SHRI VENKATESHWARA UNIVERSITY

Syllabus

M.TECH (Highway Engineering)

(Two Years Post Graduation Programme)

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

Evaluation for M.Tech (Highway Engineering)

SEMESTER-II													
Sl. No.	**Subject Codes**	**Subject**	**Periods**			**Evaluation Scheme**				**End Semester**		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	MHE-201	Traffic Systems Design	3	0	0	20	10	30		70		100	3
2	MHE-202	Pavement Construction and Evaluation	3	0	0	20	10	30		70		100	3
3	MHE-032	Intelligent Transportation Systems	3	0	0	20	10	30		70		100	3
4	MHE-041	Regional Transportation Planning	3	0	0	20	10	30		70		100	3
5	MHE-211	Pavement Materials and Evaluation Lab	0	0	4				25		25	50	2
6	MHE-212	Transportation Engineering Software Lab	0	0	4				25		25	50	2
7	MHE-221	Mini Project	0	0	4				50		50	100	2
8	AUD-102	Disaster Management	2	0	0								0
		Total										600	18

M.Tech II Semester

MHE-201: TRAFFIC SYSTEM DESIGN

Course Type: Core; Instruction: L-T-P-C: 3-0-0-3

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

CO1	Design the geometric elements for better traffic system.
CO2	Analyze and design uncontrolled and signalized intersection with collected data.
CO3	Design and improve the bicyclists and pedestrians traffic flow facilities.
CO4	Analyze and design appropriate parking layouts and facilities.
CO5	Examine and design better street lighting systems.

Detailed Syllabus:

Geometric design of traffic flow systems:

Elements of geometric design, cross sectional elements, sight distance considerations, factor affecting geometric design, highway alignment and topography, design of horizontal alignment, tangents and curves, layouts and radius, design of vertical alignment, tangent grades, vertical curvature, design controls and criteria, mobility and accessibility, landscaping, design of freeway and multilane highways, expressways design requirements, weaving segments and configurations, auxiliary lanes and its elements, speed change lanes, and design practice.

Design of at grade intersections:

At grade intersections types and their suitability, factors affecting design, data requirement, parameters selection, intersection controls, estimation of conflict points, uncontrolled intercession analysis, capacity of rotary, roundabouts and design methodologies, Design of signalized intersection, warrants for signalization, saturation flow rate and capacity, estimation of amber time, design of all aspects of signal timings, LOS studies, estimation of queue length and control delay, signal coordination, channelization and its objectives, channelizing devices, design considerations, typical channelizing examples.

Design of traffic Interchanges and its elements:

Necessities of interchanges, classification and types of common interchanges, layouts of interchange, interchange warrants, interchange design elements, spacing and design speed, design of ramps, ramp configurations, weaving at interchange, design examples.

Design of traffic system for bicycle and pedestrians:

Bicycle flow characteristics, performance measures, LOS criteria and capacity, interrupted and uninterrupted bicycle paths, design of bikeways, shared off-street and on-street paths, urban street bicycle path, control delay and LOS, pedestrian flow behavior, factor affecting behavior, fundamental traffic flow relations, pedestrians space requirement, performance measures, pedestrian demand analysis, design of pedestrians facility at uncontrolled and signalized junctions, side walk and cross walk design, street corner analysis, pedestrian signals, and design examples.

Design of parking facilities:

Parking and influencing factors, type of parking system, parking angles and aisle width, on- street parking design, design parameters, parking surveys and demand estimation, various parking layouts and vehicle circulation, design of off street parking facilities, types and layouts, design examples.

Street lighting:

Definitions and background, pavement luminance and its measurement, illumination level, Veiling Luminance, longitudinal uniformity, utilization factor, depreciation factor, maintenance factor, traffic criteria and warranting conditions, and design practice.

READING:

C. Jotin Khisty and B. Kent Lall, Transportation Engineering: An Introduction, Third Edition, Prentice Hall; 2002.

Coleman A. O 'Flaherty, Transport Planning and Traffic Engineering, Butterworth- heinemann, 2009.

Fred L. Mannering, Scott S. Washburn, Kilareski Walter P., Principles Of Highway Engineering And Traffic Analysis, Wiley India Pvt Ltd., 4th Edition, 2011.

