M.Tech. Transportation Engineering (Part-Time)

Scheme and Syllabus

Batch 2023 and Onwards

Department of Civil Engineering

Semester 1st									Total Credits=9	
Sr. No.	Category	Subject Code	Course Title	Contact Hours			Maximum Marks		Total Marks	Credits
				L	T	P	Internal	External		
1.	Core Subject	MTTE-101	Advanced Traffic Engineering	3	0	0	40	60	100	3
2.	Core Subject	MTTE-102	Advanced Soil Engineering	3	0	0	40	60	100	3
3.	Department Elective	MTTE-111	Reinforced Soil Design & Construction	3	0	0	40	60	100	3
		MTTE-112	Transportation Economics & Finance)							
		MTTE-113	Transportation & Environment							
4.	Mandatory (Non-Credit)	SBS101C	Introduction to Shaheed Bhagat Singh and his co-patriots	1	0	0	S/US			
Total				**10**	**0**	**0**	**120**	**180**	**300**	**9**

Semester 2nd									Total Credits=8	
Sr. No.	Category	Subject Code	Course Title	Contact Hours			Maximum Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	Core Subject	MTTE-201	Highway Construction Material and Methods	3	0	0	40	60	100	3
2	Core Subject	MTTE-202	Application of GIS in Transportation Engineering	3	0	0	40	60	100	3
3	Core Subject	MTTE-203	Pavement Materials Testing Laboratory	0	0	4	30	20	100	2
Total				**6**	**0**	**4**	**110**	**140**	**300**	**8**

Semester 3rd									Total Credits=9	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1.	Core Subject	MTTE-301	Transportation System Planning & Management	3	0	0	40	60	100	3
2.	Core Subject	MTTE-302	Advanced Foundation Engineering	3	0	0	40	60	100	3
3.	Department Elective	MTTE-311	Railway Infrastructure Planning and Design	3	0	0	40	60	100	3
		MTTE-312	Sustainable Transportation Systems							
		MTTE-313	Road Safety and Management							
Total				**9**	**0**	**0**	**120**	**180**	**300**	**9**

Semester 4th									Total Credits=10	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	MTTE-401	Research Methodology and IPR	3	0	0	40	60	100	3
2	Core Subject	MTTE-402	Airport Infrastructure, Planning and Design	3	0	0	40	60	100	3
3	Core Subject	MTTE-403	Seminar	0	0	8	60	40	100	4
Total				**6**	**0**	**8**	**140**	**160**	**300**	**10**

Semester 5th									Total Credits=13	
Sr. No.	Category	Subject Code	Course Title	Contact Hours			Maximum Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	Core Subject	MTTE-501	Intelligent Transportation System	3	0	0	40	60	100	3
2	Research	MTTE-502	Project	-	-	-	60	40	100	10
Total				**3**	**0**	**0**	**100**	**100**	**200**	**13**

Semester 6th									Total Credits=20	
Sr. No.	Category	Subject Code	Course Title	Contact Hours			Maximum Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	Dissertation	MTTE-601	Thesis	-	-	-	00	00	S/US	20
Total										**20**

SEMESTER 1st

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-101	Advanced Traffic Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. know the traffic flow characteristics
2. study various traffic surveys
3. understand the traffic signal timing design and traffic flow theories.

UNIT-I

Introduction to Traffic Engineering: Properties of traffic engineering elements, road vehicle performance.
Traffic Studies: Volume studies, speed studies, origin & destination studies and parking studies.

UNIT-II

Traffic Control devices: Various traffic control devices, principles of intersection design, design of signalized and unsignalized intersections, signal coordination, traffic regulations and statistical methods.

UNIT-III

Traffic Safety and Level-of-service: Accidents, lighting, capacity and level-of-service analysis**.**
Uninterrupted traffic Flow Theory: Fundamentals of traffic flow theory, uninterrupted traffic flow including macroscopic and microscopic traffic flow models.

UNIT-IV

Interrupted traffic Flow Theory: Fundamentals of interrupted traffic flow, shockwave analysis, car following theory, queuing theory, vehicle arrival: gap and gap acceptance, simulation of traffic systems

Course Outcomes: Upon completion of this course the student shall be able to:

1. use the traffic survey analysis for management of traffic and for designing new road infrastructure
2. design various types of intersections
3. implement of traffic control devices and traffic regulations
4. apply of traffic flow theories in solving congestion problems and use of simulation techniques.

Books Recommended :

1. Kadiyali, L. R., Traffic Engineering and Transport Planning,. Khanna Publishers
2. O'Flaherty C A, "Transport Planning and Traffic Engineering", Butterworth Heinemann, Elsevier, Burlington, MA
3. Mannering Fred L., Kilarski Walter P. and Washburn Scott S., Principles of Traffic Engineering and Traffic Analysis, Third Edition, Wiley
4. Chakroborty Partha and Animesh Das, Principles of Transportation Engineering, Prentice hall

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-102	Advanced Soil Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. understand the engineering properties and behaviour of soil under different field condition and loading.

UNIT-I

Origin, nature and distribution of soils: Engineering behaviour of soils of India, black cotton soils, alluvial silts and sands, laterites, collapsible and sensitive soils, aeolin deposits.

Clay Mineralogy and Soil Structure: Introduction, Gravitational and Surface Forces, Primary valence bonds, Hydrogen bonds, Secondary valence bonds, Basic structural units of clay minerals, Isomorphous substitution, Kaolinite minerals, Montmorillinte mineral, Illite mineral, Electrical charges on clay minerals, Base exchange capacity, Diffused double layer, Adsorbed water, Soil structures.

