

ACADEMIC REGULATIONS & COURSE STRUCTURE

For

TRANSPORTATION ENGINEERING

(Applicable for batches admitted from 2016-2017)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA
KAKINADA - 533 003, Andhra Pradesh, India

I Semester

S. No.	Subject	L	P	Credits
1	Advanced Mathematics	4	-	3
2	Pavement Analysis Design and Evaluation	4	-	3
3	Traffic Engineering	4	-	3
4	Urban Transportation Program	4	-	3
5	Elective – I I. Bridge Engineering II. Project Management	4	-	3
6	Elective – II I. GIS for Transportation II. Pavement Management System	4	-	3
7	Transportation Engineering Lab – I	-	3	2
Total Credits				20

II Semester

S. No.	Subject	L	P	Credits
1	Transportation Economics and Project Appraisal	4	-	3
2	Traffic Flow Analysis	4	-	3
3	Land Use and Regional Transportation Planning		-	3
4	Transportation Systems Management	4	-	3
5	Elective – III I. Pavement Construction and Evaluation II. Environmental Impact Assessment	4	-	3
6	Elective – IV I. Intelligent Transportation Systems II. Ground Improvement Techniques	4	-	3
7	Transportation Engineering Lab – II	-	3	2
Total Credits				20

III Semester

S. No.	Subject	L	P	Credits
1	Comprehensive Viva-Voce	--	--	2
2	Seminar – I	--	--	2
3	Project Work Part – I	--	--	16
Total Credits				20

IV Semester

S. No.	Subject	L	P	Credits
1	Seminar – II	--	--	2
2	Project Work Part - II	--	--	18
Total Credits				20

I Year I Semester	ADVANCED MATHEMATICS	L	P	C
		4	0	3

Common for M.Tech.
(Structural Engineering, Soil Mechanics & Foundation Engineering,
Geotechnical Engineering and Transportation Engineering)

UNIT-I

Applied partial Differential Equations: One-dimensional Heat equation Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry). Two-dimensional Laplace Equation in Cartesian, cylindrical and spherical coordinates (problems having axi-symmetry) – Analytical solution by separation of variables technique.

UNIT-II

Numerical solutions to Heat and Laplace Equations in Cartesian coordinates using finite – differences. Implicit methods, Crank NicholSEN Method, Jacobi Method, Gauss Seidal method.

UNIT-III

Applied Statistics: Regression and correlation analysis – Method of Least squares – Curve fitting – Curvilinear Regression – Non-linear curves – correlation coefficient – Correlation of grouped bi-variate data – coefficient of determination Multiple Regression – partial Regression coefficients.

UNIT-IV

Tests of significance – Analysis of variance for regression – Multiple correlation coefficients – Multiple linear regression with two independent variables.

UNIT-V

Linear Programming Problem Formation, Graphical Method, Simplex method, artificial variable method-Big-M method-Two Phase Method. Non Linear Programming Problem Gradient method, Steepest Ascent Descent Methods.

TEXT BOOKS

1. Solutions of Partial Differential Equations” – Duffy, D.G. CBS Publishers, 1988
2. Introductory Methods of Numerical Analysis – Sastry, S.S. Prentice-Hall, 2nd Edition, 1992
3. Basic Statistics – Agarval, B.L., Wiley 1991, 2nd edition.
4. Operations Research – Hamdy A, Taha.
5. Optimization Techniques.- S.S.Rao.

I Year I Semester	PAVEMENT ANALYSIS, DESIGN AND EVALUATION	L	P	C
		4	0	3

UNIT -I

Pavement Types, 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, AASHTO Method of Flexible Pavement Design, IRC Method for Rigid Pavements, 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.

~~Structural Conditional Evaluation Technique: Benkelman~~ Beam Deflection Method, Pavement Distress Rating Technique. Design of Overlays by Benkelmen Beam Deflection Methods as per IRC – 81 - 1997 – pavements on problematic soils.