Institute of Transportation Engineers, Anurag Pande and Brian Wolshon, Traffic Engineering Handbook, Seventh Edition, John Wiley & Sons, New Jersey, 2016.

L.R. Kadiyali, Traffic Engineering and Transportation Planning, Khanna Publishers, 2011.

Louis J. Pignataro and Edmund J. Cantilli, Traffic Engineering: Theory and Practice; Prentice hall, Inc.1973

(Digitised in 2007)
Mike Slinn, Paul Matthews, Peter Guest, Traffic Engineering Design: Principles and Practice, Butterworth-heinemann, 2nd Edition, 2005.
Nicholas J. Garber, and Lester A. Hoel, Principles of Traffic and Highway Engineering, Cengage Learning India, 2nd Edition, 2010.
Richard J. Salter and N.B Hounsell, Highway Traffic Analysis and Design, Third Edition, Macmillan, 1996.
Roger P. Roess, Elena S. Prassas and William R. McShane, Traffic Engineering, Prentice Hall, 4th Edition,

MHE-202: PAVEMENT CONSTRUCTION AND EVALUATION

Course Type: Core; Instruction: L-T-P-C: 3-0-0-3

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

CO1	Select appropriate earth moving and compaction equipment depending upon the requirement.
CO2	Prepare quality assurance and quality control plans in an attempt to construct better performing pavements.
CO3	Evaluate the pavements based on the functional and structural characteristics.
CO4	Evaluate the safety aspects of the pavements specifically in terms of friction and other related distresses.
CO5	Select maintenance technique depending upon the intensity of the distresses.

Detailed Syllabus:

Highway Construction Equipment:

Applications and safety aspects of earth moving equipments, compaction equipments, road making equipments, concreting equipments and paving equipments.

Pavement Construction:

Construction and preparation of subgrade soil, construction of sub-base layer, construction of base layer, construction of bituminous surface layers, construction of cement concrete surface layer and MoRT&H specifications.

Functional Evaluation of Pavements:

Introduction, factors affecting pavement deterioration, functional condition evaluation techniques, roughness measurements, Identification of uniform sections, serviceability concepts, visual and ride rating techniques

Structural Evaluation of pavements:

Structural condition evaluation techniques, NDT procedures, rebound deflection, deflection bowl measurement and analysis, IRC overlay design method, structural evaluation using falling weight deflectometer, back calculation of layer moduli, ground penetrating radar for pavement evaluation, evaluation of pavement safety: skid resistance and hydroplaning.

Pavement Maintenance:

Routine maintenance, periodic maintenance, special repairs, responsive maintenance programme, rehabilitation and reconstruction, treatment strategies and selection

READING:

1) **David Croney and Paul Croney,** *The Design and Performance of Road Pavements*, Third Edition, McGraw-Hill Professional, 1997.
2) **Haas, R., W.R. Hudson** and **J.P. Zaniewski.** *Modern Pavement Management*, Krieger Publishing Company, Malabar, Florida, USA, 1994.
3) **Mallick, R.B.** and **T. El-Korchi** *Pavement Engineering – Principles and Practice*, CRC Press, Taylor and Francis Group, Florida, USA, 2009.
4) **Ministry of Road Transport and Highways.** *Specifications for Road and Bridge Works*, Fifth Edition, Indian Roads Congress, New Delhi, India, 2013.
5) **Nai C. Yang,** *Design of Functional Pavements*, McGraw-Hill Book Company, New York, USA,

1972 (Digitised in 2007)
6) **Papagiannakis, A.T.** and **E.A. Masad** *Pavement Design and Materials*, John Wiley and Sons, New Jersey, USA, 2008.
7) **Rajib B. Mallick and Tahar El-Korchi,** Pavement Engineering: Principles and Practice, Second Edition, CRC Press, London, 2013
8) **Shahin, M.Y.** *Pavement Management for Airports, Roads, and Parking Lots*, Third Edition, Kluwer Academic Publisher, Massachusetts, USA, 2005.

MHE-211: PAVEMENT MATERIALS AND EVALUATION LABORATORY
Course Type: Core; Instruction: L-T-P-C: 0-0-3-2

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

CO1	Characterize the pavement materials including soil, aggregate, bitumen, and bituminous mixes in the laboratory.
CO2	Perform quality control tests on pavements and pavement materials.
CO3	Measure the functional response characteristics of in-service pavements.
CO4	Measure the structural response characteristics of in-service pavements.

