

GURU KASHI UNIVERSITY



**Master of Technology in Civil Engineering
(Specialization in Transportation Engineering)
Annexure-III**

Session: 2025-26

Faculty of Engineering & Technology

Graduate Attributes of the Programme: -

Type of learning outcomes	The Learning Outcomes Descriptors
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/interdisciplinary areas of learning	technical & analytical skills and research promotion in the field of Civil Engineering to identify, formulate, analyze, and solve complex engineering problems in order to develop sustainable construction and planning solutions in broader economic, societal, and environmental contexts.
	practical, professional, and procedural knowledge required for carrying out planning and construction related tasks, which will lead the students to obtain the entrepreneurship skills
	skills of innovation, creative and critical thinking that enable student to follow systematic ways for analyzing and finding innovative solutions in the field of transportation, geotechnical, structural, construction management, materials, planning, water resources, and field survey.
	comprehensive knowledge and understanding of the fundamentals and theories of science, engineering, and mathematics and advanced specialized knowledge in Civil Engineering.
Generic learning outcomes	The graduates should be able to demonstrate the ability of creativity, critical thinking, and innovation in solving the complex problems that do not have simple solutions
	The graduates should be able to demonstrate the skills of excellent communication, writing, and understanding the technical documents in more than one recognized language.
	<i>Coordinating/collaborating with others:</i> working effectively either individually or in groups, with the ability to lead work teams flexibly and effectively and having the skills of listening and communicating effectively.
	Commitment to professional ethics that are compatible with societal and cultural values, participation in finding valuable solutions to some societal issues, and a commitment to responsible citizenship.
	Having the attribute of lifelong learning to keep up with the latest developments in the field of specialization, as well as to use modern digital technologies and applications to analyze and process data and information.

	The graduates should be able to demonstrate the ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge. The graduates should be able to evaluate critically and apply knowledge, methods and skills through self-identified sources and self-directed learning for locating, accessing, and utilizing relevant information sources as related to civil engineering.
	The graduates should be able to demonstrate the ability of mitigating the effects of environmental degradation, climate change, and pollution, effective waste management, conservation of forest and sustainable development and living.
	The graduates should be able to demonstrate the capability to participate in community-engaged services/ activities for promoting the well-being of society.

Programme Learning outcomes: An Master of Vocational in Civil Engineering (Specialization in Transportation Engineering) is awarded to students who have demonstrated the achievement of the outcomes located at level 6.5:

Element of the Descriptor	Programme learning outcomes relating to M.Voc
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	knowledge of facts, concepts, principles, theories, and processes in basic sciences, multidisciplinary learning contexts within engineering
	understanding of the linkages between the fundamentals of engineering and its application
	procedural knowledge required for performing skilled or paraprofessional tasks associated with the electrical, mechanical, and computing fields.
General, technical and professional skills required to perform and accomplish tasks	a range of cognitive and technical skills related to manufacturing practices, computing, economics, sciences, communication skills for accomplishing assigned tasks in civil engineering
Application of knowledge and skills	The graduates should be able to demonstrate the ability to apply the acquired operational or technical and theoretical knowledge, and a range of cognitive and practical skills to select and use basic methods, tools, materials, and information to generate solutions to specific problems
Generic learning outcomes	The graduates should be able to demonstrate the ability of effective communication, critical thinking, self-directed and self-managed learning, gather and interpret relevant quantitative and qualitative data, critically evaluate principles and theories associated with the basic sciences and engineering, make judgment and take decisions, based on analysis of data and evidence, for formulating responses to issues/problems.
Constitutional, humanistic, ethical, and moral values	The graduates should be able to demonstrate the willingness to practice constitutional, humanistic, ethical, and moral values in one's life, and practice these values in real-life situations
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	ability to exercise responsibility for the completion of assigned tasks and for the outputs of own work, and to take some responsibility for group work and output as a member of the group.
Credit requirements	The successful completion of the first year (two semesters) of the M.Tech of 40 credit hours followed by an exit 4-credit 8-weeks internship/industrial training.
Entry requirements	Passed B.Tech. or equivalent degree in relevant discipline with at least 50% in the aggregate.

Program Structure

SEMESTER: 1 st									
Course Code	Course Title	Type of Courses	L	T	P	No. of Credits	Int.	Ext.	Total Marks
MTE1450	Pavement Material Characterization	Core Course	4	0	0	4	30	70	100
MTE1451	Traffic Analysis & Design	Core Course	4	0	0	4	30	70	100
MTE1500	Pavement Analysis & Design	Core Course	3	1	0	4	30	70	100
MTE1501	Construction Practices	Practicum Course	3	0	0	3	30	70	100
MTE1502	Quality Control Lab	Practicum Course	0	0	2	1	30	70	100
MTE1503	Seminar	Seminar	0	0	4	2	30	70	100
Discipline Specific Elective (DSE) Course 1 (Any one of the following)									
MTE1504	Numerical Methods & Applied Statistics	Discipline Specific Elective Course	3	1	0	4	30	70	100
MTE1505	Bridge Engineering								
Total			17	2	6	22	210	490	700

SEMESTER: 2 nd									
Course Code	Course Title	Type of Courses	L	T	P	No. of Credits	Int.	Ext.	Total Marks
MTE2550	Geometric Design of Transportation Infrastructure	Core Course	3	1	0	4	30	70	100
MTE2551	Transportation & Economics	Core Course	3	1	0	4	30	70	100
MTE2552	Transportation Planning	Core Course	3	1	0	4	30	70	100
MTE2553	Geotechnical Engineering for Highways	Practicum Course	2	0	0	2	30	70	100
MTE2554	CAD in Transportation Engineering	Practicum Course	0	0	4	2	30	70	100
MTE2555	Pavement Materials & Evaluation Lab	Core Course	0	0	2	1	30	70	100
MTE2556	Traffic Engineering Lab	Core Course	0	0	2	1	30	70	100
Discipline Specific Elective (DSE) Course 2 (Any one of the following)									
MTE2557	Environmental Impact Assessment	Discipline Specific Elective Course	3	1	0	4	30	70	100
MTE2558	Intelligent Transportation Systems								
Total			14	4	8	22	240	560	800

Programme learning outcomes: A Master of Technology in Civil Engineering (Specialization in Transportation Engineering) is awarded to students who have demonstrated the achievement of the outcomes located at level 7:

Element of the Descriptor	Programme learning outcomes relating to M.Tech
The graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Advanced knowledge about management of highway, airport, railway, and rural roads.
	advanced knowledge and understanding of the research principles, methods, and techniques related to traffic engineering, planning, pavement, geometry, airport runway, railway permanent way.
	procedural knowledge required for performing and accomplishing complex and specialized and professional tasks relating to transportation engineering
Skills required to perform and accomplish tasks	advanced cognitive and technical skills required for performing and accomplishing complex tasks related to the advanced transportation engineering aspects
	advanced cognitive and technical skills required for evaluating research findings and designing and conducting relevant research that contributes to the generation of new knowledge.
Application of knowledge and skills	apply the acquired advanced theoretical and/or technical knowledge about pavement materials and design, traffic analysis, planning, airport, railway, transportation management, and a range of cognitive and practical skills to identify and analyze problems and issues, including real-life problems, associated with the modern transportation.
Generic learning outcomes	present in a concise manner view on the relevance and applications of the findings of recent research and evaluation studies in the context of emerging developments and issues with the modern transportation.
	problematize, synthesize, and articulate issues and design research proposals
	define problems, formulate appropriate and relevant research questions, formulate hypotheses, test hypotheses using quantitative and qualitative data, establish hypotheses, make inferences based on the analysis and interpretation of data, and predict cause-and-effect relationships,
	develop appropriate tools for data collection for research, plan, execute, and report the results of an investigation,
	follow basic research ethics and skills in practicing/doing ethics in the field/ in one's own research work.

	make judgement across a range of functions requiring the exercise of full responsibility and accountability for personal and/or group actions to generate solutions to specific problems associated with the chosen fields/subfields of study, work, or professional practice.
	listen carefully, read texts and research papers analytically, and present complex information in a clear and concise manner to different groups/audiences,
Constitutional, humanistic, ethical, and moral values	follow ethical principles and practices in all aspects of research and development, including inducements for enrolling participants, avoiding unethical practices such as fabrication, falsification or misrepresentation of data or committing plagiarism.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	The graduates should be able to demonstrate the acquisition of knowledge and skills set required for: • adapting to the future of work and responding to the demands of the fast pace of technological developments and innovations in the field of transportation engineering
Credit requirements	The 2-year/4-semester M.Tech. builds on a 4-year/8-semester B.E./B.Tech. and requires a total of 88 credits from the first and second years of the programme, with 44 credits in the first year and 44 credits in the second year of the programme at level 6 on the NHEQF.
Entry requirements	M.Voc. in relevant field for admission to Second year of M.Tech

SEMESTER: 3rd									
Course Code	Course Title	Type of Courses	L	T	P	No. of Credits	Int.	Ext.	Total Marks
MTE3600	Dissertation Phase-I	Research Based	0	0	0	12	30	70	100
MTE3601	Airport Infrastructure Planning & Design	Core Course	3	1	0	4	30	70	100
MTE3602	Railway Infrastructure. Planning & Design	Core Course	3	1	0	4	30	70	100
MTE3603	Project	Skill Based	0	0	4	2	30	70	100
Total			6	2	4	22	120	280	400

SEMESTER: 4 th									
Course Code	Course Title	Type of Courses	L	T	P	No. of Credits	Int.	Ext.	Total Marks
MTE4651	Dissertation Phase-II	Research Based	0	0	0	12	30	70	100
MTE4652	Pavement Maintenance Management System	Core Course	3	1	0	4	30	70	100
MTE4655	Business Ownership	Employability & Entrepreneurship Skill Course (EEC)	2	0	0	2	30	70	100
Discipline Specific Elective (DSE) Course 3 (Any one of the following)									
MTE4653	Low Volume Roads	Discipline Specific Elective	3	1	0	4	30	70	100
MTE4654	Urban Transportation System								
Total			8	2	0	22	120	280	400

Total Credits and Marks

Semester	L	T	P	Total Credits	Total Marks	Qualification
I	17	2	6	22	800	M.Voc
II	14	4	8	22	700	
III	6	2	4	22	400	M.Tech
IV	8	2	0	22	400	
Total				88	2300	

Semester: 1st

COURSE TITLE: Pavement Material Characterization	L	T	P	Cr.
COURSE CODE: MTE1450	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze and recognize the basics of the pavement materials.
2. Apply the basic knowledge of characterization in highway construction.
3. Analyze the materials for mix design.
4. Apply the structural evaluation of pavement materials in highway.

Course Content**Unit-I****15 Hours**

TESTING OF SOIL: Field and Laboratory tests on soil, stabilization techniques. Geo synthetics testing and specifications.

TESTING OF AGGREGATES: Tests on fine and coarse aggregates including the quarrying, crushing, stacking and gradation.

TESTING ON BITUMEN: Tests on bitumen and importance of viscosity grading, tests on bitumen emulsions and application, tests on modified bitumen. Tests on joint filler and sealant materials.

Unit-II**15 Hours**

PERFORMANCE GRADING OF BITUMEN: Performance grading of bitumen, rheology test as per ASTM standards. Performance tests on bituminous mixtures such as resilient modulus, dynamic modulus, creep tests, 4-point bending fatigue test and Hamburg wheel tracking rutting test.

Unit-III**15 Hours**

BITUMINOUS MIXTURE DESIGN: Volumetric in mix design, Bituminous mixture design using Marshall's and Superpave methods. Pavement Quality Concrete (PQC) mixture design.

Unit-IV**15 Hours**

Cement Concrete Pavement Materials: Role of ingredients of cement in concrete, Properties of Fresh and Hardened Concrete.

CEMENT CONCRETE MIX DESIGN: Mix design as per IS 10262.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Reading:

- Robert Hunter, Andy Self and John Read (2015). *Shell Bitumen Handbook*. ICE

Publishing.

- *Khanna S. K., Justo, C.E.G and Veeraragavan, A. (2010). Highway Material Testing Laboratory Manual. Nem Chand & Bros.*
- *Rajib B. Mallick and Tahar E I Korchi. (2016). Pavement Engineering, Principles and Practice. CRC Press.*
- *A. M. Neville (2011). Properties of Concrete. Pearson. 5th Edition.*
- *Other Relevant BIS, IRC, AASHTO, ASTM. Super-Pave standards and codes.*

COURSE TITLE: Highway Traffic Analysis & Design	L	T	P	Cr.
COURSE CODE: MTE1451	4	0	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply a compact foundation in the field of traffic engineering, its management in order to achieve the safety to the road users.
2. Apply the basic principles of traffic engineering in the design of traffic facilities based on traffic flow theory.
3. Analyze traffic system management in the urban area.
4. To estimate capacity and level of service for the rural and urban area.

Course Contents

UNIT I **15 hours**

ELEMENTS OF TRAFFIC ENGINEERING -road user, vehicle and road way. Vehicle characteristics - IRC standards - Design speed, volume. Highway capacity and levels of service - capacity of urban and rural roads - PCU concept and its limitations - Road user facilities - Parking facilities - Cycle tracks and cycle ways - Pedestrian facilities.

UNIT II **15 hours**

TRAFFIC VOLUME STUDIES- origin destination studies, speed studies, travel time and delay studies, Parking studies, Accident studies.

Elements of design - Alignment - Cross sectional elements - Stopping and passing sight distance. Horizontal curves - Vertical curves. Design problems – Hill Roads.

