DEPARTMENT OF TRANSPORTATION ENGINEERING

CONVENING ORDER - BOARD OF STUDIES

The Board of Studies is the basic constituent of the academic system of an autonomous college. Its functions will include framing the syllabi for various courses, reviewing and updating syllabi from time to time, introducing new courses of study, determining details of continuous assessment, recommending panels. of examiners under the semester system, etc. The Board of studies is constituted with the following members:

S.No	Name of the Member	Designation/occupation	category
1	Dr. K. Sreekar Chand	Head of the Department	Chairman
2	Dr. M. Swaroopa Rani	Professor, CIVIL Department, UCEK, JNTUK Kakinada	University Nominee
3	Dr.D.Srinivas	Associate Professor & HOD, Department of Architecture, School Of Planning& Architecture Vijayawada	Subject experts outside parent university
4	Dr. T. Chandra Sekhar Rao	Professor, & HOD Bapatla Engineering College-ANU	
5	Mr. N. Dilip Kumar	Deputy Project Manager in Projects DEC infra india private limited	Industrialist
6	Mr. K. Ramu	Asst. Professor	Faculty Member
7	Mrs. P. Madhuri Swaraj	Government Employee, State Government of A.P	Alumni Member

P.T.O.

Term: The term of the nominated members shall be three years. **Meetings:** The Board of Studies shall meet at least twice a year. **Functions:**

The Board of Studies of a Transportation Engineering in Civil Department in the college shall:

- Prepare syllabi for various courses keeping in view the objectives of the college, interest of the stakeholders and national requirement for consideration and approval of the Academic Council;
- Suggest methodologies for innovative teaching and evaluation techniques;
- Suggest panel of names to the Academic Council for appointment of examiners;
- Coordinate research, teaching, extension and other academic activities in the Department! College.

HOD
Dept. Of CE

HEAD OF THE DEPARTMENT
CIVIL ENGINEERING
A.M. REDDY MEMORIAL COLLEGE OF ENGG & TECH
PETLURIVARIPALEM
Narasaraopet (Md.), Guntur (Dt.).

Copy to:
1. Principal.
2. IQAC

Estd : 2007

A.M. REDDY MEMORIAL COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Approved by AICTE New Delhi, Permanently Affiliated to JNTU - Kakinada, Accredited by NAAC
Recognized by UGC 2(f), An ISO Certified 9001:2015

Vinukonda Road, Petlurivaripalem, Narasaraopet, Palnadu District, Andhra Pradesh - 522 601.

AMR/TE/BOS/2025-26/Circular/1 Date: 03/09/2025

Meeting Notice

Greetings from A.M. Reddy Memorial College of Engineering and Technology we request you to participate in Transportation Engineering in Civil Department Board of Study meeting scheduled on 3th September 2025 at 03.00 M through online (Google Meeting)

S.No	Name of the Member	Designation/occupation	category
1	Dr. K. Sreekar Chand	Head of the Department	Chairman
2	Dr. M. Swaroopa Rani	Professor, CIVIL Department, UCEK, JNTUK Kakinada	University Nominee
3	Dr.D.Srinivas	Associate Professor & HOD, Department of Architecture, School Of Planning& Architecture Vijayawada	Subject experts outside parent university
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7	Mrs. P. Madhuri Swaraj	Government Employee, State Government of A.P	Alumni Member

Agenda of the meeting–

- Introducing the members of Board of Studies.
- Finalization of AMR- 25 CBCS (Choice Based Credit System) – Syllabus for I year I & II Sem which are related to TE Department.
- Course structure modifications (If any)
- Discuss on Approval for I year M.Tech I Sem and II Sem.
- Any other matters.

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Vinukonda Road, Petlurivaripalem, Narasaraopet, Palnadu District, Andhra Pradesh - 522 601.

AMR/TE/BOS/2025-26/MOM/1 Date : 05-09-2025

DEPARTMENT OF TRANSPORTATION ENGINEERING

MINUTES OF MEETING - BOARD OF STUDIES (BOS)

The Meeting of the Board of Studies of Transportation Engineering in Civil Department was held on 03th September 2025 at 03.00 PM through online (Google Meeting Platform). The following members were attended the online meeting.

