

MULTIDISCIPLINARY MINOR BUCKET
for AFFILIATED INSTITUTES
MINOR DEGREE IN CIVIL & INFRASTRUCTURE ENGINEERING
(other than B.Tech. in Civil & Infrastructure Engineering program students)

Semester	Subject Code	Subject Name	Total Credit
SEM-III	25AF1918MD306	Introduction to Engineering Geology	3
SEM-III	25AF1918MD306A	Urban Transportation Planning	3
SEM-IV	25AF1918MD406	Highway Engineering	3
SEM-V	25AF1918MD506	Concrete Technology	3
SEM-VI	25AF1918MD606	Project Management	3
SEM-VII	25AF1918MD706	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	
25AF1918MD306		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
<p>Introduction and history of Engineering Geology and related branches, applications in Civil engineering.</p> <p>Interior of Earth, Plate tectonics, Earthquakes, seismic zones in India.</p> <p>Geomorphology: - basic principles and processes like denudation and types of weathering.</p> <p>Landform formation and types associated with river, wind, and sea, and their relevance to civil engineering.</p>		
Module 2	Mineralogy and Petrology	Hrs. 8
<p>Mineralogy: - Study of physical properties of minerals and study of common rock-forming minerals & clay minerals.</p> <p>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.</p>		

Module 3	Structural Geology and Groundwater	Hrs. 6
<p>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.</p>		
Module 4	Geological Investigations	Hrs. 6
<p>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.</p>		
Module 5	Geology of Dams, Reservoirs, and Tunnels	Hrs. 8
<p>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.</p> <p>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.</p> <p>Bridges: - Types of bridges, dependence of types of bridges on geological conditions and remedial measures.</p>		

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		<h1>Urban Transportation Planning</h1>				CREDITS	
25AF1918MD306A						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 relationship between transport systems and socio-economic development in urban and regional contexts.
COBJ 2	To study various transport planning processes and forecasting techniques for passenger and freight movements.
COBJ 3	To apply quantitative models for trip generation, distribution, modal split, and route assignment.
COBJ 4	To understand survey methods and data collection techniques for transportation planning.
COBJ 5	To explore land-use and transport interaction through models and its implications for urban development.

Course Outcomes: Students will be able to	
CO1	Explain the historical development and socio-economic role of transportation systems in urban areas.
CO2	Apply the four-step transportation planning process to real-world problems including problem definition, alternative generation, analysis, and evaluation.
CO3	Develop and apply trip generation and modal split models using aggregate and disaggregate approaches such as the logit model.
CO4	Implement and compare various route assignment techniques including all-or-nothing and capacity-restrained models.
CO5	Design and evaluate transportation surveys and determine appropriate data collection strategies for different types of movements.

Course Contents

Module 1	Fundamentals of Transport Systems and Planning Process	Hrs. 8
Transport and socioeconomic activities, historical development of transport, transportation in the cities, freight transportation, future developments, transport planning process, problem definition, solution, generation, solution analysis, evaluation and choice, implementation, sequence of activities involved in transport analysis.		
Module 2	Trip Generation and Modal Split Modelling	Hrs. 8
Trip production analysis, category analysis, trip attraction modelling, Influencing Factors, earlier modal split models, trip-end type modal split model, trip-interchange modal split model, disaggregate mode-choice model, logit model of mode-choice, binary choice situations, multinomial logit model, model calibration, case studies.		
Module 3	Traffic Assignment and Network Modelling	Hrs. 6
Route assignment, description of transport network, route choice behaviour, the minimum path, minimum path algorithm, route assignment techniques, all-or-nothing assignment, multipath traffic assignment, capacity-restrained traffic assignment.		
Module 4	Transportation Surveys and Data Collection Techniques	Hrs. 6
Transportation survey, definition of study area zoning types of movements types of surveys, home-interview survey, commercial vehicle survey, intermediate public transport survey, cordon-line survey, post-card questionnaire survey, registration-number survey, tag-on-vehicle survey.		

Module 5	Land Use–Transport Interaction and Urban Freight Movement	Hrs. 6
Development of land-use models, the lowry model, application of lowry model, urban activity systems, urban movement hierarchies, types of urban structure - centripetal, linear, directional grid urban structure, classification of urban goods movements, methodology of approach to analysis of goods movement. modelling demand for urban goods transport.		

Text Books:	
1	Ortuzar, J.D.D. and Willumsen, L.G. “Modelling Transport”, John Wiley & Sons, 1990.
2	Ben Akiva, M.E. and Lerman, S. R., “Discrete Choice Analysis: Theory and Application to Travel Demand”, The MIT Press, Cambridge, Massachusetts, 1985.
3	Hutchinson, B. G., “Principles of Urban Transport Systems Planning”, McGraw Hill Book Company, 1974.
4	Kadiyali, L.R., “Traffic Engineering and Transport Planning” Khanna Publishers, New Delhi, 2006.
Reference Books:	
1	Khisty, C.J. & Lall B. Kent, “Transportation Engineering: An Introduction”, Prentice Hall Punlication.
2	Papacostas, C.S. & Prevedouros, P.D. “Transportation Engineering and Planning” Pearson Publication
3	Indian Roads Congress (IRC) Guidelines <ul style="list-style-type: none"> • IRC 102: Guidelines for Capacity of Urban Roads in Plain Areas. • IRC SP-41: Guidelines for Planning and Design of Urban Roads. • Practical context for surveys and planning in India.

