SEMESTER VII

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPC19	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Pre-stressed Concrete	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce fundamental of pre stressing and develop understanding of pre stressing system.
- To determine loss of pre stress in pre tensioned and post tensioned members as per IS Code provision.
- To analyze simple and composite section in flexure.
- To evaluate deflection in beam and design simply supported beams as per IS Code provision.
- To design the members for shear reinforcement, Ultimate Shear Strength and end block design.

Course Content:

UNIT 1: Introduction: Fundamentals of Prestressing - Classification and types of Prestressing- Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers.

UNIT 2: Prestressing Systems: Principles of pretensioning and post tensioning - study of common systems of prestressing for wires strands and bars. Losses of Prestress: Losses of prestress in pre tensioned and post tensioned members - I.S. code provisions.

UNIT 3: Analysis of Sections: In flexure, simple sections in flexure, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.

UNIT 4: Deflection of Beams: Long term and Short term deflectionand Design of Simply Supported Beams, Allowable stress as per I.S. 1343 - elastic design of rectangular and I-sections.

UNIT 5: Shear and Bond: Shear and bond is prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.

Text Books:

1. Krishna Raju. N “Prestressed Concrete”, Tata Mc Graw Hill.
2. Lin.T.Y, “Prestressed concrete”, Mc Graw Hill Pub. Co.
3. Rajagopalan, “Prestressed concrete”, Narosa Publishing House.

Course Outcomes-

On completion of this course the student will be able

CO1: Describe mechanical properties of pre stressed concrete, types of pre stressing and its system.

CO2: Calculate losses in pre-tensioned and post tensioned members.

CO3: Analyze pre-stressed concrete members for flexure, shear and cracking moment.

CO4: Design pre stressed concrete beams of rectangular and I section and compute deflection.

CO5: Explain principle of end block design, pre stress transfer, shear and bond.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPC20	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Water Resources Engineering-II	3	0	0	15	15	30			

Course Learning Objectives:

- Introduce the types of dams and its failure criteria for structural stability
- Introduce the concepts of spillways and energy dissipaters
- Discuss the concept of diversion Head-works and understand design theory of seepage flow
- Introduce the concepts of regulation works, falls and hydraulic gates of spillways
- Know the concepts and design principles of Cross Drainage Works

Course Content:

UNIT 1: Dams: Types of Dams, Forces, failure of dams and criteria for structural stability, principle and shear stress, stability analysis, Elementary profile of a gravity dam, Profile from practical considerations, Openings in dams.

UNIT 2: Spillways and Energy Dissipaters: Introduction, essential requirements of a spillway, spillway capacity, components, Types of spillways, Ogee Spillway, Energy Dissipation below spillways, Types of Energy dissipater, USBR and Indian stilling basins.

UNIT 3: Diversion Head-works: Introduction, Types of diversion works, location and components, Weir and Barrage, Effect of construction of weir on the river regime, Bligh's creep theory, Theory of seepage flow, Khosla's theory, Vertical drop Weir.

UNIT 4: Regulation Works: Introduction, Definition of falls, necessity and location of falls, comparative study of the main types of falls. Hydraulic Gates: Spillway gates, types, tainter gates, Roller gates.

UNIT 5: Cross Drainage Works: Introduction, suitability, various types of C-D Works, Design principles of C-D Works

Text Books:

1. Irrigation Engineering and Hydraulic Structures – S.K. Garg (Khanna Publications)
2. Irrigation Engineering – B.C. Punmia (Laxmi Publications)
3. Irrigation, Water Resources and Water Power Engineering – Dr. P.N. Modi (Standard Book House)

Course Outcome

On completion of this course the student will be able:

CO1: Explain the various forces acting on gravity dam and its stability analysis

CO2: Design of ogee spillway and getting concept of energy dissipation

CO3: Explain the diversion head-works and the theory of seepage flow

CO4: Demonstrate the concept of regulation works, falls and spillways gates

CO5: Apply the basic design principles of Cross Drainage Works

<table>
<tr><th colspan="8">SYLLABUS</th></tr>
<tr><td>Subject Code:</td><td colspan="2">CE207TPE02X</td><td colspan="3">CREDITS: 3</td><td colspan="2">SESSIONAL - TA</td><td>ESE</td></tr>
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or
Professional Elective-2B
or
Professional Elective-2C
or
Professional Elective-2D
or
Professional Elective-2E</td><td colspan="6">Any one subject to be Selected from the Professional Electives Group-2</td></tr>
<tr><th colspan="9">Professional Electives Group -2</th></tr>
<tr><td colspan="3">CE207TPE02A</td><td colspan="6">Environmental Geo-technology</td></tr>
<tr><td colspan="3">CE207TPE02B</td><td colspan="6">Air and Noise Pollution and Control</td></tr>
<tr><td colspan="3">CE207TPE02C</td><td colspan="6">Solid and Hazardous Waste Management</td></tr>
<tr><td colspan="3">CE207TPE02D</td><td colspan="6">Urban Hydrology and Hydraulics</td></tr>
<tr><td colspan="3">CE207TPE02E</td><td colspan="6">Environmental Impact Assessment and Life Cycle Analysis</td></tr>
</table>

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Environmental Geo-technology	3	0	0	15	15	30			

Course Learning Objectives:

- Learning various soil engineering for land reclamation purposes, conversion of degraded waste land in new land use.
- Understanding land degradation and soil pollution and their restoration.
- Integration of engineering techniques with ecological process for restoration of productivity.

Course Content:

UNIT-1 Soil and ground water pollutants - their sources, nature, composition and polluting effects. The physico-chemical aspects of soils contaminated by various pollutants. Effects of environment and wastes on the properties of soils.

UNIT–2 Solid and liquid wastes disposal method and management. land treatment systems.

UNIT-3 Man made changes in geotechnical environment - mining, embankments, pumping, reservoir, land fills and reclamation effects and control.

UNIT- 4 Control of contamination with use of clay barriers, geosynthetics, cut-off walls, leachate collection systems.

UNIT- 5 Stabilization - different materials and techniques in control of ground pollution and treatment.

Text Books:

1. D.E.Daniel, Geotechnical Practice for Waste Disposal, Chaman & Hall, London, 1993
2. Hsai_Yang Fang and Daniels, J.L. Introductory Geotechnical Engineering an Environmental Perspective, Taylor & Francis, Oxon., 2006.
3. Lakshmi N. Reddy, Hilary. I. Inyang – Geo-Environmental Engineering – Principles and Applications – Makcel Dekker Ink, 2000
4. Mitchell, J.K. and Soga, K., Fundamentals of Soil Behaviour, John Wiley & Sons, Inc., New Jersey., 2005.
5. Mohamed, A.M.O. and Antia, H.E., Geo-environmental Engineering, Elsevier, Netherlands, 1998.
6. Reddy, L.N. and Inyang. H. I., Geo-environmental Engineering –Principles and Applications, Marcel Dekker, Inc., New York., 2000.
7. Yong, R. N., Geo-environmental Engineering: Contaminated Soils, Pollutant Fate and Mitigation", CRC press LLC, Florida., 2001.

Course Outcomes-

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

CO1: Understanding causes of soil pollution.

CO2: Understand the fundamentals of soil behavior under varied environmental conditions.

CO3: Identify contaminant transport mechanisms in soils.

CO4: Specify site investigation techniques in the characterization of the contaminated site

CO5: Understand remediation techniques to reclaim degraded land for conversion in to various land uses.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Air and Noise Pollution and Control	3	0	0	15	15	30			

Course Learning Objectives:

- To comprehend the essential concepts of Air and Noise pollution Learning
- To understand, measure and evaluate the character &behaviour of air and noise pollutants
- To understand the measurement techniques and strategies to control their presence in the ambient atmosphere.

Course Content:

Unit I: Air pollution: composition and structure of atmosphere, global implications of air pollution. classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants.

Unit II: Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

Unit III: Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling. Control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

Unit IV: Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

Unit V NOISE POLLUTION: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices.

Text Books:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. M.N.Rao& HVN Rao, Air Pollution, Tata McGraw-Hill Publishing Company Limited, New Delhi.
5. Environmental Pollution Control Engineering- CS Rao, Wiley Eastern Ltd., New Delhi, 1996.
6. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987
7. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.
8. Suess and Craxford: W.H.O. Manual on Urban Air Quality Management

Course Outcomes-

After studying the course, the students will be able to

CO1: Identify the major sources, effects and monitoring of air and noise pollutants.
CO2: Understand the key transformations and meteorological influence on air and noise.
CO3: Understand the behaviour of air pollutants in atmosphere.
CO4: Relate and analyse the pollution regulation on its scientific basis.
CO5: Application of various control equipment's for the abatement of air and noise.
CO6: Evaluate the engineering solutions for industrial and vehicular air & noise pollution problems.

Syllabus	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Solid and Hazardous Waste Management	3	0	0	15	15	30			

Course Learning Objectives:

- To define and characterize municipal solid wastes from technical and regulatory points of view.
- To provide comprehensive ways of collection, transportation and management of different types of solid wastes.
- To classify the waste and remove hazardous wastes; apply different methods of management.
- .To introduce the most common techniques for hazardous waste disposal.
- To use laboratorial tests in sampling & characterization of solid wastes.

Course Content:

UNIT-1:Municipal Solid Waste Management

Legal and Organizational foundation: Definition of Solid Waste, Waste Generation Technological Society, Major Legislation, Monitoring Responsibilities, Sources and Types of Solid Waste, Sampling and Characterization – Determination of Composition of MSW, Storage and Handling of Solid Waste ,Future Changes in Waste Composition.

UNIT-2:Collection and Transport of Solid Waste

Collection of Solid Waste: Type of Waste Collection Systems, Analysis of Collection System, Alternative Techniques for Collection System, Separation, Processing and Transformation of Solid Waste: UNIT Operations User for Separation and Processing, Materials Recovery Facilities, Waste Transformation through Combustion and Aerobic Composting, Anaerobic Methods for Materials Recovery and Treatment, Energy Recovery.