S. No	Name of the Member	Designation/occupation	category	Signature
1	Dr. K. Sreekar Chand	Head of the Department	Chairman	
2	Dr. M. Swaroopa Rani	Professor, CIVIL Department, UCEK, JNTUK Kakinada	University Nominee	
3	Dr.D.Srinivas	Associate Professor & HOD, Department of Architecture, School of Planning& Architecture Vijayawada	Subject experts outside parent university	
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6	Mr. K. Ramu	Asst. Professor	Faculty Member	
7	Mrs. P. Madhuri Swaraj	Government Employee, State Government of A.P	Alumni Member	

The Meeting began with chairman, Board of studies extending a warm welcome to all the members of participating in the meeting.

The following points were discussed and approved during the meeting

1. The following proposed AMR-25 Course Structure and the detailed syllabi of I-I, I-II were presented, discussed and approved.

COURSES (TE)		
I Year – I SEM		
S.No.	**Title**	**Credits**
1	Pavement Materials and Characterization	4
2	Traffic Engineering and Management	4
3	Urban Transportation Systems Planning	4
4	Ground Improvement Technique	3
5	GIS for Transportation	3
6	Pavement materials laboratory	2
7	Traffic Engineering laboratory	2
8	Seminar-I	1
I SEM - TOTAL CREDITS		**23**

COURSES (TE)		
I Year – II SEM		
S.No.	**Title**	**Credits**
1	Analysis and Design of Pavement	4
2	Probability and Statistics for Transportation Engineering	4
3	Road Safety Engineering and Management	4
4	Environmental Impact Assessment for Transportation Infrastructure	3
5	Pavement Evaluation and Maintenance	3
6	Pavement Evaluation laboratory	2
7	Transportation Studio laboratory	2
8	Seminar - II	1
II SEM - TOTAL CREDITS		**23**

1. The syllabus for Pavement materials and characterization **(Annexure -1),** Traffic engineering and management **(Annexure -2)** , Urban transportation systems planning **(Annexure -3),** Ground Improvement Techniques **(Annexure -4),** GIS For Transportation **(Annexure -5),** Pavement Materials Lab **(Annexure -6),** Traffic Engineering Lab **(Annexure -7),** Analysis and Design of Pavement **(Annexure -8),** Probability and Statistics for Transportation Engineering **(Annexure -9),** Road Safety Engineering and Management **(Annexure -10),** Environmental Impact Assessment for Transportation Infrastructure **(Annexure -11),** Pavement Evaluation and Maintenance **(Annexure -12),** Pavement Evaluation lab **(Annexure -13),** Transportation Studio lab **(Annexure -14)** and has been approved by the Board of Studies.

The following points were suggested for future possible implementations: Prescribed Textbooks:

Advised to add recent prescribed textbooks or updated editions for the course.

References:

More references are recommended to be added for various topics.

Information Sharing:

All the updated information should be shared at least 15 days before the next Board of Studies (BOS) meeting.

The BOS chairman concluded the session and informed that the suggested points will be implemented and mail the same for approval and requested the experts to approve and ended with Vote of Thanks.

HEAD OF THE DEPARTMENT
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Estd : 2007

(Annexure -1)

AMR-25

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PAVEMENT MATERIALS AND CHARACTERIZATION

UNIT I:

Introduction to Pavement Systems and Materials: Overview of pavement types: Flexible, Rigid, Composite, Functional requirements of pavement materials, Material components: aggregates, bitumen, cement, additives. Influence of climate, traffic loading, and subgrade on material selection. Historical evolution and current trends in pavement design.

UNIT II:

Characterization of Aggregates: Aggregate classification and properties (gradation, shape, angularity). Physical tests: Specific gravity, water absorption, impact and crushing value. Durability and soundness assessments as per IS, ASTM standards, Specifications of aggregates and gradations as per MoRTH specifications for different types of pavement layers Superpave tests on aggregates, Influence of aggregate characteristics on pavement performance.

UNIT III:

Bituminous Material Properties and Testing: Types of bituminous binders, modified binders: polymer-modified, crumb rubber modified, Bituminous emulsions and types, Tests on binders- penetration, ductility, viscosity, softening point tests as per IS and ASTM, Specifications of binders as per BIS code, Rheological properties of binder: Dynamic Shear Rheometer (DSR), Bending Beam Rheometer (BBR). Bitumen behaviour under temperature and loading variations.