Detailed Syllabus:

1 **Tests on Soils:** liquid limit, plastic limit, soil classification (dry and wet), maximum dry density and moisture content.
2 **Tests on Soils:** CBR.
3 **Tests on Aggregate:** aggregate gradation, shape tests, specific gravity, water absorption.
4 **Tests on Aggregate:** Los Angeles abrasion value, aggregate impact value, soundness test.
5 **Tests on Bitumen:** penetration, absolute and kinematic viscosity, flash and fire point, ductility and elastic recovery, softening point, specific gravity.
6 **Tests on Bitumen:** measuring apparent viscosity of bitumen using SC-4-27 spindle in a rotational viscometer from 60 to 150 □C in increments of 10 □C at different shear rates, short- term aging of bitumen.
7 **Field Tests:** field density using sand replacement method, rapid moisture meter.
8 **Tests on Bituminous Mixes:** stripping value of aggregate, determination of Gmm of given bituminous mixtures using CoreLok system, Marshall mix design.
9 **Tests on Bituminous Mixes:** bitumen content and gradation using centrifuge extractor and NCAT ignition oven, determination of tensile strength ratio for a given bitumen mix.
10 **Tests on Bituminous Mixes:** roller compaction and permanent deformation using wheel tracking equipment.
11 **Field Evaluation:** skid resistance using British pendulum, texture depth using sand patch test, stiffness of unbound pavement layers using GeoGauge.
12 **Field Evaluation:** pavement condition rating, unevenness using MERLIN.
13 **Field Evaluation:** Dynamic Cone Penetrometer, Clegg Impact Test, determination of modulus and rebound deflection using Portable Falling Weight Deflectometer.
14 **Field Evaluation:** overlay design using Benkelman beam.

READING:

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

Relevant IS, IRC, ASTM Codes.

MHE-212: TRANSPORTATION ENGINEERING SOFTWARE LABORATORY
Course Type: Core; Instruction: L-T-P-C: 0-0-3-2
Course Outcomes: *At the end of the course, students will be able to*

CO1	Estimate Travel Demand using transportation planning packages like VISUM.
CO2	Design isolated and coordinated traffic signals using SIDRA.
CO3	Design Flexible and Rigid Pavements using Ken layer and Ken slab software.
CO4	Simulate traffic at mid block as well as at Intersections using VISSIM.

Detailed Syllabus:
Exercises on Usages of the Packages and Mini-Project:
TRANSPORTATION PLANNING PACKAGES:
Trip Generation - Multiple Linear Regression Analysis. Trip Distribution - Growth Factor Methods, Gravity Model. Mode Choice - Logit Model.
Trip Assignment - All or Nothing Technique. VISUM
CUBE
Land use Transportation Planning
TRAFFIC ENGINEERING PACKAGES:
MXRoad VISSIM SIDRA SUMO VISWALK VISTRO
VISUM Safety VISWALK
PAVEMENT EVALUATION & ECONOMIC ANALYSIS PACKAGES:
Ken-layer & Ken-slab HDM – IV

READING:
1. User Manuals of various packages.

MHE-032: INTELLIGENT TRANSPORTATION SYSTEMS
Course Type: Elective; Instruction: L-T-P-C: 3-0-0-3

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

CO1	Identify and differentiate ITS user services and its components.
CO2	Select and provide appropriate ITS technology to solve real-life traffic problems.
CO3	Manage the traffic congestion by acquisition of big data using advanced devises.
CO4	Design and implement the suitable ITS and services for effective transportation.

Detailed Syllabus:
ITS Background and Telemetric systems:
Definitions, features and objectives of ITS, History of ITS and its development over the world, telemetric concept, transport telemetric, telemetric structure, ITS taxonomy, ITS application areas, uses, and application overview.

ITS User Services:
infrastructure based services; Arterial management and integration, freeway/highway management, crash prevention and safety, road weather management, roadway operation and maintenance, transit management, emergency management, Electronic payment and pricing, traveller information, COV, etc., Intelligent vehicle based services; collision notification and avoidance system, driver assistance system, and examples.

