

Scheme & Syllabus

As per (CBCS Scheme)

For

M. Tech. Civil Engineering (Transportation Engineering)

(w.e.f. session 2024-25)



**UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY
FACULTY OF ENGINEERING AND TECHNOLOGY
MAHARSHI DAYANAND UNIVERSITY
ROHTAK -124001(HARYANA)**

M. Tech Civil Engineering (Transportation Engineering)

Program Outcomes (POs):

After completion of the program graduates will be able to

- A. Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.
- B. Identify, formulate and solve engineering problems in the domain of transportation engineering field.
- C. Use different software tools for Analysis and Design of structures for transportation engineering domain.
- D. Design and conduct experiments, analyze and interpret data, for development of simulation experiments.
- E. Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
Foundation Elective	Foundation Elective Subject
Open elective	Open elective course
CL	Core Lab

MAHARSHI DAYANAND UNIVERSITY ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M. Tech Civil Engineering (Transportation Engineering)
CBCS Scheme w.e.f. 2024-25

Semester1 st								Examination schedule (marks)					
Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Total Contact Hrs. per week	Credit	Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
				L	T	P							
1.	Program core course	24MTTE21C1	Transportation Systems Planning and Management	4	0	0	4	4	50	100	-	150	3
2.	Program core course	24MTTE21C2	Pavement Materials and Design	4	0	0	4	4	50	100	-	150	3
3.	Program core course	24MTTE21C3	Highway Construction and Maintenance	4	0	0	4	4	50	100	-	150	3
4.	Program core course	24MTTE21C4	Road Safety Evaluation	4	0	0	4	4	50	100	-	150	3
5.	Program core course	24MTTE21C5	Tunnel Engineering	4	0	0	4	4	50	100	-	150	3
6.	Program Core Lab	24MTTE21CL1	Pavement Design and Evaluations Laboratory	0	0	2	2	2	50	-	50	100	3
7.	Program Core Lab	24MTTE21CL2	Pavement Materials and Testing Laboratory	0	0	2	2	2	50	-	50	100	3
Total Credit				24									

MAHARSHI DAYANAND UNIVERSITY ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M. Tech Civil Engineering (Transportation Engineering)
CBCS Scheme w.e.f. 2024-25

Semester 2nd										Examination schedule(marks)			
Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Total Contact Hrs. per week	Credit	Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
				L	T	P							
1.	Program core course	24MTTE22C1	Geometric Design of Transportation Facilities	4	0	0	4	4	50	100	-	150	3
2.	Program core course	24MTTE22C2	Advanced Traffic Engineering	4	0	0	4	4	50	100	-	150	3
4.	Program Core Lab	24MTTE22CL1	Traffic Engineering Lab	0	0	2	2	2	50	-	50	100	3
5.	Program Core Lab	24MTTE22CL2	Road safety and audit lab	0	0	2	2	2	50	-	50	100	3
6.	Program core Elective course	*	Elective – I	4	0	0	4	4	50	100	-	150	3
7.	Open Elective course	**	Open Elective				3	3					3
8.	Foundation Elective	***	Foundation Elective				2	2					2
Total Credits				21									

Note:

1. * Choose any one subject from Elective-I. (List given)
2. ** Choose any one subject from the pool of open electives subjects provided by the university.
3. *** Choose any one subject from the pool of Foundation electives subjects provided by the university.

Elective –I	1.	Transportation Economics and Finance	24MTTE 22E1
	2.	Geotechnical Investigations	24MTTE 22E2
	3.	Remote sensing and GIS	24MTTE 22E3
	4.	Disaster Management	24MTTE 22E4

MAHARSHI DAYANAND UNIVERSITY ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M. Tech Civil Engineering (Transportation Engineering)
CBCS Scheme w.e.f. 2025-26

Semester 3 rd										Examination schedule (marks)			
Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Total Contact Hrs. per week	Credit	Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
				L	T	P							
1.	Program core course	24MTTE23C1	Airport Infrastructure, Planning and Design	4	-	0	4	4	50	100	-	150	3
2.	Program core course	24MTTE23C2	Advanced Railway Engineering	4	-	0	4	4	50	100	-	150	3
3.	Dissertation	24MTTE23C3	Literature Survey (Dissertation Phase-I)	-	-	2	4	2	100	-	-	100	-
4.	Seminar	24MTTE23C4	Seminar	-	-	2	2	2	50			50	-
5.	Program Core Lab.	24MTTE23CL1	MX Road Lab	-	-	2	2	2	50	-	50	100	-
6.	Open elective course	*	Open elective				3	3					3
Total Credit				17									