Incinerators Transfer and Transport

Need for Transfer Operation, Transport Means and Methods, Transfer Station Types and Design Requirements, Landfills, Site Selection, Design and Operation, drainage and Leachate Collection Systems , Requirements and Technical solution, Designated Waste Landfill Remediation, Integrated Waste Management Facilities.

UNIT-3:Hazardous Waste Management

Definition and Identification of Hazardous Wastes-Sources and Characteristics, Hazardous Wastes in Municipal Waste ,Hazardous Wastes Regulations ,Minimization of Hazardous Waste-Compatibility, Handling and Storage of Hazardous Waste-Collection and Transport, e-waste Sources, Collection, Treatment and Reuse Management.

UNIT-4:Hazardous waste treatment and Design

Hazardous Waste Treatment Technologies, Design and Operation , Facilities for Physical, Chemical and Thermal Treatment of Hazardous Waste –,Solidification, Chemical Fixation and Encapsulation, Incineration, Hazardous Waste landfills: Site Selection, Design and Operation, Remediation of Hazardous Waste Disposal Sites.

UNIT-5:Laboratory Practice: Sampling and Characterization of Solid Wastes; TCLP Tests and Leachate Studies.

Text Books:

1) Integrated Solid Waste Management by George Techobanoglous et al, McGraw-Hill Publication, 1993.
2) Hazardous Waste Management by Charles A. Wentz, McGraw Hill Publication, 1995.

Reference Books:

1) Solid and Hazardous Waste Management by S.C. Bhatia**,**Atlantic Publishers; Edition (1 December 2007).
2) Solid and Hazardous Waste Management by M.N Rao & Razia Sultana,BS Publications, Second Edition (2020)

Course Outcomes- At the end of the course completion, the students shall be able to:

CO1: Ability to characterize municipal solid wastes from technical view.
CO2: Learn ways of collection, transportation and management of different types of solid wastes.
CO3: Apply different methods of managements for hazardous wastes.
CO4: Develop most suitable techniques for disposal of hazardous wastes.
CO5: Learn different laboratorial tests for solid wastes.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Urban Hydrology and Hydraulics	3	0	0	15	15	30			

Course Learning Objectives:

- To describe physical properties of urban area.
- To understand the elements of drainage systems.
- To study about urban water supply
- To know about the measures to control storm water pollution
- To learn urban watershed software.

Course Content:

UNIT 1: Urbanisation: Process of urbanisation, Trends of urbanisation and industrialisation, influence on hydrologic cycle, effects and consequences for drainage, Rainfall analysis in urban environment, design storm. Urban Runoff computations: Empirical, Time-area and unit hydrograph approaches. Urban storm water runoff: overland flow.

UNIT 2: Design of drainage system elements: Hydraulic fundamentals, infiltration and on-site detention of storm water, design of sewerage and drainage channels, design of appurtenances, road drainage, design of pumping stations

UNIT 3: Urban water supply: Estimate of demand, sources in surface and groundwater, Reservoir, capacity estimation.

UNIT 4: Control of storm water pollution: Pollution build-up and wash off process with reference to urban drainage systems. Source control in commercial and industrial complexes, storage options - dry and wet ponds, biological treatment of wastewater, chemical treatment of storm water

UNIT 5: Introduction to urban watershed software - Hydrologic Cistern, water conservation and ecological aspects, Water harvesting.

TEXT BOOKS:

1. Chow V T, Handbook of Applied Hydrology: A Compendium of Water resources technology, McGraw Hill, New York, 1964.
2. Gupta R S, Hydrology and Hydraulic Systems, Prentice Hall Publishers, New Jersey, 1989.
3. Geiger W F, Marsalek J Z, and Rawls G J, Manual on Drainage in Urban Areas, 2 Volumes, UNESCO, Paris, 1987
4. Hall M J, Urban Hydrology, Elsevier Applied Science Publishers, New York, 1984.
5. Stahre P, and Urbonas B, Stormwater Detention for Drainage, water quality and CSO Management, Prentice Hall Publishers, New Jersey, 1983.
6. Wanielista M P, and Yousef Y A, Stormwater Management, JohnWiley and Sons, New York, 1993.

Course Outcome: At the end of the course students shall be able to:

CO1: Understand and explain the effects of urbanization on rainfall and runoff.

CO2: Design various urban drainage system elements.

CO3: Estimate the demand of urban areas

CO4: Identify and apply the control required for storm water pollution

CO5: Use urban watershed software for simulation purpose.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE02E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Environmental Impact Assessment and Life Cycle Analysis	3	0	0	15	15	30			

Course Learning Objectives:

- Identify environmental attributes for the EIA study.
- Identify methodology and prepare EIA reports.
- Specify methods for prediction of the impacts.
- Formulate environmental management plans.
- Understand the concept of life cycle analysis (LCA) and the basic principles.

Course Content:

UNIT-1: Introduction: Historical development of Environmental Impact Assessment (EIA). EIA in Project Cycle. Legal and Regulatory aspects in India. – Types and limitations of EIA – Cross sectoral issues and terms of reference in EIA – Public Participation in EIA. EIA process- screening – scoping - setting – analysis – mitigation

UNIT–2: Components and Methods for EIA: Matrices – Networks – Checklists – Connections and combinations of processes – Cost benefit analysis – Analysis of alternatives – Software packages for EIA – Expert systems in EIA. Prediction tools for EIA – Mathematical modelling for impact prediction – Assessment of impacts – air – water – soil – noise – biological — Cumulative Impact Assessment – Documentation of EIA findings – planning – organization of information and visual display materials – Report preparation. EIA methods in other countries.

UNIT-3: Environmental Management Plan: Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment.

UNIT- 4: An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus). Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

UNIT- 5: Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools). Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Text Books:

1) Anjaneyulu.Y., and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007
2) Canter, L.W., Environmental Impact Assessment, McGraw Hill Pub. Co., New York. 1997
3) David P. Lawrence, Environmental Impact Assessment: Practical Solutions to Recurrent Problems, John Wiley & Sons, 2003
4) Environmental Assessment, 2001. Ravi Jain, LV Urban, GS Stacey, H Balbach, McGraw-Hill.
5) Handbook on Life Cycle Assessment : Operational guide to the ISO standards, Kluwer Academic Publishers, 2004
6) Hosetti, B. B., Kumar A, Eds, Environmental Impact Assessment & Management, Daya Publishing House, 1998
7) Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Inter science, New Jersey, 2003.
8) Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science, London, 1999.

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

CO1: Identify environmental attributes for the EIA study.
CO2: Identify methodology and prepare EIA reports.
CO3: Specify methods for prediction of the impacts.
CO4: Understand EIA tools & methodologies, auditing and documentation of EIA
CO5: Formulate environmental management plans
CO6: Perform life cycle inventory analysis of products.
CO7: Develop strategies to bring energy efficiency in all stages of the product development cycle.
CO8: Formulate plans for comprehensive environmental protection, in order to comply with environmental laws

<table>
<tr><td colspan="8">SYLLABUS

(SEMESTER-VII)</td></tr>
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or
Professional Elective-3B
or
Professional Elective-3C
or
Professional Elective-3D
or
Professional Elective-3E</td><td colspan="7">Any one subject to be Selected
from the Professional Electives</td></tr>
<tr><td colspan="9">Professional Electives Group -3</td></tr>
<tr><td colspan="2">CE207TPE03A</td><td colspan="7">Engineering Hydrology</td></tr>
<tr><td colspan="2">CE207TPE03B</td><td colspan="7">Structural Dynamics</td></tr>
<tr><td colspan="2">CE207TPE03C</td><td colspan="7">Foundation Engineering</td></tr>
<tr><td colspan="2">CE207TPE03D</td><td colspan="7">Rock Mechanics</td></tr>
<tr><td colspan="2">CE207TPE03E</td><td colspan="7">Water Resources Planning & Management</td></tr>
</table>

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Engineering Hydrology	3	0	0	15	15	30			

Course Learning Objectives:

- To develop the fundamentals of hydrology and Precipitation.
- To study various abstractions of precipitation.
- To understand the concepts of Rainfall-Runoff correlations
- To learn about the importance of Hydrographs and the basics of the flood.
- To understand the fundamentals of groundwater hydrology

Course Content:

UNIT-1 Introduction Description of Hydrologic Cycle, Overview of the applications of hydrology in engineering, Forms of precipitation, measurement, depth-area-duration, and intensity-duration frequency relations.

UNIT–2Abstraction from Precipitation, Evaporation - process, measurement, and estimation, Evapotranspiration measurement and estimation Infiltration process, measurement, and estimation.

UNIT-3 Runoff Surface Runoff and Stream Flow Measurements, Rainfall-Runoff relations.

UNIT- 4 Hydrograph Factors affecting flow hydrograph, Unit hydrograph, its analysis, and S-curve hydrograph, Synthetic and instantaneous unit hydrographs. Basics of Flood and Flood Routing.

UNIT- 5 Groundwater Occurrence of groundwater, types of aquifers, aquifer properties, Darcy's law, Conductivity and Transmissivity, the yield from a well under steady-state conditions, Laboratory and field measurement of permeability

Text Books:

1. Engineering Hydrology K.Subramanya, Tata McGraw-HillEducation
2. Hydrology Principles, Analysis and Design H.M.Raghunath, New AgeInternational
3. Hand BookofAppliedhydrologyV.T.Chow, McGraw-Hill,Inc
4. ViesmannWandLewisGLt(2008)"IntroductiontoHydrology".PrenticeHallofIndia
5. Ojha,C.S.P. , Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University PressCanada.
6. K. C. Patra, Hydrology and Water Resources Engg., Narosa Publishing house, New Delhi.
7. D. K. Todd, Groundwater Hydrology, John Wiley and Sons

Course Outcomes-Upon completion of this course students shall be able to

CO1: Describe the basic concepts of hydrology and precipitation to integrate them with the physical hydrological processes.

CO2: Understand and Explain the various process, measurements, and estimations of hydrological components

CO3: Formulate the rainfall-runoff relationship and apply it to engineering practices.

CO4: Explain and use the hydrographs for practical purposes and investigations.