UNIT IV:

Characterization of Cement and Concrete for Rigid Pavements: Cement types and hydration chemistry. Concrete mix design for pavements (MORTH and IRC guidelines). Properties: compressive strength, flexural strength, workability. Durability aspects: shrinkage, scaling, alkali-silica reaction. NDT techniques: rebound hammer, ultrasonic pulse velocity.

UNIT V:

Pavement Materials Evaluation and Performance-Based Characterization: Lab-based performance evaluation of mixes: Marshall Stability, Superpave. Field performance indicators: rutting, cracking, skid resistance. Surface characterization using sensors and remote sensing (thermal/microwave). Use of FWD

(Falling Weight Deflectometer), GPR (Ground Penetrating Radar). Material selection for sustainability and climate resilience.

Textbooks:

1. A.T. Papagiannakis & E.A. Masad ,2008, Pavement Design and Materials, John Wiley & Sons Inc; 1st edition. IS
2. Nick Tom, 2008. Principles of Pavement Engineering, Thomas Telford Ltd Publications, 1st edition Relevant and ASTM codes, Superpave
3. Specifications for Road works and Bridges, 2013, MoRTH 5th edition, New Delhi

References:.

1. Dar-Hao Chen & Cindy Estakhri, 2009, Material, Design, Construction, Maintenance, and Testing of ASCE Publisher, 2nd edition
2. S.K. Khanna & C.E.G. Justo, 2013, Highway Engineering, Nemchand Bros, 10th edition

(Annexure -2)

AMR-25

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TRAFFIC ENGINEERING AND MANAGEMENT

UNIT I:

TRAFFIC PLANNING AND CHARACTERISTICS: Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town, country, regional and all urban infrastructure – Towards Sustainable approach. – land use & transport and modal integration.

UNIT II:

TRAFFIC SURVEYS: Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including nonmotorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking Survey – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT III:

TRAFFIC DESIGN AND VISUAL AIDS: Intersection Design – channelization, Rotary intersection design – Signal design – Coordination of signals — Grade separation – Traffic signs including VMS and road markings – Significant roles of traffic control personnel – Networking pedestrian facilities & cycle tracks.

UNIT IV:

TRAFFIC SAFETY AND ENVIRONMENT: Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT V:

TRAFFIC MANAGEMENT: Area Traffic Management System – Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods- Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

Textbooks:

1. Kadiyali. L.R, 2013, Traffic Engineering and Transport Planning, Khanna Publishers, Delhi.
2. Garber and Hoel, 2010, Principles of Traffic and Highway Engineering, CENGAGE Learning, New Delhi
3. Salter. R.I and Hounsell N.B, 1996, Highway Traffic Analysis and design, Macmillan Press Ltd.

References:

1. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, 2011, Principles of Highway Engineering Traffic Analysis, Wiley India Pvt. Ltd., New Delhi
2. Indian Roads Congress (IRC) 75-2015 Guidelines for Traffic Management in Urban Areas
3. Taylor MAP and Young W, 1998, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company.

(Annexure -3)

AMR-25

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URBAN TRANSPORTATION SYSTEMS PLANNING

UNIT I:

URBANIZATION: Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning.

UNIT II:

URBAN MASS TRANSPORTATION SYSTEMS: Urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

UNIT III:

LAND USE PLANNING METHODS: Land use and transportation interaction. The transportation study area definition; division into traffic zones; network identification and coding; types of trips, characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks.

UNIT IV:

TRAVEL DEMAND MODELING: Trip generation-zonal regression and category analysis, Trip distribution-growth factor models, gravity model, opportunity models, Desire line diagram. Modal split analysis-trip end models, trip interchange models, logit models, Trip assignment techniques-route choice, diversion curves, shortest path algorithms, all- or-nothing assignment, capacity restraint models and Direct demand models.

UNIT V:

MASS TRANSIT SYSTEMS: Introduction to routing and scheduling, transit system's performance parameters. Corridor identification and corridor screen line analysis. Urban forms and structures: point, linear, radial, poly-nuclear developments and suitable transit systems, Urban goods movement. Preparation of comprehensive plan and transportation system management planning.

Textbooks:

1. CS Papacostas, 2015. Transportation Engineering and Planning, Pearson Publishers, 3rd edition
2. Michael D Meyer and Eric J Miller, 2001. Urban Transportation Planning, Mc Graw Hill, 2nd edition

References:

1. Konstadinos G. Goulias, 2002, "Transportation Systems Planning: Methods and Applications", CRC Press, Boca Raton
2. Edward K.Morlok, 1978, "Introduction to Transportation Engineering and Planning" McGraw-Hill College

(Annexure -4)

AMR-25

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GROUND IMPROVEMENT TECHNIQUES

UNIT I:

INTRODUCTION – Need for Engineering Ground – Classifications of Ground Modification Techniques – Suitability, Feasibility and Desirability. Densification of cohesionless soils – deep Compaction – Vibroflobation – Vibro Composer method Blasting – Densification at Ground. - Vibrocompaction - Heavy Tamping, Stability of foundation trenches and surrounding structures through soil Nailing.

UNIT II:

STABILIZATION- Mechanical Stabilization, Lime Stabilization, Cement Stabilization, Bitumen Stabilization, Thermal Stabilization and Chemical Stabilization.

UNIT III:

DEWATERING AND GROUTING: - Dewatering methods – open sumps and ditches – gravity flow wells – Vacuum dewatering – Electro – kinetic dewatering – electroosmosis - Overview of grouting - Suspension grouts – Solution grouts – Methods of grouting – Grouting applications– Dams, Tunnels, Shafts and drifts, excavations.

UNIT IV:

IMPROVEMENT OF COHESIVE SOILS – Preloading Soil Replacement – Radial Consolidation – Vertical and Radial Consolidation - Vertical Drains – Sand Drains – Effect of Smear – Sand wicks – Band drains – Dynamic Compaction.

UNIT V:

STONE COLUMNS – Methods of installation of Stone Columns – Load shared by stone columns and the stabilized ground – uses of stone columns Lime columns and granular trenches – Installation – Improvements expected on Soil behavior. In situ ground reinforcement– ground anchors – types – Components and applications – uplift capability.

Textbooks:

1. Robert M. Koerner, 1988, Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Book Co, 2nd edition.
2. P. Purushothama Raj, 2005, Ground Improvement Techniques, Laxmi Publications (P) Ltd., New Delhi.

References:

1. Joseph E. Bowles, 2001, Foundation Analysis and Design, McGraw-Hill, 5th edition

(Annexure -5)

AMR-25

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GIS FOR TRANSPORTATION

UNIT I:

INTRODUCTION TO GIS AND TRANSPORTATION SYSTEMS, GIS over view, use of GIS in decision making, Data processing, Components of GIS, The GIS and the organization.

UNIT II:

GIS DATA INPUT AND OUTPUT: Data input - Key board entry, Remotely and sensed data, existing digital data, census related data sets, Data output - Hard copy and soft, copy devices.

UNIT III:

DATA QUALITY AND DATA MANAGEMENT: Components of data quality - Micro level, Macro level components, Sources of error, A note about data accuracy. The data base approach, 3 classic data models, Nature of geographic data, Spatial data models, Databases for GIS.

UNIT IV:

GIS ANALYSIS, FUNCTIONS AND IMPLEMENTATION: Organizing geographic data for analysis, Maintenance and analysis of the spatial data and non-spatial attribute data and its integration output formatting. Awareness, Developing system requirements, Evaluation of alternative systems, System justification and Development of an implementation plan, System acquisition and start up, Operation of the system.

UNIT V:

APPLICATION OF GIS IN TRANSPORTATION ENGINEERING : Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning. GIS applications in environment impact assessment, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation.

Textbooks:

1. Harvey J. Miller (Author), Shih-Lung Shaw ,2001, Geographic Information Systems for Transportation: Principles and Applications, Oxford University, 3rd edition
2. Paul A. Longley, 2015, Geographic Information Science and Systems, Wiley Publications, 4th edition

References:

1. John Stillwell, Graham Clarke, 2019, Applied GIS and Spatial Analysis, Wiley Publications, 1st edition

(Annexure -6)

AMR-25

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PAVEMENT MATERIALS LAB

Experiments:

1. Aggregate: Gradation Analysis, Specific Gravity, Absorption of Aggregates, Los Angeles Abrasion Test, Sand Equivalent Test on fine aggregates
2. Tests on Bitumen binders: Penetration Test, Ductility test, Softening Point Test, Viscosity Test of Bitumen, Flash and Fire point test,
3. Tests on modified binders: Elastic Recovery, Separation Test, Ductility Test
4. Test on soils: Compaction Test (Proctor and Modified), California Bearing Ratio (CBR) Test,
5. Test on subgrade and GSB pavement materials (lab and field test): Dynamic Cone Penetrometer (DCP) test
6. Development of Correlation between CBR of soil and DCP value of soil