SUBJECT CODE		<h1>Highway Engineering</h1>				CREDITS	
25AF1918MD406						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 introduce the fundamentals of transportation systems and their role in societal development.
COBJ2	To provide understanding of the design principles for geometric features of highways and roadways.
COBJ3	To impart knowledge on material properties and mix design relevant to highway construction.
COBJ4	To familiarize students with traffic studies, traffic control devices, and road safety practices.
COBJ5	To explain pavement design methodologies as per IRC guidelines for both flexible and rigid pavements.

Course Outcomes: Students will be able to	
CO1	Explain the role and components of various transportation modes and describe highway development processes and surveys.
CO2	Design the geometric elements of highways including curves, gradients, and intersections as per IRC standards.
CO3	Evaluate the engineering properties of highway materials and apply mix design methods for pavement construction.
CO4	Conduct traffic surveys, analyze data, and design appropriate traffic control and safety systems.
CO5	Apply IRC methods for the structural design of flexible and rigid pavements using appropriate mix design principles.

Course Contents

Module 1	Ingredients of Concrete	Hrs. 6
Introduction to Transportation Engineering & Highway Engineering, Importance of various modes of transportation, Road Classification, Developments in Road Construction, Highway Planning, Alignment and Surveys, Role of transportation in society Factors affecting transportation.		
Other modes of Transport - Introduction to Expressways, Railways, Airways, Waterways, Pipeline Transportation, Classification, Requirements, Comparative Studies.		
Module 2	Geometric Design	Hrs. 6
Cross section elements, Sight distances, Horizontal alignment, Vertical alignment, Intersections, Construction of Pavements, Construction and Maintenance of Drainage, Road Arboriculture		
Module 3	Highway Materials	Hrs. 6
Soil – relevant properties, Various tests, Aggregates – strength, hardness, toughness, soundness, durability, shape, specific gravity, water absorption, Bituminous materials – Bitumen, Tar, and Asphalt – various properties, Design of Bituminous paving mixes-Marshall stability test		

Module 4	Traffic Engineering	Hrs. 6
<p>Traffic Characteristics, Speed, Journey Time and Delays, Vehicle Volume Counts, Origin and Destination Studies, Analysis and Interpretation of Survey Data, Traffic Operations, Design of Signals and Rotary intersections, Parking Space Design, Highway Lighting, Planning and Administration, Road Markings, Signs 15</p> <p>Road Accidents and Safety: Classification, Causes, Mitigation and Control Measures, Aspects of Safety in Usage of Roads, Type and Design of anti-crash barriers, Introduction to Intelligent Transport Systems (ITS).</p>		
Module 5	Pavement Design	Hrs. 6
<p>Introduction to pavement design, factors affecting pavement design, bituminous mix design , dry mix design , marshal mix design, Basic Principles, Methods for different Types of Pavements, Design of flexible pavement using IRC: 37- 2012, Design of rigid pavement using IRC: 58-2011</p>		

Text Books:	
1	Khanna and Justo, “Highway Engineering”, Nemchand & Bros., Roorkee
2	Khanna S.K., “Highway Engineering”
3	Arora N. L., “Transportation Engineering”
4	Bindra and Arora, “Highway Engineering”, Standard Publishers
5	Vazirani V.N. and Chandola S.P., “Transportation Engineering”, Vol.I Khanna Publishers, N. Delhi
6	Shahani P.B, “Road Techniques” Khanna Publishers, N. Delhi

Reference Books:	
1	Garber, N.J. and Hoel, L.A., “Traffic and Highway Engineering”, West Publishing Company, New York
2	Jones, J.H., “Geometric Design of Modern Highways’, E & FN SPON Ltd., London.
3	Khistry, C.J., “Transportation Engineering – An Introduction’, Prentice Hall of India Ltd.
4	Agor R., “Surface Transportation (Railways and Highways)”, Khanna Publishers, N. Delhi

SUBJECT CODE		Multi-Disciplinary Minor-IV				CREDITS	
25AF1918MD606		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, 2 nd Edition, 2011.
2	Introduction to Geographic Information Systems by Kang-Tsung Chang, McGraw-Hill Education (Indian Edition), 7 th Edition, 2015.
3	Fundamentals of Geographic Information Systems by Michael N. Demers, 4 th 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, 7 th Edition, 2015.
2	Geographic Information systems – An Introduction by Tor Bernhardsen, Wiley India Publication, 3 rd Edition, 2010.
3	Advanced Surveying: Total Station, GIS and Remote Sensing by Satheesh Gopi, R. Sathi Kumar, N. Madhu, Pearson Education, 1 st Edition, 2007.

SUBJECT CODE		Multi-Disciplinary Minor-V						CREDITS
25AF1918MD706		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.