CO5: Understand and explain the basics of groundwater hydrology.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Structural Dynamics	3	0	0	15	15	30			

Course Learning Objectives:

- To Introduce fundamentals of vibrations of SDOF system
- To Impart damped and undamped system
- To Present free and forced vibration
- To Acquaint with free and forced vibration of MDOF system
- To Present free and forced vibration of continuous system

Course Content:

UNIT- 1: INTRODUCTION: Comparison between static and dynamic analysis; Degrees of freedom; Undamped system; Newton's law of motion; 'D' Alembert's principle; Solution of the differential equation of motion.

UNIT-2: FREE VIBATION OF SINGLE DEGREE - OF - FREEDOM SYSTEM: Equation of motion for single degree - of - freedom system; free undamped vibration of the SDOF system; Damped single degree - of - freedom system -Viscous damping, Equation of motion, critically damped system, Over- damped system. Under-damped system and Logarithmic decrement.

UNIT-3: RESPONSE OF SDOF SYSTEM TO HARMONIC LOADING: Undamped harmonic excitation; Damped harmonic excitation; Evaluation of damping at resonance; Response to support motion; Force transmitted to the foundation. Response of' SDOF system to general dynamic loading: Impulsive loading and Duhamel's integral; Numerical evaluation of Duhamel's integral — Undamped system;Numerical evaluation of Duhamel's integral -Damped system.

UNIT-4: GENERALIZED COORDINATES AND RAYLEIGH'S METHOD: Principle of virtual work; Generalized SDOF system - Rigid body; Generalized SDOF system - Distributed elasticity; Rayleigh's method; Improved Rayleigh's method.

UNIT-5: STRUCTURES MODELED AS SHEAR BUILDINGS: Stiffness equations for the shear building; Flexibility equations for the shear building; Free vibration of a shear building (Single bay two Storeyed) - Natural frequencies and normal modes. Forced motion of shear buildings (Two Storeyed): Modal superposition method; Response of a shear building to base motion; Harmonic forced excitation.

Text Books/Reference Books:

1. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
2. Dynamics of Structures by Clough, R.W. &Penzin, J., McGraw Hill, 1993.
3. Earthquake Resistant Design of Structures by Pankaj Agarwal, Manish Shrikhande , 1st edition (2006), Prentice Hall of India Private Ltd., New Delhi .
4. Dynamics of Structures by Humar, J.L., Prentice Hall, 1990.
5. Structural Dynamics by Mario, Paz, CBS Publ. New-Delhi, 1995.
6. Advanced Dynamics by Timoshenko, S., McGraw Hill Book Co, NY, 1948.
7. Elements of Vibration Analysis by Meirovitch, L., 2nd Edi. McGraw Hill Intr. Edi.,Singapore, 1986.
8. Introduction of Structural Dynamics, Biggs, J.M., McGraw Hill, NY, 1964
9. Principles and techniques of vibrations by L Meirovich, 1997, Prentice Hall, NJ.
10. Analytical methods in vibrations by L Meirovich, 1967, Macmillan, NY.
11. Theory of vibrations by W T Thompson, 1983, Prentice hall, New Delhi
12. Vibration: fundamentals and practice by C W de Silva, 1999, CRC Press, Boca Raton.
13. Mechanical Vibrations by S S Rao, 2004, 4th Edition, Pearson Education, New Delhi.

Course Outcomes:

On the completion of this course, the student will be able to

CO1: Convert a physical structure into SDOF system/model
CO2: Find response of free and force vibration (harmonic, periodic and transient) of SDOF system
CO3: Calculate natural frequency and mode shapes of MDOF system
CO4: Carry out modal analysis of MDOF system
CO5: Get the Response of structures by performing experiments and/or by computer simulation.

SYLLABUS	(SEMESTER VII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Foundation Engineering	3	0	0	15	15	30			

Course Learning Objectives:

- To introduction of different methods of soil exploration.
- To provide comprehensive studies of shallow foundation and calculate settlements.
- To analyze various types of footings & rafts.
- To introduction of various types of piles foundations and to calculate bearing capacity.
- To introduce Comprehensive studies of Retaining walls and determine stability.

Course Content:

UNIT-1 Site Investigation And Selection Of Foundation: Scope and Objectives, Methods of Exploration , Auguring and Boring ,Wash Boring and Rotary Drilling ,Depth and Spacing of Bore Holes ,Soil Samples ,Representative and Undisturbed, Sampling Methods Split Spoon Sampler, Thin Wall Sampler, Stationary Piston Sampler ,Penetration Tests (SPT and SCPT) ,Data Interpretation ,Strength Parameters ,Bore Log Report and Selection of Foundation.

UNIT–2 Shallow Foundation: Location and Depth of foundation, Codal Provisions, Bearing Capacity of Shallow Foundation onHomogeneous Deposits ,Terzaghi's Formula and BIS formula ,Factors Affecting Bearing Capacity Bearing Capacity from In-Situ Tests (SPT, SCPT and Plate Load) ,Allowable Bearing Pressure , Seismic Considerations in Bearing Capacity Evaluation, Determination of Settlement of Foundations on Granular and Clay Deposits ,Total and Differential Settlement , Allowable Settlements , Codal Provision , Methods of Minimizing Total and Differential Settlements.

UNIT-3 Footings And Rafts: Types of Isolated Footing, Combined Footing, Mat Foundation, Contact Pressure and Settlement Distribution, Proportioning of Foundations for Conventional Rigid Behavior, Minimum Thickness for Rigid Behavior, Applications, Compensated Foundation, Codal Provisions.

UNIT- 4 Pile Foundation: Types of Piles and Functions ,Factors Influencing the Selection of Pile , Carrying Capacity of Single Pile in Granular and Cohesive Soil , Static Formula ,Dynamic Formulae (Engineering News and Hileys) ,Capacity from In-Situ Tests (SPT and SCPT) , Negative Skin Friction , Uplift Capacity, Group Capacity by Different Methods (Feld's rule, Converse — La-Barrae formula and Block Failure Criterion) ,Settlement of Pile Groups , Interpretation of Pile Load Test (Routine Test Only), Under Reamed Piles, Capacity under Compression and Uplift , Cohesive -Expansive ,Non Expansive — Cohesionless Soils , Codal Provisions.

UNIT- 5 Retaining Walls: Plastic Equilibrium in Soils ,Active and Passive States , Rankine's Theory for Cohesionless and Cohesive Soil ,Coulomb's Wedge Theory , Condition for Critical Failure Plane ,Earth Pressure on Retaining Walls of Simple Configurations , Culmann's Graphical method ,Pressure on the Wall due to Line Load ,Stability Analysis of Retaining Walls ,Codal Provisions.

Text Books:

1) Foundation Analysis and Design by J. E. Bowels, McGraw Hill. Companies, Inc. 6th Ed. 2001.
2) Principles of Foundation Engineering by B. M. Das, CENGAGE Learning. Seventh Edition.
3) Foundation Engineering Handbook by R. W. Day, McGraw Hill. ConstructionASCE Press. Ed. 2006.
4) Basic and Applied Soil Mechanics by Gopal Ranjan & A.S. R. Rao, New Age International (P) Limited Publishers, New Delhi-110002.
5) Textbook of Soil Mechanics and Foundation Engineering –Geotechnical Engineering Series (PB 2018) by V.N. S. Murthy, CBS Publications, New Delhi
6) Soil Mechanics by Robert V. Whitman & T. William Lambe, Wiley India Pvt Ltd., New Delhi.
7) Soil Mechanics and Foundation Engineering (Geotechnical Engineering) by Dr. P.N. Modi, Standard Book House(Rajsons Publications Pvt Ltd), New Delhi-110002

Course Outcomes-At the end of the course completion, the students shall be able to:

CO1: Understand different methods of soil exploration.
CO2: Analyze various shallow foundations and calculate different types of settlements.
CO3: Understand various types of footings & rafts.
CO4: Analyze bearing capacity of piles with different methods
CO5: Design stability of Retaining walls.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Rock Mechanics	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basics of rock mechanics and able to analysis stress.
- To calculate strain and determine physical properties of rocks.
- To determine mechanical properties of rocks by different methods.
- To analyse different models of stress–strain in rocks.
- To determine the static & dynamic elastic constants of rocks.

Course Content:

UNIT – 1: INTRODUCTION TO ROCK MECHANICS

Definition, Scope, Importance & Development, Application in Mining, Discontinuities; Description of Discontinuities, Introduction to Mapping and Hemispherical Projection of Discontinuities, Barton's Shear Strength of Joints.

Analysis of Stress: Introduction, Definition and Basic Concepts, Stress in a Plane(2-D), Mohr's Circle of Stress, Secondary Principal Stress, Equations of Equilibrium, Plane Stress Equations.

UNIT – 2: ANALYSIS OF STRAIN

Introduction, Definition and Basic Concepts, Strain in a Pane (2-D), Mohr's Circle of Strain, Equations of Compatibility, Stress-Strain Relationship, Basic Equations in Elastic Theory, Pain Strain Equations, Elasto Plastic Behaviour of Rocks, Stress – Strain Curves of Various Rocks.

Physical Properties: Definition and Determination of Density, Hardness, Porosity, Permeability, Moisture Content, Degree of Saturation. Electrical and Thermal Properties of Rocks.

UNIT – 3: MECHANICAL PROPERTIES

Definition and Determination of Compressive Strength, Tensile Strength, Shear Strength, Triaxial Testing. Time Dependent Properties, Scaling of Laboratory Data to In-Situ Values.

Rock Indices: Protodyakanov Strength Index, Point Load Strength Index, RQD, In-Situ Strength Properties of Rocks, Necessity and Requirement, Methods of In-Situ Stress Measurements, Plate Load Test, Cable Jack Test, Bore Hole Test, Dilatometer Test, Flat Jack Test, Hydraulic Fracture and Velocity Propagation.

UNIT – 4: RHEOLOGICAL MODELS

Relationship and Rate of Change of Stress-Strain for Idealizing Materials – Models Representing Elastic, Plastic, Viscous, Elasto-Plastic, Non-Elastic and Brittle Rock Properties.

