Scheme of Instruction & Syllabi

of

M.Tech (Civil Engineering)

(With Effective From Academic Session 2024-2025)

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HOD CE

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Study & Evaluation Scheme
M.Tech (Civil Engineering)
(w.e.f. academic session 2024-25)
Year I, Semester- I

S. No.	Subject Code	Course Title/Subject	Hours Per Week			Evaluation Scheme			Credits
			L	T	P	CA	EE	Total	
Theory									
1.	MCE101	Research Process and Methodology	4	0	0	30	70	100	4
2.	MCE102	Advanced Soil Mechanics	3	1	0	30	70	100	4
3.	MCE103	Advanced Concrete Structure Design	3	1	0	30	70	100	4
4.	MCE104	Advanced Concrete Technology	3	1	0	30	70	100	4
5.	MCE011 to MCE014	Elective- I	4	0	0	30	70	100	4
Practical									
6.	MCE151	Soil Mechanics Lab	0	0	4	20	30	50	2
7.	MCE152	Concrete Technology Lab	0	0	4	20	30	50	2
Total			**18**	**2**	**8**	**190**	**410**	**600**	**24**

L-Lecture, T- Tutorial, P- Practical, CA-Continuous Assessment, EE – End Semester Examination

Study & Evaluation Scheme
M.Tech (Civil Engineering)
(w.e.f. academic session 2024-25)
Year I, Semester- II

S. No.	Subject Code	Course Title/Subject	Hours Per Week			Evaluation Scheme			Credits
			L	T	P	CA	EE	Total	
Theory									
1.	MCE201	Advanced Traffic Engineering	3	1	0	30	70	100	4
2.	MCE202	Ground Improvement and Geosynthetics	3	1	0	30	70	100	4
3.	MCE203	Advanced Steel Structure	3	1	0	30	70	100	4
4.	MCE021 to MCE024	Elective- II	4	0	0	30	70	100	4
5.	MCE031 to MCE034	Elective- III	3	1	0	30	70	100	4
Practical/Seminar									
6	MCE251	Transportation Lab	0	0	4	20	30	50	2
7	MCE252	Seminar-I	0	0	4	20	30	50	2
Total			**17**	**3**	**8**	**190**	**410**	**600**	**24**

L-Lecture, T- Tutorial, P- Practical, CA-Continuous Assessment, EE – End Semester Examination

Study & Evaluation Scheme
M.Tech (Civil Engineering)
(w.e.f. academic session 2024-25)
Year II, Semester- III

S. No.	Subject Code	Course Title/Subject	Hours Per Week			Evaluation Scheme			Credits
			L	T	P	CA	EE	Total	
Thesis/Seminar/Training									
1	MCE351	Seminar-II	0	0	4	30	70	100	4
2	MCE352	Preliminary Thesis	0	0	20	150	350	500	20
Total			0	0	24	180	420	600	24

L-Lecture, T- Tutorial, P- Practical, CA-Continuous Assessment, EE – End Semester Examination

Study & Evaluation Scheme
M.Tech (Civil Engineering)
(w.e.f. academic session 2024-25)
Year II, Semester- IV

S. No.	Subject Code	Course Title/Subject	Hours Per Week			Evaluation Scheme			Credits
			L	T	P	CA	EE	Total	
Thesis									
1	MCE451	Thesis	0	0	24	180	420	600	24
Total			0	0	24	180	420	600	24

L-Lecture, T- Tutorial, P- Practical, CA-Continuous Assessment, EE – End Semester Examination

Departmental Elective Subjects

Elective I

MCE011- Environment Engineering & Management
MCE012- Sediment Transport
MCE013- Road Safety and Management
MCE014- Advance Water Supply Systems

Elective II

MCE021- Industrial Effluent and Sewage Treatment
MCE022- Flood Control and River Training Work
MCE023- Geographic Information System
MCE024- Watershed Management

Elective III

MCE031- Pavement Analysis and Design
MCE032- Reinforced Soil Design
MCE033- Pre-Stressed Concrete Structures
MCE034- Earthquake Resistant Design of Structures

MCE-101	Research Process and Methodology	4L:0T:0P	4 credits

Course Objectives:

CO1	To develop an understanding of foundational principles and ethical considerations in research.
CO2	To equip the scholars with knowledge of various research designs and their applicability
CO3	To Explore the Research Designs
CO4	To Evaluate existing literature discerningly, identifying gaps and implications.
CO5	Learn about diverse data collection techniques and their suitability.
CO6	Knowledge dissemination about Referencing and referencing styles and final report.

Module 1:

Introduction to Research: Understanding the meaning, objectives and significance of research, various types of research, steps involved in the research process, defining a research problem.
Research Design: Concept of research design, methods of research design, steps involved in research process, literature survey and its significance in research.

Module 2:

Data Collection: Data classification, methods for collecting data, principles of sampling, sampling techniques and ethical considerations in research.
Data Analysis and Interpretation: significance of data and it's analysis, selection of appropriate statistical techniques, hypotheses formulation, hypothesis testing, utilizing data processing software like SPSS, techniques of statistical inferences and interpreting results.

Module 3:

Technical Writing and Research Reporting: Understanding different types of research reports (theses, research papers, review articles, and conference presentations), referencing and citation styles, research journals, concept of journal indexing and citation, Intellectual Property Rights (IPRs) and plagiarism.

Text Books:

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques, New Age International publishers, Third Edition.
2. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
3. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013

Reference Books:

1. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition,
   SAGE, 2005
2. Nirali Prakashan Research Methodology (English, Paperback, Kokare Chandrakant Dr)
3. Research Methodology by Pannerselven (Eastern Economy Edition)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Define key concepts and terminology related to research process and methodology.
CO2	Identify the importance of research in various disciplines and real-world applications.
CO3	Formulate clear and focused research questions that address gaps in existing literature.
CO4	Select appropriate research designs based on the nature of the research questions and objectives.
CO5	Critically evaluate existing literature and research studies relevant to the chosen research topic.
CO6	Use the knowledge, skills, and competencies necessary to conduct research effectively and ethically, from formulating research questions to collecting, analyzing data and forming report.