References:

1. Rao, G.V. Ramachandra Rao, K, Pahari, K. and Bhavanna Rao, D.V. 2019 Highway Material Testing and Quality Control, Dreamtech Press. 2nd edition
2. Khanna, S.K., Justo, CEG, Veeraragavan, 2013 A. Highway Materials and Pavement Testing, Nem Chand Bros. 5th edition
3. IS:73(2013) Specifications for PAVING BITUMEN, Fourth Revision, New Delhi
4. IS:15462, 2004, Specifications for Polymer and Rubber Modified Bitumen, New Delhi
5. Specifications for Road works and Bridges, 2013, MoRTH 5th edition, New Delhi

(Annexure -7)

AMR-25

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TRAFFIC ENGINEERING LAB

Experiments:

1. Roadway Geometric Design Evaluation
2. Traffic Volume Count- Vehicle classification, Peak hour factors
3. Speed Measurement- Speed limit adherence, spot speed
4. Intersection Capacity Analysis- Lane utilization , Capacity 1
5. Develop traffic signal times for intersection – Using IRC and Webster method
6. Pedestrian Crossing Behavior Study- Volume and safety 2
7. Traffic Flow Characteristics – traffic flow, including density, speed, and flow rate
8. Level of Service (LOS) Analysis
9. Traffic Control Device Effectiveness
10. Public Transport Usage Study
11. Traffic queue study
12. Delay studies

References:

1. Murthy, A.N. and Mohle, H.R., 2001. Transportation Engineering Basics (2nd edition). American Society of Civil Engineers.
2. Jamar Technologies Manuals, 2022, Traffic Engineering II, 3rd edition

(Annexure -8)

AMR-25

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ANALYSIS AND DESIGN OF PAVEMENT

UNIT I:

PAVEMENT TYPES- Introduction, Wheel Loads and Design Factors Definition of Pavement Types, Comparison of Highway pavements, Wheel Loads, Tyre pressure, Contact pressure, Design Factors: Traffic and Loading, Environment, Materials, Failure criteria, Reliability.

UNIT II:

STRESSES IN PAVEMENTS, Layered System Concepts: One Layer System: Boussinesq Theory. Two Layer Theory: Burmister's Theory. Three Layer System. Stresses in Rigid Pavements. Relative Stiffness of Slabs, Modulus of Subgrade Reaction, Stresses due to Warping, Stresses due to Friction, Stresses due to Load, IRC Recommendations.

UNIT III:

PAVEMENT DESIGN IRC Method of Flexible Pavement Design (IRC:37-2018), AASHTO Method of Flexible Pavement Design, IRC Method for Rigid Pavements(IRC:58-2015), use of Geosynthetics in pavements.

UNIT IV:

PAVEMENT INVENTORIES: Serviceability Concepts, Visual Rating, Pavement Serviceability Index, Roughness, Measurements, Measurement of Distress Modes Cracking, Rutting, Rebound Deflection, using Benkleman Beam Deflection Method, Load Man Concept, Skid Resistance Measurement.

UNIT V:

PAVEMENT EVALUATION- Functional Pavement Performance Evaluation: AASHTO Method, Psycho Physical and Psycho Metric Scaling Techniques, Deduct Value Method.Beam Deflection Method, Pavement Distress Rating Technique. Design of Overlays by Benkelmen Beam Deflection Methods as per IRC – 81 - 1997 – pavements on problematic soils

Textbooks:

1. Yang, H. Huang, 2001 "Pavement Analysis and Design", Prentice Hall Publication, Englewood Cliffs, New Jersy. 2nd
2. Yoder and Witzorack, 1978, "Principles of Pavement Design", John Willey and Sons.