REFERENCES:

1. Yoder and Witzorack, "Principles of Pavement Design", John Willey and Sons.
2. Yang, H. Huang, "Pavement Analysis and Design", Prentice Hall Publication, Englewood Cliffs, New Jersey.
3. Sargious, M.A. Pavements and Surfacing for Highways and Airports
– Applied science Publishers limited

4. Ralphs Hass and Hudson, W.R. " Pavement Management System" Mc-Graw Hill Book Company.
5. IRC codes of practice.

I Year I Semester	TRAFFIC ENGINEERING	L	P	C
		4	0	3

UNIT-I

Traffic Characteristics Measurement And Analysis: Basic traffic Characteristics - Speed, Volume and Concentration. Relationship between Flow, Speed and Concentration. Traffic Measurement and Analysis - Volume Studies - Objectives, Methods; Speed studies – Objectives, Definition of Spot Speed, time mean speed and space mean speed; Methods of conducting speed studies; Presentation of speed study data; Head ways and Gaps; Critical Gap; Gap acceptance studies.

UNIT-II

Highway Capacity And Level Of Service: Basic definitions related to capacity; Level of service concept; Factors affecting capacity and level of service; Computation of capacity and level of service for two lane highways, Multilane highways and free ways.

UNIT-III

Parking Analysis And Traffic Safety : Types of parking facilities – On-street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume. Traffic Safety -Accident studies and analysis; Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.

UNIT-IV

Traffic Control, Regulation Signal Coordination: Traffic Signals – Types of Signals; Principles of Phasing; Timing Diagram; Design of Isolated Traffic Signal by Webster method, Warrants for signalization. Signal Coordination - Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems.

UNIT-V

Traffic And Environment: Detrimental effects of Traffic on Environment, Air pollution; Noise Pollution; Measures to curtail environmental degradation due to traffic.

REFERENCES:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
2. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.
3. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication.

4. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication
5. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
6. I.T.E. Traffic Engineering Hand Book.

I Year I Semester	URBAN TRANSPORTATION PLANNING	L	P	C
		4	0	3

UNIT-I

Urban Transportation Problem Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand

– Systems approach. Travel Demand: Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT-II

Data Collection And Inventories: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT-III

Four Stage Demand Forecasting : UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates. Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.

UNIT-IV

Mode Choice and Traffic Assignment : Mode Choice Behaviour, Competing Modes, Mode Split Curves, Models and Probabilistic Approaches. Traffic Assignment: Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment, Diversion Curves.

UNIT-V

Plan Preparation And Evaluation: Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis.

REFERENCES:

1. Introduction to Transportation Planning – M.J.Bruton; Hutchinson of London Ltd.
2. Introduction to Urban System Planning - B.G.Hutchinson; Mc Graw Hill.
3. Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers
4. Lecture notes on UTP - Prof. S. Raghavachari , R.E.C.Warangal.

I Year I Semester	L	P	C
	4	0	3

**BRIDGE ENGINEERING
(ELECTIVE-1)**

UNIT-I

Masonry arch Bridge design details- Rise, radius, and thickness of arch- Arch ring- Dimensioning of sub structures- Abutments pier and end connections.(Ref: IRC- SP-13)

UNIT-II

Super Structure: Slab bridge- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Pigeaud's method- design of longitudinal girders- Guyon-Messonet method- Hendry Jaegar method- Courbon's theory. (Ref: IRC-21), voided slabs, T-Beam bridges.

UNIT-III

Plate girder bridges- Elements of plate girder and their design-web-flange- intermediate stiffener- vertical stiffeners- bearing stiffener-design problem

UNIT-IV

Composite bridges- Composite action- shear connectors- composite or transformed section- design problem. (Ref: IRC:Section-VI)

UNIT-V

Sub structure- Abutments- Stability analysis of abutments- piers- loads on piers – Analysis of piers- Design problem(Ref: IRC-13, IRC-21, IRC-78)- Pipe culvert- Flow pattern in pipe culvers- culvert alignment- culvert entrance structure- Hydraulic design and structural design of pipe culverts- reinforcements in pipes .(Ref: IRC: SP-13)

REFERENCES:

- 1.Design of concrete bridges- Aswini, Vazirani, Ratwani
- 2.Essentials of bridge engineering- Jhonson Victor D
- 3.Design of bridges- Krishna Raju

PROJECT MANAGEMENT (ELECTIVE – I)

UNIT-I

Introduction to Project Management: A systems Approach, Systems Theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques, Project Management – Processes and Organisational Structures – Team Management – Project Manager as a Team Leader – Leadership Qualities, PMIS.