UNIT – 5: STATIC AND DYNAMIC ELASTIC CONSTANTS OF ROCKS

Static Elastic Constants of Rocks: Introduction, Definition, Instrument, Measurement of Deformation, Mechanical, Optical, Electrical Gauges, LVDT, Calculation of Elastic Constants of Rocks.

Dynamic Elastic Constants of Rocks: Introduction, Elastic Wave, Calculation of Modulus of Elasticity.

TEXT BOOKS:

1) Rock Mechanics for Engineers - B. P. Verma, 2nd edition, Khanna Publishers, 1989.
2) Strata Mechanics in Coal Mining - Jeremic, K. L. Jeremic, Rotterdam, Balkema, 1985.
3) Fundamentals of Rock Mechanics - Jager & Cook, Methuen andco. London, 1969.
4) Handbook on Mechanical Properties of rocks - R.D. Lama, V. S. Vutukuri, Vol. I to IV, Transtech Publications,1978.
5) Rock Mechanics for Underground Mining - 2nd edition, Brady and Brown, Kluwer AcademicPubllishers, 1993.

Course Outcomes: At the end of the course completion, the students shall be able to:

CO1: Learn basics of rock mechanics and calculate stresses.
CO2: Determine physical properties of rocks and strain.
CO3: Evaluate mechanical properties of rocks.
CO4: Compare stress strain in rocks by different methods.
CO5: Determine the static & dynamic elastic constants of rocks.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE03E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Water Resources Planning & Management	3	0	0	15	15	30			

Course Learning Objectives:

- To learn how to assess water resources
- To study how to develop suitable plans for water resources development and management
- To understand various types of water resources systems.
- To learn managing the water resources quality and quantity
- To understand water quantity and quality modelling.

Course Content:

UNIT 1: Introduction: Role of water in national development, assessment of water resources of country, scope of water resources development vis-a-vis environment, Irrigation development in India, utilisation of Irrigation potential.

UNIT 2: Planning: Water resources planning process; planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis.

UNIT 3: Water Resources Systems: Definition, types of system, optimization techniques, system approach, system analysis, linear programming, and formulation of a linear programming problem, formulation with different types of constraints, graphical analysis, graphical solution, simplex method, optimization techniques and systems approach.

UNIT 4: Management: Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water, conjunctive use of surface and ground water.

UNIT 5: Modelling: Water quantity and quality modelling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

Text Books:

1. Principles of Water Resources Planning – Good Man, A.S., (Prentice Hall, Inc., Englewood Cliffs, N.J. 1984.)
2. Water Resources Systems -S Vedula and P P Mujumdar, Tata McGraw-Hill Education, 2005
3. James, L. Douglas, and Robert R. Lee, Economics of Water resources Planning, McGraw-Hill Book Company, 1971.
4. Quentin Grafton, R. and Karen Hussey, Water Resources Planning and Management, Cambridge University Press, 2011.
5. Water Resources System, Planning and Management – M.C. Chaturvedy (Tata McGraw Hill)
6. Water Resources System, Planning and Management – Helweg O.J. (John and Wiley & Sons)

Course Outcomes- after completion of the course the students shall be able to

CO1: Describe the potential of assessing water resources
CO2: Prepare master and strategic water resources planning
CO3: Apply the optimization techniques for water resources systems.
CO4: Exercise the management of water resources in different real life situations
CO5: Solve various water resources problems using modelling.

<table>
<tr><td colspan="8">SYLLABUS

(SEMESTER-VII)</td></tr>
<tr><td>Subject Code:</td><td colspan="2">CE207TPE04X</td><td colspan="3">CREDITS:3</td><td colspan="2">SESSIONAL - TA</td><td>ESE</td></tr>
<tr><td rowspan="2">Subject:</td><td rowspan="2" colspan="2">Professional Elective - 4X</td><td>L</td><td>T</td><td>P</td><td>CT -I</td><td>CT-II</td><td>TOTAL</td><td rowspan="2">70</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>15</td><td>15</td><td>30</td></tr>
<tr><td colspan="3">Professional Elective-4A
or
Professional Elective-4B
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Professional Elective-4C
or
Professional Elective-4D
or
Professional Elective-4E</td><td colspan="6">Any one subject to be Selected
from the Professional Electives</td></tr>
<tr><td colspan="9">Professional Electives Group -4</td></tr>
<tr><td colspan="3">CE207TPE04A</td><td colspan="6">Industrial Structures</td></tr>
<tr><td colspan="3">CE207TPE04B</td><td colspan="6">Airport Planning and Design</td></tr>
<tr><td colspan="3">CE207TPE04C</td><td colspan="6">Railway Engineering</td></tr>
<tr><td colspan="3">CE207TPE04D</td><td colspan="6">Contracts Management</td></tr>
<tr><td colspan="3">CE207TPE04E</td><td colspan="6">Construction Projects Planning & Systems</td></tr>
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SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Industrial Structures	3	0	0	15	15	30			

Course Learning Objectives:

The purpose of this course is to:

- Develop an in-depth knowledge in the area of design of industrial structure with the latest code of practice as per the Indian Standard.
- To introduce the students about planning & functional requirement of industries
- To analyse& design the industrial buildings, bunkers & Silos
- To understand the design concept of chimneys
- To understand the principles of cylindrical shells

Course Content:

UNIT: I Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations

UNIT-II Thin Walled / Cold Formed Steel Members: Definitions – Local Buckling of Thin-Elements-Post Buckling of Thin-Elements – Light Gauge Steel Columns and Compression Members – Form-Factor for Columns and Compression Members – Behaviour of Stiffened Elements Under Uniform Compression – Multiple Stiffened Compression Elements –Effective Length of Light Gauge Steel Compression Members – Light Gauge Steel Tension Members.

UNIT-III RC Bunkers & Silos: Introduction – Janssen's Theory – Airy's Theory – Design of Square, Rectangular and Circular Bunkers; Design of Silos.

UNIT-IV RC Chimneys: Introduction – Wind Pressure – Stresses in Chimney Shaft Due to Self-Weight and Wind – Stresses in Horizontal Reinforcement Due to Wind Shear – Stresses Due to Temperature Difference – Combined Effect of Self Load, Wind and Temperature – Temperature Stresses in Horizontal Reinforcement Problems.

UNIT-V Design Principles of Cylindrical Shells & Design Problems.

TEXT BOOKS

1) Advanced Reinforced Concrete Design, By N. Krishna Raju (CBS Publishers & Distributors) 2005
2) Design of Steel Structures, By Ram Chandra and Virendra Gehlot vol-II, 2007.
3) Design of Steel Structures, By Duggal - Tata McGraw-Hill publishers – 2010
4) Handbook on Machine Foundations by P. Srinivasulu and C. V. Vaidyanathan, Structural Engineering Research Center
5) Tall Chimneys- Design and Construction by S. N. Manohar Tata Mc Grawhill Publishing Company

REFERENCES:

1) Transmission Line Structures by S. S. Murthy and A. R. Santakumar McGraw Hill
2) SP 32: 1986, Handbook on functional requirements of Industrial buildings
3) Design of steel structures by N. Subramanian

Course Outcomes-

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

CO1: Plan the functional requirements of structural systems for various industries.
CO2: Get an idea about the materials used and design of industrial structural elements.
CO3: Realize the basic concepts and design of power plant structures.
CO4: Design power transmission structures.
CO5: Possess the ability to understand the design concepts of Chimneys, bunkers and silos

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04B	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Airport Planning and Design	3	0	0	15	15	30			

Course Learning Objectives:

- To familiarize students with of airport planning.
- To develop the knowledge for design and analysis of airport runway, taxiway and airport pavement crust.
- To understand air traffic control system.

Course Content:

UNIT-1 Airport Planning: Significance of transport, Different modes of transportation, Airport master plan-FAA recommendation. Regional planning, airport site selection, survey for site selection, Estimation of future air traffic, Characteristics of aircraft, Environmental consideration.

UNIT–2Runway Design: Orientation of runway , Basic runway length, Corrections for basic runway length, Runway geometric design

UNIT-3 Taxiway Design: Controlling factors of taxiway, Geometric design for taxiway, Design for exit taxiways.

UNIT- 4 Airport Pavement Design: Design factors, Design of flexible pavement, Design of rigid pavement, design of overlay pavements

UNIT- 5Air Traffic Control and Visual Aids: Air traffic control objectives, control system. Visual aids-airport markings and lighting

Text Books:

1. Dr. S. K. Khanna, M.G. Arora and S.S. Jain, Airport Planning & Design, Nem Chand &Bros.,Roorkee
2. G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
3. S.C. Rangwala and K.S, Rangwala, Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand

Course Outcomes-

After learning the course the students should be able to:

CO1: Understand the fundamentals of airport planning.

CO2: Familiarize with design of runway.

CO3: Recognize design of taxiway

CO4: Understand airport pavement design

CO5: Analyse air traffic control system.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04C	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Railway Engineering	3	0	0	15	15	30			

Course Learning Objectives:
The objective of this Course is

- Comprehend the history of indian railway and basic study required with respect to construction of railway track.
- To make aware of the different components of railway track and the recent updation in indian railway with respect to the components.
- Comprehensive understanding of the factors involved in designing of the various alignment elements.
- Explain essential features, requirements and components of different types of point, crossings, turnouts, switches, crossovers etc.
- Detailed study and uderstanding of the signalling and station yard system of railway.

Course Content:

UNIT 1: Introduction to Railways in India: Role of Indian Railways in National Development Railways for Urban Transportation –LRT & MRTS. Alignment of Railway Lines: Engineering Surveys for Track Alignment. Permanent Way: Components and their Functions

UNIT 2: Rails - Types of Rails, Length of rail, Weight of Rail, Rail Joints, Creep of rail, Buckling of rail, Kinks of Rail Fastenings, Coning of Wheels & tilting of rails.
Sleepers –Types, Functions, sleeper density
Ballasts- Types, function, advantage & disadvantage of each type.

UNIT 3: Geometric Design of Railway Tracks: Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal Curves.

UNIT 4: Points and Crossings, Turnouts: Working Principles, Cross overs.

