MULTIDISCIPLINARY MINOR BUCKET
for AFFILIATED INSTITUTES
MINOR DEGREE IN CIVIL & ENVIRONMENTAL ENINGEERING
(other than B.Tech. in Civil & Environmental Engineering program students)

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AF1922MD306	Introduction to Engineering Geology	3
SEM-III	25AF1922MD306A	Water Supply Engineering	3
SEM-IV	25AF1922MD406	Waste Water Engineering	3
SEM-V	25AF1922MD506	Concrete Technology	3
SEM-VI	25AF1922MD606	Project Management	3
SEM-VII	25AF1922MD706	Construction Equipment and Site Safety Management	2
MINIMUM CREDITS REQUIRED TO COMPLETE A MINOR DEGREE IN CIVIL ENGINEERING			**14**

SUBJECT CODE	Multi-Disciplinary Minor-I						CREDITS
25AF1922MD306	Engineering Geology						3
Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ 1	To recognize and classify rock and soil materials to identify suitable construction materials or as a stable foundation.
COBJ 2	To offer the essential geological knowledge necessary for the construction of various kinds of civil engineering structures.
COBJ 3	To focus on the core activities of engineering geologists like site characterization and geologic hazard identification and mitigation.
COBJ 4	To arrange, and carry out site investigation methods to extract the necessary characteristics for a variety of technical applications.
COBJ 5	To interpret field and laboratory data for safety and security of mega structures like tunnels and dams.

Course Outcomes: Students will be able to	
CO1	Learn mineralogical and petrological features that are significant in characterizing its competency as a building material and foundation.
CO2	Learn how different geological conditions influence the design parameters of Civil Engineering.
CO3	Understand the earth's structure and deformation history before applying rock mechanics theory.
CO4	Understand the site selection criteria for designing civil engineering projects that are both safe and cost-effective.
CO5	Learn about the influence of geological conditions on dams and tunnels, and also provide related remedial measures.

Course Contents

Module 1	**Introduction and Geomorphology**	**Hrs. 8**
Introduction and history of Engineering Geology and related branches, applications in Civil engineering. Interior of Earth, Plate tectonics, Earthquakes, seismic zones in India. Geomorphology: - basic principles and processes loke denudation and types of weathering. Landform formation and types associated with river, wind, and sea, and their relevance to civil engineering.		
Module 2	**Mineralogy and Petrology**	**Hrs. 8**
Mineralogy: - Study of physical properties of minerals and study of common rock-forming minerals & clay minerals. Petrology: Definition, rock cycle. Civil engineering significance. Igneous rocks: Origin, classification, textures, related structures, and their importance. Sedimentary rocks: Formation, classification, textures and structures, and their importance. Metamorphic rocks: Agents and types of metamorphism, textures, and structures and their importance.		

Module 3	Structural Geology and Groundwater	Hrs. 6
Geological maps: - Geologic cross-section, Attitude of beds like outcrops, strike, and dip. Study of tectonic structures like folds and faults their origin, classification, diverse effects, and case studies. Joints and unconformities their origin, types, and diverse effects case studies. Groundwater: Sources of groundwater, water table, zones of groundwater, porosity, and permeability.		
Module 4	**Geological Investigations**	**Hrs. 6**
Introduction, geological survey, steps in geological investigations. Exploratory drilling types and limitations, preservation of cores, core logging, core recovery, Rock Quality Designation (RQD). Engineering properties of rocks like density, unit weight, porosity, strength, and index properties. Geophysical investigation applications in Civil engineering methods like electrical resistivity method, gravity method.		
Module 5	**Geology of Dams, Reservoirs, and Tunnels**	**Hrs. 8**
Dams: - Influence of geological conditions on location, alignment, design, and type of a dam, geological considerations in site selection for dams, and site improvement techniques e.g. grouting. Tunnelling: - Types of tunnels, tunnelling in various conditions e.g. folded/faulted region, deccan trap or any other kind of rocks. Influence of geological conditions on tunnelling and remedial measures like tunnel lining. Bridges: - Types of bridges, dependence of types of bridges on geological conditions and remedial measures.		

Text Books:	
1	Singh Prabin, 2009, "Engineering and General Geology", S. K. Katariya and sons, Delhi.
2	Mukerjee P. K., 2013, "A Text Book of Geology", World Press Pvt. Ltd., Calcutta.
3	Gokhale K.V.G.K. and Rao D. M., 1982, "Experiments in Engineering Geology", TMN.
4	Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune.
5	Subinoy Gangopadhyay, 2013, "Engineering Geology", Oxford University Press.
Reference Books:	
1	G. W. Tyrrell, 1926, "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi .
2	Legget R. F., 1983"Geology Handbook in Civil Engineering", McGraw-Hill, New York.
3	Krynine D. P. & Judd W. R., 2005, "Principles of Engineering Geology & Geo- technics", CBS Publishers & distri. New Delhi.
4	Billings M. P., 1942, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.
5	A. Holmes, 1944, "Principles of Physical Geology", ELBS Chapman & Hall, London.

SUBJECT CODE	Water Supply Engineering	CREDITS
25AF1922MD306A		3

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ 1	To understand the environmental significance of water, its sources, and assess water demand and quality as per standards.
COBJ 2	To study the methods of collection and conveyance of raw water including design aspects.
COBJ 3	To learn various water treatment processes.
COBJ 4	To understand disinfection techniques and water softening methods for potable water quality.
COBJ 5	To explore different water supply systems, distribution networks, and their components.

Course Outcomes: On completion of course, students will be able to	
CO1	Understand the different sources of water.
CO2	Study different types of water treatment operations.
CO3	Study various parameters of water.
CO4	Apply appropriate disinfection and water softening techniques based on water quality and treatment goals.
CO5	Design and maintain efficient water distribution systems, including pipe networks, storage structures, and appurtenances.

Course Contents

Module 1	**Introduction, quantity and quality of Water**	**Hrs. 08**
Environment and its components, importance of water, role of environmental engineer, sources of water, water demand: Design flow, design period, design population, factors affecting water consumption, variation in demand, and design capacity for water supply components, quality of water: Physical, chemical, biological characteristics, Indian standard for quality of potable water		
Module 2	**Collection and conveyance of water**	**Hrs. 05**
Conveyance of raw water: Canals and pipelines, hydraulics of conduits, laying and jointing of pipelines, testing of pipe lines, designing of rising main, type of valves, types of pumps, intake structure, types of intake structures		
Module 3	**Treatment of water**	**Hrs. 10**
Necessity of water treatment processes Types of Treatments: Aeration: Necessity, methods, removal of taste and odour, design of aeration fountain Sedimentation: Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements Coagulation: Necessity, coagulant dosage, choice of coagulants, optimum pH Rapid Mixing: Necessity, gravitational, mechanical, pneumatic devices Slow Mixing and Flocculation: Design of flocculation chamber, mean velocity gradient, design of clari-flocculator, plate settler and tube settler Filtration: Theory of filtration, filter materials, types of filters, components, working and cleaning of filters		

Module 4	Disinfection	Hrs. 07
Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants, break point chlorination, bleaching powder estimation Water softening methods: Lime-soda, ion exchange method, demineralization .		
Module 5	**System of Water Supply**	**Hrs. 06**
Gravitational, pumping and combined schemes, materials of water supply pipes, house connection from mains, different valves, meters and hydrants, storage reservoirs, balancing reservoir, detection and prevention of leaks in the distribution systems, maintenance of distribution systems.		

Text Books:	
1	Garg S. K., "Water Supply Engineering", Khanna Publishers, New Delhi
2	Birdi J. S. and Birdi G. S., "Water Supply & Sanitary Engineering", Dhanpat Rai Pub. Company, 8th edition, New Delhi
3	Dr. B.C. Punmia, Ashok Jain, Arun Jain " Water Supply Engineering" Laxmi Publications
4	Howard S. Peavy, Donald R. Rowe, George Tchobanoglous "Environmental Engineering", McGraw Hill Publications
Reference Books:	
1	Peavy and Rowe, "Environmental Engineering", McGraw Hill Publications
2	Government Of India Publication, "Water Supply and Treatment Manual
3	Warren Viessman Jr., Mark J. Hammer, Elizabeth M. Perez, Paul A. Chadik "Water Supply and Pollution Control", Pearson Education
4	Mackenzie L. Davis "Water and Wastewater Engineering", McGraw-Hill Education

SUBJECT CODE	Waste Water Engineering						CREDITS
25AF1922MD406							3
Teaching Work Load/week(Hrs.)				Examination Scheme(Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ1	To understand the characteristics, sources, and flow dynamics of wastewater and factors affecting sewer design and sewage pumping.
COBJ2	To gain knowledge of primary and secondary physical and biological treatment processes for wastewater.
COBJ3	To study anaerobic treatment methods and factors influencing their efficiency in wastewater management.
COBJ4	To learn the various sludge treatment processes including thickening, stabilization, and disposal techniques.
COBJ5	To comprehend wastewater disposal methods, disinfection needs, and environmental standards for safe effluent discharge.

Course Outcomes: On completion of course, students will be able to	
CO1	Identify and quantify wastewater components, estimate flow rates, and design basic sewer systems and pumping stations.
CO2	Analyze and apply physical unit operations and biological processes for primary and secondary treatment of wastewater.
CO3	Explain the principles and operational factors of anaerobic treatment systems such as UASB and septic tanks.
CO4	Design and evaluate sludge treatment processes including thickening, stabilization, and disposal methods.
CO5	Assess wastewater disposal techniques, model self-purification of water bodies, and apply effluent standards for environmental protection.

Course Contents

Module 1	**Introduction, Quantity & Quality of Wastewater**	**Hrs. 8**
Components of Wastewater Flows, Wastewater Sources & Flowrate, Variations in Flowrates & Strength, Characteristics of Wastewater, Quantity of Wastewater, Sewer Design Considerations- Minimum Size of Sewer, Limiting Velocities, Peak Factor Sewage Pumping, Location, Capacity, Pumping Station Design		
Module 2	**Primary and Secondary Treatment of Waste water**	**Hrs.10**
Physical Unit Operations- Screening, Grit Removal, Oil & Grease Removal, Primary Sedimentation, Secondary Treatment: Fundamentals of Biological Treatment, Microbial Metabolism, Bacterial Growth & Kinetics, Suspended & Attached Growth Processes, Activated Sludge Process & its Modifications, Trickling Filters, Aerated Lagoons, Oxidation Ditch		

Module 3	Anaerobic Treatment of Wastewater	Hrs. 6
Anaerobic Suspended & Attached Growth Processes, Factors affecting Anaerobic Processes, Anaerobic Lagoons, UASB, Septic Tank		
Module 4	**Sludge Treatment**	**Hrs. 6**
Solid Sources, Characteristics & Quantities, Sludge Pumping, Treatment-Thickening, Stabilization, Design of Sludge Digester, Conditioning, Dewatering, Drying, Ultimate Disposal of Sludge Solids		
Module 5	**Disposal of Wastewater**	**Hrs. 6**
Need of Disinfection, Self-Purification, DO Sag Curve, Streeter Phelp's Model, Stream Classification, Effluent Standards for Discharge into Surface Water & on Land		

Text Books:	
1	Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Environmental Engineering" Vol. II, Laxmi Publications (P) Ltd.
2	M.N. Rao, A.K. Datta, "Wastewater Treatment: Theory and Design", Oxford & IBH Publishing Co.
3	S.K. Garg, "Environmental Engineering", Khanna Publishers
4	G.S. Birdie, J.S. Birdie, "Water Supply and Sanitary Engineering" Dhanpat Rai & Co. Pvt. Ltd.

Reference Books:	
1	Peavey, H.S.Rowe, D.R., and Tchobanoglous, Environmental Engineering, McGraw-Hill Book Company.
2	Viessman W. and Hammer M.J. Water supply and pollution Control, Harper Collins College publishers.
3	Hammer M.J. Water and Waste water Technology, Prentice-Hall of India P.Ltd.
4	Metcalf & Eddy, Waste Water Engg. Treatment & Disposal, Tata McGraw Hill.
5	Manual on sewerage and sewage Treatment systems – CPHEEO, Government of India in collaboration with JICA.

SUBJECT CODE	Multi-Disciplinary Minor-II	CREDITS
25AF1922MD506	Concrete Technology	3

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ1	To Learn about different ingredients of concrete.
COBJ2	Understand the manufacturing of concrete
COBJ3	To Learn about use of concrete as per type of construction.
COBJ4	Understand behavior of concrete after casting.
COBJ5	To learn about increasing strength of concrete.

Course Outcomes: Students will be able to	
CO1	Understand the various types and properties of ingredients of concrete
CO2	Understand the fresh properties of fresh concrete.
CO3	Understand effect of admixtures on the behavior of the fresh and hardened concrete.
CO4	Understand the fresh properties of harden concrete.
CO5	Formulate concrete design mix for various grades of concrete.

Course Contents

Module 1	**Ingredients of Concrete**	**Hrs. 6**

Cement-manufacturing process, physical properties, hydration of cement, hydration products, chemical compounds in cement, types of cement,

Aggregates- classification of aggregates, physical properties, mechanical properties, fineness and gradation of aggregates using sieve analysis, tests on aggregates.

Water-specifications of water to be used for concert, quality of water for use in concrete,

Module 2	**Properties of Fresh Concrete**	**Hrs. 6**

Nominal mix concrete, types of batching, mixing, transportation, placing including pumping and compaction techniques, workability, factors affecting workability, methods of measuring workability, segregation and bleeding, setting time, curing of concrete, types of curing, temperature effects on fresh concrete.