UNIT-II

Construction Cost and Value Engineering: Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimisation and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.

UNIT-III

Contract Management Safety in Construction Industry : Tendering and Contracting, Laws of Contracts, subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts. Quality Management and Safety in Construction Industry - Quality control by statistical methods, sampling plan, control charts, ISO 14000, Safety Measures, Safety Programmes, Safety Awareness and Implementation of Safety Plan – Compensation.

UNIT-IV

Project Scheduling and Analysis Methods : CPM, PERT, Linear programming, queuing concept, simulation, bidding models, game theory.

UNIT-V

Human Resource Management and Construction Management Practices : Man Power Planning – Training – Motivation – Industrial Relations – Welfare Measures – MIS – Components and Structure – Personal Management. Resource Management and Inventory - Basic concepts, labour requirements & productivity, non-productive activities, site productivity, equipment and material management, inventory control. Construction Management Practices - Implementation of Procedures and Practices – International Experiences
– Case Studies – Examples.

REFERENCES:

1. Herold Kerzner - Project Management - A systems approach to Planning, Scheduling and Controlling. CBS Publishers and Distributors.
2. K.Waker A Teraih and Jose M.Grevarn; Fundamentals of Construction Management and

Organisations.

3. Anghel Patterson - Construction Cost Engineering Handbook - Marcel Dekken Inc.
4. Dell Isola - Value Engineering in Construction Industry, Van Nostrand Reinhold Co.,
5. Choudhary, S. Project Management, Tata McGraw Hill Publishing Co., Ltd.,
6. Raina UK, Construction management Practices, Tata Mc Grawhill Publishing Company Ltd.
7. Sengupta B and Guha H, Construction Management and Planning, Tata McGraw-Hill Publishing Company Limited, New Delhi.

I Year I Semester		L	P	C
		4	0	3

**GIS FOR TRANSPORTATION
(ELECTIVE – II)**

UNIT-I

Introduction to GIS: Introduction, GIS over view, use of GIS in decision making, Data processing, Components of GIS, The GIS and the organization.

UNIT-II

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.

REFERENCES:

GIS A Management, Perspenfi Stan Aronoff, WDL Publisher.

PAVEMENT MANAGEMENT SYSTEMS (ELECTIVE – II)

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. Equipments

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. Equipments. 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.

TEXT BOOKS:

1. Ralph Haas and Ronald W. Hudson, '**Pavement Management System**', McGraw Hill Book Co. 1978
2. Ralph Haas, Ronald Hudson Zanieswki. '**Modern Pavement Management**, Kreiger Publications.
3. Proceedings of North American Conference on **Managing Pavement** .
4. Proceedings of International Conference on **Structural Design of Asphalt Pavements** NCHRP, TRR and TRB Special Reports

I Year I Semester	TRANSPORTATION ENGINEERING LAB – I	L	P	C
		0	3	2

1. Tests on Pavement Materials
2. Tests on bitumen, soil and aggregates, aggregate blending, viscosity of binders, bituminous mix design, viscoelastic properties of bituminous mixtures,
3. Tests on modified binders, Soil stabilization
4. Test for Pavement Evaluation
5. Benkelman Beam tests, Roughness survey of roads, Pavement evaluation using DCP.

I Year II Semester	TRANSPORTATION ECONOMICS AND PROJECT APPRAISAL	L	P	C
		4	0	3

UNIT-I

TRANSPORT ECONOMICS AND ANALYSIS: Review of Engineering Economics and Microeconomics, Welfare Theory and Equilibrium Conditions, Goals and Objectives, Principles of Economic Analysis. Discounted Cash Flows: Analysis of User Costs and Benefits, RUCS Models for Costs and Benefits, Methods of Economic Analysis; Suitability, Analysis for Null Alternative

UNIT-II

INVESTMENT POLICIES AND PRICING: Average Cost, Marginal Cost, Allocation of Resources within Transport Sectors, Financing of Transport Sectors, Transport Investment Policies - Pricing Policies. Issues in transport policy: Budgeting, Non-user Impact Analysis, Analysis of Related Endeavour, Monitoring and Continuous Evaluation Strategies, Case Studies.