MCE-102	Advanced Soil Mechanics	3L:1T:0P	4 credits

Course Objectives:

CO1	Understanding the factors influencing soil nature and formation.
CO2	Compare the effects of compaction on soil properties under different moisture conditions
CO3	Explore earth pressure theories, including Rankine and Coulomb methods, for designing stable retaining wall structures.
CO4	Apply wedge analysis methods to identify critical slip circles and assess slope stability under varying conditions.
CO5	Assess the practical implications of soil consolidation theories in geotechnical engineering applications.

Module 1: Factors influencing nature and formation of soils, Soils as multiphase materials. Complexity of soil nature, typical soil deposits with special reference to Indian Soils/ Sits. Soil Structure: Type of bonds, important clay minerals, Atomic and symbolic representation, Base Exchange capacity, Force fields between soils particles and exchangeable ions, Guoy-Champman diffused double layer theory, Clay structural measurement. Behavior of compacted soils: General, Effect of compaction on structure, swelling pressure, Shrinkage, Shear Strength, Pore Water pressure, Permeability, Comparison of dry of O.M.C & wet of O.M.C.

Module 2: Stability analysis of slope -effective vs. total stress analysis, Stability Analysis of Slope: Effective and total stress approach, shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical conditions. Earth pressure: Rankine, Columb and Graphical Methods, retaining walls structures, Gravity cantilever and counter fort retaining walls: Stability checks and design:

Module 3: One and three dimensional consolidation theories and applications, immediate settlement, Methods of determination, Estimation of Pre-consolidation pressure, Secondary consolidation. Shear strength parameters of cohesion less and saturated cohesive soils, Principles of Effective stress condition, Effect of rate of stress on shear parameters, Stress-Strain relationship, Skempton's Pore pressure coefficients, Hvorslev's true shear parameters, Effect of over consolidation on shear parameters.

Text/Reference Books:

1. B M Das, Advanced Soil Mechanics, Taylor and Francis
2. R F Scott, Principles of Soil Mechanics, Addison & Wesley.
3. Advance Geotechnical Engg.- Alam Singh, pub. CBS Publishers and Distributors.
4. Theoretical Soil Mechanics- M. E. Harr, pub. Tata McGraw-Hill.
5. Theoretical Soil Mechanics -Jumikis, pub. R.E. Krieger Pub.

Course Outcomes: After the completion of the course:

CO1	Students will be able to identify and classify different types of soils found in India.
CO2	Students will demonstrate knowledge of soil structure and composition, including the role of clay minerals.
CO3	Ability to differentiate between effective and total stress approaches in slope stability analysis
CO4	Ability to design effective retaining wall structures.
CO5	Students will gain a comprehensive understanding of the theory of consolidation and its practical implications in predicting soil settlement behavior.

MCE103	Advanced Concrete Structure Design	3L:1T:0P	4 credits

Course Objectives: The objective of this course is to design the water retaining structures, flat slab, plate and shells, bunkers, silos and bunkers.

CO1	Understand the techniques of Design of Water tank.
CO2	Explore the applications of water tank as per community requirement
CO3	Analyze the factors retaining wall & its application
CO4	Analyze and design a flat slab system
CO5	Analyze and design bunkers, silos and chimneys.

Module 1:

Analysis and design of flat slabs: Introduction, Proportioning of flat slabs, Determination of bending moment by direct design method, slab reinforcement details, Water Tanks- Introduction, Design of water tanks.

Module 2:

Retaining wall: Fundamental of retaining wall & its Types, Design of Retaining Wall**,**

Plate & shell: Design of folded plate and shell roof

Module 3:

Bunkers and silos: Introduction, Design of rectangular bunkers, circular bunkers and silos

Chimneys: Introduction, Design factors, Stresses due to self-weight, wind and temperature, Combinations of stresses.

Text Books:

1. Plain & Reinforced Concrete, Vol. I & II- O.P.Jain&Jaikrishna(1998).
2. Theory & Design of Concrete Shells- B.K.Chatterjee(1990).
3. Fundamentals of Reinforced Concrete - N.C. Sinha& Roy(2007).
4. BIS Codes

Reference Books:

1. Reinforced Concrete (Limit State Design)- A.K.Jain (1983)
2. Reinforced Concrete Design- Mosley W.H. &Bungey J.H(1999)

Course Outcomes: After the completion of respective course the students will be able the design and carry out of the reinforcement detain of building frames as roofing elements. They will get the knowledge about the design and detail of folded plate and shell roof, analysis and design of slabs using yield line theory. Design special RC elements including, chimney, silos and bunkers

MCE-104	Advanced Concrete Technology	3L:1T:0P	4 credits

Course Objectives:

CO1	Understand the theoretical concept of Concrete material which includes Cement, Admixtures and Aggregates,
CO2	Learn different types of aggregates, admixtures & know the mechanism of hydration of cement
CO3	Comprehend the properties of Fresh Concrete, & manufacturing process of concrete
CO4	Understand the properties of hardened concrete, factors affecting Elasticity, creep & Shrinkage in concrete.
CO5	Understand the concept of mix design of concrete& its importance in estimation of composition of materials
CO6	Know various types of special concretes & its application

Module 1:

Introduction, Properties of cement, fine aggregate and coarse aggregates, Additives and Admixtures in Concrete, Rheology of Concrete
Different types of cementitious materials, Types of cements and pozzolanas, energy efficient cement burning technologies. Admixtures and Construction Chemicals: Benefits of admixtures, Type of admixtures, plasticizers, super- plasticizers, classification of super plasticizers, effect of super-plasticizers, doses of super plasticizers, super plasticizers-cement compatibility, waterproofing admixture

Module 2:

Manufacturing and methods of concreting, Properties of fresh and hardened concrete, mix design by I.S. method
Design and manufacture of normal concrete, Light weight concrete – Cellular concrete – No fines concrete – Aerated & foamed concrete, fiber reinforced concrete, Polymer concrete – Fly ash concrete, Self-compacting concrete – High performance concrete – Very high strength concrete – High density concrete

Module 3:

Durability of Concrete: Causes of inadequate durability, transportation mechanism in concrete, diffusion, absorption, water permeability of concrete, air and vapour permeability, carbonation, acid attack on concrete, sulphate attack on concrete, efflorescence, effect of sea water on concrete, alkali-silica reaction, type of cracking, action of frost, air entrainment, effect of de-icing agent, chloride attack, threshold content of chloride ions, influence of

blended cement on corrosion, other factors affecting corrosion of reinforcement, test for penetrability of concrete to chlorides, stopping corrosion

Text Books:

1. Neville, A.M. and Brookes, J.J., "Concrete Technology", 2 nd Edition, Pearson Education, 2010.
2. Gambhir, M.L., "Concrete Technology", 2 nd Edition, Tata McGraw Hill Publishers, New Delhi, 2009.

Reference Books:

1. Neville, A.M., "Properties of Concrete", 3rd Edition, Longman Scientific and General, 1992.
2. Shanta Kumar A.R., "Concrete Technology", 2 nd Edition, Oxford University Press, New Delhi, 2000.
3. Krishna Raju. N, "Design of Concrete Mixes", 2nd Edition, CBS Publishers and Distributors, 2009.
4. Shetty, M.S., "Concrete Technology", 3 rd Edition, S.Chand Publications, 2008.)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Explain the properties of the constituent materials of concrete.
CO2	Describe the physical & mechanical properties of aggregates.
CO3	Study the behavior of concrete at its fresh and hardened state, describe and carry out tests relevant to the use of concrete on site..
CO4	Understand the factors influencing concrete mix & know the BIS method of mix design.
CO5	Explain factors affecting strength of concrete
CO6	Define special concretes, their application for practical purpose.

MCE-151	Soil Mechanics Lab	0L:0T:4P	2 credits

1. Need and importance of site investigation.
2. Methods of site exploration, Procuring and handling of disturbed and un-disturbed samples. Basic Test on Soils.
3. Modified Proctor (Heavy compaction) Test.
4. Unconfined Compression Strength Test.
5. California Bearing Ratio and Expansion Ratio Test.
6. Permeability test using Falling and Constant-head method.
7. Consolidation Test.
8. Direct shear Test.
9. Triaxial Test.
10. Characterization and evaluation of contaminated soils.

References:

1. IS code Provisions 2720 series or SP 36 part I and II.
2. Soil Testing and Exploration- Alam Singh, pub. Asia Publishing House.
3. Soil Testing for Engineers- T.W. Lambe, pub. John wiley & Sons.
4. Gopal Ranjan and A.S.R. Rao: Basic and Applied Soil Mechanics, pub. New Age International Publishers.
5. Purushotama Raj: Geotechnical Engineering, pub. Pearson Education.
6. V. N. S. Murthy: Geotechnical Engineering, pub. CRC press.

MCE-152	Concrete Technology Lab	0L:0T:4P	2 credits

1. Testing of aggregates - fine and coarse as per BIS procedure.
2. Testing of cement with reference to IS specifications and cement grade.
3. Concrete mix design for desired grade from given materials.
4. (a) Design and testing of workability of concrete for a given C.C proportion.
5. (b) Design and determination of cube strength with given materials and proportions.
6. (c) Design of concrete mix proportions.
7. Study of effect of compaction on strength of concrete.
8. Study the effect of plasticizers on workability of concrete.
9. Study the permeability of concrete.
10. Conduct chemical analysis of hardened concrete to determine the cement content.
11. Non Destructive testing- Impact Hammer test, UPV test

MCE201	Advanced Traffic Engineering	3L:1T:0P	4 credits

Course Objectives:

CO1	To know the traffic flow characteristics.
CO2	To study various traffic surveys.
CO3	To understand the Traffic Signal timing design and Traffic Flow theories.

Module 1:

Basic Aspects of Traffic Engineering Aim of traffic engineering, traffic stream components and characteristics, road user characteristics, vehicle characteristics, acceleration characteristics, measures of quality, measures of separation, relationship among traffic parameters and empirical relationships, mechanics of traffic flow, macroscopic approach, microscopic-approach and human factors approach, discrete distributions, binomial distribution, Poisson's distribution, exponential distribution, exponential distribution, normal distribution.

Traffic Studies, Measurement and Analysis; Volume studies, speed studies, travel forecasting principles and techniques, design hourly volumes and speed, origin and destination studies, presentation of data and analysis, testing of hypothesis relating to improvements.

Module 2:

Travel Time amid Delay Studies; Various uses, travel time and delay studies, various methods, data collection and analysis, density studies and headways, gap acceptance studies, intersection delay studies, traffic flow theory, queuing theory and simulation models.

Capacity Analysis of Traffic Facilities; Uninterrupted facilities, interrupted facilities, Level of Service, quality of service as per HCM, factors affecting LOS, computation of capacity and LOS, Measure of effectiveness, highway capacity and performance characteristics, intersection design.

Module 3:

Traffic Control, Design and Regulation; Traffic signals, types, principles of phasing, tune diagram, signalized intersection, saturation flow, saturation headway, capacity of lane group, concept of critical lane group, signal timing, phase plan, phase diagram, splitting of phase, clearance interval, pedestrian requirement, guidelines for protected movements, signal coordination, emerging themes, inter-modalism, access management, congestion management, environmental impact assessment.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the fundamental traffic flow theories and identify basic traffic variables and their relationships including speed, density and flow
CO2	Analyze a variety of traffic facilities and evaluate capacity and level of service (LOS)
CO3	Design signalized intersections including isolated, coordinated and round abouts.
CO4	Assess, evaluate and justify methods of traffic management and control.
CO5	Understand the use of advanced simulation methods for the analysis of traffic systems and software tools for the design of traffic control strategies.
CO6	To evaluate the Traffic Control, Design and Regulation.

Text/ Reference Books:

1. Introduction to Traffic Engineering, R. Srinivasa Kumar, Universities Press, 2018.
2. Highway Capacity Manual, Transportation Research Board, National Research Council, Washington, D.C., 2010.
3. Daganzo, C.R, Fundamentals of Transportation and Traffic Operations, Pergamon, Elsevier Science Inc., New York, 1997.
4. Wohl, M. and Martin, B.V, Traffic System Analysis for Engineers and Planners, McGraw Hill, New York, 1983.
5. Drew, D.R., Traffic Flow Theory, McGraw Hill, New York, 1964.

MCE202	Ground Improvement and Geosynthetics	3L:1T:0P	4 credits

Course Objectives:

CO1	Understand the principles and techniques of ground improvement methods.
CO2	Explore the applications of geosynthetics in civil engineering projects.
CO3	Analyze the factors influencing the selection of ground improvement techniques.
CO4	Evaluate the performance and effectiveness of various geosynthetic materials.
CO5	Apply theoretical knowledge to solve practical problems in ground improvement projects.

Module 1:

Fundamentals of compaction principles, Behavior of compacted clays in engineering contexts, Surface stabilization techniques using lime, fly ash, and cement, Deep stabilization methods, Introduction to grouting techniques such as permeation, compaction and jet grouting, Overview of dewatering systems for soil improvement.

Module 2:

Geosynthetics: Varieties and roles in civil engineering, Material composition and manufacturing methods of geosynthetics, Testing procedures and evaluation criteria for geosynthetic materials, Introduction to reinforced soil structures, principles of soil reinforcement, application of geotextiles and geogrids in infrastructure projects like roads, walls, and embankments.

Module 3:

Utilization of geotextiles, geonets and geocomposites as drainage and filtration systems, Examination of geosynthetics' multiple functions in railway construction and pavement design, Application of geosynthetics in environmental protection measures (covers and liners for landfills), considerations of material properties and stability.

Text Books:

1. Principles of Geotechnical Engineering by Braja M. Das and Khaled Sobhan (Cengage Learning)
2. Geosynthetics in Civil Engineering by G.C. Sahu and Anand J. Puppala (CRC Press)
3. Geotechnical Engineering: Principles and Practices by Donald P. Coduto, Man-chu Ronald Yeung, and William A. Kitch (Pearson Education India)
4. Geosynthetics and Their Applications by Sanjay Kumar Shukla (PHI Learning Pvt. Ltd.)

Reference Books:

1. Soil Mechanics and Foundation Engineering by B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain (Laxmi Publications)
2. Soil Mechanics and Foundation Engineering by Dr. K. R. Arora (Standard Publishers)

Course Outcomes: After the completion of the course the student will be able to:

CO1	Demonstrate proficiency in applying ground improvement methods to enhance soil properties.
CO2	Utilize geosynthetics effectively in diverse civil engineering applications.
CO3	Evaluate site-specific conditions to select appropriate ground improvement techniques.
CO4	Assess the performance and durability of geosynthetic materials in real-world scenarios.
CO5	Apply learned concepts to design and implement sustainable ground improvement solutions.

MCE-203	Advanced Steel Structure	3L:1T:0P	4 credits

Course Objectives:

CO1	To learn advanced design concepts for structural steel applicable to various types of steel structures.
CO2	To understand primary code source applies to building design, which is supplemented by a strong theoretical background in steel behavior applicable to non-typical structures.
CO3	To elaborate design of industrial steel structures.
CO4	To introduce design of steel structure
CO5	To introduce use steel sections and composite construction.
CO6	To introduce use steel truss and Girder Bridges

Module 1:

Simple Connections – Riveted, Bolted Pinned and Welded Connections: Riveted Connections – Bolted Connections –Load Transfer Mechanism – Failure of Bolted Joints – Specifications for Bolted Joints – Bearing – Type Connections – Tensile Strength of Plate – Strength and Efficiency of the Joint – Combined Shear and Tension – Slip-Critical connections – Prying Action – Combined Shear and Tension for Slip-Critical Connections. Design of Groove Welds - Design of Fillet Welds – Design of Intermittent Fillet Welds – Failure of Welds.

Module 2:

Plastic Analysis: Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli - shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.
Eccentric and Moment Connections: Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.

Module 3:

Analysis and Design of Industrial Buildings: Dead loads, live loads and wind loads on roofs. Design wind speed and pressure, wind pressure on roofs; wind effect on cladding and louvers; Design of angular roof truss, tubular truss, truss for a railway platform. Design of purlins for roofs, design of built up purlins. Design of bracings.

Design of Steel Truss Girder Bridges: Types of truss bridges, component parts of a truss bridge, economic Proportions of trusses, self-weight of truss girders, design of bridge Compression members, tension members; wind load on truss girder Bridges; wind effect on top lateral bracing; bottom lateral bracing; portal Bracing; sway bracing Design of Lacing.

Text Books:

1. Limit State Design of Steel Structures S.K. Duggal Mc Graw Hill Education Private Ltd. New Delhi.
2. Design of steel structures by N. Subramanian, Oxford University Press
3. Design Steel Structures Volume-II, Ramachandra & Vivendra Gehlot, Scientific Publishes Journals Department.