Module 3	**Properties of Harden Concrete**	**Hrs. 6**

Desired properties of concrete, strength, durability, characteristic strength, compressive, tensile and flexure strength of concrete, stress-strain relationship tests on concrete, modulus of elasticity, effect of w/c ratio and admixtures on strength, creep and shrinkage of concrete, durability of concrete: minimum & maximum cement content, strength & durability relationship, exposure to different conditions, factors contributing to cracks in concrete, sulphate attack, alkali aggregate reaction.

Module 4	**Admixtures &** Special **concretes**	**Hrs. 6**
Admixtures -Role of admixture, classification and types of admixtures like accelerators, retarders, plasticizers, super plasticizers, mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag. Special concretes – Lightweight concrete and its types, self-compacting concrete, high density concrete, fiber reinforced concrete, High Strength Concrete, High Performance concrete, geo-polymer concrete and Ferrocement technique.		
Module 5	**Concrete Mix Design**	**Hrs. 6**
Factors Governing Mix Design, Methods of Mix Design. factors affecting the mix design, Methods of Expressing Proportions, Trial Mixes, Acceptance Criteria, Factors Causing Variations, Quality Measurement in Concrete Construction, Non-destructive Testing of Concrete-rebound hammer test, ultrasonic pulse velocity test.		

Text Books:	
1	Gambhir M. L. "Concrete Technology", Tata Mc-Graw Hill 2015 15th edition
2	Shetty M. S. "Concrete Technology", S. Chand 2005
3	Krishnaswamy, "Concrete Technology", DhanapatRai and Sons

Reference Books:	
1	Orchard, "Concrete Technology", Applied Science Publishers
2	Neville A. M., "Concrete Technology", Pearson Education
3	Neville A. M., "Properties of Concrete", Pearson Education
4	Relevant Publications by Bureau of Indian Standards, New Delhi
5	IS:10262(2009), IS:456 (2009), IS 4926 (2003)

SUBJECT CODE	Multi-Disciplinary Minor-IV	CREDITS
25AF1922MD606	Project Management	3

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
3	0	0	3	20	20	60	100

Course Objectives	
COBJ1	Understand the fundamentals of Project Management
COBJ2	Explain the roles and responsibilities of a Project Manager
COBJ3	Identify, initiate, and evaluate projects using pre-feasibility and feasibility study
COBJ4	Apply systematic project planning methods
COBJ5	Develop and analyze project schedules using network techniques

Course Outcomes: Students will be able to	
CO1	Explain basic concepts, need, knowledge areas, processes, and life cycle of Project Management for engineering applications.
CO2	Analyze the role of the Project Manager, project phases, management principles, and the impact of delays on project completion
CO3	Perform project identification, initiation, feasibility analysis, and determine project viability using break-even analysis.
CO4	Prepare project plans using structured approaches such as WBS, team coordination, and project planning processes.
CO5	Construct and analyze PERT and CPM networks to determine critical paths, project duration, variability, and project costs.

Course Contents

Module 1	**Basics of Project Management**	**Hrs. 6**
Introduction, Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle.		
Module 2	**Project Management Processes**	**Hrs. 6**
The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles.		
Module 3	**Project Identification and Selection**	**Hrs. 6**
Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point.		
Module 4	**Project Planning**	**Hrs. 6**
Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS).		
Module 5	**PERT and CPM**	**Hrs.6**
Introduction, Development of Project Network, Time Estimation, Determination of the Critical Path, PERT Model, Measures of variability, CPM Model, Network Cost System.		

Text Books:	
1	Remote Sensing and GIS by Basudeb Bhatta, Oxford University Press, 2nd Edition, 2011.
2	Introduction to Geographic Information Systems by Kang-Tsung Chang, McGraw-Hill Education (Indian Edition), 7th Edition, 2015.
3	Fundamentals of Geographic Information Systems by Michael N. Demers, 4th Edition, Wiley Publishers, 2012.
4	Textbook of Remote Sensing and Geographical Information Systems by M. Anji Reddy.
Reference Books:	
1	Remote Sensing and Image Interpretation by Thomas M. Lillesand and Ralph W. Kiefer, Wiley Publishers, 7th Edition, 2015.
2	Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3rd Edition, 2010.
3	Advanced Surveying: Total Station, GIS and Remote Sensing by Satheesh Gopi, R. Sathi Kumar, N. Madhu, Pearson Education, 1st Edition, 2007.

SUBJECT CODE	Multi-Disciplinary Minor-V	CREDITS
25AF1922MD706	Construction Equipment and Site Safety Management	2

Teaching Work Load/week (Hrs.)				Examination Scheme (Marks)			
Theory	Tutorial	Laboratory	Total	ISE	MSE	ESE	Total
2	0	0	2	20	20	60	100

Course Objectives	
1	To provide foundational knowledge on the types, selection criteria, economic evaluation (including ownership and operating costs), and life-cycle planning of construction machinery, along with an introduction to automation trends in the industry.
2	To familiarize students with various earthmoving and material handling machines used in construction, their specific applications in foundational work, and the importance of regular safety inspections and operational protocols.
3	To introduce the machinery and techniques involved in road construction and concrete operations, with a focus on modern technologies and practical deployment strategies through real-world case studies.
4	To impart knowledge of essential safety practices on construction sites, identify major hazards, and promote awareness of safety measures, layout planning, PPE usage, and emergency preparedness.
5	To develop an understanding of construction safety legislation, standards (e.g., OSHA, ISO 45001), risk analysis tools, and structured safety management systems to ensure legal compliance and promote a culture of proactive safety.

Course Outcomes: On completion of course, students will be able to	
CO1	Students will be able to identify, classify, and evaluate construction equipment based on project suitability, cost-effectiveness, and operational productivity, and perform ownership and operating cost analysis including equipment depreciation and replacement planning.
CO2	Students will be able to explain the working principles and applications of various earthmoving and material handling equipment and demonstrate an understanding of safety requirements and inspection protocols in field operations.
CO3	Students will be able to select and apply appropriate equipment for road construction and concreting tasks, analyze construction case studies, and evaluate modern concreting techniques and technologies such as shotcreting and slip-forming.
CO4	Students will be able to assess construction site hazards, apply standard safety practices and preventive measures, and plan for site layout and emergency preparedness to mitigate risks effectively.
CO5	Students will be able to interpret and apply construction safety regulations, conduct risk assessments and safety audits, and implement effective Safety Management Systems aligned with international standards.

Course Contents

Module 1	**Introduction to Construction Equipment**	**Hrs. 08**

The classification of construction equipment, the fundamental criteria for selecting appropriate machinery based on productivity, cost-effectiveness, project suitability, The estimation of ownership and operating costs, understanding equipment depreciation, replacement policies, introduction to automation trends in construction equipment.

Module 2	Earthmoving and Material Handling Equipment	Hrs. 08
Types of earthmoving machinery such as excavators, bulldozers, backhoe loaders, and scrapers, along with compacting equipment like rollers and rammers, material handling tools including different types of cranes, hoists, conveyors, forklifts. Emphasis is placed on equipment used for foundation works, the importance of safety protocols and inspection routines for all these machines.		
Module 3	**Road Construction and Concreting Equipment**	**Hrs. 08**
The equipment used in road construction including pavers, graders, and milling machines. Equipment for concrete-related operations such as batching plants, transit mixers, concrete pumps, and slip-forming machines, advanced techniques such as shotcreting, the use of asphalt mixing and laying equipment, practical case studies to illustrate the effective deployment of such equipment in real-world projects.		
Module 4	**Construction Site Safety Management**	**Hrs. 08**
The concept of construction safety, common hazards, and accident trends in the industry, safety measures such as proper signage, the use of personal protective equipment (PPE), the role of site layout in enhancing safety, risks associated with working at heights, excavation, trenching, fire hazards, and electrical safety, emergency planning and basic first aid procedures.		
Module 5	**Safety Laws, Regulations, and Management Systems**	**Hrs. 08**
The legal and regulatory framework governing construction safety, relevant national standards and international benchmarks such as OSHA and ISO 45001. Statutory compliance, conducting safety audits and inspections, preparation of safety reports, risk assessment methods, job hazard analysis (JHA), the implementation of comprehensive Safety Management Systems (SMS), behavior-based safety approaches.		

Text Books:	
1	Sharma, S.C., Construction Equipment and Management, Khanna Publishers.
2	Hinze, J., Construction Safety, Prentice Hall.
3	Peurifoy, R.L., Construction Planning, Equipment, and Methods, McGraw-Hill.
4	Goetsch, D.L., Construction Safety and Health, Pearson
5	Mahesh Varma, Construction Equipment and Its Planning and Application, Metropolitan Book Co. Pvt. Ltd.
Reference Books:	
1	IS Codes and OSHA Construction Safety Manuals.
2	CPWD Safety Code and Manuals.