***Note: Choose any one subject from the pool of open electives subjects provided by the university.**

MAHARSHI DAYANAND UNIVERSITY ROHTAK
SCHEME OF STUDIES AND EXAMINATION
M. Tech Civil Engineering (Transportation Engineering)
CBCS Scheme w.e.f. 2025-26

Semester 4 th								Examination schedule (marks)			
Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Credit	Internal Assessment	External Examination	Practical	Total
				L	T	P					
1.	Dissertation	24MTTE24C1	Dissertation and viva (Dissertation Phase-II)	-	-	-	20	250	-	500	750
Total Credits				20							
Total Credits for the Programme = 24 + 21 +17 +20 = 82											

Note: The student has to publish atleast one research paper related to his/her research work in peer reviewed/ Refereed/ UGC/ SCOPUS/ SCI Journal/Proceeding of National/ International conference before the final viva of Dissertation Phase-II.

For dissertation/project/field work, 0.05 hrs per credit per week per student will be counted for the purpose of work load of a teacher. No teacher will be allotted more than 8 students for dissertation/project/field work and less than 4 hours for class room lectures. If there is Co-supervisor/Co-mentor for dissertation/project/field work, then half of the work load i.e. 0.025 hrs per credit per week per student will be counted for the purpose of work load of a teacher.

Transportation Systems Planning and Management			
Course Code	24MTTE21C1	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Students will gain an experience in the implementation of planning transportation routes in new developing towns and cities.
- The students will get a diverse knowledge to solve the problem of congestion and inconvenience.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction to transportation planning: Fields of transportation Engineering, Transportation planning process, Development plans, objectives and goals, level of planning; role of transportation at national, regional and urban level.

Urbanization: Definition of urban area, trends in urbanization, urban class groups, metropolitan city, transportation problems & identification.

UNIT-2

Travel Demand: Concepts of travel demand; factors affecting demand and the demand functions; calibration methods; sequential, direct demand models; introduction to aggregate and disaggregate approaches.

Transportation Surveys: Division into traffic zones, network identification and coding, types of travel and characteristics of various surveys, home interview, roadside survey, goods, mass transit and intermediate public transport surveys, sampling and expansion factors, accuracy checks, screen line checks, consistency checks..

UNIT-3

Travel Forecasting: Growth factor methods and urban transportation planning system; growth factors; average growth factor method and Furness method

Transportation Modes and Technologies: Technologies of Transport and System Components, Path Characteristics, Path-Vehicle Interaction, Discrete Flows and Continuous Flows, Vehicle and its Performance, Terminal Planning, Operational Planning.

UNIT-4

Urban transportation planning process: Trip generation, zonal regression methods and category analysis, trip distribution method, gravity models and opportunity models, modal split methods, factors affecting modal split, trip end models and trip distribution models, route assignment, factors affecting route choice, diversion curve, shortest paths, all or nothing assignment.

Transportation Plan Preparation: Urban forms and structure, point, linear, radial, poly-nuclear developments and preparation of plan, comprehensive and traffic system management plans.

References Books:

- L.R. Kadiyalli, Traffic Engineering and Transport Planning, Khanna Publishers.
- C. S. Papacostas, P. D. Prevedouros, Transportation Engineering and Planning, PHI Publication.
- Salter, R J., Highway Traffic Analysis and Design, ELBS
- Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co.

Pavement Materials and Design			
Course Code	24MTTE21C2	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Learn and understand the engineering properties and characteristics of pavement materials.
- Understand the testing and evaluation of soil, granular, and bituminous materials for pavement analysis and design

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Aggregates: Classification, Rounded aggregates, Irregular or partly rounded aggregates, angular aggregates, flaky aggregates, elongated aggregates, physical and strength characteristics, proportioning of aggregates, aggregate texture and skid resistance, polishing of aggregates, tests on aggregates.

UNIT-2

Soil: Classification, sand, silt and clay, Structural and Constructional problems in soil sub grade, Identification and strength tests, Soil-moisture movement, Sub-soil drainage, Soil stabilization, Characteristics and use of Fly Ash, Bottom ash and Pond Ash.

UNIT-3

Bitumen: Bitumen sources and manufacturing, Bitumen constituents, structure and Rheology, Mechanical and engineering properties of bitumen, Tests on bitumen, Penetration test, Ductility test, Softening point test, Specific gravity test, Viscosity test, Flash and Fire point test, Float test, Water content test., types, Durability of bitumen, Adhesion of bitumen, Modified bitumen.

Bituminous Mixes: Desirable properties of mixes, Design of bituminous mixes, Fillers, Theory of fillers and specifications.

UNIT-4

Cement Concrete: Constituents and their requirements, Physical, plastic and structural properties of concrete, tests on concrete, Compression Test, Flexural Strength Test, Water Absorption Test, Moisture Content Test, Chloride Ion Penetration Test, factors influencing mix design, Design of concrete mixes for DLC and PQC with appropriate admixtures like fly ash and high range water reducing admixtures.

References Books:

- Read, J. And White oak, D., “The Shell Bitumen Handbook”, Fifth edition, Shell Bitumen, Thomas Telford Publishing, London
- Krebs, Robert D. And Walker, R. D., “Highway Materials”, McGraw Hill Book Co., New York
- Relevant IRC and IS codes

Highway Construction and Maintenance			
Course Code	24MTTE21C3	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Apply knowledge of mathematics, science and engineering in understanding various components of highway.
- Design highway and performance analysis with different material alternatives associated with availability, cost, and construction.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Highway planning in India, Development, Rural and urban roads, Road departments in India, Road classification, Road authorities i.e. IRC, CRRI, NHAI, NHDP etc, Pavement components and their role, type of pavements, Flexible Pavements, Rigid Pavements, Composite Pavements, Perpetual Pavements, and Asphalt Pavements.

UNIT-2

Highway Alignment & Surveys: Reconnaissance, Aerial surveys, Location surveys, Location of bridges, Problems in rural and urban areas. Highway drawings & reports Highway project preparation.

Highway Construction: Construction of various types of roads, Joints in cement concrete pavements, Road side development: Arboriculture, street lighting.

UNIT-3

Design of Highway Pavements: Design of flexible (G.I. method and CBR method using million standard axles) and rigid pavements (Fatigue concept of pavement design), Maintenance of pavements.

Quality control measures: Highway drainage, Construction machineries, bulldozers, backhoe loaders, excavators, cranes, concrete mixers, and dumpers.

UNIT-4

Highway Drainage & Maintenance: Significance of highway drainage, requirement of highway drainage, Pavement failures, strengthening of existing pavements, surface drainage, subsurface drainage, and cross-drainage, Shoulder drainage, median drainage.

References Books:

- Highways by Coleman A. O'Flaherty, 4th edition.
- Bituminous mixtures in Road Construction by Robert N. Hunter, 1984
- Quality Control in Road Construction by Michel Ruban, 2002
- Road Construction by Robert Genat, 1995

Road Safety Evaluation			
Course Code	24MTTE21C4	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- To make students aware of road safety scenario in India and the need of planning and design for safety.
- To develop abilities of accident analysis.
- To inculcate skills of road design and speed management for safety.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Road Safety scenario in India and World, Road Accident Characteristics, Need of planning for network, land use and road environment for safety, junctions.

UNIT-2

Crash investigation, human factors relating to crashes/accidents, crash/accident investigation & crash problem diagnosing, investigation reporting, crash/accident costing, accident modification factors.

Safety at Construction Site: Safety provisions for workers at construction site, construction zone markings, signs.

UNIT-3

Street Lighting & Traffic Signals, Provisions for NMT Vehicles in India, Safety Provisions for Pedestrians & Cyclists, Road Signs and Pavement Markings.

UNIT-4

Road Safety Auditing: Introduction, Concept and need of Road Safety Audit (RSA). Procedures in RSA, design standards, audit tasks, stages of road safety audit, Road Safety Audit Types, audit team and requirements.

References Books:

- Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
- BABKOV, V.F. 'Road conditions and Traffic Safety', MIR publications, - 1975.
- Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications.
- Road safety audit Manual

TUNNEL ENGINEERING			
Course Code	24MTTE21C5	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Identify and plan tunnel excavation method from technical, production, and sustainability point of view.
- Analyze cost and time for ordinary tunnels based on risks and construction management principles

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Necessity/Advantage of a tunnel, Classification of Tunnels, Size and shape of a tunnel, Alignment of a Tunnel, Portals and Shafts, Problems in Tunneling, Site investigations, Geotechnical Considerations of tunneling.

UNIT-2

Historical: Natural caves, archeological caves and their construction, tunnels for road, rail and hydropower.

Modern Developments: Underground ring roads in mega cities, submerged and floating tunnels, underground libraries, museums, dwelling units, resorts, Construction & Excavation methods , soft ground tunnels , Rock tunnels.

UNIT-3

Tunneling in Hard Rock: Sequence of operation, Faces of attack, Methods of tunneling in hard rock, Tunnel Boring Machine (TBM) tunneling and the Drill and Blast method.

Tunneling in Soft Ground: Types and factors affecting the choice of method to sort ground, Methods of tunneling in soft rocks, Fore poling method, Needle beam method, Shield tunneling method.