Reference Books:

1. Design of Steel Structures. P. Dayaratnam, S. Chand, Edition 2011-12.
2. Design of Steel Structures Galyord & Gaylord, Tata Mc Graw Hill, Education, Edition 2012.
3. Indian Standard Code – IS – 800-2007. 4. Indian Standard Code – IS – 875 – Part III - 2015

Course Outcomes: After the completion of the course the student will be able to:

CO1	Apply unified code philosophy to steel building design
CO2	Apply plastic method for design of beams and frames
CO3	Apply plastic method for eccentric and moment connection
CO4	Design & detail Industrial building, steel stacks & composite structures as per the IS code
CO5	Use of cold form sections in the steel structure including pre-engineered building.
CO6	Develop design basis report

MCE251	Transportation Lab	0L:0T:4P	2 credits

1. Aggregate crushing value
2. Aggregate impact test
3. Attrition test
4. Aggregate abrasion value test
5. Shape tests for aggregate
6. Specific gravity and water absorption of Aggregate
7. Penetration test for bitumen
8. Ductility test
9. Flash and fire point test
10. Marshall stability test
11. Softening point test
12. Viscosity test
13. Stripping test
14. Traffic studies—Intersection
15. Traffic studies— Rotary Intersection

Elective I

MCE-011	Environment Engineering & Management	4L:0T:0P	4 credits

Course Objectives:

CO1	To study the water demands and water standards.
CO2	To learn about the different treatment methods for waste water treatment
CO3	To study the different types of environmental pollution
CO4	To impart basic concepts of solid waste management.
CO5	To understand the different methods of solid waste management.
CO6	To understand the Management of electronic waste management.

Module 1:

Water and Wastewater Treatment: Water requirements, Surface water and Ground water sources, Water quality and drinking water standards, Determination of reservoir capacity, Transportation and distribution of water Water treatment systems, Physico-chemical processes, Sedimentation, Coagulation, Flocculation, Granular media filtration, Disinfection, Water softening, Adsorption and ion exchange processes

Module 2:

Air Pollution and Control Sources of air pollutants: Monitoring of air pollutants. Evaluation of Air Quality Index. Removal of gaseous pollutants by adsorption, absorption, reaction and other methods, Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods

Module 3:

Solid Waste Management: Classification of solid wastes. Waste management. Waste processing techniques: Thermochemical conversion techniques- incineration, pyrolysis, refuse derived fuel, gasification. Biochemical conversion techniques- composting, bio methanation. Waste disposal methods. Biomedical, hazardous and electronic waste management.

Text/Reference Books:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition2008.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York1985. 4. Met Calf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.
4. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
5. Plumbing Engineering. Theory, Design and Practice, S.M. Patil,1999
6. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication

Course Outcomes: After the completion of the course the student will be able to:

CO1	To understand the water requirement ,standards and parameters for public use.
CO2	To equip the scholars with knowledge water distribution system.
CO3	To learn about the air pollution and their control.
CO4	Knowledge about the solid waste management.
CO5	Learn about the different methods of solid waste management.
CO6	Knowledge about the electronic waste management.

MCE012	Sediment Transport	4L:0T:0P	4credits

Course Objectives:

CO1	To understand the mechanism of sediment transport.
CO2	To get familiar with the dynamics of natural streams.
CO3	To know about behaviour and maintenance of open channels

Module 1:

Introduction to sediment: Physical properties of fluid and sediment, origin and properties of sediments, nature of problems.

Fluvial hydraulics: Scour criteria and problems: regimes of flow, Shields curve, incipient motion of sediment particles, terminal fall velocity of sediment in fluid, alluvial bed forms and Resistance to flow.

Sediment transport: Bed load, suspended load and total load transport, Meyer-Peter approach, du Boys' approach, Einstein's approach, Engelund and Fredsøe's approach, sediment samplers, design of stable channels, alluvial stream and their hydraulic geometry.

Module 2:

Turbulent Fluvial Flows: Decomposition and averaging procedure, equation of motion (Reynolds equations), Prandtl's mixing length theory, hypothesis of von Kármán, velocity distribution, the linear law in viscous sub-layer, the logarithmic law in turbulent wall shear layer, law in buffer layer, log-wake law and velocity defect law, turbulence intensity, calculation of bed shear stress using bed slope, velocity distribution, average velocity, Reynolds shear stress distribution, turbulent kinetic energy distribution.

Module 3:

River Training Works: Objectives, classification of river training works, design of guide banks, groynes or spurs their design and classification ISI Recommendations of approach embankments and afflux embankments, pitched islands, artificial cut-offs, objects and design considerations, river control-objectives and methods.

Sediment control: Silt management, management of canal in Punjab, Bhakra canal, delta formation.

Course Outcomes: After the completion of the course the student will be able to:

CO1	To evaluate the quantity of sediment transport in alluvial channels
CO2	To analyze the flow structure on deformable boundaries
CO3	To take initiative to protect the rivers by erosion and deposition
CO4	To Understand site management and river training works.
CO5	To analyze the different flows.
CO6	To understand the Sediment control.

Text/ Reference Books:

1. Loucks, D.P., Stedinger, P.J.R., Haith, D.A., Water Resources Systems Planning and Management, Prentice Hall, New Jersy, 1987.
2. Hall, K., A and Draoup, J.A., Water Resources Systems Engineering, Tata McGraw Hill, 1970.
3. Neil, G.S., Water Resources Planning, McGraw Hill, 1985.
4. National Water Policy, Ministry of Water Resources, Government of India, 1987.

MCE013	Road Safety and Management	4L:0T:0P	4credits

Course Objectives:

CO1	The objective is to give exposure about the needs for road safety and identification of various road Factors contributing to road crashes.
CO2	Exposing students about road crash data collection Procedure and its analysis.

Module 1:

Introduction to safety: Road accidents, Trends, causes, Collision and Condition diagrams, Highway safety, human factors, vehicle factors,

Road safety management system: Multi-causal dynamic systems approach to safety, crash vs accident, road safety improvement strategies, elements of a road safety plan, Safety Data Needs.

Module 2:

Statistical interpretation and analysis of crash data: Before-after methods in crash analysis, Advanced statistical methods, Black Spot Identification &Investigations, Case Studies.

Road safety audits: Key elements of a road safety audit, Road Safety Audits & Investigations, Crash investigation and analysis, describe methods for identifying hazardous road locations, Case Studies.

Module 3:

Crash reconstruction: Describe the basic information that can be obtained from the roadway surface, understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies. Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.

Course Outcomes: After the completion of the course the student will be able to:

CO1	To investigate & determine the collective factors & remedies of accident involved.
CO2	Understand the importance of multidisciplinary approach to planning for Road safety and rehabilitation.
CO3	Interpretation and Analysis of Crash Data.
CO4	Understand Stages and Steps of Road Safety Audits.
CO5	To Understand better planning for Accident prevention.
CO6	To design & planning various road geometrics.

Text/ Reference Books:

1. The Traffic Safety Toolbox: A Primer on Traffic Safety ITE, 1999 , Institute of Transportation
2. Engineers (ITE) 1st Edition ,Washington, D.C.:Institute of Transportation Engineers, 1999.
3. Safer Roads: A Guide to Road Safety Engineering. Ogden, K.W. 1st Edition ,Aldershot England: Ashgate, 2004.
4. Observational Before-After Studies in Road Safety , Ezra Hauer 4th Edition, U.K. : Emerald Group Pub.2008
5. The Handbook of Road Safety Measures, Rune Elvik and TrulsVaa, 2nd Edition, Elsevier, 2004.

MCE-014	Advanced water supply system	4L:0T:0P	4 credits

Course Objectives:

CO1	To learn about water demands.
CO2	To know the utilization of natural water and their conservation
CO3	To study the use of non -potable water for different purpose.
CO4	To study the water distribution system.
CO5	To understand the requirement of water distribution system according to industry.
CO6	To understand Sanitation, and principles of sanitation .

Module-I:

Necessity of water, sources of water, water demands, dual supply of water: Potable and non-potable water, Protected water, Grey water, Black water.

Module-II

Distribution of Water: Based on topography, Gravity distribution, Direct pumping, Combined pumping and gravity flow. Service Reservoirs, Continuous supply, Intermittent supply, Networks of distribution, Emergency water supply as in case of fire accidents, Valves, hydrants and meters.

Module-III

Dependencies of Industries on water: Location of Industry with reference to sources of water, Quality of water required for industrial operations, characteristics of waste water, Standards for disposing industrial effluents into different sources of water.

Reference books /Text books:

1. Environmental Engineering by S.K. DUGGAL
2. Water and Waste water technology by Hammer and Hammer
3. Environmental engineering by Peery, Rowe and Tehabanaglous

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the broad outline of the various facets of water usage in daily life
CO2	Know the origin of Natural waters and also to synthesize it for regular use.
CO3	Learn the conservation of drinking water and how to utilize non-potable water for various other uses.
CO4	Learn the water quality parameters.
CO5	Understand the concept of domestic and Potable Water use for different purpose.
CO6	Understand the Rain water harvesting and ground water recharge techniques.

Elective II

MCE-021	Industrial Effluent and Sewage Treatment	4L:0T:0P	4 credits

Course Objectives-:

CO1	To learn about the industrial effluent and sewage comes from industries.
CO2	To understand the specific pollutant from Industrial waste.
CO3	To explore and learn about sewage treatment.
CO4	To learn about treatments of industrial effluents.

Module 1:

Industrial waste water: kinds, sources, and attributes, industrial water standards and requirements of quality

Module 2:

General treatment options for industrial effluents, common equipment's used for industrial wastewater treatment. Removal of specific pollutants in industrial effluents, eg oil & grease, phenol, cyanide, harmful organics, heavy metals.

Module 3:

Handling of industrial wastewater that comes from dairy, paper & pulp, textile, tannery, distillery, electro-plating, petroleum & petro-chemical complex, iron & steel industry, pharmaceutical, food processing units.

Reference Books-:

1. Wastewater Engineering: Treatment and Resource Recovery" by Metcalf & Eddy, George Tchobanoglous, Franklin L. Burton, H. David Stensel, Ryujiro Tsuchihashi, Hiroaki Tanaka
2. "Industrial Water Pollution Control" by W. Wesley Eckenfelder Jr., Davis L. Ford, André W. Hudson
3. "Handbook of Industrial Water Treatment" by Frank Woodard

Course Outcomes-:

CO1	Understanding treatment technologies
CO2	Ability to designed treatment system
CO3	Able to assess the environmental impact of industrial effluent and sewage discharge
CO4	Should be familiar with relevant regulations, standards, and policies governing the discharge of industrial effluents and sewage

MCE-022	Flood Control and River Training Work	4L:0T:0P	4 credits

Course Objectives-:

CO1	To learn about Hydrological processes
CO2	To learn about designing the flood control structures
CO3	To understand the flood control and management

Module 1:

Introduction to Alluvial streams and their hydraulic geometry, bed level variation of alluvial streams, variation in plan form of alluvial streams. Analytical models of river morphology, Numerical models for morphological studies, flood plain analysis and morphology of some Indian rivers.

Module 2:

Computational of peak floods, flood frequency analysis Case Study: To analyze peak flood using hydrological data of a watershed and visit to Water Resources Engineering Department. Floods in major Indian river basin, types and design of flood forecasting and protection systems and basic software's for flood modeling and forecasting. Stochastic Hydrology, probabilistic analysis.

Module 3:

Operational hydrology, reservoir operation for flood control and management, flood damage estimation models. Guide lines for planning and design of river training works and maintenance of river training works.

Reference Books:

1. BIS 107051(1994), 12094 (2000), 12926 (1995), 8408 (1994)
2. "Mechanics of sediment transportation and alluvial streams problems", Garde R J and Ranga Raju K G , New age International Limited Publishers, New Delhi 2000
3. "River Morphology", Garde R J , New Age International Publishers, New Delhi 2006
4. "Hydraulic Design Handbook", Mays Larry W., Mc Graw Hill Companies, New Delhi 1999
5. "Applied Hydrology" Mutreja K.N. Tata McGraw-Hill Publishing company Ltd., New Delhi 1990
6. "Elementary Hydrology", Singh Vijay. P, Prentice Hall, India

Course Outcomes-:

CO1	Analyze the peak floods of given basin.
CO2	Estimate flood damage under different conditions
CO3	Develop flood forecasting methods under different hydrological conditions
CO4	Designed for river training work

MCE-023	Geographic Information System	4L:0T:0P	4 credits

Course Objectives-:

CO1	Develop a comprehensive understanding of the fundamental principles, theories, and concepts underlying Geographic Information Systems
CO2	Acquire proficiency in advanced spatial analysis techniques
CO3	Learn about preparation of maps.
CO4	To know about procedure for analysis of GIS in planning and design

Module1:

Geographic Information Systems, Modelling Real World Features Data, Data Models – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Metadata., Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware and Software.