UNIT III **15 hours**

TRAFFIC REGULATION AND CONTROL - Signs and markings - Traffic System Management - Design of at-grade intersections – Principles of design – Channelization - Design of rotaries - Traffic signals - pre-timed and traffic actuated. Design of signal setting - phase diagrams, timing diagram – Signal co-ordination.

UNIT IV **15 hours**

GRADE SEPARATED INTERSECTIONS - Geometric elements for divided and access-controlled highways and expressways – Road furniture - Street lighting. Traffic Safety – Principles and Practices – Road Safety Audit.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- 1.ITE Hand Book, Highway Engineering Hand Book, Mc Graw - Hill.

- *AASHTO A Policy on Geometric Design of Highway and Streets*
- *R. J. Salter and N. B. Hounsel, Highway Traffic Analysis and Design, Macmillan Press Ltd, 1996.*

COURSE TITLE: Pavement Analysis & Design	L	T	P	Cr.
COURSE CODE: MTE1500	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the material specifications and design factors of pavements.
2. Analyze stresses in flexible and rigid pavements.
3. Design of flexible and rigid pavements.
4. Interpret the constructional operations and equipment's.

Course Contents

UNIT I 15 hours

INTRODUCTION: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements, functions of pavement components

UNIT II 15 hours

PAVEMENT DESIGN FACTORS: Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure. Drainage – Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures

UNIT III 15 hours

FLEXIBLE PAVEMENT DESIGN: Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC, AASHTO Methods, applications of pavement design software.

RIGID PAVEMENT DESIGN: Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design.

UNIT IV 15 hours

PAVEMENT MANAGEMENT: Pavement failures, maintenance of highways, structural and functional condition evaluation of pavements, pavement management system.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons*
2. *Yang. H. Huang, Pavement Analysis and Design, Second Edition, Prentice Hall Inc.*
3. *Rajib B. Mallick and Tahar El-Korchi, Pavement Engineering – Principles and Practice, CRC Press (Taylor and Francis Group)*
4. *W.Ronald Hudson, Ralph Haas and Zeniswki , Modern Pavement Management, Mc Graw Hill and Co*
5. *Relevant IRC Codes*

COURSE TITLE: Construction Practices	L	T	P	Cr.
COURSE CODE: MTE1501	3	0	0	3

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. To impart knowledge on modern construction materials and techniques.
2. To understand the construction of roads, bridges, and other transportation infrastructure.
3. To familiarize with quality control, safety, and environmental considerations.
4. To introduce automation and emerging technologies in construction.

Course Contents

UNIT I **10 hours**

CONSTRUCTION MATERIALS FOR TRANSPORTATION INFRASTRUCTURE:

Properties and selection criteria of materials for roads, bridges, and railways. Soil stabilization techniques for subgrade improvement. Advanced bituminous and cement concrete materials (modified binders, geopolymer concrete). Use of industrial waste and recycled materials in construction. New-generation construction materials: Nano-materials, fiber-reinforced composites.

UNIT II **10 hours**

HIGHWAY CONSTRUCTION TECHNIQUES:

Flexible Pavement Construction: Subgrade preparation, granular and bituminous layers, compaction techniques. Rigid Pavement Construction: Concrete pavement laying, reinforcement, joints, curing, and finishing. Soil Mechanics in Construction: Earthwork, embankment design, and slope stability. Drainage in Highway Construction: Surface and subsurface drainage systems, geosynthetics applications.

UNIT III **12 hours**

BRIDGE AND TUNNEL CONSTRUCTION: Bridge Construction: Foundation types, substructure and superstructure construction, bearing installation, deck slab construction. Prestressed Concrete Bridges: Construction techniques, pre-tensioning and post-tensioning methods. Tunnel Construction: Conventional tunnelling methods, TBM (Tunnel Boring Machine), NATM (New Austrian Tunnelling Method), ventilation, lighting, and safety considerations.

UNIT IV **13 hours**

CONSTRUCTION EQUIPMENT AND AUTOMATION: Overview of heavy machinery, Excavators, graders, pavers, compactors, and batching plants. Equipment selection and optimization for transportation projects. Automation in construction:

Drones, GPS-based earthmoving, and AI-driven monitoring. Building Information Modeling (BIM) and digital twins in construction.

QUALITY CONTROL, SAFETY, AND ENVIRONMENTAL CONSIDERATIONS:

Quality control tests for materials and pavement layers (Marshall Stability, Benkelman Beam, FWD testing). Safety protocols in transportation infrastructure construction. Environmental impact assessment and sustainability in construction. Waste management and eco-friendly construction practices.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Khanna, S.K. & Justo, C.E.G., Highway Engineering, Nem Chand & Bros.*
2. *Gambhir, M.L., Concrete Technology, Tata McGraw-Hill.*
3. *Peurifoy, R.L. & Schexnayder, C.J., Construction Planning, Equipment, and Methods, McGraw-Hill.*
4. *IRC and MoRTH specifications for road construction.*
5. *Relevant IS and ASTM standards*

COURSE TITLE: Quality Control Lab	L	T	P	Credits
COURSE CODE: MCT1502	0	0	2	1

Course Content

List of Experiments

1. CEMENT
 - a) Sampling procedures and sample collections
 - b) Test for cement
2. AGGREGATE
 - a) Sampling Procedures and Sample Collections
 - b) Test for Fine Aggregate (Sand)
 - c) Test for Coarse Aggregate
3. BRICKS
 - a) Sampling Procedures and Sample Collections
 - b) Test for Bricks IS: 1077- 1992
4. CONCRETE
 - a) Sampling Procedures and Sample Collections
 - b) Test of Cement Concrete
5. STEEL
 - a) Sampling Procedures and Sample Collection
 - b) Test of Steel for Reinforcement IS: 1786 – 2008
6. PIPES
 - a) Sampling Procedures and Sample Collections
7. WATER FOR CONSTRUCTION PURPOSES
 - a) Sampling of Water
8. BRICK BALLAST IS: 3068-1986 and IS: 3182-1986
9. CHECKS AND TESTS OF FINISHED WORKS

COURSE TITLE: Seminar	L	T	P	Credits
COURSE CODE: MTE1503	0	0	4	2

Every student requires to present a seminar talk on a topic approved by the department except on his/her dissertation & submit the report to the department. The committee constituted by the Head of the department will evaluates the presentation and will award the marks. Student who is awarded with 'F' grade will be required to repeat the seminar on the same topic.

COURSE TITLE: Numerical Methods & Applied Statistics	L	T	P	Cr.
COURSE CODE: MTE1504	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze the different samples of data at different level of significance using various hypothesis testing.
2. Develop a framework for estimating and predicting the different sample of data for handling the uncertainties.
3. Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
4. Solve system of linear equations numerically using direct and iterative methods.

Course Contents

UNIT I 15 hours

LINEAR SYSTEM – Gaussian elimination and Gauss – Jordan methods – matrix inversion – Gauss seidel method – Nonlinear equations – Regulafalsi and Newton-Raphson methods – interpolation – Newton’s and Lagrange’s interpolation.

UNIT II 15 hours

LINEAR PROGRAMMING – Graphical and Simplex methods – Measures of central tendency, dispersion, skewness and Kurtosis – Probability – conditional probability – Bayes’ theorem

RANDOM VARIABLE – Two dimensional random variables – standard probability distributions – Binomial Poisson and normal distributions - moment generating function

UNIT III 15 hours

SAMPLING DISTRIBUTIONS – confidence interval estimation of population parameters – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – curve fitting-method of least squares.

UNIT IV 15 hours

REGRESSION AND CORRELATION – rank correlation – multiple and partial correlation – analysis of variance-one way and two-way classifications – experimental design – Latin square design – Time series analysis

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Bowker and Liberman, Engineering Statistics, Prentice-Hall, 1972.*

2. *Venkatraman, M.K., Numerical Methods in Science and Engineering, National Publisher Company.*

COURSE TITLE: Bridge Engineering	L	T	P	Cr.
COURSE CODE: MTE1505	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Interpret the basic concepts of transportation and the importance of transportation.
2. Illustrate all modes and components of transport
3. Classify the integration of transportation.
4. Express the legal regulations related to land, air, sea and railway.

Course Content

UNIT I **15 hours**
Introduction, Classification and Types. IRC Specifications for Road Bridges. Earthquake Resistant Design Considerations.

UNIT II **15 hours**
Analysis of Bridges - Effect of concentrated loads on slabs, Load Distribution Theories - Courbon's method, Hendry-Jaeger method and Guyon-Massonet method. Design of PSC Bridges - Slab Type, T-beam Type, Box Type.

UNIT III **15 hours**
Classification and Design of Bearings - Metallic bearings, Elastomeric bearings, POT and PTFE bearings.

UNIT IV **15 hours**
Analysis and Design of Abutment and Pier. Introduction to Design of Open Well, Pile and Caisson Foundations. Analysis and Design of Wing Walls

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. N. Krishna Raju, "Design of Bridges", Oxford and IBH Publishing Co. Ltd., New Delhi and Kolkata (2001)
2. T.R. Jagdeesh, M. A. Jayaram, "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd., New Delhi (2003) 19
3. D. Johnson Victor, "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. Ltd., 5th Edition, (2001)
4. M.J.N. Priestley, G. M. Calvi, "Seismic Design and Retrofit of Bridges"

Semester: 2nd

COURSE TITLE: Geometric Design of Transportation Infrastructure	L	T	P	Cr.
COURSE CODE: MTE2550	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze the different samples of data at different level of significance using various hypothesis testing.
2. Develop a framework for estimating and predicting the different sample of data for handling the uncertainties.
3. Learn how to obtain numerical solution of nonlinear equations using Bisection, Newton – Raphson and fixed-point iteration methods.
4. Solve system of linear equations numerically using direct and iterative methods.

Course Contents**UNIT I** **15 hours**

INTRODUCTION TO GEOMETRIC DESIGN: Importance and objectives of geometric design, Functional classification of roads, Basic elements of geometric design, Design controls and criteria (human factors, vehicle characteristics, road users).

HIGHWAY CROSS-SECTION ELEMENTS: Right of way, roadway width, and carriageway width. Shoulders, medians, footpaths, and cycle tracks. Camber and its significance. Sight distance: Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), and Intermediate Sight Distance.

UNIT II **15 hours**

HORIZONTAL ALIGNMENT DESIGN: Design speed and its influence, Horizontal curves: simple, compound, and reverse curves, Super-elevation: calculation and design standards, Extra widening on curves, Transition curves: length and design considerations.

VERTICAL ALIGNMENT DESIGN: Gradients: ruling, limiting, and exceptional gradients, Vertical curves: summit and valley curves, Design considerations for comfort and safety, Coordination of horizontal and vertical alignment.

UNIT III **15 hours**

INTERSECTION AND INTERCHANGE DESIGN: Types of intersections: at-grade and grade-separated, Design principles for at-grade intersections (channelization, traffic islands, conflict points), Rotary intersections: advantages and design considerations, Types of interchanges (diamond, cloverleaf, trumpet, and directional).

GEOMETRIC DESIGN STANDARDS AND GUIDELINES: Indian Roads Congress (IRC) design standards, AASHTO guidelines for geometric design, Highway Capacity Manual (HCM) and its application, Case studies of major transportation projects.

UNIT IV**15 hours**

GEOMETRIC DESIGN OF RAILWAYS AND AIRPORTS: Railway geometric design elements (gauge, gradient, curves, super elevation), Station yard layout and track junction design, Airport runway orientation, taxiway design, and terminal layout, Runway and taxiway geometric standards (ICAO guidelines)

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Wolhuter, Keith M. (2015), Geometric Design of Roads Handbook*
2. *A Policy on Geometric Design of Highways and Streets by AASTHO.*
3. *T.F. Fwa., Highway Engineering Handbook, National Publisher Company.*

COURSE TITLE: Transportation & Economics	L	T	P	Cr.
COURSE CODE: MTE2551	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Apply Economic Principles to Transportation Systems.
2. Assess Transportation Costs and Pricing Strategies.
3. Evaluate Economic Feasibility of Transportation Projects.
4. Understand Urban and Freight Transport Economics

Course Contents

UNIT I **15 hours**

INTRODUCTION TO TRANSPORTATION ECONOMICS: Basic economic concepts related to transportation, Role and importance of transportation in economic development, Demand and supply in transportation, Economic characteristics of different transportation modes.

COST AND PRICING IN TRANSPORTATION: Fixed, variable, and marginal costs in transportation, Cost estimation and cost functions, Pricing strategies in transportation (marginal cost pricing, average cost pricing, peak-load pricing), Fare structures in public transportation.

UNIT II **15 hours**

ECONOMIC EVALUATION OF TRANSPORTATION PROJECTS: Need for economic evaluation, Methods of economic evaluation: Cost-Benefit Analysis (CBA); Net Present Value (NPV); Benefit-Cost Ratio (BCR); Internal Rate of Return (IRR), Economic life-cycle analysis of transportation infrastructure.

UNIT III **15 hours**

TRANSPORTATION DEMAND AND SUPPLY ANALYSIS: Factors affecting transportation demand, Travel demand forecasting methods (Trip Generation, Trip Distribution, Modal Split, and Traffic Assignment), Elasticity of demand in transportation, Supply characteristics of various transport modes.

TRANSPORTATION FINANCE AND INVESTMENT: Sources of financing transportation projects (public, private, PPP models), Toll pricing and revenue models, Financial analysis of transportation projects, Public-private partnerships (PPP) in transportation infrastructure.

UNIT IV **15 hours**

URBAN TRANSPORTATION ECONOMICS: Urban transportation planning and land use, Economic aspects of congestion management, Parking economics and pricing strategies, Case studies of successful urban transport economic policies.

FREIGHT TRANSPORTATION ECONOMICS: Freight transportation cost structures, Freight demand forecasting, Logistics and supply chain economics, Role of transportation in trade and commerce

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. John G. Schoon. (2015), *Economic Analysis of Transportation Projects*
2. Kenneth Button (2013), *Transport Economics*.
3. Tae Hoon Oum, David Gillen, & William Waters, *Transport Economics*, National Publisher Company.

COURSE TITLE: Transportation Planning	L	T	P	Cr.
COURSE CODE: MTE2552	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the urban transportation and illustrate planning.
2. Classify trip and demonstrate trip production models.
3. Interpret various split models on transportation engineering.
4. Analyze the land use between various transport means and suggest an alternative plan for land use.

Course Contents

UNIT I **15 hours**

URBAN TRANSPORTATION PLANNING - Goals and objectives - Hierarchical levels of transportation planning - Forecast - Implementation - Constraints. UTP survey - Inventory of land use.

UNIT II **15 hours**

TRIP GENERATION - Trip classification - productions and attractions - Multiple regression models - Category analysis - Trip production models - Trip distribution models - Linear programming approach.

UNIT III **15 hours**

MODAL SPLIT MODELS - Behavioral models - Probabilistic models - Utility functions - logit models - Two stage model. Traffic assignment - Assignment methods - Route-choice behavior - Network analysis.

UNIT IV **15 hours**

LANDUSE AND ITS INTERACTION - Lowry derivative models - Quick response techniques - non-Transport solutions for transport problems. Characteristics of urban structure. Town planning concepts.

PREPARATION OF ALTERNATIVE PLANS -Evaluation techniques - Plan implementation – Monitoring- Financing of Project – Case studies.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Hutchinson, B.G., *Principles of Urban Transport Systems Planning*, Scripta, McGraw-Hill, NewYork, 1974.

2. *Khisty C.J., Transportation Engineering - An Introduction, Prentice Hall, India, 2002.*

COURSE TITLE: Geotechnical Engineering for Highways	L	T	P	Cr.
COURSE CODE: MTE2553	2	0	0	2

Total Hours: 30

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Comprehend the urban transportation and illustrate planning.
2. Classify trip and demonstrate trip production models.
3. Interpret various split models on transportation engineering.
4. Analyze the land use between various transport means and suggest an alternative plan for land use.

Course Contents

UNIT I 8 hours **INTRODUCTION TO GEOTECHNICAL ENGINEERING FOR HIGHWAYS:**

Importance of geotechnical engineering in highway construction, Soil as a highway material: types and classification, Soil compaction and its role in pavement performance, Field and laboratory compaction tests (Proctor test, Modified Proctor test).

SOIL PROPERTIES AND SUBGRADE EVALUATION: Index properties of soil (Atterberg limits, grain size distribution), Engineering properties of subgrade soil (CBR, modulus of subgrade reaction), California Bearing Ratio (CBR) test and its applications in pavement design, Plate load test and resilient modulus determination, Group index and soil classification for highway subgrades

UNIT II 7 hours **HIGHWAY SUBGRADE AND FOUNDATION DESIGN:**

Subgrade preparation and stabilization techniques, Design of embankments and cut sections, Subgrade drainage requirements and its effects on pavement performance, Frost action and frost heave prevention in highways, Expansive soils and their impact on highways.

UNIT III 7 hours **Pavement Materials and Geotechnical Considerations:**

Properties and selection of pavement materials (soils, aggregates, bitumen, cement), Laboratory and field tests for pavement materials (gradation, specific gravity, strength tests), Soil stabilization techniques: mechanical, chemical, and bituminous stabilization, Use of geosynthetics in highway engineering (geotextiles, geogrids, geomembranes).

UNIT IV 8 hours **SUBSURFACE INVESTIGATIONS AND FIELD TESTING:**

Importance of subsurface exploration for highway projects, Boring, sampling, and in-situ testing

methods (SPT, CPT, vane shear test), Field CBR test and Dynamic Cone Penetrometer (DCP) test, Geotechnical reports for highway projects

SLOPE STABILITY AND EARTHWORKS FOR HIGHWAYS: Slope stability analysis and failure mechanisms in highway embankments, Stability of cut slopes and embankments, Landslide mitigation and slope stabilization techniques, Retaining walls and reinforced soil structures in highways

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Braja M. Das., *Principles of Geotechnical Engineering, Scripta, McGraw-Hill, NewYork, 2020.*
2. G. Venkatappa Rao & G.V.S. Suryanarayana Raju, *Soil Mechanics in Highway Engineering, Mcgraw Hill, 2010.*

COURSE TITLE: CAD in Transportation Engineering	L	T	P	Cr.
COURSE CODE: MTE2554	0	0	4	2

Course Contents

Transportation Software – Mx Road, REI heads, HDM4, TRIPS, MIGRAN GIS and Remote Sensing Packages – ArcGIS, Geo-Concept, GRAM++, ENVI, ERDAS Imagine

Computer Aided Drafting - DBMS concepts - Civil Engineering Databases – Data entry & Reports. Spreadsheet concepts – Worksheet calculations in Civil Eng, - Regression & Matrix Inversion.

COURSE TITLE: Pavement Materials & Evaluation Lab	L	T	P	Cr.
COURSE CODE: MTE2555	0	0	2	1

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. To understand and evaluate the properties of pavement materials, including aggregates, bitumen, and subgrade soil.
2. To conduct tests for pavement performance assessment.
3. To develop skills for pavement condition evaluation and maintenance planning.

Course Contents

List of Experiments

1. **AGGREGATE TESTING:** Particle Size Distribution – Sieve analysis of coarse and fine aggregates. Shape Tests – Flakiness and elongation index. Strength Tests Aggregate Impact Test. Los Angeles Abrasion Test. Crushing Value Test. Specific Gravity and Water Absorption Test.
 2. **SUBGRADE SOIL TESTING:** Grain Size Distribution – Hydrometer analysis for fine soil. Atterberg Limits – Liquid limit, plastic limit, and shrinkage limit. Compaction Test – Standard and modified Proctor test. CBR (California Bearing Ratio) Test – For subgrade strength evaluation.
 3. **BITUMEN AND BITUMINOUS MIX TESTING:** Bitumen Consistency Tests, Penetration Test. Softening Point Test, Ductility Test, Viscosity Test, Bitumen Adhesion Properties – Stripping value test, Bitumen Specific Gravity and Flash & Fire Point Test, Marshall Stability Test – Design of bituminous mixes.
 4. **PAVEMENT CONDITION EVALUATION:** Benkelman Beam Test-Measurement of pavement deflection. Roughness Measurement – Using Bump Integrator or MERLIN. Pavement Skid Resistance – British Pendulum Test. Structural Evaluation – Falling Weight Deflectometer (FWD) demonstration.
- NON-DESTRUCTIVE TESTING (NDT) METHODS – GPR and Ultrasonic Pulse Velocity (UPV).

COURSE TITLE: Traffic Engineering Lab	L	T	P	Cr.
COURSE CODE: MTE2556	0	0	2	1

Course Learning Outcomes: After completion of this course, the learner will be able to:

- 1 Overview of traffic engineering and its importance
- 2 Equipment and tools used in traffic data collection

Course Contents

1. Traffic Volume Studies

- Objectives and significance of traffic volume studies
- Manual and automatic traffic volume count methods
- Peak hour factor determination

2. Spot Speed Studies

- Methods of speed measurement (Radar gun, Enoscope, etc.)
- Speed distribution curves (Mean speed, 85th percentile speed)
- Speed and delay study methods

3. Intersection and Roadway Capacity Studies

- Measurement of intersection capacity
- Level of Service (LOS) analysis using Highway Capacity Manual (HCM)
- Critical movement identification

4. Traffic Density and Headway Analysis

- Data collection for traffic density and time headway
- Calculation of fundamental traffic flow parameters
- Greenshields' model and its application

5. Parking Studies

- On-street and off-street parking surveys
- Parking accumulation, parking turnover, and parking index
- Parking demand and supply analysis

6. Pedestrian Studies

- Pedestrian flow characteristics
- Measurement of pedestrian speed and density
- Pedestrian delay and Level of Service analysis

7. Traffic Signal Design and Analysis

- Types of traffic signals and phases
- Cycle length and signal timing calculations using Webster's method
- Signal coordination and progression analysis

8. Traffic Accident Studies

- Data collection and accident analysis
- Black spot identification
- Road safety measures and accident preventive strategies

COURSE TITLE: Environmental Impact Assessment	L	T	P	Cr.
COURSE CODE: MTE2557	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify the objectives and scope of EIA
2. Illustrate the necessity of public participation in EIA studies
3. Summarize the importance of Environmental Attributes
4. Quantify impacts for various developmental projects

Course Contents**UNIT I****15 hours**

INTRODUCTION TO EIA: Definition, Evaluation of EIA in INDIA, Rapid and Comprehensive EIA, EIA, EIS, FONSI and NDS. Need for EIA studies, Baseline data, Step-by-step procedure for conducting EIA, Advantages and Limitations of EIA, Hierarchy in EIA, Statutory requirements in EIA, MoEF guidelines in siting Developmental Projects.

UNIT II**15 hours**

OBJECTIVES AND SCOPE OF EIA: Contents of EIA, Methodologies and Evaluation Techniques of EIA, Selection for specific projects

PUBLIC PARTICIPATION IN EIA: Elements of Effective Public Participation, Benefits and Procedures, EMP and DMP, Environmental Information System, Environmental Monitoring Systems, Public information network

UNIT III**10 hours**

ENVIRONMENTAL IMPACT CASE STUDIES: Case studies on Human impact on Himalayan Ecosystem, Urban solid waste management with reference to Hyderabad City, Irrigation impacts of Upper Thunga Project (UTP) at Shimoga, Impact on air quality due to cement making – A case study of ACC limited, Madhukkarai, Coimbatore, Bhopal Gas tragedy.

UNIT IV**15 hours**

IMPACT QUANTIFICATION: Impact quantification study on - Water Resource Developmental projects, Hazardous waste disposal sites, Sanitary land filling, Mining projects, Thermal/Nuclear power plant and pharmaceutical industries.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

- *Environmental Impact Analysis, Urban & Stacey, Jain R.K.*
- *Environmental Impact Assessment, Mc Graw Hill Inc, L.W. Canter (1996)*

- *Environmental Impact Assessment and Management, Daya Publishing house, Hosetti B.B., Kumar A. (2014)*

COURSE TITLE: Intelligent Transportation Systems	L	T	P	Cr.
COURSE CODE: MTE2558	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Compare ITS & ATIS
2. Interpret about the Advanced Transportation Management System
3. Comprehend about APTS, CVO, new technology and ETC
4. Comprehend the regional architecture, integration of infrastructure and operational planning.

Course Contents

UNIT I 15 hours

INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.

UNIT II 15 hours

TELECOMMUNICATIONS IN ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System.

UNIT III 15 hours

ITS FUNCTIONAL AREAS – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).

UNIT IV 15 hours

ITS USER NEEDS AND SERVICES – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

AUTOMATED HIGHWAY SYSTEMS - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *ITS Hand Book 2000: Recommendations for World Road Association (PIARC)* by Kan Paul Chen, John Miles.

2. *Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.*
3. *National ITS Architecture Documentation, US Department of Transportation, 2007 (CD-ROM).*

Semester 3rd

COURSE TITLE: Dissertation Phase-I	L	T	P	Cr.
COURSE CODE: MTE3600	0	0	0	12

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Identify structural engineering problems reviewing available literature.
2. Identify appropriate techniques to analyze complex structural systems.
3. Apply engineering and management principles through efficient handling of project

Course Contents

The dissertation will normally contain:

1. Dissertation-I will have mid semester presentation and end semester presentation. Mid semester
2. Presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.
3. 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 individual's contribution.
4. Continuous assessment of Dissertation – I at Mid Sem and End Sem will be evaluated by the departmental committee.
5. The Dissertation – I will be continued in the 4th semester.

COURSE TITLE: Airport Infrastructure Planning & Design	L	T	P	Cr.
COURSE CODE: MTE3601	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Classify the different components of airport and aircrafts.
2. Analyze the requirements of an airport layout with respect to international regulations.
3. Interpret the airport runway design.
4. Design Taxiways & Aprons.

Course Contents

UNIT I 15 hours

AIR TRANSPORTATION: Airport terminology, component parts of Aeroplan, Classification and size of airports; Aircraft characteristics. Air traffic control need for ATC, Air traffic control network, Air traffic control aids –enroute aids, landing aids. Airport site location and necessary surveys for site section, airport obstructions.

UNIT II 15 hours

PLANNING: Airport master plan – FAA recommendations, Regional Planning, ICAO recommendations, Estimation of future airport traffic needs- layout of Air Port

RUNWAYS: Runway orientation, basic runway length, corrections for elevation, temperature and gradient, runway geometric design

UNIT III 15 hours

TAXIWAYS AND APRONS: Loading aprons – holding aprons – Geometric design standards, exit taxiways – optional location, design, and fillet and separation clearance.

UNIT IV 15 hours

TERMINAL SERVICE FACILITIES: Passenger, baggage and cargo handling systems; Lighting, visual airport marking, airport lighting aids, airport drainage.

OPERATIONS AND SCHEDULING: Ground transportation facilities; Airport capacity, runway capacity and delays.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Khanna S.K., Arora M.G., Jain S.S., “Airport Planning & Design”, 1 st Edition, Nemchand Bros. Roorkee, 2009.
2. Robert Horonjeff, Francis McKelvey, William Sproule and Seth Young, “Planning and Design of Airports” 5 th Edition, 2010.

COURSE TITLE: Railway Infrastructure Planning & Design	L	T	P	Cr.
COURSE CODE: MTE3602	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Illustrate the Railway planning, design, construction and maintenance and planning and design principles of Airports and Harbor's.
2. Illustrate the basic procedure of railway construction and its maintenance
3. Illustrate the planning of airport and its components in layout.
4. Comprehend the airport design and interpret the basic needs in the airport construction.

Course Contents

UNIT I **15 hours**

Planning of Railway Lines Network Railways operational system, historical background of Indian railways, plans and developments, policy and standards, traffic forecast and surveys, railway alignment, project appraisal and organization setup.

UNIT II **15 hours**

Component of Railway Track and Rolling Stock Permanent way, forces acting, rails, function of rails, rail fixtures and fastenings, sleepers and ballast, rail joints, elements of junctions and layouts, types of traction, locomotives and other rolling stock, brake systems, resistance due to friction, wave action, wind, gradient, curvature, starting, tractive effort of a locomotive, hauling power of a locomotive.

UNIT III **15 hours**

Track Construction and Maintenance Special considerations and construction practices, track laying, inspection and maintenance, maintenance tools, maintenance of rail surface, track drainage, track circuited lengths, track tolerances, mechanized method, offtrack tampers, shovel packing, ballast confinement and directed track maintenance, bridge maintenance, renewal, classification of renewal works, through sleeper renewals, mechanized relaying, track renewal trains.

UNIT IV **15 hours**

Railway Station and Yards Site selection, facilities, classification, platforms, building areas, types of yards, catch sidings, ship sidings, foot over bridges, subways, cranes, weigh bridge, loading gauge, end loading ramps, locomotive sheds, ash-pits, water columns, turntable, triangles, traverse, carriage washing platforms, buffer stop, scotch block, derailling switch, sand hump, fouling mark. High Speed Railways Modernization of railways, effect of high-speed track, vehicle performance on track, high speed ground transportation system, ballast less track, elevated railways, underground and tube railways.

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. Clifford F. Bonnett, *“Practical Railway Engineering”*, 2nd Edition, Imperial College Press, London, 2005.
2. Gupta, B.L. and Amit Gupta, *“Railway Engineering”*, Third Edition, Standard Publishers, New Delhi, India, 2005
3. J.S. Mundrey, *“Railway Track Engineering”*, Fourth Edition, Tata McGraw-Hill Education Private Limited, New Delhi, 2010.

Course Title: Project	L	T	P	Credits
Course Code: MTE3603	0	0	4	2

Every student will carry out project under the supervision of a supervisor(s). The topic shall be approved by a Committee constituted by the Head of the concerned department. Every student will be required to present two seminar talks, first at the beginning of the project to present the scope of the work to finalize the topic, and second at the end of the semester, presenting the work carried out by him/her in the semester.

Semester 4th

COURSE TITLE: Dissertation Phase-II	L	T	P	Cr.
COURSE CODE: MTE4651	0	0	0	12

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Create, analyse and critically evaluate different technical/architectural solutions.
2. Analyze the consciousness critically of the ethical aspects of research and development work.
3. Analyze and evaluate different technical/architectural solutions.
4. Explain the capability of critically and systematically integrate knowledge.

Course Contents

The dissertation will normally contain:

Dissertation – II will be extension of the to 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.

COURSE TITLE: Pavement Maintenance Management System	L	T	P	Cr.
COURSE CODE: MTE4652	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Illustrate the Railway planning, design, construction and maintenance and planning and design principles of Airports and Harbor's.
2. Illustrate the basic procedure of railway construction and its maintenance
3. Illustrate the planning of airport and its components in layout.
4. Comprehend the airport design and interpret the basic needs in the airport construction.

Course Contents

UNIT I 15 hours

INTRODUCTION TO PAVEMENT MAINTENANCE AND MANAGEMENT:

Importance of pavement maintenance, Objectives and benefits of a Pavement Maintenance Management System (PMMS), Pavement performance and serviceability concepts, Pavement deterioration mechanisms and causes.

PAVEMENT EVALUATION AND PERFORMANCE ASSESSMENT: Functional and structural evaluation of pavements, Pavement condition assessment methods: Surface distress surveys; Roughness measurement (IRI, Bump Integrator); Skid resistance testing; Deflection measurements (Benkelman Beam, Falling Weight Deflectometer - FWD); Pavement condition indices (PCI, PSI, PQI)

UNIT II 15 hours

PAVEMENT MAINTENANCE STRATEGIES AND TECHNIQUES: Preventive, corrective, and emergency maintenance, Routine maintenance (crack sealing, pothole patching, surface cleaning), Periodic maintenance (overlay, resurfacing, rejuvenation), Rehabilitation techniques (mill and overlay, full-depth reclamation)

UNIT III 15 hours

PAVEMENT DISTRESSES AND THEIR REMEDIES: Types of flexible pavement failures (Rutting, fatigue cracking, bleeding, potholes), Types of rigid pavement failures (Joint distress, faulting, scaling, pumping), Repair techniques for flexible and rigid pavements, Use of geosynthetics in pavement maintenance

UNIT IV 15 hours

PAVEMENT MANAGEMENT SYSTEM (PMS): Components of a Pavement Management System (PMS), Data collection and database management, Pavement performance modelling, Maintenance decision-making process, Life Cycle Cost Analysis (LCCA) for pavement management.

PAVEMENT PRESERVATION AND SUSTAINABILITY: sustainable pavement maintenance techniques, recycling and reuse of pavement materials, cold in-place and hot in-place recycling, green materials for pavement preservation, climate change considerations in pavement maintenance

Transactional Mode:

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning

Suggested Readings:

1. *Ralph Haas, Ronald Hudson, & Zongzhi Li, "Pavement Management Systems",*
2. *J.P. Zaniewski, "Pavement Evaluation and Maintenance Management"*
3. *David G. Peshkin, "Pavement Maintenance and Rehabilitation".*

COURSE TITLE: Business Ownership	L	T	P	Cr.
COURSE CODE: MTE4655	2	0	0	2

Total Hours: 30

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Assess the commercial viability of new technologies, business opportunities and existing companies
2. Plan, organize, and execute a project or new venture with the goal of bringing new products and service to the market
3. Carry out scientific research in the field of entrepreneurship
4. Improved your interpersonal and collaborative skills

Course Contents

UNIT I

10 Hours

INTRODUCTION TO GENERIC SKILLS: Importance of Generic Skill Development (GSD), Global and Local Scenario of GSD, Life Long Learning (LLL) and associated importance of GSD.

MANAGING SELF: Knowing Self for Self-Development- Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc., Managing Self – Physical- Personal grooming, Health, Hygiene, Time Management, Managing Self – Intellectual development -Information Search: Sources of information, Reading: Purpose of reading, different styles of reading, techniques of systematic reading, Note Taking: Importance of note taking, techniques of note taking, Writing: Writing a rough draft, review and final draft. Managing Self – Psychological, Stress, Emotions, Anxiety-concepts and significance, Techniques to manage the above.

UNIT II

5 Hours

MANAGING IN TEAM: Team - definition, hierarchy, team dynamics, Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background, Communication in group - conversation and listening skills.

UNIT III

5 Hours

TASK MANAGEMENT: Task Initiation, Task Planning, Task execution, Task close out, Exercises/case studies on task planning towards development of skills for task management

PROBLEM SOLVING: Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving, Different approaches for problem solving. Steps followed in problem solving. Exercises/case studies on problem solving.

UNIT IV

10 Hours

ENTREPRENEURSHIP: Introduction, Concept/Meaning and its need, Competencies/qualities of an entrepreneur, Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level. Market Survey and Opportunity

Identification (Business Planning)- How to start a small-scale industry, Procedures for registration of small-scale industry, List of items reserved for exclusive manufacture in small-scale industry, Assessment of demand and supply in potential areas of growth, understanding business opportunity, Considerations in product selection, Data collection for setting up small ventures.

PROJECT REPORT PREPARATION- Preliminary Project Report, Techno-Economic Feasibility Report, Exercises regarding “Project Report Writing” for small projects.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. Khanka, S. S. (2006). *Entrepreneurial development*. S. Chand Publishing.
2. Desai, V. (2009). *Dynamics of entrepreneurial development and management* (pp. 119-134). Himalaya Publishing House.
3. Kennedy, A. (2015). *Business development for dummies*. John Wiley & Sons.

COURSE TITLE: Low Volume Roads	L	T	P	Cr.
COURSE CODE: MTE4653	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze Soil and Subgrade Characteristics
2. Design Rural Roads Based on Traffic and Environmental Conditions
3. Implement Construction Techniques for Different Types of Rural Roads
4. Evaluate Drainage and Environmental Considerations

Course Contents**UNIT I****15 Hours**

INTRODUCTION TO RURAL ROADS: Importance of rural roads in economic and social development, Rural road classification as per Indian Roads Congress (IRC) and other international standards, Challenges in rural road development (topography, drainage, funding), Rural road planning under Pradhan Mantri Gram Sadak Yojana (PMGSY).

SOIL MECHANICS AND SUBGRADE PREPARATION: Soil classification and properties for rural roads, Subgrade soil strength assessment (California Bearing Ratio - CBR test), Soil compaction techniques and field tests, Expansive soils and their treatment in rural roads.

UNIT II**15 Hours**

DESIGN OF RURAL ROADS: Design considerations as per IRC:SP:72-2015 (Guidelines for the Design of Flexible Pavements for Low-Volume Rural Roads), Empirical and mechanistic design approaches, Selection of pavement layers (sub-base, base, surface), Design of rural roads on hilly and black cotton soil terrains.

MATERIALS FOR RURAL ROAD CONSTRUCTION: Selection of locally available materials for cost-effective construction, Gravel, laterite, and soil-aggregate mixtures, Use of industrial waste (fly ash, slag, construction and demolition waste) Stabilization techniques (lime, cement, bitumen, geosynthetics)

UNIT III**15 Hours**

RURAL ROAD CONSTRUCTION TECHNIQUES: Construction of Earthen Roads (site selection, alignment, compaction), Gravel Roads (material selection, spreading, rolling, drainage considerations), Water Bound Macadam (WBM) Roads (layer composition, aggregates, binding material), Bituminous Roads (surface dressing, penetration macadam, premix carpets), Cement Concrete Roads (low-cost concrete pavements, joint design).

DRAINAGE AND ENVIRONMENTAL CONSIDERATIONS: Importance of drainage in rural roads, Surface and subsurface drainage systems, Sustainable drainage solutions (soak pits, bio-drainage, roadside vegetation), Climate-resilient rural road technologies.

UNIT IV**15 Hours**

MAINTENANCE AND REHABILITATION OF RURAL ROADS: Common defects in rural roads and their causes, Routine and periodic maintenance strategies,

Techniques for repairing potholes, edge failures, and surface cracks, Low-cost rehabilitation techniques (recycling, use of stabilizers).

POLICIES, STANDARDS, AND CASE STUDIES- Overview of PMGSY Guidelines and specifications, IRC and MoRTH specifications for rural roads, Case studies on successful rural road projects in India and other countries, Role of Public-Private Partnerships (PPP) and community participation in rural road development.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. Khanka, S. S. (2006). *Entrepreneurial development*. S. Chand Publishing.
2. Desai, V. (2009). *Dynamics of entrepreneurial development and management* (pp. 119-134). Himalaya Publishing House.
3. Kennedy, A. (2015). *Business development for dummies*. John Wiley & Sons.

COURSE TITLE: Urban Transportation System	L	T	P	Cr.
COURSE CODE: MTE4654	3	1	0	4

Total Hours: 60

Course Learning Outcomes: After completion of this course, the learner will be able to:

1. Analyze Urban Transportation Planning and Policy
2. Evaluate Public Transportation Systems
3. Apply Traffic Management and Congestion Mitigation Strategies
4. Assess Urban Freight Transportation and Logistics
5. Design Urban Transport Infrastructure and Financing Models

Course Contents

UNIT I

15 Hours

Introduction to Urban Transportation: Importance of urban transportation in city development, Characteristics of urban transport systems, Urban travel behavior and demand patterns, Transportation planning process for urban areas.

Urban Transportation Planning and Policy: Urban transport policies and governance, Transportation system management (TSM) strategies, Land use and transportation interaction, Transit-oriented development (TOD), Smart city transportation planning.

UNIT II

15 Hours

Public Transportation Systems: Modes of urban public transport - Bus systems (BRTS, express buses, minibuses); Rail-based transit (Metro, Light Rail Transit, Monorail, Suburban Rail); Non-motorized transport (cycling, pedestrian facilities), Design, capacity, and operational aspects, Challenges and solutions in public transit planning

UNIT III

15 Hours

Traffic Management and Urban Mobility: Traffic congestion and mitigation strategies, Intelligent Transportation Systems (ITS) in urban areas, Signal design and intersection management, Parking management and policies, Road safety and pedestrian facilities.

UNIT IV

15 Hours

Urban Freight Transportation: Characteristics and challenges of urban freight movement, Last-mile delivery solutions, Freight terminals and logistics hubs, Sustainable urban freight planning

Urban Transport Infrastructure and Financing: Road network design for urban areas, Mass transit infrastructure planning, Public-private partnership (PPP) models in urban transport, Economic evaluation of urban transport projects.

Transaction Modes

Lecture, Seminar, e-Team Teaching, e-Tutoring, Dialogue, Peer Group Discussion, Mobile Teaching, Self-Learning, Collaborative Learning and Cooperative Learning.

Suggested Readings

1. Meyer & Miller (2006). *Urban Transportation Planning*.

2. *C.S. Papacostas & P.D. Prevedouros. (2009). Transportation Engineering and Planning*
3. *Lester A. Hoel, Nicholas J. Garber (2015). Transportation Infrastructure Engineering*