UNIT-II

Methods of site investigations: Direct methods, Geophysical methods, Seismic methods, Electrical resistivity methods, methods, drilling methods, boring in soils and rocks, Types of soil samples, Types of samplers, Standard Penetration Test.

UNIT-III

Soil Stabilization: Introduction, Mechanical stabilization, Cement stabilization, Lime stabilization, Bituminous stabilization, Chemical stabilization, thermal stabilization, electrical stabilization, Stabilization by grouting.

UNIT-IV

Geosynthetics: Types and functions, materials and manufacturing processes, principles of soil reinforcement, design and construction of geosynthetic reinforced soil retaining structures.

Geosynthetics in pavements: Geosynthetics in roads and railways, separations, drainage and filtering in road pavements and railway tracks.

Course Outcomes: Upon completion of this course the student shall be able to:

1. ascertain the behavior of soil as a construction material or supporting medium for Civil Engineering structures.
2. learn different methods of soil investigation.
3. apply different soil stabilization techniques to the field problems.

Books Recommended :

1. Soil Mechanics in Engineering Practice, Terzaghi and Peck, John Wiley and Sons.
2. Physical and geotechnical properties of soils, Bowles
3. Design aids in soil mechanics and foundation engineering, Kaniraj S.K.
4. Soil Mechanics, Lambe and Whitman, Wiley India
5. Reinforced soil and its engineering application, Swami Saran, I K International

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	MTTE-111	Reinforced Soil Design & Construction	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. develop a basic understanding of characteristics of the different types of reinforcing material
2. examine, evaluate and select appropriate reinforcement material as per desired requirements
3. carry out the design of the structures using reinforced soil
4. get acquainted with the geosynthetics, its properties, application and usage in soil stabilization.

UNIT-I

Introduction: Basic concept of the reinforced soil, mechanism design principles, materials used for construction, advantages of reinforced soil.

Practical Applications: Reinforced soil in flyovers bridges and other civil engineering structures, basic components and strength characteristics of reinforced soil, reinforced soil construction detailing.

UNIT-II

Geosynthetics: An overview of geosynthetics, description of geotextiles, geogrids, geonets, geomembranes, geocomposites, geocells- properties and test methods, functions, design methods for separation, stabilization, filtration, drainage.

Retaining Walls: Types of walls, earth pressures for gravity/counterfort walls, structural design of wall and its foundation, stability of the wall-soil system,slip circle analysis.

UNIT-III

Reinforced soil walls: Stability analysis and construction aspects of reinforced soil walls, effect of reinforced sloped backfill on soil wall design, drainage design procedure.

Wall with reinforced backfill: Theoretical analysis, pressure-intensity on the wall, stability against sliding and overturning, design procedure, limitations of the analysis.

UNIT-IV

Foundations on reinforced soil: Brief overview, analysis of strip footing, isolated- square and rectangular footing on reinforced soil bed, determination of pressure ratio.

Soil nailing and anchors: Applications of soil nailing, its components, advantages and limitations, design aspects.

Course Outcomes: Upon completion of this course the student shall be able to:

1. learn the concepts of reinforced soil and its applications in the Civil Engineering field.
2. distinguish between different types and varied applications of geosynthetics.
3. design the reinforced soil walls.

Books Recommended :

1. Designing with Geosynthetics, Robert M. Koerner, Prentice Hall. (2012)
2. Engineering with Geosynthetics, G.V Rao& GVS SuryanarayanaRaju, Tata McGraw Hill Publishing Co. New Delhi. (1990)
3. Reinforced Soil and its Engineering Application," Swami Saran, New Age Publication. (2006)

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	MTTE-112	Transportation Economics & Finance	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. gain an insight into road user cost, transportation cost, finance, taxation and economic evaluation of transportation projects
2. acknowledge the economic functions of transportation systems
3. analyze and evaluate the operating costs of vehicles
4. get acquainted with the concept of financing of highway projects and estimation of direct and indirect costs related to transportation.

UNIT-I

Introductory Concepts in Transportation Decision Making: Overall transportation project development, budgeting, financial planning, the process of transportation project development, models associated with transportation impact evaluation

Economic evaluation of transport projects: Need for economic evaluation, cost and benefits of transport projects, time horizon in economic assessment, basic principles of economic evaluation, interest rate, method of economic evaluation, benefit cost ratio method, first year rate of return, net present value method, internal rate of return method, comparison of methods of economic evaluation.

UNIT-II

Vehicle operating costs: Introduction, road user and cost study in India, components of VOC, factors affecting VOC, fuel consumption relationship, spare parts consumption, maintenance and repairs, labour, cost, tyre life, lubricants, utilization, and fixed costs.

Economic analysis of projects: Methods of evaluation - cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods; indirect costs and benefits of transport projects.

UNIT-III

Value of travel time savings: Introduction, classes of transport users enjoying travel time savings, methodology for monetary evaluation of passengers' travel time, review of work in India on passengers' travel time.

Accident costs: Introduction, relevance of accident costing for a developing country, review of alternative methodologies for accident costing, Indian studies.

UNIT-IV

Traffic congestion, traffic restraints and road pricing: Congestion as a factor in road traffic, traffic restraint, road pricing.