ITS components, tools and strategies:
Components of user services; advanced traffic management system, advanced traveler information system, advanced vehicle control system, commercial vehicle operational management, advanced public transportation system, electronic payment system, advanced rural transportations, security and safety

systems, urban traffic control, scoot and scat systems, benefits and limitations.

Design and implementation:
Design components; data acquisition methods, equipment and used technology, radar and sensor, detectors, vehicle identifiers, and GPS, Communication tools; DSRC, CALM, traveler information tools, data handling, processing and management; TCM, and its working, worldwide ITS implementation and challenges, case studies.

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

READING:

1. AUSTROADS, The Implication of Intelligent Transport Systems for Road Safety, Austroads Incorporated, 1999.
2. Bob Williams, Intelligent Transport Systems Standards, Artech House Publishers, 2008.

1. Chowdhury, M. A. and Sadek, A, Fundamentals of Intelligent Transportation Systems Planning, Artech House, 2003.
2. E. Bekiaris and Y.J. Nakanishi, Economic Impacts of Intelligent Transportation Systems: Innovations and Case Studies, Elsevier/JAI, 2004.
3. IET Intelligent Transport Systems and 15th International IEEE Conference on Intelligent Transportation Systems (ITSC), 16-19 September, 2012. (http://digital-library.theiet.org/content/journals/iet-its)
4. J.M. Sussman, *Perspectives on Intelligent Transportation Systems* (ITS), Springer, 2005
5. L. Vlacic, M. Parent, F. Harashima, Intelligent Vehicle Technologies – Theory and Applications, Butterworth-Heinemann, 2010.

MHE-041: REGIONAL TRANSPORTATION PLANNING
Course Type: Elective; Instruction: L-T-P-C: 3-0-0-3

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

CO1	Delineate regions for transportation planning.
CO2	Estimate demand for both regional and intercity passenger travel.
CO3	Estimate regional goods travel demand.
CO4	Plan and evaluate regional transportation networks.

Detailed Syllabus:

Delineation of Regions:
Concept of Region, Types of regions, Hierarchy of activities & Issues Related to Regional Planning, Hierarchy of Regions, mega region development, Methods of Delineation Regions
– Qualitative approaches – Quantitative approaches, Formal regions – weighted index method and factor analysis method; Functional regions – flow analysis & gravitational analysis.

Regional Passenger Travel Demand Estimation:
Comparison of Urban and Regional travel; Factors Affecting Passenger Flows, Use of Mathematical Models to Estimate Passenger Travel Demand, Direct Demand Models, Abstract Mode Models, Mode Specific Models, case studies.

Intercity Passenger Travel:
Definition of Intercity travel, dimensions of intercity travel decision making, aggregate and disaggregate

models.

Regional Goods Travel Demand Estimation:
Factors Affecting Goods Flows; Characteristics of freight travel; Use of Mathematical Models to Estimate Freight Demand; Aggregate and disaggregate models – Freight Generation, trip distribution, mode choice & traffic assignment; Input – output model, MIT Model, etc.

Regional network planning:
Problems in Developing Countries, Network Characteristics - Circuitry, Connectivity, Mobility, Accessibility and Level of Service Concepts - Network Structures and Indices – Network Planning – Evaluation - Graph Theory – Cut sets – Flows & Traversing – Optimum Network - Inter-modal Co-ordination. Special features of low volume Roads – Rural Road Network Planning

READING:

1. C.J. Khisty and B. Kent Lall, Transportation Engineering, Prentice Hall of India Pvt. Ltd., 2002.
2. C.S. Papacostas and P.D. Prevedouros, Transportation Engineering and Planning, Prentice Hall of India Pvt. Ltd., 2001.

MHE-221 Mini Project (Credits- 0:0:4 = 2)

Teaching Scheme Lectures: 4hrs/week
Course Outcomes: At the end of the course, the student will be able to:

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. work on the solutions given and present solution by using his/her technique applying engineering principles.

Syllabus Contents:

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

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

AUDIT 2: DISASTER MANAGEMENT AUD 102

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. critically understand the strengths and weaknesses of disaster management approaches,

planning and programming in different countries, particularly their home country or the countries they

work in.

SYLLABUS CONTENTS

Introduction
Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.
Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.
Disaster Prone Areas In India
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics
Disaster Preparedness And Management
Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.
Risk Assessment
Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.
Disaster Mitigation
Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi