1	Determine different properties of Air Pollutants, Sound, and solid waste	Understand Analyze
CO2	Demonstrate Quantity and methods of Air Quality Measurement	Understand
CO3	Measure the intensity of sound with respect to location time and activity	Analyze
CO4	Green Building and its development	Analyze
CO5	Different forms and measurement of Energy	Understand Analyze

PRACTICALS

Sr. No.	**Practical/ Experiment/Tutorial Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Visit to Residential, Commercial and industrial Buildings for its Water, wastewater, Electricity requirements-use optimization and its study	2	Analyze
2	Measurement of Noise levels at various location at and around – Traffic Signals, Hospitals, Schools, Industries etc	2	Analyze
3	Problems on Residential, Commercial and industrial Buildings for its energy uses Water, Electricity and resources budgeting.	2	Analyze
4	Planning for optimal use of natural energy and its application.	2	Analyze

CO - PO Mapping

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

REFERENCES

	Text Books
1	Sewage Disposal and Air Pollution Engineering - Garg S.K., [Khanna Publishers], 39th edition
2	Solid Waste Management in Developing countries - Bhide A.D. and Sundersen B.B. [Indian National Scientific Documentation Centre, New Delhi]
3	Air Pollution- Rao M.N. and Rao H.V.N. [Tata McGrawHill]
4	Environmental Noise Pollution: Noise Mapping, Public Health, and Policy Paperback – Import by Enda Murphy (Author), Eoin A King (Author)
	Reference Books
1	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
2	Manual on Municipal Solid Waste Management- Ministry of Urban Development Govt. of India

CE606P – BUILDING MODELLING & DESIGN

Practical's: 2 hrs / week

Examination Scheme:

Credits: 1

ISA: 50 Marks
POE: 25 Marks

Course Objectives: The objective of the course is to
4) To familiarize the students with the quality and quantity of Air, sound and solid waste
5) To familiarize the students Concept and Design of green Building
6) To understand Location and development of sound and its measurement

Course Outcomes (CO):		
COs	**At the end of successful completion of the course the student will be able to**	**Blooms Taxonomy**
CO1	Student should have a good working knowledge of SketchUp's 2D & 3D drawing tools as well as editing tools	Understand Analyze
CO2	Students to know how to create a group or component, and how to paint a face with colors or materials,	Understand Analyze
CO3	Students to know how to use texture positioning, Photo Match, scenes, layers, or styles	Understand Analyze
CO4	Using this software study student will present building in all ways.	Analyze

PRACTICALS

Sr. No.	**Practical/ Experiment/Tutorial Topic**	**Hrs.**	**Bloom's Taxonomy**
1	Introduction Google SketchUp , Establishing the Modeling Mind-Set, Getting Off to a Running Start	2	Analyze
2	Modeling in SketchUp, Develop Buildings, Falling in Love with Components Going Beyond Buildings, Keeping Your Model Organized	2	Analyze
3	Modeling with Photographs, Viewing Your Model in Different Ways, Working with Styles and Shadows	2	Analyze
4	Working with Google Earth and the 3D Warehouse, Printing Your Work, Exporting Images and Animations, Creating Presentation Documents with LayOut.application.	2	Analyze

CO - PO Mapping

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

REFERENCES

	Text Books
1	Aidan Chopra - Google SketchUp 7 For Dummies-For Dummies (2009) [Wiley Publishing]
2	SketchUp website - online videos and tutorials (go to http://sketchup.google.com/training).
	Reference Books
1	O'Reilly's Google SketchUp: The Missing Manual by Chris Grover.
2	SketchUp website - online videos and tutorials

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