Appraisal and Evaluation of Transportation Projects: Feasibility and evaluation, cost, impacts and performance levels, evaluation of alternatives, analysis techniques, cost-benefit analysis, social and financial benefits, valuation of time, measures of land value and consumer benefits from transportation projects, prioritization of projects, multi-criteria decision assessment.

Highway finance: Methods for raising funds for maintenance, improvement and expansion of transportation networks, taxation and user fee, financing through loans, bonds, PPPs.

Course Outcomes: Upon completion of this course the student shall be able to:

1. analyse transportation project case studies
2. evaluate transportation project case studies.
3. perform analysis to determine vehicle operational cost, losses and expenditure cost of accidents.
4. compare various methods for raising funds for a highway project and chose the most feasible and viable among them.

Books Recommended :

1. Principles of Transportation engineering by Chakroborty& Das, Prentice Hall, India..
2. Highway Engg by S.K Khanna& CEG Justo, Nem Chand Bros., Roorkee
3. Principles and practices of Highway engg by L.R Kadyali, Khanna Publishers, Delhi. Edition 6
4. Principles of Transportation and Highway engg by G.V Rao, Tata McgrawHill Publishing Co.Ltd. N.Delhi
5. HarralClell G., A Manual for the Economic Appraisal of Transport Projects, World Bank Report, Washington D.C

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Departmental Elective	MTTE-113	Transportation & Environment	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. study the relation between transportation and environment and the effect of increasing transportation demand on land use
2. analyze and evaluate the direct and indirect effects of transportation sector on environment
3. get acquainted with various policies of Governmental organizations.

UNIT-I

Environmental effects of transport: Problems of identification,environmental impact assessment, evaluation of environmental impact due to construction of new facilities and the effect of traffic thereon due to bypasses, widening/four laning, expressway; grade separators,assessment and attenuation.

UNIT-II

Assessment of Environmental impacts of Transportation: Noise, vibration, air pollution, emission levels, air-pollution dispersion, the box model, noise generation, noise measurement, noise propagation and mitigation strategies, noise measures, mathematical models of transportation noise, energy consumption and related issues, environmental traffic management, co-ordinated signal system on urban arterial road intersections to reduce air pollution.

UNIT-III

Pedestrian delay and danger: Severance, accidents, visual intrusion and aesthetics, toxic freight, construction effects.

UNIT-IV

Land consumption and land-use effects: Planning blight and compensation; global climate, energy and resource use; and sustainability, GOI policies and requirements for clearances for road projects. emergency care, institutions and management of traffic safety, education, training, policing, penalties, risk perception, probability, indices and indicators.

Course Outcomes: Upon completion of this course the student shall be able to:

1. learn about measures for controlling pollution for various transportation systems
2. aware of various environmental regulations
3. carry out EIA of an existing transportation facility and suggest required modifications to minimize the overall impact.

Books Recommended :

1. The Art of Regression Modeling in Road Safety,Hauer, E, Springer, 2015
2. The Way Forward: Transportation Planning and Road Safety. Tiwari, G., Mohan, D. and Muhlrad, N.(eds) New Delhi: Macmillan India Ltd., 2005.
3. Transport, Climate Change and the City, Robin Hickman and David Banister. Routledge, London, 2014
4. Human Factors in Traffic Safety, Paul Olson and Robert Dewar (2007) Amazon Digital.
5. World Report on Road Traffic Injury Prevention, Peden, M., et al. World Health Organization, Geneva, 2004.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Mandatory (Non-Credit)	SBS101C	Introduction to Shaheed Bhagat Singh and his co- patriots	1	0	0	S/US

1. Introduction to Bhagat Singh as a person through the eyes of his colleagues.
   Family background and childhood, Education and participation in National Freedom Movement, his visits to Jallianwala Bagh and Nankana Sahib.

2. His contribution to National Freedom Moment.
   Building of Youth Movement , His contribution through his writings, National College Movement and his comrades, Dwarka Das Library and Lahore Science movement, List of books Shaheed Bhagat Singh read.

3. Shaheed Bhagat Singh's experiences at Kanpur
   As journalist and joining Hindustan Republican Association.

4. His return to Punjab
   Jatto Morcha, His First experience of underground life, Shaheed Bhagat Singh at Kisri Magazine, Establishment Hindustan Socialist Republican Association

5. Shaheed Bhagat Singh's attacks on British rule
   Saunders case, Assembly bomb case, Hunger Strike for Jail Reforms, Cut Short Justice system of the British.

6. Overall contributions and his vision of free India.

Books Recommended :

1. Sardar Bhagat Singh by Jatinder Nath Sanyal, National Book Trust New Delhi

SEMESTER 2nd

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Core Subject	MTTE-201	Highway Construction Material and Methods	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. To get acquainted with quality assurance, and economic selection of pavement materials.
2. To be able to perform all the necessary lab tests required to be done on highway construction materials.
3. To familiarize the fundamentals of mix design and carry out mix design.
4. To study and evaluate the applications of the recent trends in the field of highway construction materials.

UNIT-I

Sub-grade Soil Characterization: Properties of sub-grade layers; different types of soils, Mechanical response of soil; Soil Classification; Index and other basic properties of soil.

Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control.

UNIT-II

Aggregate Characterization: Desirable characteristics of Road aggregates, proportioning of aggregates, Artificial aggregates, Sustainability and availability of sound aggregates.

Bitumen and Bituminous Concrete Mix Characterization: Bitumen sources and manufacturing, Chemistry of bitumen, bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test, Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes.