UNIT 5: Signalling: Types and their function. Station and Yards: Types, Requirements, factors for site selection.

Text Books:

1. Chandra S. and M.M. Agarwal, Railway Engineering, Oxford University Press, New Delhi, India, 2007.
2. Saxena, S.C. and S.P. Arora, Railway Engineering, Dhanpat Rai and Sons, New Delhi, India, 1997.
3. Agarwal, M.M., Indian Railway Track, Prabha and Co., New Delhi, India, 1988.
4. Rangwala, S.C., Principles of Railway Engineering, Charotar Publishing House, Anand, India, 1988.
5. J. S. Mundrey, “Railway Track Engineering”, McGraw Hill Publishing Co., 2009

Course Outcomes

At the end of the course the students shall be able to:

CO1: The students are expected to prepare the detailed project report for the construction, design and operation of mass transit systems that use a fixed guide way.
CO2: The students understands the basic requirents of the components of the railway tracks and also got global updation about the railway track components.
CO3: The students are expected to handle the tasks that include determining horizontal alignment and vertical alignment design.
CO4: The students are able to design various components of point, crossing, turnouts etc.
CO5: The students understand the requiremnets and also diffentiate the signalling system for particular track. Also understand the basic factors and requirtemnet of station yards.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04D	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Contracts Management	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce about various Authorities, indulge in construction contract management.
- To impart knowledge on municipal bye-laws related to construction.
- To elaborate about construction contracts, arbitration, and litigation procedures

Course Content:

UNIT-1 Introduction and concepts of Construction law-public law-government departments and local authorities.

UNIT–2 Private law-contracts-torts-property law and building law-concepts-salient features sections

UNIT-3 Construction contracts-contracts specifications-types of contract documents used for construction.

UNIT- 4 Contract procurement- selection of contractor-contract procedure-salient features.

UNIT- 5 Arbitration and litigation procedure-preparation, settlement, evidence, price adjustment-need for the formulae-civil engineering and building formulae- practical implications.

Text Books:

1. Gajaria G. T., laws relating to building and engineering contracts in India, M. M Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, construction contracts, 2nd edition. McGraw hill, 2001.
3. Joseph T. Bockrath, contracts and the legal environment for engineers and architects, 6th edition, McGraw Hill, 2000.

Course Outcomes-

CO1: To remember about various Authorities, indulge in construction contract management.

CO2: To understand about municipal bye-laws related to construction.

CO3: To remember & understand about various classifications of construction contacts.

CO4: To review about various steps of contract procurement in construction industry.

CO5: To evaluate the role of Arbitration and litigation procedure in settlement of contract related disputes.

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE207TPE04E	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Construction Projects Planning & Systems	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the project management and different scheduling techniques.
- To expertise in PERT network analysis.
- To learn CPM network analysis and compared with PERT.
- To understand time-cost analysis and resource scheduling.
- To understand the factor for equipment selection and cost of owing and operating and expertise in evaluation and analysis of different equipment life.

Course Content:

UNIT 1: Introduction: Objectives and functions of project management, project feasibility reports, Planning for construction projects: Steps, factors, advantages and disadvantages for different stake holder.

Scheduling: Scheduling Job layout and Line of balance, project management through networking, Bar Chart, Linked bar chart, Work-break down structures, Activity-on-arrow diagrams.

UNIT 2: PERT: Network analysis, critical path, probability of project.

UNIT3: CPM: Network analysis, Critical Path, Difference between CPM and PERT.

UNIT 4: Time-Cost Trade-off, Resource Scheduling

UNIT 5: Time and motion studies, Standard and special equipment, factors affecting selection of construction equipment, cost of owning and operating the construction Equipment, Equipment Life and Replacement Analysis

Text Books:

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Srinath,L.S., "PERT and CPM Priniples and Applications ", Affiliated East West Press, 2001
3. Chris Hendrickson and Tung Au, "ProjectManagement for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pitsburgh, 2000.
4. Moder.J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
5. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986.
6. Halpin,D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 1985.

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

CO1: To apply the knowledge in managing and handling of different civil engineering project and also able to schedule the project.

CO2: To do PERT analysis and able to find the project completion time and its probability.

CO3: To do CPM analysis and able to find the project completion time and compare with PERT analysis.

CO4: To do cost and time analysis and also resource allocation, scheduling and crashing for different activities of the network.

CO5: To apply the knowledge in equipment selection and able to find cost of owing and operating and able to find the equipment life, which help in comparisons of different equipments.

SYLLABUS **(SEMESTER-VII)**								
Subject Code:	CE207TOE02	CREDITS:3			SESSIONAL - TA			ESE
Subject:	Open Elective	L	T	P	CT-I	CT -II	TOTAL	70
		3	-	-	15	15	30	
CE207TOE02		Green Building and Sustainable Materials						

SYLLABUS	**(SEMESTER VII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE07TOE02A	L	T	P	CT-I	CT-II	TOTAL	70	100	3
Subject:	Green Building and Sustainable Materials	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the basics of Green Buildings.
- To learn the concept of site selection and planning.
- To study the use of efficient energies.
- To understand the types of sustainable building materials.
- To learn about maintenance of Indoor environmental quality.

Course Content:

UNIT-I
Green Buildings: Introduction, Definition, sustainable development, typicalfeatures of green buildings, benefits,key Requisites for Constructing a Green Building,Greenbuildingrating systems – GRIHA, IGBC and LEED.

UNIT- II
Site selection and building planning: Criteria for site selection, preservation of landscape, soil erosion control,minimizing urban heat island effect, maximize comfort by proper orientation of building facades, daylighting, ventilation, etc.
Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof,water demand, water efficient plumbing systems, water metering, waste water disposal, recycle and reuse systems.

UNIT-III
Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy,operationalenergy and life cycle energy. Methods to reduce operational energy: Energy efficientbuildingenvelopes, efficient lighting technologies, energy efficient appliances for heating and airconditioningsystems in buildings, zero ozone depleting potential (ODP) materials, wind and solarenergyharvesting,energy metering and monitoring, concept of net zero buildings. Optimum EnergyEfficiency, Typical Energy Saving Approach in Buildings Use of Renewable Energy Sources

UNIT-IV
Sustainable Building materials: local building materials, natural and renewable materials like bamboo, timber,

rammed earth, stabilized mud blocks, materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. Reuse of waste and salvaged materials

UNIT-V

Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation,exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to greenbuildings: NBC, ECBC, ASHRAE, UPC etc.Rapidly renewable building materials and furniture; Environment Quality And Occupational Health: Air conditioning, air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books

1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.
4. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
8. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

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

CO1: To apply the knowledge of Green Building in handling any physical projects.

CO2: To conduct a site selection process with respect to green buildings.

CO3: To make use of technologies with efficient energies.

CO4: To select and work with various sustainable materials.

CO5: To apply the knowledge in maintaining the indoor environmental quality.

SYLLABUS	**(SEMESTER VII)**					
Subject Code:	CE207PPC08	CREDITS: 1			SESSIONAL - TA	ESE
Subject:	Seminar	L	T	P	IA	
		-	-	2	50	-

SYLLABUS	**(SEMESTER VII)**					
Subject Code:	CE207PPC09	CREDITS:3			SESSIONAL - TA	ESE
Subject:	Minor project	L	T	P	IA	
		-	-	6	60	40

SEMESTER VIII

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPC21	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Earthquake Resistant Design of Structures	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce Engineering seismology and functional planning and the effects of configurations of buildings for earthquakes.
- To introduce the requirements for conceptual design for earthquake safety and the analysis methods.
- To acquaint with IS code-based design lateral forces for earthquake resistant design of structures.
- To identify the behavior of structural and nonstructural elements for seismic resistance and impart design of shear walls.
- Introduce Capacity Design as per IS 13920: 2016, Capacity Design for Beams, Columns, beam column joints and structure as a whole.

Course Content:

UNIT 1: Engineering Seismology: Earthquake phenomenon cause of earthquakes-Faults- Plate tectonics- Seismic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismoscope, Seismograph, accelerograph-Characteristics of strong ground motions- Seismic zones of India. Introduction-Functional Planning-Continuous load path-Overall form-simplicity and symmetry-elongated shapes-stiffness and strength - Seismic design requirements-regular and irregular configurations-basic assumptions.

UNIT 2: Conceptual Design - Horizontal and Vertical Load Resisting Systems - System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials – Unconfined Concrete & Confined Concrete – Masonry, Steel Structures. Design Earthquake Loads – Basic Load Combinations – Permissible Stresses. Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method – Modal Analysis Torsion.

UNIT 3: Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods. RC Buildings – IS Code based Method. - Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear –.

UNIT 4: Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands – Behaviour of infill Walls - Non Structural Elements – Failure Mechanism of Nonstructural Elements – Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures, Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls.

UNIT 5: Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction Impact of Ductility-Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during earthquakes-Vulnerability of open ground storey and short columns during earthquake- Seismic Evaluation and Retrofitting. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns-Case studies.

Text Books/References:

1. Seismic Design of Reinforced Concrete and Masonry Building – T. Paulay and M.J.N. Priestly, John Wiley & Sons
2. Earthquake Resistant Design of structures – Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd
3. Earthquake Resistant Design for Engineers & Architects by Dowrick, D. J., John Willey & Sons, 2nd Edition; 1987.
4. Earthquake Resistant Design of structures by S. K. Duggal, Oxford University Press.
5. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.

6. Reinforced Concrete Structures by Park, R. &Paulay, T., John Willey & Sons, 2nd Edition; 1975.
7. Masonry and Timber structures including earthquake Resistant Design –Anand S.Arya, Nemchand& Bros.
8. Earthquake –Resistant Design of Masonry Building –Miha Tomazevic, Imperial College Press.
9. Design of Reinforced Concrete Structures by N. Subramanian, Oxford University Press.
10. Dynamics of Structures by A.K.Chopra, Second edition (2001), Prentice Hall India Private Ltd
11. Handbook on Seismic Analysis and Design of Structures by Farzad Naeim, Kluwer Academic Publisher, 2001.

Reference Codes:

1. IS 1893 (Part-1): 2016, "Criteria for Earthquake Resistant – Design of structures." B.I.S., New Delhi.
2. IS 4326: 2013, "Earthquake Resistant Design and Construction of Building", Code of Practice, B.I.S., New Delhi.
3. IS 13920: 2016, "Ductile design and detailing of reinforced concrete structures subjected to seismic forces" – Code of practice, B.I.S., New Delhi.

Course Outcomes:

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

CO1: Identify the causes of earthquakes, its propagation, and measurement and can quantify the hazard at the location of the structure and quantify the forces based on the source.

CO2: Adopt a suitable structural system to resist earthquake forces considering safe behavior of structural and nonstructural elements with different material properties and load combinations.

CO3: Design seismically safe structures in accordance with the provisions of Indian code IS 1893.

CO4: Implement design of shear wall elements for earthquake safety of structures.

CO5: Design or retrofitting of structures by detailing the elements, beams, columns, beam-column joints as per capacity-based design adopting ductility provisions as per IS 1893, IS 13920, to mitigate the vulnerability of earthquake damages of elements and structures.

<table>
<tr><td colspan="8">SYLLABUS

(SEMESTER-VIII)</td></tr>
<tr><td>Subject Code:</td><td colspan="2">CE208TPE05X</td><td colspan="3">CREDITS:3</td><td colspan="2">SESSIONAL - TA</td><td>ESE</td></tr>
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Professional Elective-5B
or
Professional Elective-5C
or
Professional Elective-5D
or
Professional Elective-5E</td><td colspan="6">Any one subject to be Selected
from the Professional Electives</td></tr>
<tr><td colspan="9">Professional Elective-5 (PE Group-5)</td></tr>
<tr><td colspan="3">CE208TPE05A</td><td colspan="6">Offshore Engineering</td></tr>
<tr><td colspan="3">CE208TPE05B</td><td colspan="6">Surface Hydrology</td></tr>
<tr><td colspan="3">CE208TPE05C</td><td colspan="6">Bridge Engineering</td></tr>
<tr><td colspan="3">CE208TPE05D</td><td colspan="6">Traffic Engineering</td></tr>
<tr><td colspan="3">CE208TPE05E</td><td colspan="6">Construction Equipment & Automation</td></tr>
</table>

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05A	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Offshore Engineering	3	0	0	15	15	30			

Course Objective:

- To introduce basics of offshore structures and its historical development.
- To characterize static and dynamic loads coming on offshore structure.
- To study about general layout consideration of deck and oil & gas processing system.
- To understand method involving platform installation.
- To learn about material used in design and construction of offshore structure.

Course Content:

UNIT I HISTORICAL DEVELOPMENT OF OFFSHORE STRUCTURES: Introduction – Definition of Offshore Structures – Historical Developments – Deep water challenges, Functions of Offshore Structures, selection of Offshore Structure and its Configurations, Bottom Supported Fixed Structures, Complaint Structures, Floating Structures – Novel offshore design – Field development concepts

UNIT 2 LOAD AND RESPONSES: Introduction, Gravity Load, Hydrostatic Loads, Resistance Loads, Current loads on Structures, Current Drag and Lift Force, Steady and Dynamic Wind Loads on Structures, Wave Loads on Structures, Varying Wind Load, Impulse loads and Introduction to design

UNIT 3TOPSIDE FACILITIES AND LAYOUT: Introduction - General layout Considerations - Areas and Equipment - Deck Impact Loads - Deck Placement and Configuration - Float over Deck Installation - Helipad - Platform Crane - Living quarters - Oil and gas treatment - Oil and gas storage, offloading and export - Utility and process support systems - Drilling facilities

UNIT 4 OFFSHORE INSTALLATION: Introduction – Installation of Fixed Platform Substructures - Floating Structures – Foundations - Subsea Templates – load outs - transportation - Platform Installation Methods and installation criteria – Installation of Pipelines and Risers.

UNIT 5: MATERIALS FOR OFFSHORE APPLICATIONS: Material for Construction-Structural Steel, Topside Materials, Advanced Composite materials, Corrosion Control, Material Reliability and Monitoring and Fracture Control.

Textbooks:

1. Dawson, T.H., “Offshore Structural Engineering”, Prentice Hall, 1983
2. B.C Gerwick, Jr. “Construction of Marine and Offshore Structures”, CRC Press, Florida, 2000.
3. Subrata K Ckakrabarti, “Handbook of Offshore Engineering”, Vol 1, Vol 2, Elsevier Publishers, 1 st edition, 2005.

Reference Books:

1. API RP 2A., “Planning Designing and Constructing Fixed Offshore Platforms”, API
2. McClelland, B &Reifel, M.D., “Planning & Design of fixed Offshore Platforms”, VanNostrand, 1986
3. Graff, W.J., “Introduction to Offshore Structures”, Gulf Publ. Co. 1981.
4. Reddy, D.V &Arockiasamy, M., “Offshore Structure” Vol.1 & 2,

Course Outcomes:

CO1: To classify types of offshore structure and know its basic fundamental knowledge.
CO2: To analyze various loads and their response on the structure.
CO3: To describe process involving deck layout and oil & gas treatment.
CO4: To outline key feature of platform, foundation and pipelines installation.
CO5: To identify and select appropriate material for construction.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05B	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Surface Hydrology	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the fundamentals of hydrology and concepts of watershed
- To study the analysis of rainfall and its components.
- To understand the estimation techniques of evapo-transpiration and infiltration
- To learn various types of Hydrographs and its uses.
- To know the Flood estimation and Flood routing methods

Course Content:

UNIT 1: Introduction: Scope and importance of hydrology, Hydrologic cycle, Global and India's Water resources, Applications of hydrology, Formation of precipitation, Climate and Weather seasons in India. Watershed concept and modeling: Catchment-topographic and ground water divide, Description of the catchment, catchment processes, demarking a catchment, stream patterns.

UNIT 2: Location of rain-gauges and optimum number of rain-gauges, Analysis of rainfall data, Rainfall mass curve and hyetograph, Intensity-Duration analysis, Intensity-Frequency-Duration analysis, Depth-Area-Duration analysis, Double mass curve. Abstractions from precipitation: Evaporation-Process, measurement, empirical equations and Estimation by water budget method and Energy budget method.

UNIT 3: Evapo-transpiration-AET & PET, Estimation by Penman's equation, Reference Crop Evapo-transpiration by Blaney Criddle formula, Infiltration-Process, Factor affecting infiltration, Measurement, Horton's equation and Philip's equation. Infiltration indices, Probability and Statistics-Introduction, Probability and Random variables, PDF and CDF, Distribution functions, Selection of distribution function and its parameter estimation.

UNIT 4: Hydrograph and its features, Unit hydrograph and its derivation, Unit hydrographs from complex storms and for various durations, S-curve hydrograph and its uses, Synthetic unit hydrograph.

UNIT 5: Flood: Design flood and its estimation- Rational method, Frequency analysis Gumbel's and Log-Pearson's type III distribution, Selection of design return period. Flood routing- Reservoir routing: Channel routing- Prism and Wedge storage, Muskingum method. Flood control: Structural and Non-structural measures.

Text Books:

1. Engineering Hydrology K.Subramanya, Tata McGraw-HillEducation
2. Hydrology Principles, Analysis and Design H.M.Raghunath, New AgeInternational
3. Hand BookofAppliedhydrologyV.T.Chow, McGraw-Hill,Inc
4. ViesmannWandLewisGLt(2008)"IntroductiontoHydrology".PrenticeHallofIndia
5. Ojha,C.S.P. Bhunya, P. and Berndtsson, R.- Engineering Hydrology, Oxford University PressCanada.
6. K. C. Patra, Hydrology and Water Resources Engg., Narosa Publishing house, New Delhi.

Course Outcomes-Upon completion of this course, students shall be able to:

CO1: Describe the basic concepts of hydrology and watershed to incorporate into physical hydrological processes.

CO2: Relate and analyze the various components involved in rainfall analysis.

CO3: Explain the various process, measurement, and estimation of hydrological components

CO4: Formulate the hydrograph's estimation and apply into engineering practices.

CO5: Examine the various statistical methods for Flood studies and can investigate historical datasets.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05C	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Bridge Engineering	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the IRC Loadings and Standards for bridge design and to know the important hydrological parameters necessary for bridge design
- To learn the design of slab bridges under various IRC loading cases
- To understand the behaviour of T-beam slab bridge and the design of T-beam bridges
- To evaluate the stresses due to various loads and design of RCC box-culverts
- To study the various forces acting on bridge piers and abutments and the design of abutment and bridge piers

Course Content:

UNIT-1: Brief historical review, Different types of Bridges and span range, Bridge codes, Importance of hydrologic factors in bridge design, Hydraulic geometry, linear water ways, economic span, afflux and scour.

UNIT-2: Design of Reinforced concrete deck slab bridges.

UNIT-3: Design of Reinforced Concrete Tee beam bridges.

UNIT-4: Design of Box culverts.

UNIT-5: Design of Piers and Abutments.

Text Books:

1. Xanthakos, P. P. (1993) Reinforced Concrete Bridges, in Theory and Design of Bridges, John Wiley & Sons, Inc., Hoboken, NJ, USA. doi: 10.1002/9780470172889.ch3
2. Design of Bridge Structures by M A Jayaram, Prentice-Hall Of India Pvt. Limited, 01-Aug-2004 - Bridges - 292 pages
3. Design of Bridges by N. Krishna raju , Oxford and IBH Publishing, ISBN 8120417410, 9788120417410
4. Essentials Of Bridge Engineering, 6/E, Vikctor , Oxford and IBH Publishing, 2007, ISBN 8120417178, 9788120417175

Course Outcome: At the end of the course the students will be able:

CO1: To explain and apply various IRC loadings as per the IRC standards in the design of bridges and also explain the importance of hydrological parameters in bridge design

CO2: To design the slab bridges under various IRC loadings

CO3: To analyse and design the T-beam girder bridges

CO4: To explain the behaviour and design the box-culverts

CO5: To describe the various forces to be considered on pier and abutment and design the bridge abutments and piers

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05D	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Traffic Engineering	3	0	0	15	15	30			

Course Objectives:

- To develop the basic knowledge of Traffic Engineering.
- To define Traffic flow characteristic.
- To develop knowledge about traffic control system.
- To understand the parking and highway lighting
- To develop the knowledge of different pollution occurring and its remedial measures.

Course Content:

UNIT 1: Introduction To Traffic Engineering-Definition and Scope of Traffic Engineering, Functions, Organization and Importance of Traffic Engineering. Elements of Traffic Engineering: Vehicular, Driver and Road Characteristics.

UNIT 2: Traffic Flow Parameters -Traffic flow parameters: volume, density, speed and related terms, Relationship between various parameters, Study and analysis of vehicle arrivals, headways, and gap acceptance in traffic flow. Highway Capacity and Level of Service.

UNIT 3: Traffic Control-Definition, functions and importance of traffic control. Methods of traffic control: Traffic signs, Road Markings, and other traffic controls aids. Traffic Regulation. Intersection control and design of traffic signals.

UNIT 4: Parking- Parking survey, types of parking, design of parking places. Lighting-Lantern arrangement, Types of lamp

UNIT 5: Traffic and Environment- Pollution problems of cities, Detrimental effects of traffic on environment, Noise pollution, Air pollution, Vibration, Environmental Impact Assessment.

Text Books:

1. Kadialy L.R., "Traffic Engg. and Transport Planning", 8th edition, Khanna Publishers.
2. Parthachakrobarty&Animesh Das, "Principles of Transportation Engineering", PHI.
3. C. JotinKhisty, B. Kent Lal, "Transportation Engineering – An Introduction", PHI.

Course Outcomes:

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

CO1: Estimate the basic characteristics of traffic stream

CO2: Conduct traffic flow studies and analyze traffic data

CO3: Design traffic signal systems

CO4: Analyse the parking and highway lighting

CO5: Manage controlling the different pollution occurring in road.

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE05E	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Construction Equipment & Automation	3	0	0	15	15	30			

Course Learning Objectives:

- To understand the factor for equipment selection and cost of owning and operating.
- To expertise in evaluation and analysis of different equipment life.
- To learn the engineering fundamentals of excavating equipments.
- To learn fundamentals of the pile driving and lifting equipments.
- To understand the concreting equipments and techniques and the advanced instruments like GIS etc. In construction.

Course Content:

UNIT 1: Introduction to course & Planning Process of Equipment Factors affecting equipment selection.Cost of Owning and Operating Construction Equipment Elements of ownership cost, Depreciation accounting methods, Cost Estimation using Average Annual Investment method. Use of compounding factors in Equipment cost estimation based on time value method, Operating cost components, Caterpillar method and Peurifoymethod.

UNIT 2: Equipment life and replacement analysis determination of economic life of equipment. Minimum cost method, Maximum profit method, Time value concept

UNIT3: Engineering Fundamentals of Moving Earth Machine Performance-Required power, Available power, Usable power, Performance chart.
Earthmoving and Excavating equipment Bull Dozers, Scrapers, Front end loaders, Excavators, Trucks, Productivity estimation and balancing of interdependent machines

UNIT 4 Piles and Pile driving equipment Pile types, pile hammers, principle of pile hammer, factors affecting pile hammer selection, Types of pile hammer: Drop hammer, Single acting and double acting steam hammers, Diesel hammers, Vibratory pile drivers.
Lifting equipment Cranes, Principles of lifting mechanism of crane, types of cranes-lattice boom crawler crane, lattice boom truck mounted cranes, telescopic boom crane, Tower cranes, Factors affecting lifting capacity of crane, Range diagram.

UNIT 5 Concreting equipment Steps in concrete making process, types of concrete mixer machines, Methods of handling and transporting concrete, Consolidation of concrete, Methods of finishing and curing of concrete.
Aerial and Satellite Surveying: GIS and GPS in Construction; use of Drones for spread out sites; Use of robots for repetitive activities.

Reference Books:

1. Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi
2. Construction Equipment & Planning and Application. - Mahesh VermaArtec Publication.
3. GPS satellite surveying- Alfred Leick,.Wiley

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

CO1: To apply the knowledge in equipment selection and able to find cost of owning and operating.
CO2: To find the equipment life, which help in comparisons of different equipments.
CO3: To select the earth excavating equipment on the basis of output and different selection factors.
CO4: To decide the pile driving equipment and lifting equipment based on safe working load determination
CO5: To decide the concreting equipment based on the construction project and relate the knowledge on Surveying to the new frontiers of science like GIS, GPS and Remote Sensing.

<table>
<tr><td>SYLLABUS</td><td colspan="7">(SEMESTER-VIII)</td></tr>
<tr><td>Subject Code:</td><td>CE208TPE06X</td><td colspan="3">CREDITS: 3</td><td colspan="2">SESSIONAL - TA</td><td rowspan="2">ESE</td></tr>
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Professional Elective-6B
or
Professional Elective-6C
or
Professional Elective-6D
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Professional Elective-6E</td><td colspan="5">Any one subject to be Selected from the Professional Electives Group-6</td></tr>
<tr><td colspan="8">Professional Electives Group -6</td></tr>
<tr><td colspan="3">CE208TPE06A</td><td colspan="5">Low Cost Housing Techniques</td></tr>
<tr><td colspan="3">CE208TPE06B</td><td colspan="5">Water and Air Quality Modelling</td></tr>
<tr><td colspan="3">CE208TPE06C</td><td colspan="5">Repair and Rehabilitation of Structures</td></tr>
<tr><td colspan="3">CE208TPE06D</td><td colspan="5">Finite Element Analysis</td></tr>
<tr><td colspan="3">CE208TPE06E</td><td colspan="5">Urban Hydrology and Hydraulics</td></tr>
</table>

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06A	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Low Cost Housing Techniques	3	0	0	15	15	30			

Course Learning Objectives:

- To introduce various housing technique adopted in different zones in country.
- To study various uses of cost effective Technologies.
- To learn needs and innovations of building techniques for low cost construction.
- To learn space norms for low cost construction.
- To learn about building materials and costing of low cost construction.

Course Content:

UNIT-1 An introduction to the subject to understand the various building techniques adopted in different climatic zones of the country, which resulting in varied vernacular expressions.

UNIT–2 Use of cost effective technologies through the use of local materials, up gradation of traditional technologies, prefabrication etc.

UNIT-3 Need for low cost construction, both in the rural and the urban sectors. Innovations of building techniques for low cost construction.

UNIT- 4 Analysis of space norms for low cost buildings. Study of usages pattern of low cost buildings by the habitants.

UNIT- 5 Comparative analysis of building materials and costing.Works of Laurie Baker, Hassan Fathy and other prominent architects.

Text Books:

1. "Building Systems for Low Income Housing", Ashok Kumar Jain; Management Publishing House, 1992
2. "Low Cost Housing in Developing Countries", Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993

Course outcomes:

Upon completion of this course students will be able to

CO1: To classify various housing techniques adopted in different zones in country.

CO2: To identify various uses of cost effective Technologies.

CO3: To understand needs and develop innovations of building techniques for low cost construction.

CO4: To explain space norms for low cost construction.

CO5: To analysis about building materials and costing of low cost construction.

SYLLABUS	(SEMESTER-VIII)	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06B	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Water and Air Quality Modelling	3	0	0	15	15	30			

Course Objectives:

- Understand the idea, methodology and basic tools of water and air quality modelling
- Understand the different modelling approaches, their scope and limitations.
- Understand the fate and transport of pollutants in different water bodies and ambient air.
- Become mindful of a wide range of applications of modelling for the water quality and air pollution.
- Understand Water quality indexing parameters and its application.

COURSE CONTENT:

UNIT I MODELING CONCEPTS: Casual and statistical models-Characteristics- Steps in model development - Importance of model building. - conservation of mass and mass balance – calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT II WATER QUALITY MODELING: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling - Contaminant solute transport equation, Numerical methods.

UNIT III AIR POLLUTION MODELING: Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution – Transport of air Pollutants - Meteorological settling for dispersal of air pollutants – Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self-cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT IV AIR QUALITY MODELS: Types of modeling technique, modeling for non-reactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation-modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source-oriented air pollution model performance, accuracy and utilization.

UNIT V Water Quality Index: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method. Air Quality Index: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, regional indices.

Reference Books:

1. Arthur C. Stern, Air Pollution, Air Pollutants, their transformation and Transport, (Ed.), (Third Ed.) Volume I , Academic Press, 2006.
2. Chapra, S.C. Surface Water-Quality Modelling, McGraw-Hill, International Edition, 2008
3. Deaton and Wine Brake, Dynamic Modeling of Environmental Systems, Wiley & Sons, 2002
4. E.V. Thomson, Principles of Surface Water Quality Modeling and Control, Happer and Row Publishers New York, 1987.
5. Hadlock, C.R., Mathematical Modelling in the Environment. The Mathematical Association of America.
6. Rastogi A.K. (2008) Numerical Groundwater Hydrology, Penram International Publishing Pvt. Ltd., Bombay.
7. Steven C. Chapra, Surface Water Quality Modeling, Tata McGraw-Hill Companies, Inc., New Delhi, 1997.
8. Wainwright, J and Mulligan, M., Environmental Modelling Finding simplicity in complexity, John Wiley and Sons Inc., New York, 2013.

Course outcomes:

CO1: To provide basic knowledge on mathematical and statistical concepts required for mode development.
CO2: To Develop models based on the mass-balance approach
CO3: To Perform data exploration and visualization
CO4: To Predict the impact of the of external waste loading on different water bodies
CO5: To Design and model of air & water quality and its applicability in the Control of pollution
CO6: To Determine and evaluate the water quality index

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06C	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Repair and Rehabilitation of Structures	3	0	0	15	15	30			

Course learning objectives:

- To learn about various distress and damages in concrete and steel structures.
- To learn about assess the damage to structures using various methods.
- To study the various methods of rehabilitation.
- To study the various methods of repairs of structures.
- To learn importance of repair and maintenance of structures.

Course Content:

UNIT 1: Aging of structures – performance of structures – need for rehabilitation. Distress in concrete / steel structures – damage – source – cause – effects – case studies.

UNIT 2: Damage assessment and Evaluation models – Damage testing methods – NDT – Core samples.

UNIT 3: Rehabilitation methods – grouting – detailing – imbalance of structural stability – case studies.

UNIT 4: Methods of repairs – shotcreting – guniting – epoxy – cement mortar injection – crack ceiling.

UNIT 5: Repair and maintenance of buildings – IS standards – Bridge repairs – Seismic strengthening.

Reading/Textbooks:

1. Diagnosis and treatment of Structures in Distress – R N Raikar.
2. Bridge Rehabilitation – V K Raina.
3. Building Failures – Diagnosis and Avoidance – W H Ranson.
4. Forensic Engineering – Kennethe and Carper.

Course outcomes:

Upon completion of this course students will be able to:

CO1: Analyze distress and damages in concrete and steel structures.

CO2: Understand about assess the damage to structures using various methods.

CO3: Classify the various methods of rehabilitation.

CO4: Classify the various methods of repairs of structures.

CO5: Understand the importance of repair and maintenance of structures.

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06D	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Finite Element Analysis	3	0	0	15	15	30			

Course Objectives:

- To introduce the fundamentals of FEM,
- Understand how it works,
- Implement (code) the method,
- Understand the capabilities of FEM

Course Content:

UNIT 1: Matrix Methods of Structural Analysis – Review of concepts – Actions and displacements – compatibility – indeterminacy – Member and joint loads – Flexibility Matrix formulation - Stiffness Matrix formulation.

UNIT 2: Analysis of Beams- Finite Element formulation and Analysis of beams by Finite Element method.

UNIT 3: Analysis of Rigid Jointed Plane Frame- Finite Element formulation and Analysis of rigid jointed plane frame by Finite Element method.

UNIT 4: Analysis of Pin Jointed Plane Frame- Finite Element formulation and Analysis of pin jointed plane frame by Finite Element method.

UNIT 5: Introduction to Plate and Shell Elements- Analysis of plane stress / strain and ax symmetric solids-triangular, quadrilateral and isoperimetric elements, Analysis of plate bending, basic equations of thin plate theory, Reissinner-Mindlin theory, plate elements and applications. Analysis of shells, degenerated shell elements.

Text Books:

1. Chandrupatla T.R., Belegundu A.D., Introduction to Finite Elements in Engineering, Prentice Hall of India Private Limited, New Delhi.
2. Desai C.S., Abel J.F., Introduction to the Finite Element Method, CBS Publishers & Distributors, Delhi.

Reference Books:

1. Krishnamurthy, C.S., Finite Element Analysis – Theory and Programming, Tata McGraw Hill Publishing Company Limited, New Delhi.
2. Finite Element Analysis – Theory and Programming by Cook R.D. et.al., Concepts and Applications of Finite Element Analysis, John Wile

Course outcomes:

Upon successful completion of this course, you should be able to:

CO1: Understand the concepts behind formulation methods in FEM.

CO2: Identify the application and characteristics of FEA elements such as bars, beams, plane.

CO3: Analyze the rigid and pin jointed plane frame using finite element method.

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TPE06E	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Design of Hydraulic Structures	3	0	0	15	15	30			

Course Learning Objectives:

- Recognise the different types of dams, identify its purpose and function and to select the most appropriate dam.
- To introduce and give explanation the Principles of Design of Hydraulic Structures.
- To develop understanding for Analysis of gravity dam.
- To develop understanding about Earth dam and stability analysis.
- To introduce the importance of Spillways and energy dissipation systems.

Course Content:

UNIT 1: Introduction - Classification of dams, Gravity dams, Earth dams, Arch dam, Buttress dam, Steel dams, Timber dams, selection of site for dam, selection of type of dam, investigations of dam sites, Engineering surveys, Geological investigations, Types of hydropower plants, site selection for power plant, General arrangement of a hydropower project.

UNIT 2: Principles of Design of Hydraulic Structures - Hydraulic structures on permeable foundations, Theories of subsurface floor, Khosla's method of independent variables, Exit gradient, Location of Hydraulic jump, water surface profiles, scour due to subsurface flow, Design Principles, Energy dissipation principles.

UNIT 3: Gravity Dams - Types of storage head works, Forces acting on gravity dams, Analysis of gravity dams, Profile of a gravity dam, Finite Element Method, Design of gravity dam, joints in gravity dam, Galleries in gravity dam, Adits and shafts, Construction of gravity dam, Foundation Grouting, Instrumentation of gravity dams.

UNIT 4: Earth dams - Types of earth dams, Causes of failure of earth dams, Seepage analysis, phreatic line, flow net construction, criteria for safe design of gravity dams, typical cross sections of earth dams, Stability analysis, Seepage control, and design of filters.

UNIT 5: Spillways and energy dissipation systems - Essential requirements of spillways, Required spillway capacity, component parts of spillway, Types of spillways, Design of Ogee spillway, Design of shaft spillway, Design of siphon spillway, Design of stilling basins. Hydropower structures - Storage power plant, Runoff River plant, Pumped storage plant, Water conveyance systems, Tunnels and Penstocks, Gates, Surge tanks, Power house layout.

Text Books:

1. Golze, A. R., Handbook of Dam Engineering, Von Rostrand Reinhold Co., 1977
2. Sharma, H.D., Concrete Dams, CBIP Publication, 1998.
3. Siddiqui, I H, Dams and Reservoirs: Planning, Engineering, Oxford University Press, USA, 2009.
4. Novak, P., Moffat, A. I. B., Nalluri, C and Narayan, R., Hydraulic Structures, Taylor & Francis, 2006.
5. Modi P.M., Irrigation Water Resources and Hydropower Engineering, Standard Publishing Company, New Delhi, 2000.
6. Arora K.L. Irrigation Water Resources Engineering, Standard Book Publishing Co., Delhi, 1996.

Course Outcomes-

CO1: Define different types of dams.
CO2: Describe the Principles of Design of Hydraulic Structures.
CO3: Explain the concept of Gravity Dams.
CO4: Explain the concept of Earth dams and its stability analysis.
CO5: Describe the concept of spillways and energy dissipation systems.

SYLLABUS	**(SEMESTER-VIII)**						
Subject Code:	CE208TOE03	CREDITS: 3			SESSIONAL - TA		
Subject:	Open Elective	L	T	P	CT-I	CT-II	TOTAL
		3	-	-	15	15	30
CE208TOE03	Infrastructure Planning and Management						

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208TOE03	L	T	P	CT-I	CT-II	TOTAL	70	100	03
Subject:	Infrastructure Planning and Management	3	0	0	15	15	30			

Course Learning Objectives:

The students will be able to:

- Understand and explain concepts of infrastructure
- Understand private involvement in infrastructure
- Learn about challenges to successful infrastructure planning and implementation
- Study strategies for successful infrastructure project implementation
- Understand sustainable development of infrastructure

Course Content:

UNIT I AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE: Introduction to Infrastructure, an overview with regards to Indian sectors(i) Power Sector , (ii) Water Supply and Sanitation Sector in India., (iii) Road, Rail, Air and Port Transportation Sectors, (iv) Telecommunications , (v) Urban Infrastructure ,(vi) Rural Infrastructure.

An Introduction to Special Economic Zones, Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle,

UNIT II PRIVATE INVOLVEMENT IN INFRASTRUCTURE: A Historical Overview of Infrastructure Privatization. The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Challenges in Privatization of Water Supply, Privatization of Infrastructure in India.

UNIT III CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION: Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure, Challenges in Construction and Maintenance of Infrastructure.

UNIT IV STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION: Risk Management Framework for Infrastructure Projects, Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Introduction to Fair Process and Negotiation, Negotiating with multiple Stakeholders on Infrastructure Projects.

UNIT V SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE: Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the

Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TEXT BOOKS

1. Grigg, Neil, Infrastructure engineering and management, Wiley, (1988).

2. Haas, Hudson, Zaniewski, Modern Pavement Management, Krieger, Malabar, (1994).

3. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).

Course Outcomes-

After course completion the students shall be able to:

CO1: Explain the basic concepts related to Infrastructure Projects
CO2: Explain the role of private sector in infrastructure growth.
CO3: Describe the strategies for successful Infrastructure Project implementation.
CO4: Develop Infrastructure modeling and Life Cycle Analysis Techniques.
CO5: Explain Sustainable development of Infrastructure

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208PPC11	L	T	P	CT-I	CT-II	TOTAL	80	200	08
Subject:	Major Project	0	0	15	-	-	120			

SYLLABUS	**(SEMESTER-VIII)**	Periods/ Week			Internal Assessment (IA)			ESE	Grand Total	Credits
Subject Code:	CE208PPC12	L	T	P	CT-I	CT-II	TOTAL	20	50	1
Subject:	Structural Detailing Lab	0	0	2	-	-	30			

Course Learning Objective:

- To learn detailing of structural steel members (tension & compression member, steel connection)
- To study in detail and draw components of industrial building.
- To understand reinforcement detailing of RCC beams and column footings.
- To know about distribution of reinforcement in slab, stair case, water tank and retaining wall.

Course Content:

Part A: (Steel Structures)

1. Detailing of Tension Members.
2. Detailing of Built-up Compression Members.
3. Detailing of Column Bases.
4. Detailing of connections.
5. Detailing of an Industrial shed.
6. Detailing of a Plate girder/Gantry girder.

Part B: (Reinforced Concrete Structures)

1. Details of reinforcement in RCC Continuous Beams.
2. Details of reinforcement for RCC column with isolated footings.
3. Details of reinforcement in a one way/two-way slabs.
4. Details of reinforcement in staircases.
5. Detailing of Combined footings.
6. Detailing of Retaining walls/Water Tanks.

Course Outcome:

CO1: To sketch detailed drawing of structural steel beams, columns and connections.

CO2: To understand design components of industrial shed and gantry girder.

CO3: To sketch reinforcement detailing of RCC member as per IS code provision.

CO4: To draw accurate arrangement of reinforcement in slab, staircase, water tank and retaining wall.