References: edition

1. IRC:37-2018, IRC:58-2015, IRC:81-1997 guidelines, Indian Roads Congress (IRC), New Delhi

(Annexure -9)

AMR-25

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PROBABILITY AND STATISTICS FOR TRANSPORTATION ENGINEERING

UNIT 1:

INTRODUCTION TO PROBABILITY: Fundamental concepts of probability and its applications in transportation. Basic definitions and concepts (sample space, events, probability). Rules of probability (addition and multiplication rules). Conditional probability and Bayes' theorem Applications of probability in transportation scenarios (e.g., traffic flow, accident analysis) Activities

UNIT 2:

RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS- Definition of random variables (discrete and continuous). Common probability distributions (Binomial, Poisson, Normal, Exponential). Properties of distributions (mean, variance, standard deviation). Applications of probability distributions in transportation (e.g., vehicle arrivals, travel times).

UNIT 3:

STATISTICAL INFERENCE- Concepts of population, sample, and sampling distributions Point estimation and interval estimation Hypothesis testing (null and alternative hypotheses, Type I and Type II errors) Applications of statistical inference in transportation data analysis (e.g., traffic counts, survey data).

UNIT 4:

REGRESSION ANALYSIS AND MODELING- Simple linear regression and multiple regression analysis Assumptions of regression models and diagnostics Model selection and validation techniques Applications of regression analysis in transportation (e.g., predicting traffic volumes, travel demand forecasting)

UNIT 5:

QUEUING THEORY AND SIMULATION- Introduction to queuing theory concepts (arrival rates, service rates, queue discipline) Common queuing models (M/M/1, M/M/c, M/G/1) Simulation techniques for analyzing transportation systems Applications of queuing theory in traffic flow, public transport, and service facilities.

Textbooks:

1. Douglas C. Montgomery and George C. Runger, 2021, Applied Statistics and Probability for Engineers Wiley Publication, 2nd edition
2. Anthony J. Hayter, 2012, Probability and Statistics for Engineers and Scientists, Duxbury Press, **3rd edition**

References:

1. David A. Hensher and Kenneth J. Button, 2000, Handbook of Transport Modeling, Pergamon, 3rd edition

(Annexure -10)

AMR-25

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ROAD SAFETY ENGINEERING AND MANAGEMENT

UNIT I:

INTRODUCTION TO SAFETY: Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

UNIT II:

STATISTICAL INTERPRETATION AND ANALYSIS OF CRASH -Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

UNIT III:

ROAD SAFETY AUDITS: Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

UNIT IV:

CRASH RECONSTRUCTION: Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies. Mitigation measures, Road safety law.

UNIT V:

ROAD SAFETY MANAGEMENT AND POLICY: Road safety management systems (RSMS) Development and implementation of road safety policies Role of enforcement in road safety (traffic laws, penalties) Public awareness campaigns and education programs. Intelligent Transportation Systems (ITS) and their applications. Role of data analytics and machine learning in predicting road safety issues. Autonomous vehicles and their impact on road safety. Future trends in road safety engineering and management

Textbooks:

1. Athelstan Popkess, 1997 (Digitized 2008).Traffic Control and Road Accident Prevention, Chapman and Hall,
2. Ezra Hauer, 1997 (reprinted 2002).Observational Before-After Studies in Road Safety, Pergamon Press.

References:

1. IRC: SP- 88 ,2010, Manual on Road Safety Audit, Indian Roads Congress (IRC), New Delhi.

(Annexure -11)

AMR-25

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ENVIRONMENTAL IMPACT ASSESSMENT FOR TRANSPORTATION INFRASTRUCTURE

UNIT 1:

INTRODUCTION: Environment and its interaction with human activities – Environmental imbalances ¬Attributes, Impacts, 'Indicators and Measurements - Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitation. Importance of EIA in transportation planning and decision-making.

UNIT II:

ENVIRONMENTAL INDICATORS - Indicators for climate - Indicators for terrestrial subsystems Indicators for aquatic subsystems - Selection of indicators - Socia-economic indicators – Basic information - Indicators for economy - Social indicators - Indicators for health and nutrition - Cultural indicators - Selection of indicators.