UNIT-III

Modified bitumen and Design of Bituminous mix: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Introduction to emulsified bitumen and its characterization; Long term and short-term ageing and its effect on bitumen performance, Tests to simulate ageing of bitumen viz. RTFOT and PAV. Desirable properties of bituminous mixes, Design of bituminous mixes: Modified Marshall's specifications, Bituminous Road construction Procedure

UNIT-IV

Cement Concrete Pavement: Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties; Introduction to advanced concretes like self-compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; IS method of cement concrete mix design with case studies; Role of different admixtures in cement concrete performance; Joint filers for Jointed Plain Cement Concrete Pavements and their characterization; Nano technology applications in cement concrete, Concrete road construction.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Examine the properties of the highway materials and perform Bituminous Mix Design.
2. Determine the suitability of the concrete and bituminous mixes in compliance to codal provisions.
3. Reduce cost with minimum adverse impact on environment.

Books Recommended :

1. Principles of Transportation engineering by Chakroborty& Das, Prentice Hall, India
2. Highway Engg by S.K Khanna& CEG Justo, Nem Chand Bros., Roorkee
3. Principles and practices of Highway engg by L.R Kadyali, Khanna Publishers, Delhi. Edition 6.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Core Subject	MTTE-202	Application of GIS in Transportation Engineering	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Expose the students to the concept of digital mapping, to make them aware of recent advancements/software in surveying like Remote sensing, digital photogrammetry, GIS, DIP etc.
2. Familiarize with map projections and working with co-ordinate systems.
3. Get acquainted with data analysis of vector based and raster based data.

UNIT-I

Modern Trends in Surveying and Mapping: Digital Mapping, Uses and applications, data collection techniques (Conventional and Nonconventional), Present Status in India and abroad.

Aerial Photogrammetry: Introduction, types, Stereoscopy, Scale of a photograph, flight planning, Mosaics, Crab & Drift, Overlap & Side lap.

UNIT-II

Geographical Information System (GIS): Introduction, advantages, objectives of GIS, Definitions of GIS, Components of GIS, Overlay analysis, Digital Terrain Modelling, Digital Elevation Model Applications of GIS in transportation engineering fields, Four M's, Elements of Image visualization

UNIT-III

Introduction to Remote Sensing (RS): Introduction, EM spectrum, Ideal RS System, Real RS System, Visual Image interpretation, active and passive remote sensing, Reflectance; spectral reflectance of land covers; Spectral characteristics of solar radiation; energy interaction in atmosphere; energy interactions with Earth's surface, Spectral reflectance curves, Resolution

UNIT-IV

Digital Image Processing (DIP): Introduction, Histogram and image statistics, Remote Sensing Image distortion and rectification: Radiometric errors and Geometric errors. Image Enhancement Techniques, Image classification – Supervised and Unsupervised classification, Formats

Global Positioning System: Introduction, GPS, DGPS, Applications,Software demonstrations and working GIS/RS software.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Apply the concepts and analytical methods related to surveying
2. Use the various surveying equipment
3. Plan and execute surveying projects
4. Prepare a map and concepts of 3-D view
5. Identify the potential use of Remote Sensing and GIS in Civil Engineering

Books Recommended :

1. Geomatics Engineering, Manoj Arora and R C Barjatiya, Nem Chand Brothers, Roorkee.
2. Principles of GIS, Peter A. Burrough, Rachael A., Oxford University Press
3. Remote Sensing and Image Interpretation, Lillesand and Kiefer, Wiley Publishers
4. Surveying Vol. I & II, B.C. Punmia, A.K. Jain & Jain. Luxmi Publications (P) Ltd., New Delhi.
5. Principle Practices & Design of Highways Engg., S. K. Sharma. S. Chand Publishing , New Delhi.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-203	Pavement Materials Testing Laboratory	L	T	P	2
				0	0	4	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:

1. Have knowledge about the various tests which need to be carried out on soils, aggregate and bitumen for the design of bituminous mixes and pavements. Evaluation tests for pavement strengthening and use of software in highway development

List of Experiments:

1. Tests on Soils (Gradation, atterberg limits, OMC and CBR).
2. Test on Aggregates (Aggregate grading and Proportioning, Impact, Abrasion crushing, water absorption, specific gravity).
3. Tests on Bitumen and Bitumen Mixes (Marshall method of mix design and Bitumen content test).
4. Pavement Evaluation tests (Benkelman beam test).
5. To determine modulus of subgrade reaction (K-value) of rigid pavement.
6. Exposure to latest software.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Knowledge about tests and bituminous mix design which will give the students added confidence when they go actually in the field.

Books/Codes Recommended :

1. Khanna, S. K., Justo, C. E. G., and Veeraragavan, A., Highway Materials laboratory Testing, Nem Chand & Brothers.
2. Relevant IRC and AASHTO Codes.

SEMESTER 3rd

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-301	Transportation System Planning & Management	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Familiarize with the techniques ofanalysis, performance evaluationandmanagement of transportation systems.
2. Acknowledge the various techniques related to estimation of transportation.
3. Examine various transportation planning techniques and their applications.

UNIT-I

General: Importance of transportation, transportation planning methodology, hierarchicallevels of planning and its relation to rural, urban areas, Long range planning, Passenger and goods transportation, General concept and process of transport planning, Land-use transport interactions, Socio-economic characteristics of Land use.