Module2:

Topology and its types, Modelling topological Relationships, Tolerances.

Spatial Analysis: Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis – Route alignment, Canal alignment; Digital Elevation Models. Map composition, Preparation of qualitative and quantitative maps.

Module3:

GIS Project Management and Execution: Identifying the Requirements, Stages of the Planning Process, Specifications, and Procedure for analysis projects and design projects.

Reference Books

1. Burrough, P. (1998) “Principles of geographical information system.” Oxford: Oxford University Press.
2. Chou, Yue-Hong (1997), “Exploring spatial analysis in geographical information systems.” OnWord Press, USA
3. Jones, Christopher (2002), “Geographical information systems and computer cartography” Longman, London.

Course Outcomes

CO1	Analyze the basic components of GIS
CO2	Able to classify and prepare maps
CO3	To understand process spatial and attribute data
CO4	Conceptualize a GIS project

MCE-024	Watershed Management	4L:0T:0P	4 credits

Course Objectives-:

CO1	To gain a comprehensive understanding of the hydrological, ecological, geological, and climatological processes that shape watershed dynamics
CO2	To learn how to develop and implement sustainable watershed management strategies that balance environmental, social, and economic objectives
CO3	To learn skills in using GIS and remote sensing technologies for watershed analysis, mapping, and monitoring
CO4	To understand the importance of interdisciplinary collaboration and stakeholder engagement in watershed management

Module 1:

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making, Watershed Management Practices in Arid and Semiarid Regions, short term and long term strategic planning, types and Sources of pollution, environmental guidelines for water quality, Perspective on recycle and reuse.

Module 2:

Morphometry, Soil erosion, Sediment Yield and Sedimentation Course Introduction: Wetland definitions and the role of water in wetland structure and function, Introduction to wetland water budgets and hydro-period Components of the water budget: inflows, outflows, and storage, Precipitation and runoff, Evapotranspiration; Surface water flows.

Module 3:

Wetland transport case studies and Field Trip, Wetland hydrologic assessment: physical and biological processes, Anthropogenic and climate change impacts on wetland hydrology, Modeling wetland hydrology, hydraulics, and hydrodynamics, Introduction to wetland treatment systems design Rain water management.

Reference book

1. Haan, C.T. “Hydrology of Small Watersheds”
2. Hillel, Daniel A. “Advances in Irrigation” Elsevier Science
3. Singh, Rajbir “Watershed Hydrology”
4. Singh, V.P. “Watershed Hydrology”
5. Schwaab, Frevert. “Soil and Water Conservation”
6. Suresh, R. “Land and Water Management Principles”

CO1	Components for watershed modelling and their evaluation.
CO2	Understanding and estimation of soil erosion, and conservation techniques.
CO3	Evaluation of hydrological processes in wetland and upland areas.
CO4	Assessment of wetland drainage in from agriculture watersheds.

Elective III

MCE-031	Pavement Analysis and Design	3L:1T:0P	4 credits

Course Objectives:

CO1	To learn about various factors affecting pavement design.
CO2	To learn about stress analysis in flexible pavement
CO6	To learn about stress analysis in rigid pavement
CO4	To learn about various methods of flexible pavement design.
CO5	To learn about various methods of rigid pavement design.

Module 1:

Pavements: History of Pavements, Types of pavement – Factors affecting design of pavements – wheel loads –ESWL Concept- tyre pressure – contact pressure, Material characteristics – Environmental and other factors.

Module 2:

Stresses in flexible Pavement: Stresses in flexible pavement – layered systems concept – one-layer system – Business Two-layer system – Burmister Theory for Pavement Design.
Stresses in Rigid Pavements: Stresses in rigid pavements – relative stiffness of slab, modulus of sub-grade reaction, Westergaard's stresses due to warping, stresses due to loads, stresses due to friction.

Module 3:

Design of Flexible Pavements: Pavement design: CBR Method of Flexible Pavement Design- IRC method of flexible pavement design, AASHTO Method of Flexible Pavement design, IRC:58-2002, IRC:58-2015
Design of rigid Pavements: IRC method of Rigid pavement design – Importance of Joints in Rigid Pavements- Types of Joints – Use of Tie Bars and Dowell Bars. AASHTO method of Rigid pavement design.

Text Books:

1. Yang H. Huang, "Pavement Analysis and Design",Pearson
2. Yoder E.J., and Witczak M.W, "Principles of Pavement Design", John Willey & Sons.
3. Pavement Engineering: Principles and Practice, Second Edition

Reference Books:

1. MORT& H, "Specifications of Road and Bridge Works"
2. Relevant IRC codes..

Course Outcomes: After the completion of the course the student will be able to:

CO1	Students can understand and recognize the components of pavement structure
CO2	To make students acquainted with various type of pavement and their analysis.
CO3	Enable them to design pavement for various requirements
CO4	Enable them to analysis of stresses in flexible pavement
CO5	Enable them to analysis of stresses in rigid pavement
CO6	Enable to Design a flexible pavement

MCE-032	Reinforced Soil Design	3L:1T:0P	4 credits

Course Objectives:

CO1	To learn about Reinforced earth
CO2	To learn about Factors affecting of soil reinforcement
CO3	To learn about reinforced earth retaining wall
CO4	To learn about stability of soil structures
CO5	To learn about application of Geo-synthhetics

Module 1:

Reinforced Earth: History, field of applications, natural fibers, overview of Geo-textiles, Geo-membranes, Geo-grids, Geo-nets, Geo-webs, Geo-mats and Geo-composites, economic aspects of their applications, Soil Reinforcement: Basic principle of soil reinforcement, shear strength of reinforced soil, Factors affecting, installation techniques

Module 2:

Design of reinforced earth retaining wall: Internal stability, External stability, soil nailing. Calculation methods: Basic concepts, embankment on soft soils, overall stability, foundation stability and bearing capacity failures Construction of the steep slope,

Module 3:

Application of Geo-synthetics in Roads and Railways, drainage system- Control of groundwater level, dewatering and reclamation of land, use of Geo-membranes – For lining applications, management and maintenance.

Text Books:

1. Geo-textiles and Geo-membranes in Civil Engg.- Gerard P.T.M. Van Santvrot A. A., CRC Press
2. Reinforced Soil and Geo-textiles- J. N. Mandal, proceedings FIGC- 1988, Oxford and IBH publishing company private Ltd., New Delhi.
3. Geosynthetics: Applications, Design and construction- R. J. Tarmat, proceedings First Europian Geosynthetics Conference, Netherland A. A. Balkema, publisher- Brookfield, U.S.A.
4. Geosynthetics World- J. N. Mandal ,John Wiley & Sons (Asia) Pvt. Ltd

Reference Books:

1. Deep Foundations and Geotechnical insitu Testing- R.Y. Liang, Feng Zhang
2. Foundation Analysis and Design- J.E. Bowles, McGraw Hill, companies, Inc.
3. Foundation Design Manual- N.V. Nayak, Jain Book Depot (JBD)

Course Outcomes: After the completion of the course the student will be able to:

CO1	To understand the history of reinforced earth
CO2	To understand the Factors affecting of soil reinforcement
CO3	To understand the geo-membranes
CO4	Enable them to analyze reinforced earth retaining wall
CO5	Enable them to understand the stability of soil structures
CO6	Enable them to understand application of Geo-synththetics

MCE-033	Pre-stressed Concrete Structures	3L:1T:0P	4 credits

Course Objectives:

CO1	To Explain the pre-stress system and losses.
CO2	To impart the concept of pre-stressing into slabs
CO3	To design the beams using pre-stress methods.
CO4	To impart the knowledge of pre-stressing into compression and tension members using IS codes
CO5	To understand the Analysis of Continuous beams-.
CO6	To understand cable layout-Linear transformation-Concordant cables.

Module-I

Principles of pre-stressing -Materials of pre-Stressing-Systems of pre-stressing - Loss of pre-Stress-Deflection of Pre-Stressed Concrete members.

Module –II

Slabs-Pre-tensioned and Post-Tensioned Beams-Design for flexure, bond and shear –IS code Provisions-Ultimate flexural and shear strength of pres-tressed concrete Sections-Design of end anchorate zones using IS code method.

Module –III

Composite beams- Analysis and design. Partial pre-stressing, non-pre-stressing reinforcements, Analysis of continuous beams, cable layout, linear transformation, concordant cables.

Reference books /Text books:

1. Agarwal, P. and Shrikhande, M. (2007), Earthquake Resistant of Design of Structures, PHI Publications.
2. Biggs, J.M. (2004), Introduction to Structural Dynamics, McGraw Hill Publications, New York, USA.
3. Chopra, A.K. (2004), Dynamics of Structures, Pearson Education, New Delhi.
4. Duggal, S.K. (2008), Earthquake Resistant of Design of Structures, Oxford University Press, New Delhi.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the concepts of earthquake and their effects.
CO2	Know types of seismic waves and their role in earthquake.
CO3	Analyze and earthquake resisting design based on the codal provisions ..
CO4	Learn the codal provision of IS-1893.
CO5	Understand the components of a bridge .
CO6	Understand the Retrofitting methods.

MCE-034	Earthquake Resistant Design of Structures	4L:0T:0P	4 credits

Course Objectives:

CO1	To Explain the Earthquake phenomenon, Causes and effects of earthquakes.
CO2	To impart the knowledge of Plate Tectonics.
CO3	To impart the knowledge the latest Indian seismic code IS:1893: 2016.
CO4	To understand the Analysis of Super structure, sub structure.
CO5	To understand Retrofitting and base isolation technique.

Module-I

Engineering Seismology: Earthquake-Causes and effects of earthquakes, Faults, Plate Tectonics, Earthquake size – Magnitude and intensity of earthquakes, Classification of earthquakes, Seismic waves, Seismic zones, Seismic Zoning Map of India, Seismograms and Accelerograms.

Module –II

Earthquake Resistant Design: Methods of seismic design, Equivalent lateral force method, Response spectrum method, Time history method.

Codal Design Provisions: Review of the latest Indian seismic code IS:1893: 2016 provisions for buildings, Earthquake design philosophy, Assumptions, Analysis by seismic coefficient.

Module -III

Retrofitting and base isolation technique: Retrofitting and strengthening of structures, Base isolation concept, isolation systems and their modelling, linear theory of base isolation, stability of elastomeric bearings, Introduction of different types of seismic dampers.

Reference books /Text books:

1. Agarwal, P. and Shrikhande, M. (2007), Earthquake Resistant of Design of Structures, PHI Publications.

2. Biggs, J.M. (2004), to Structural Dynamics, McGraw Hill Publications, New York, USA.

3. Chopra, A.K. (2004), Dynamics Introduction of Structures, Pearson Education, New Delhi.

4. Duggal, S.K. (2008), Earthquake Resistant of Design of Structures, Oxford University Press, New Delhi.

5. IS: 1983. (2016), Criterion for Earthquake Resistant Design, Bureau of Indian Standards, New Delhi.

Course Outcomes: After the completion of the course the student will be able to:

CO1	Understand the phenomena of earthquake and their effects.
CO2	Know types of seismic waves and their effect in earthquake.
CO3	Analyze and earthquake resisting design based on the codal provisions ..
CO4	Learn the codal provision of IS-1893.
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