UNIT III:

ENVIRONMENTAL IMPACTS IN TRANSPORTATION- Potential environmental impacts associated with transportation infrastructure projects. Assessment of impacts on air quality, noise, and vibration. Effects on water resources and aquatic ecosystems. Impacts on terrestrial ecosystems and biodiversity. Socio-economic impacts and community considerations

UNIT IV:

MITIGATION MEASURES AND ENVIRONMENTAL MANAGEMENT PLANS- Identification of mitigation measures for various environmental impacts. Development of Environmental Management Plans (EMPs). Monitoring and evaluation of environmental impacts post-implementation. Role of adaptive management in transportation projects

UNIT V:

EMERGING TRENDS AND CHALLENGES IN EIA FOR TRANSPORTATION- Integration of sustainability principles in EIA Climate change considerations in transportation projects. Technological advancements in EIA (e.g., remote sensing, big data). Challenges in EIA implementation and compliance

Textbooks:

1. Peter Wathern, 2013, Environmental Impact Assessment: Theory and Practice, Routledge Press, 5th edition
2. Charles H. Eccleston, 2013, Environmental Impact Assessment: A Guide to Best Professional Practices, CRC Press, 3rd edition

References:

1. Jain, R.K., Urban, L.V., Stracy, G.S., 1991, Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 5th edition

(Annexure -12)

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PAVEMENT EVALUATION AND MAINTENANCE

UNIT I:

INTRODUCTION: Definition -Components of Pavement Management Systems, Essential features. Pavement Management Levels and functions: Ideal PMS- Network and Project levels of PMS Influence Levels- PMS Functions- Function of Pavement evaluation.

UNIT II:

PAVEMENT PERFORMANCE: Serviceability Concepts- roughness-Roughness Components Equipment-IRI - modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models.

UNIT III:

PAVEMENT EVALUATION: Functional Evaluation: Functional and Structural deterioration models, unevenness prediction models and other models, comparison. Case studies. Equipment's Structural Evaluation:- Basics- NDT and Analysis—Condition Surveys-Distress Destructive Structural Analysis-Application in Network and Project Levels

UNIT IV:

DESIGN ALTERNATIVES, Rehabilitation and Maintenance: Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, life cycle costing, analysis of alternate pavement strategies based on distress and performance, case studies. Equipment Identification of Alternatives-Deterioration Modeling- Priority Programming Methods.

UNIT V:

EXPERT SYSTEMS AND PAVEMENT MANAGEMENT: Role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems, case studies.

Textbooks:

1. Ralph Haas and Ronald W. Hudson, 1982, Pavement Management System, McGraw Hill Book Co. 2nd edition.
2. Ralph Haas, Ronald Hudson Zanieswki. 1994, Modern Pavement Management, Kreiger Publications 2nd edition

References:

1. Proceedings of North American Conference on Managing Pavement, 1985, AASHTO proceedings

(Annexure -13)

AMR-25

L	T	P	C
3	0	0	3

PAVEMENT EVALUATION LAB

EXPERIMENTS LIST:

1. Bituminous Mix Design by Marshall Method for finding out optimum binder content
2. Tensile strength Ratio (TSR) and Indirect Tensile Strength (ITS) Test on bituminous mixes
3. Road Roughness by MERLIN device
4. Core collection of bituminous mixes from pavement (field) and extraction of bitumen and aggregate gradation from field cores
5. Studies on wheel wandering (lateral placement) of vehicles
6. Benkelman Beam Deflection studies for measurement of rebound deflection of existing pavements and calculation of overlay thickness of existing pavement

References:

1. MS-2 Asphalt Mix Design Methods, 2017, Asphalt Institute Publisher, USA, 7th edition
2. ASTM D6927-15 Standard Test Method for Marshall Stability and Flow of Asphalt Mixtures
3. Khanna, S.K., Justo, CEG, Veeraragavan, 2013 A. Highway Materials and Pavement Testing, 2013, Nem Chand Bros. 10th edition

(Annexure -14)

AMR-25

L	T	P	C
3	0	0	3

TRANSPORTATION STUDIO LAB

Experiment List:

1. Traffic Volume and Flow Analysis
2. Speed Measurement and Analysis
3. Intersection Design and Analysis
4. Traffic Signal Timing Optimization
5. Pedestrian Behaviour Study
6. Public Transport Accessibility Assessment
7. Road Safety Audit
8. Travel Demand Forecasting
9. GIS for Transportation planning (network allocation, Optimized route)
10. Queue analysis for a busy Intersection.
11. Simulation of Traffic
12. Environmental Impact Assessment of Transportation Projects
13. Smart City using transportation
14. Accident analysis and IoT applications for safety

References:

1. National Highway Authority of India Publications (MORTH)
2. Transportation Research Board (TRB) Publications & Reports 1 2
3. American Association of State Highway and Transportation Officials (AASHTO) Resources