Transportation and society: Role of Transport in Society and Economy – Functions and Problems in Transportation Planning - Economic, Geographical, Political, Technological, Social and Cultural Factors in Planning of Transportation System.

UNIT-II

Transport Technology: System Classification and their Variation; Conventional Systems and Unconventional Systems - Air, Water and Ground Modes.

Transportation Systems: Multi modal transportation system; Characteristics of Mass Transit systemsincluding technical, demand operational and economic problems, Mass RapidTransit System Elevated, Surface and Underground construction, Express BusSystem, Operating Characteristics of Terminal and Transfer facilities.

UNIT-III

Urban Transportation Planning Studies: Urban Travel Characteristics, Transportation demand Surveys, Delineation of theurban area, zoning, Origin-Destination Studies, Home interviews trip, Classification and Socio-Economic variables in trip making projections.

Planning Methodology and Systems Analysis: Study of existing network-trip generation techniques, Category analysis, multipleregression techniques, Trip distribution techniques, Growth Factor model, Gravitymodels, Opportunity models and multiple regression models, Traffic assignmentmethods, Minimum Path Tree-All or nothing assignment

UNIT-IV

Maintaining and Operating System: Operational Controls of Air, Water, Railway and Highway Transportation Systems, Functions of Control & Communications - Signals and Traffic Control Devices - Navigational Aids of the different Transportation Systems, Air Traffic Control, Navigational Control, Automatic Signalling Systems of Railway and Highway Movements.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Gain Knowledge of various systems of transportation.
2. Have an in-depth knowledge of demand projection techniques of various transportationsystems.
3. Identify and analyse the impact of various factors that affect various aspects of urban transportation system.

Books Recommended :

1. Kadiyali, L.R., “Traffic Engineering and Transport Planning”, KhannaPublishers.
2. Khanna,S.K. and Justo, C. E.G. “Highway Engg.” New Chand Publication.
3. Papacostas, C.S. and Prevedouros, P.D., “Transportation Engineering and Planning”, Prentice Hall of India Private Limited.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-302	Advanced Foundation Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Study the different types of foundation and their suitability for particular site and structure.
2. Be able to analyze and design shallow foundations and deep foundations.
3. Learn the concepts of caisson and well foundations.
4. Get acquainted with the concept of soil liquefaction and its remedial measures.

UNIT-I

Shallow Foundations: Design considerations- factors of safety (including limit state), Allowable settlements, Location and depth of foundations, Codal provisions, Consolidation settlement in clays (with correction factors). Immediate settlement. Settlement in sands from N- values, Elastic solutions. Static cone tests, Plate load test.

UNIT-II

Deep Foundations: Type of Piles. Construction methods. Axial capacity of single piles-static formulae, Skin friction and end bearing in sands and clays, Axial capacity of groups, Laterally Loaded Piles, Short and long piles, Free head and fixed head piles, Lateral load capacity of single piles, Lateral deflection, Elastic analysis, Group effect, Lateral load test, Codal provisions.

UNIT-III

Caissons and Wells: Major areas of use of caissons, Advantages and disadvantages of open box and pneumatic caissons, Essential part of a pneumatic caisson, Components of a well foundation, Calculation of allowable bearing pressure, Conditions for stability of a well, Forces acting on a well foundation, Computation of scour depth.

UNIT-IV

SoilLiquefaction: Concept of soil liquefaction, Effects of soil liquefaction , quick sand condition and remedial measures, stone column, vibrofloatation, deep compaction.

UNIT-V

Reinforced Earth Retaining Wall: Principles, concepts and mechanism of reinforced earth – designconsideration of reinforced earth retaining wall.

Foundations in Difficult Soils: Expansive soils, chemically aggressive environment, soft soils, fills, regions of subsidence.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Decide the type of foundation required for a particular site and structure.
2. Make geotechnical design of the foundations for civil engineering structures under varied field conditions.
3. Carry out analysis to identify problems of liquefaction and ascertain remedial measure for soil improvement.
4. Learn the Principles and concepts of Reinforced Earth Retaining Walls.

Books Recommended :

1. Bowles, J.E., “Foundation Analysis and Design”, Mc-Graw Hill Publications.
2. Kaniraj, S.K., “Design aids in soil mechanics and foundation engineering”, Mc-GrawHill .
3. Poulos, H.G. and Davis, E.H., “Pile Foundation Analysis and Design”, John Wiley.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Department Elective	MTTE-311	Railway Infrastructure Planning and Design	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Over view of importance of railway, its infrastructure and analyze the travel behavior and plan for the railway line network.
2. Design the geometry of the track system.
3. Get acquainted with the signaling, interlocking, maintenance and management of the railway track system.
4. Explore and evaluate the recent advancements in the field of railway and their applications.

UNIT-I

Planning of Railway Lines: 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.

Components of Railway Track and Rolling Stock: Permanent way, forces acting, 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-II

Railway Track Geometric Design: Right of way and formation, field investigations, geometric design elements, safe speed on curves, speeds computation, string lining of curves, gradients, grade compensation, railway cant and cant deficiency, traction.

Track Construction and Maintenance: Track laying, inspection and maintenance, maintenance tools, maintenance of rail surface, track drainage, track tolerances, mechanized method, ballast confinement and directed track maintenance, bridge maintenance, renewal, classification of renewal works, mechanized relaying, track renewal trains.

UNIT-III

Signaling and Interlocking: Objectives, classification, fixed signals, stop signals, signaling systems, mechanical signaling system, electrical signaling system, systems for controlling train movement, interlocking, modern signaling installations.

Railway Accidents and Safety: Train accidents, collision, derailments, causes, restoration of traffic, safety measures, disaster management, classification of level crossings, accidents at level crossings, remedial measures, maintenance of level crossings.

UNIT-IV

Railway Station and Yards: Site selection, facilities, classification, platforms, building areas, types of yards, catch sidings, slip sidings, foot over bridges, subways, cranes, weighbridge, loading gauge, end loading amps, locomotive sheds, triangles, traverser, carriage washing platforms, buffer stop, scotch block, derailing switch, sand hump, fouling mark.

High-Speed Railways: Modernization of railways, the effect of high-speed track, vehicle performance on the track, railway track design for high speeds, dedicated freight corridors, high-speed ground transportation system, ballast less track, elevated railways, underground and tube railways.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Plan the railway network.
2. Determine factors governing the design of railway infrastructure.
3. Design the railway track system and identify a suitable signal system and develop maintenance strategies.
4. Assess requirements of high-speed railway track and recommend suitable measures for the safety of the railway network.

Books Recommended :

1. Chandra, S., and Agarwal, M.M., "Railway Engineering, Oxford University Press", Noida, India, Second Edition, 2013.
2. Mundrey, J.S., "Railway Track Engineering", McGraw-Hill Education Private Limited, New Delhi, India, 2017, Fifth Edition.
3. Gupta, B.L., and Gupta, A., "Railway Engineering" Standard Publishers Distributors, New Delhi, India, Third Edition, 2012.
4. Rangwala, S.C., Charotar"Railway Engineering" Publishing House Pvt. Ltd., Anand, India, Twenty Seventh Edition, 2017.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Department Elective	MTTE-312	Sustainable Transportation Systems	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. examine the sustainability of transportation systems by determining environmental issues, their characteristic, scale of the problem related to transportation systems.
2. evaluate the challenges of potential solutions in order to reduce unsustainable impacts of the transport
3. study the concept of Environmental Impact Assessment and different planning processes related to sustainability in transportation.
4. familiarize with different modes of sustainable transportation

UNIT-I

Introduction to Transportation Systems: Evolution of Transportation modes, Transportation Systems, Factors influencing Development & Efficiency of a Transport System, Components of Transportation System, Multimodal Transport, Concept of Sustainability, Current Scenario of Transportation in India, Climate change: Indicators and impacts.

UNIT-II

Impacts of Transportation Systems-I: Transport-Environmental Link, Energy consumption and Emissions by Transport Sector, Environmental Impacts of Transport, Traffic generated Air Pollution (The Case of Los Angeles, California), Policy implication, Health Improvement Strategies, Case Study, Mitigation Measures, Conclusion

Impacts of Transportation Systems-II: Noise, Harmful Effects of Noise, Noise Level Standards, Factors affecting Traffic Noise, Sources of Vehicular Noise, Noise measurements, Mitigation measures for Noise pollution, Numerical Problems.

UNIT-III

Introduction to Environmental Impact Assessment (EIA): EIA processes, Methodologies of EIA, Global practices in EIA process EIA Process in India, Case Study.

Introduction of Land Use: Land use planning & zoning, Transit Oriented Development(TOD), TOD implementation, TOD case study – Section of Delhi Metro.

Introduction to Sustainable Transport Planning: Material Flow Analysis (MFA), Concept of Circular economy in Transport Sector, Initiatives & Policies for Environmental Sustainability, National Clean Air programme & Transport Sector.

UNIT-IV

Alternative Fuels and Sustainable Transportation: Non-Motorized Transport (NMT), Electric vehicles, Emerging Transport Technology – Hyperloop, Case Study- Bus Rapid Transit System (BRTS), Mass Rapid Transit Systems(MRT).

Sustainability Indicators: Sustainable Transport Appraisal Rating (STAR), Measuring Sustainability, Material Flow Analysis Tool- STAN.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Explain the unsustainable impacts of today's transport sector.
2. Analyze and compare the potentials and challenges of technological, organizational and policy solutions.
3. Find optimum solutions and propose a plan towards sustainable transportation.

Books Recommended :

1. Sucharov, L.J. and Baldasano, J.M., "Urban Transport and the Environment, Vol. II", Computational Mechanics Publications,1996.
2. Wood, C. and Wood, C., "Environmental Impact Assessment: A Comparative Review", Prentice Hall, 2002
3. Petts, J., "Handbook of Environmental Impact Assessment", Blackwell Publishing, 1999.
4. Zannetti P. (Ed.), "Environmental Modeling, Vol. I", Computational Mechanics Publication, Elsevier Applied Science,1993.
5. Assessment & Decision Making for Sustainable Transport, European Conference of Ministers of Transport, OECD Publishing, 2004.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Department Elective	MTTE-313	Road Safety and Management	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the causes of accidents, statistical measures of accident data analysis and computer application in data analysis.
2. Examine and evaluate different parameters responsible for providing road safety in the construction of new roads.
3. Learn about road safety audit principle and procedure, various traffic management techniques and their effectiveness.

UNIT-I

Road accidents, Causes, Scientific Investigations and Data Collection: Analysis of Individual Accidents to Arrive at Real Causes; Statistical Methods of Analysis of Accident Data, Application of Computer Analysis of Accident Data**.**

Ensuring Traffic Safety in Designing New Roads: Ways of Ensuring Traffic Safety in Road Design considering the Features of Vehicle Fleet, Psychological Features of Drivers, Natural and Meteorological Conditions, Structure of Traffic Streams, Orientation of a Driver on the Direction of a Road beyond the Limits of Actual Visibility and Roadway Cross Section & Objects.

UNIT-II

Ensuring Traffic Safety in Road Reconstruction: Road Reconstruction and Traffic Safety, Reconstruction Principles, Plotting of Speed Diagram for Working out Reconstruction Projects, Use of Accident Data in Planning Reconstruction of Roads, Examples of Reconstruction of Selected Road Sections for Improving Traffic Safety, Improving Traffic Conditions on Grades, Sharp Curves, Redesign of Intersections, Channelized At-grade Intersections, Bus Stops, Parking & Rest Areas and Effectiveness of Minor Road Improvements.

UNIT-III

Ensuring Traffic Safety in Road Operation: Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guardrails & Barriers and Road Lighting.

UNIT-IV

Road Safety Practices: Principles- Procedures and Practice, Code of Good Practice and Checklists. Road Safety Issues and Various Measures through Engineering, education and enforcement measures for improving road safety.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Acquire knowledge statistical methods and computer application of accident analysis.
2. Analyzing the factors affecting the construction of new roads, reconstruction of existing road and operational conditions of road.
3. Remember the process of road safety audit and the measures of improving road safety.
4. Evaluate the effectiveness of various management techniques adopted in reducing road accident.

Books Recommended :

1. Kadiyali, L.R., “Traffic Engineering and Transport Planning”,Khanna Publishers, 2009.
2. Kishty, J.C. and Lall, K.B., “Transportation Engineering- An Introduction”, Thrid Edition, Prentice Hall of India Private Limited, New Delhi, 2006.
3. Khanna, S.K.and Justo, C. E.G.,“Highway Engg.” New ChandPublication, 2001.
4. Babkov, V.F., “Road conditions and Traffic Safety”, MIR, Publications,Mascow, 1975.

SEMESTER 4th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Core Subject	MTTE-401	Research Methodology and IPR	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Introduce the fundamentals of Statistical techniques, Sampling techniques, and Data Collection and the interpretation to the students.
2. Make the students understand the concept of research, need for research, types of research and steps in conducting research.

UNIT-I

Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.

Identifying and Defining Research Problem: Locating, Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them.

UNIT-II

Data Collection: Static and dynamic characteristics of instruments used in experimental set up, calibration of various instruments, sampling methods, methods of data collection, Selection of Appropriate Method for Data Collection, Data collection using a digital computer system, case studies of data collection.

Data Analysis: Data processing, data analysis strategies and tools, data analysis with statistical packages, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.

UNIT-III

Research Reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, developing research proposal. Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, illustrations and tables, bibliography, referencing and footnotes, word processing tools such as Latex oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

UNIT-IV

Research Ethics, IPR and Publishing Ethics: Ethical issues. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Make use of various Research methodologies and its applications in the relevant field of engineering.
2. Organize and conduct research in a more appropriate manner.

Books Recommended :

1. C.R. Kothari, "Research Methodology - Methods and Techniques", Wiley Eastern Ltd 2009.
2. B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods Techniques, Pearson, 2006.
4. S.P Gupta,"Statistical Methods", Sultan and Chand & Sons, 2006.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-402	Airport Infrastructure, Planning and Design	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Acquainted with the fundamentals of airport planning, demand forecasting, geometrics of the air field and carry out its analysis.
2. Plan and perform geometric design of airfields and terminals
3. Acknowledge and evaluate the importance of air traffic management and familiarize with different air traffic management systems.
4. Develop the understanding of various air travel demand forecasting and their application.

UNIT-I

Airport Planning and Air Travel Demand Forecasting: Airport system planning Hierarchy of Planning - Airport Master Plan - Elements of Airport Master Plan - Airport Layout Plan - Forecasting methods: time series method, market share method, econometric modelling. Facilities requirements – Design alternatives - Financial plans- Land use planning – Environmental planning - Air Transport Planning in India – Airport Site Selection

UNIT-II

Geometric Design of the Airfield: Airport classification - Principles of Airport Layout -Airfield Configuration - Runway Orientation - Obstructions to Airspace - Runway Length-Runway and Taxiway Cross Section - Longitudinal-Grade Design for Runways and Stop- ways - Longitudinal-Grade Design for Taxiways -Taxiway Design - exit taxiway - Capacity - Level of Service - Airside Capacity - Factors Affecting Airside Capacity and Delay - Determination of Runway Capacity and Delay - Annual Service Volume – Calculating Aircraft Delay - Taxiway and Gate Capacity

UNIT-III

Planning and Design of the Terminal Area: Components of airport terminal - Function of Airport Passenger and Cargo Terminal - Facilities Required at Passenger Terminal – Design considerations: terminal demand parameters, facility classification, level of service criteria. Terminal planning process: overall space requirements, concept development, horizontal distribution concepts, vertical distribution concepts. Passenger and Baggage Flow – Apron gate system: number of gates, ramp charts, gate size, aircraft parking type, apron layout, apron circulation, passenger conveyance to aircraft, apron utility requirements Design of Air Freight Terminals - Airport access - Airport Landside planning – Capacity

UNIT-IV

Air Traffic Management: Navigational aids: ground-based systems, satellite based systems – Air traffic control and surveillance facilities – Weather reporting facilities - Requirements of visual aids, Air field lighting - approach lighting system configurations, visual approach slope aids, threshold lighting - Runway lighting, taxiway lighting. Runway and taxiway marking, airfield signage - Air traffic separation rules: vertical separation, flight altitudes, longitudinal separation, and lateral separation – future enhancements to air traffic management.