UNIT-4

Lighting, Ventilation and Dust control: Tunnel Lighting, Ventilation of Tunnel, Methods of Ventilation, Dust control, Drainage of tunnel.

Traffic surveillance and control system (TSCS) in tunnels: Traffic control signs, signals, lights, cameras.

References Books:

- Tunnel Engineering Handbook, John O. Bickel and T. R. Kuesel, Krieger Publishing Company
- Engineering Geology & Tunnels Engineering, Jaafar Mohammed
- Harbour, Dock And Tunnel Engineerin, R. Srinivasan ,Charoter publishing house

Pavement Design and Evaluations Laboratory			
Course Code	24MTTE21CL1	Practical marks:	25
Credits	2	Internal marks:	25
L-T-P	0:0:2	Total marks:	50
		Duration of Examination:	2 hrs

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

- Understand the concepts and element of geometric design of rural road
- Analyze and design the pavements using IRC recommendations.

List of Experiments

1. To do estimation of Design MSA for a road
2. To do estimation of Design CBR
3. To perform Design of flexible pavement
4. To perform Design of Rigid pavement
5. To conduct Benkelman Beam test on road
6. To determine bitumen content of given sample using bitumen extractor.
7. To perform Plate load test for calculating modulus of subgrade reaction
8. To estimate Group Index Value
9. To study California Resistance Value Method

Reference Books:

- Highway material Testing - S.K. Khanna & C.E.G. Justo.
- Highway Engineering – S.K. Khanna & C.E.G. Justo. New Chand & Brothers.

Pavement Materials and Testing Laboratory			
Course Code	24MTTE21CL2	Practical marks:	25
Credits	2	Internal marks:	25
L-T-P	0:0:2	Total marks:	50
		Duration of Examination:	2 hrs

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

- Characterize the pavement materials including soil, aggregate, bitumen, and bituminous mixes in the laboratory.
- Perform quality control tests on pavements and pavement materials.
- Measure the functional response characteristics of in-service pavements.
- Measure the structural response characteristics of in-service pavements.

List of Experiments

1. Tests on aggregates – Specific gravity, Sieve Analysis, Shape test, Flakiness Index – Elongation Index – Angularity Number, Aggregate Crushing value, Impact value, Abrasion value, Attrition value, C.B.R Test
2. Tests on bitumen – Specific gravity, Penetration value, Viscosity value, Softening point, Ductility value, Flash and Fire point.
3. Tests on sub grade soil – C.B.R. test (IS 2720 – Part-XVI), N.D.C. Penetration test (IS 2720 Part-XXXII), Group Index.
4. Bitumen Extraction Test, Marshal Stability Test
5. Pavement Evaluation – Benkelman Beam Test
6. Marshal Mix design of bitumen and aggregates for different construction techniques.

Reference Books:

- Khanna, S.K., Justo, C.E.G. and A. Veeraragavan Highway Materials and Pavement Testing, 5th Edition, Nem Chand and Bros, Roorkee, India, 2009.
- Yang H. Huang, Pavement Analysis and Design, Second Edition, Pearson Prentice Hall, New Jersey, USA, 2004 Relevant IS, IRC, ASTM Codes.

Geometric Design of Transportation Facilities			
Course Code	24MTTE22C1	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Ability to understand elements of geometric design and factors affecting geometric design of highways.
- Geometric design skills of hill roads.
- Understanding of design provisions for vulnerable road users.
- Details of IRC standards and guidelines for design of expressways, rural and urban roads.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Classification of rural highways and urban roads, objectives and requirements of highway geometric design.

Design Controls: Topography and physical features, traffic, vehicular characteristics, speed and safety; Space standards for urban, rural and hill roads, Sight distance requirements, Access controls.

UNIT-2

Cross-section Elements : Right of way and width considerations, roadway, shoulders, kerbs traffic barriers, medians, frontage roads; Facilities for pedestrians, bicycles, buses and trucks, Pavement surface characteristics - types, cross slope, skid resistance, unevenness.

Sight distances: Types, analysis, factors affecting, measurements, Horizontal alignment--design considerations, stability at curves, super-elevation, widening, transition curves; curvature at intersections.

UNIT-3

Vertical alignment: Grades, ramps, design of summit and valley curves, combination of vertical and horizontal alignment including design of hair pin bends.

Intersection Geometry: Visibility requirements, Principles of channelization, Layout design for types of intersections, on-ramps and off-ramps (flyovers and Access controlled facilities), Acceleration and deceleration lanes, Two-way turn lanes.

UNIT-4

Design of Facilities: Design of on-street and off-street parking facilities, multi-storied Parking; Design of bus shelters and bus lay-bye, Bus terminal, Truck terminals and truck lay-bye, Container terminal, Toll Plaza, Foot-over bridge and sky-walk.

References Books:

- Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna publishers
- Wright, P.H. & Dixon, K.K., "Highway Engineering", 7th Ed., John Wiley & Sons. 2004
- Khisty, C.J. and Lal, B.K., "Transportation Engineering - An Introduction", Prentice Hall of India Pvt. Ltd. 2006
- IRC-SP41: Guidelines for the Design of At-Grade Intersections in Rural & Urban Areas

Advanced Traffic Engineering			
Course Code	24MTTE22C2	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- To gain knowledge of traffic characteristics and traffic studies
- To impart design skills of various traffic control devices
- To gain basic knowledge of traffic management.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Road user characteristics: Human factors including reaction time and vehicular characteristics affecting road design and traffic flow.

Traffic studies: Data collection, analysis and interpretation of results of classified traffic volume, spot speed, speed and delay, origin and destination and parking studies, Sampling in traffic studies. Evaluation of improvement measures by "before and after studies".

UNIT-2

Traffic flow characteristics: Traffic flow variables, speed-flow-density relationship, PCU values, level of service, factors influencing roadway capacity, capacity of roads at various levels of service, capacity of intersections, Spot Speed Data presentation.

Traffic flow theory-scope, relationship between flow variable, bottle necks, Queuing theory and applications; vehicle arrivals, delays at intersections, Elements of simulation technique in traffic Engineering

UNIT-3

Traffic Control Devices: Traffic signs and markings and road lightings. Different types of Traffic islands, channelization; median openings, Delineators, Barriers and other road furniture.

Design of at Grade Intersections: Characteristics and design considerations of grade intersections, Rotary intersections.

UNIT-4

Grade separations and interchanges: Types, warrants, adaptability and design details, Interchanges-different types, ramps, computer applications for intersection and interchange design.

Transportation System Management and energy: Scope of STM, Tidal flow operation, One way streets, Type of IPT vehicles, Transportation and energy, Measure of economy of fuel, Traffic Calming measures.

References Books:

- Kadiyali L.R. "Traffic Engineering and Transportation Planning"-Khanna Publication, New Delhi
- Salter RJ and Hounsell NB, "Highway, Traffic Analysis and Design"- Macmillan Press Ltd., London
- Khanna and Justo, "Highway Engineering"- Nem Chand and Bros., Roorkee
- IRC: SP:41-1994, IRC SP:31-1992, IRC 43-1994, Indian Roads Congress

Road safety and audit lab			
Course Code	24MTTE22CL1	Practical marks:	25
Credits	2	Internal marks:	25
L-T-P	0:0:2	Total marks:	50
		Duration of Examination:	2 hrs

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

- Acquire understanding of data limitations in safety research.
- Develop abilities of accident analysis.
- Conduct audit of various stages.
- Prioritize audit recommendations.

List of Experiments/Assignments:

1. Design stage audit: Study of project Drawings to identify safety concerns
2. Case Study/ Site Visits for Construction stage audit
3. Site Visits for existing road audit
4. Preparation of the Audit Reports
5. Compilation of FIR data and study of its limitations
6. Identification of black spots from FIR data
7. Study of accident recording forms of IRC
8. Study of IRC 88: Check list for Junctions.
9. Study of IRC 88: Checklist for Road Signs and markings.
10. To understand concepts of prioritization of audit recommendations through field visits.

References Books:

- Highway Engineering by Khanna and Justo, Nem Chand & Brothers, Roorkee
- BABKOV, V.F. 'Road conditions and Traffic Safety', MIR publications, - 1975.
- Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publications.
- Road safety audit Manual

Traffic Engineering Lab			
Course Code	24MTTE22CL2	Practical marks:	25
Credits	2	Internal marks:	25
L-T-P	0:0:2	Total marks:	50
		Duration of Examination:	2 hrs

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

- To study various Performa for traffic survey.
- To perform various traffic volume and speed studies.
- To perform parking studies.
- To perform accident studies.

List of Experiments:

1. Classified traffic volume count
2. Parking analysis survey
3. Intersection turning movements count
4. Measurements of Spot speeds
5. Study and fill Performa for Registration number plate survey.
6. Study and fill Performa for Road side interview method
7. Study and fill Performa for house hold interviews method
8. Before and After studies
9. Study the detail of IRC accident recording forms A-1 and form 4
10. Speed and delay study by moving car method

References Books:

- Kadiyali L.R. “Traffic Engineering and Transportation Planning”-Khanna Publication, New Delhi
- Salter RJ and Hounsell NB, “Highway, Traffic Analysis and Design”- Macmillan Press Ltd., London
- Khanna and Justo, “Highway Engineering”- Nem Chand and Bros., Roorkee

Elective-I

Transportation Economics and Finance			
Course Code	24MTTE 22E1	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Describe principles of transport economics
- Explain the investment policy and pricing
- Describe the TQM of highway projects

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Transport economics and analysis: Review of Engineering Economics and Microeconomics, Welfare Theory and Equilibrium Conditions, Goals and Objectives, Principles of Economic Analysis.