UNIT-V

Airport Drainage: Design runoff, inlet size and location design, surface and subsurface design

Course Outcomes: Upon completion of this course the student shall be able to:

1. Apply the concept of airport planning and demand forecasting.
2. Design the runways, taxiways and aprons.
3. Design the components of airport terminal.

Books Recommended :

1. Khanna, S. K., Arora, M. G., and Jain, S. S. Kaniraj, S.K., "Airport planning and Design", Sixth Edition. Nem Chand and Bros, Roorkee, India,
2. Norman J. Ashford, SalehMumayiz, Paul H. Wright, "Airport Engineering Planning, Design, and Development of 21st century Airports", John Wiley.
3. Horonjeff, R., McKelvey, F. X., Sproule, W. J., and Young, S. B., "Planning and Design of Airports", Fifth Edition, McGraw-Hill, New York, USA.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-403	Seminar	L	T	P	4
				0	0	8	
Internal Marks: 60, External Marks: 40, Total Marks: 100							

Course Objectives: This course is focused to facilitate student to gain skills of collecting, interpreting and presenting information of interest through seminar and report presentation.

Course Content:

The main aim of the course is to develop an understanding of literature survey, its analysis and develop good presentation skills amongst the students. The PPTs should use slides, charts, graphs, and images to illustrate the content of presentation. The evaluation strategy for the seminar will include:

1. **Oral Presentation Skills:** A power point presentation and discussion therein that will highlight the strength of the presenter in the concept, background, literature and gap/lacunae related to identified area/topic.
2. **Report Writing and Formatting:** A technical report that will highlight the student's strength in concept and literature base on the identified are/topic; and capability to present the information in appropriate scientific formats.

Semester 5th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	MTTE-501	Intelligent Transportation System	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Introduce fundamental concepts of ITS and its functional areas, get acquainted with different types of sensors and their applications.
2. Overview of ITS implementation in developed countries.
3. Estimate traffic congestion by the acquisition of big data using advanced devices.
4. Familiarize with various simulation techniques/softwares in the field of transportation engineering and their application.

UNIT-I

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

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-III

ITS User Needs and Services: Travel and Traffic management, Public Transportation Management, Electronic Payment, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT-IV

ITS Standards: ITS standards, development process, legal issues, financial issues, Mainstreaming ITS; integration and up-gradation; Future of ITS, case studies.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Outline the need of ITS and illustrate role of communication systems in ITS.
2. Identify functional areas and services of ITS.
3. Apply the various ITS methodologies.
4. Simulate the various traffic conditions using VISSIM.

Books Recommended :

1. Chowdhury, M. A., and Sadek, A., “Fundamentals of Intelligent Transportation Systems Planning” Artech House
2. Kadyali, “Traffic Engineering and Transport Planning”, Khanna publishers.
3. Sussman, J. M., “Perspectives on Intelligent Transportation Systems (ITS)”, Springer.
4. Turban, E., and Aronson, J. E., Decision Support Systems and Intelligent Systems, 5th Edition, Prentice Hall.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Research	MTTE-502	Project	L	T	P	10
				-	-	-	
Internal Marks: 60, External Marks: 40, Total Marks: 100							

Course Objective:
This course is focused to facilitate student to carry out minor projects within the scope of the dissertation projects, so as to acquire skills of problem identification, designing feasible and innovative solutions for the problem solving, and presentation of report.

The Evaluation Scheme for awarding marks will include the following criterion:
1. **Oral Presentation:** A power-point presentation and discussion therein that will highlight the strength of the presenter on the problem identification, understanding of limitations and feasibility appropriate to the place of work.
2. **Report Writing:** A technical report that will highlight the student's strengths in concept and technical base on the identified problems.
3. **Mentor's Feedback:** Feedback of the mentor on the capacity of the student to identify problems and develop solutions.

Semester 6th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Dissertation	MTTE-601	Thesis	L	T	P	20
				-	-	-	
Internal Marks: 00, External Marks: 00, Total Marks: S/US*							

Course Objective: This course is focused to facilitate student to carry out extensive research and development project or technical project at place of work through problem and gap identification, development of methodology for problem solving, interpretation of findings, presentation of results and discussion of findings in context of national and international research. The overall goal of the dissertation is for the student to display the knowledge and capability required for independent work.

Course Contents: The Students will be required to carry out experimental research related the relevant field. They have to demonstrate their results as a PPT presentation and prepare a hard bound report. The examination will be conducted as pre submission stage by a departmental committee. Once the committee is satisfied with the work presented, a final external viva-voce examination will be held.

The criterion for awarding satisfactory grade in the Thesis (Dissertation) will be based on:

(i) Relevance of the subject in the present context
(ii) Originality
(iii) Literature Review and Research Methodology
(iv) Problem formulation
(v) Experimental observation / theoretical modelling
(vi) Results and discussions
(vii) Conclusions and scope of future work
(viii) Overall presentation of the thesis/ oral presentation
(ix) Defence and Viva Voce
(x) Outcome of the dissertation resulting in an article publication.

***Satisfactory/ Unsatisfactory grade will be awarded based on Satisfactory performance in front of the external examiner.**