Discounted cash flows: Analysis of User Costs and Benefits, RUCS Models for Costs and Benefits, Methods of Economic Analysis; Suitability, Analysis for Null Alternative

UNIT-2

Investment policies and pricing: Average Cost, Marginal Cost, Allocation of Resources within Transport Sectors, Financing of Transport Sectors, Transport Investment Policies - Pricing Policies.

Issues in transport policy: Budgeting, Non-user Impact Analysis, Analysis of Related Endeavour, Monitoring and Continuous Evaluation Strategies, Case Studies.

UNIT-3

System selection, evaluation and cost analysis: Framework of Evaluation, Transport Planning Evaluation at Urban and Regional levels, Other Evaluation Procedures - Traditional Economic Analysis, Achievement Matrices, Factor Profiles, Plan Ranking.

UNIT-4

TQM in highway projects: Need for TQM, TQM Principles, Phases in TQM, Conceptual stage to Operations stage, TQM in Traffic & Transportation projects, Case Studies.

References Books:

- Highway investment in Developing countries - Thomas Telford Ltd., Institute of Civil Engineers, 3rd Edition, 1983
- Winfrey R, "Economic Analysis for Highways", International Text Book Co., Pennsylvania, 1969.
- Dickey, J.W., "Road Project Appraisal for Developing countries", John Wiley and Sons. 4th Edition, 1984.
- Road User Cost Study - Final Report - Central Road Research Institute, New Delhi.

Geotechnical Investigations			
Course Code	24MTTE 22E2	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- The students will be able to understand the procedure, applicability, and limitations of various methods of geotechnical investigation.
- The students will be able to make engineering judgments and take appropriate decisions related to geotechnical investigations.
- The students will be able to understand the procedure and applications of penetration tests and geophysical tests for exploration of the soil profile

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction and practical importance: Objectives of soil exploration, planning of a sub-surface exploration program, Collection of existing information, reconnaissance, preliminary and detailed investigation.

Methods of exploration: Open pits, Auger boring, Wash boring, percussion drilling, rotary drilling.

UNIT-2

Sounding methods Standard Penetration Test- Procedure, corrections to be applied to observed N values, Numerical examples, Factors influencing the SPT results and precautions to obtain reliable results, Merits and drawbacks of the test, index properties of soils.

Static Cone Penetration Test- Procedure, Merits/drawbacks, Dynamic Cone Penetration Test – Brief Procedure – Merits/drawbacks.

UNIT-3

Geophysical methods- Seismic refraction method, Procedure, uses, limitations, Electrical resistivity method, Electrical profiling and electrical sounding, Procedure, uses, limitations Stabilization of boreholes.

UNIT-4

Soil sampling- Undisturbed, disturbed, and representative samples, Chunk and tube samples, Factors affecting sample disturbance and methods to minimize them, Handling and transportation of samples ,Types of samplers ,Thin-walled sampler ,Piston sampler ,Split spoon sampler, Methods for collection of sand samples from beneath the water table.

References Books:

- Gopal Ranjan and Rao A.S.R., “Basic and Applied Soil Mechanics”, New Age International (P) Limited, New Delhi, 2002.
- Venkata Ramaiah, “Geotechnical Engineering”, Universities Press (India) Limited, Hyderabad, 2000.
- Arora K.R., “Geotechnical Engineering”, Standard Publishers Distributors, New Delhi, 2006
- Purushothamaraj P., Soil Mechanics and Foundation Engineering, Dorling Kindersley(India) Pvt. Ltd., 2013

Remote sensing and GIS			
Course Code	24MTTE 22E3	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- To develop understanding of remote sensing and digital image processing..
- To impart understanding of basic concepts of GIS and GPS.
- Practical applications of GIS in transportation problems.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Concept and foundations of remote sensing, Basics of Remote sensing, remote sensing Art or Science process, Energy: Sources of energy, Energy radiation principle, Energy interaction in the atmosphere , Energy interactions with earth surface feature, Recording energy by sensor transmission, Reception processing, Interpretation & Analysis.

UNIT-2

Image interpretation: Satellite imagery interpretation, Elements of image interpretation, image interpretation strategies, interpretation keys, temporal aspect of image interpretation, interpretation techniques, methods of search in image interpretation. Steps of Image interpretation.

UNIT-3

Geographical Information system: Evolution of Geographical Information system, Concept of Geographic information systems, Definition of GIS, Key components of GIS, Data Conceptual model of spatial information: Spatial Information and data models conceptual models of spatial information-raster and models vector data models, advantages and disadvantages of raster and vector data models.

UNIT-4

Global positioning system: Concept of Global positioning system (GPS) and its architecture, working procedure of GPS, Different types of Errors in GPS, Kinds of GPS and application of GPS in different applications.

References Books:

- Remote Sensing and Image interpretation: Thomas Lille sand & R.W. Keifer, John Wiley and Sons
- Manual of Remote Sensing, Vol. 1, American Society of Photogrammetry.
- Remote Sensing: Principles and Interpretation: F. Sabins, Freeman Publication.
- Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2006..
- Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersey, 2010
- Geo Information Systems – Applications of GIS and Related Spatial Information Technologies, ASTER Publication Co., Chestern (England), 1992

Disaster Management			
Course Code	24MTTE 22E4	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Learning and understanding the basic knowledge of Disaster Management concept and Different approaches to reduce the impact of disaster
- Understand the types of disaster their origin causes and their management and the Disaster profile of India
- Learning to apply the knowledge of technology for monitoring and management of the Disaster

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Concepts and definitions of disaster, hazard, vulnerability, resilience, risk, Disaster Management meaning and concept, method and approaches for disaster management, pre-disaster stage and post disaster stage.

UNIT-2

Categories of disasters - natural and manmade, Natural disasters (origin, causes and their management), earthquake, tsunami, cyclone, flood, land slide, Disaster Profile of India – Mega Disasters of India and Lessons Learnt (Bengal Famine ,Bhopal gas tragedy, Bhuj earthquake, Tsunami) Factors affecting Vulnerabilities

UNIT-3

Geo-informatics in Disaster Management- Remote Sensing, Geographical information system (GIS), Global Positioning Service (GPS), Indian Regional Navigation Satellite System (IRNSS): Navy Indian Tsunami Early Warning System (ITEWS) Use of ICT and mobile technology for Disaster management, Application of Drone.

UNIT-4

Disaster Management Act 2005, Institutional framework under Disaster Management act 2005, Role of National Disaster Management Authority (NDMA) Search and Rescue Operations, (one and two-person method) Demonstration of Earthquake Evacuation Drill Demonstration of Fire Drill

References Books:

- Savindra Singh, Jeetendra Singh, Disaster management, Pravalika Publications,Allahabad,2016
- Alexander David, Introduction in Confronting Catastrophe, Oxford University Press,2000.
- Kapur, Anu& others, Disasters in India Studies of grim reality, Rawat Publishers, Jaipur,2005.
- Andharia J. Vulnerability in Disaster Discourse, JTCDM, Tata Institute of Social Sciences Working Paper No. 8, 2008.
- Govt. of India: Disaster Management Act 2005, Government of India, New Delhi.

Airport Infrastructure, Planning and Design			
Course Code	24MTTE23C1	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Describe the different components of airport and aircrafts.
- Analyze the requirements of an airport layout.
- Design Taxiways & Aprons.

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, air craft's and its characteristics, airport classifications as per ICAO.

UNIT-2

Airport Planning : Regional planning-concepts and advantages, location and planning of airport as per ICAO and F.A.A. recommendations, airport Elements -airfield, terminal area, obstructions, approach zone, zoning laws, airport capacity, airport size and site selection, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.

UNIT-3

Run Way Design: Wind rose and orientation of runway, wind coverage and crosswind component, factors affecting runway length, basic runway length, and corrections to runway length, runway geometrics and runway patterns (configurations).Runway marking, threshold limits cross section of runway.

UNIT-4

Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility. Aprons -locations, size, gate positions, aircraft parking configurations and parking systems, hanger-site selection, planning and design considerations, Fuel storage area, blast pads, wind direction indicator

Air Traffic Control and Visual Aids: Air traffic control objectives, control system, control network-visual aids-landing information system, airport markings and lighting.

References Books:

- Dr. S. K. Khanna, M.G.Arora and S.S. Jain, Airport Planning & Design, Nem Chand & Bros.,Roorkee
- G.V. Rao Airport Engineering, Tata McGraw Hill Pub. Co., New Delhi
- Airport Engineering, Charotar Publishing House Pvt. Ltd, Anand
- S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai& Sons, NewDelhi
- N.J. Ashford, P.H. Wright, Airport Engineering, 3rd Edition, 1992, John Wiley
- R.M. Horonjeff, F.X. Mc Kelvey, W.J Sproule, Seth Young, Planning and Design of Airports, TMH International Publishers, Fifth Edition, 2009

Advanced Railway Engineering			
Course Code	24MTTE23C2	External marks:	100
Credits	4	Internal marks:	50
L-T-P	4-0-0	Total marks:	150
		Duration of Examination:	3 hrs

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

- Have fundamental knowledge in track alignment and geometry design.
- Have basic knowledge of components and its functionality in railway superstructure and substructure.
- Have fundamental knowledge in designing a well functional and sustainable railway infrastructure.
- Have basic knowledge about railway track maintenance

NOTE: Examiner will set nine questions in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus

UNIT-1

Introduction: Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, Functions of various Components - Rails, Sleepers and Ballast, Rails - types of rails, rail sections, defects in rails, creep of rails, rail fixtures and fastenings, rail joints and welding of rails, sleepers – types, spacing and density, Ballast – types, advantages and disadvantages, Sub grade – Requirement, embankment.

UNIT-2

Geometric design of railway track: Gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves. Track layouts, Switches, Tongue Rails, Crossings, Layout of Turnout – Double Turnout, Diamond crossing, Scissors crossing.

UNIT-3

Railway Stations: Railway traction and track resistance, stresses in railway track – rails, sleepers, ballast, Points and crossings – turnouts, switches, crossings, Track junctions -types, splits, diamond, gauntlet, scissor crossovers, Railway station-requirements, facilities, classifications, platforms, loops, sidings.

UNIT-4

Railway yards: Types, required equipment in yard, Signaling and control system -objectives, classification, interlocking of signals and points.

Maintenance of Railway Track: Introduction of Maintenance Programme, Monsoon, Pre-Monsoon & Post- Monsoon Maintenance, Causes For Maintenance, Routine Maintenance , Tools For Railway Track Maintenance & Their Functions, Surface Defects And Their Remedial Measures

References Books:

- Satish Chandra and M.M. Agrawal, “Railway Engineering”, Oxford University Press, New Delhi
- J.S. Mundrey, Railway Track Engineering, Tata McGraw Hill Co. Ltd., 3rd Edition, 2000.
- M.M. Agarwal, Railway Track Engineering, Standard Publishers, 1st Ed. 2005.
- S. Chandra and Aqarwal, Railway Engineering, Oxford University Press, 1st Ed. Feb 2008.
- A.D. Kerr, Fundamentals of Railway Track Engineering, Simmons Boardman Pub Co 2003.

Literature Survey (Dissertation Phase –I)			
Course Code	24MTTE23C3	Practical marks:	-
Credits	2	Internal marks:	100
L-T-P	0-0-2	Total marks:	100
		Duration of Examination:	-----

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

- Identify transportation engineering problems reviewing available literature.
- Identify appropriate techniques to analyze complex transportation systems.
- Apply engineering and management principles through efficient handling of project

SYLLABUS

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals' contribution. The marks will be given on the basis of a report prepared covering the above said contents, contents of the presentation, communication and presentation skills.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

Seminar			
Course Code	24MTTE23C4	Practical marks:	-
Credits	2	Internal marks:	50
L-T-P	0-0-2	Total marks:	50
		Duration of Examination:	-

A candidate has to present a seminar on a recent topic/ technology/ research advancement and has to submit a seminar report. The marks will be given on the basis of seminar report, contents of the presentation, communication and presentation skills.

MX Road Lab			
Course Code	24MTTE23CL1	Practical marks:	25
Credits	2	Internal marks:	25
L-T-P	0:0:2	Total marks:	50
		Duration of Examination:	2 hrs

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

- To perform road design using software.
- Design horizontal and vertical alignment

List of Experiments

1. Alignment Design using MX Road
2. Horizontal Alignment using MX Road
3. Vertical Alignment using MX Road
4. L-Section using MX Road
5. Cross Sections using MX Road
6. Earthwork calculations using MX Road

Reference Books:

- MX Road software

Dissertation & Viva (Dissertation Phase – II)			
Course Code	24MTTE24C1	Practical marks:	500
Credits	20	Internal marks:	250
L-T-P	0-0-0	Total marks:	750
		Duration of Examination:	-----

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

- Solve complex transportation problems by applying appropriate techniques and tools.
- Exhibit good communication skill to the engineering community and society.
- Demonstrate professional ethics and work culture.

Syllabus Content

Dissertation – II will be extension of the work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

Note: The student has to publish atleast one research paper related to his/her research work in peer reviewed/Refereed/UGC/ SCOPUS/SCI Journal/Proceeding of National/ International conference before the final viva of Dissertation Phase-II.