UNIT-III

SYSTEM SELECTION, EVALUATION AND COST ANALYSIS: Framework of Evaluation, Transport Planning Evaluation at Urban and Regional levels, Other Evaluation Procedures - Traditional Economic Analysis, Achievement Matrices, Factor Profiles, Plan Ranking, Introduction to Mathematical Programming, Case Studies. Life cycle cost analysis: Factors consider for Life Cycle Cost Analysis; Data requirements for highway project feasibility analysis, establishment of Technical/ Economic/ Financial feasibility of a highway project, Social Benefits, Role of HDM in feasibility studies.

UNIT-IV

PROJECT APPRAISAL - PRIVATE SECTOR PARTICIPATION: BOT, BOOT, BOLT Projects - Case history - Project Planning - Project System Management - Project Implementation - Funds Planning - Budgetary

and Control - Tendering and Contract - Value Analysis, Information System - Impact assessment, Project Report Preparation.

UNIT-I

TQM IN HIGHWAY PROJECTS: Need for TQM, TQM Principles, Phases in TQM - Conceptual stage to Operations stage, TQM in Traffic & Transportation projects, Case Studies.

REFERENCES:

1. Highway investment in Developing countries - Thomas Telford Ltd., Institute of Civil

Engineers

2. Winfrey R, Economic Analysis for Highways - International Text Book Co., Pennsylvania
3. Road User Cost Study - Final Report - Central Road Research Institute, New Delhi
4. Dickey, J.W. - Road Project Appraisal for Developing countries, John Wiley and Sons.
5. Ian Heggie, Transport Engineering Economics, McGraw Hill

I Year II Semester	TRAFFIC FLOW ANALYSIS	L	P	C
		4	0	3

UNIT-I

Traffic Flow Description: Traffic Stream Characteristics and Description Using Distributions: Measurement, Microscopic and Macroscopic Study of Traffic Stream Characteristics - Flow, Speed and Concentration; Use of Counting, Interval and Translated Distributions for Describing Vehicle Arrivals, Headways, Speeds, Gaps and Lags; Fitting of Distributions, Goodness of Fit Tests.

UNIT-II

Traffic Stream Models: Fundamental Equation of Traffic Flow, Speed-Flow-Concentration Relationships, Normalised Relationship, Fluid Flow Analogy Approach, Shock Wave Theory - Flow-Density diagram use in Shockwave analysis; Use of Time-space diagram for shockwave description; Bottleneck situations and shockwaves; traffic signal and shockwave theory; numerical Examples for application of shockwave theory; Platoon Diffusion and Boltzman Like Behaviour of Traffic Flow, Car-Following Theory, Linear and Non-Linear Car-Following Models, Acceleration Noise, Fuel consumption models

UNIT-III

Queuing Analysis: Fundamentals of Queuing Theory, Demand Service Characteristics, Deterministic Queuing Models, Stochastic Queuing Models, Multiple Service Channels, Analysis of M/M/1 system; Assumptions and Derivation of System State Equations; Application of M/M/1 analysis for parking Garages and Toll Plazas- numerical Examples; Analysis of D/D/1 system for delay characteristics; Traffic Signal analysis as D/D/1 system; Computation of delays and queue dissipation Time – Numerical Examples.

UNIT-IV

Pedestrian Delays And Gaps: Pedestrian Gap acceptance and delays; Concept of Blocks, Anti-blocks, Gaps and Non-Gaps; Underwood's

analysis for Pedestrian Delays; Warrants for Pedestrian Crossing Facilities – Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant.

UNIT-V

Simulation Models: Philosophy of Simulation Modelling, Formulation of Simulation Model, Methodology of System Simulation, Simulation Languages, Generation of Random Numbers, Generation of Inputs – Vehicle Arrivals, Vehicle Characteristics, Road Geometrics, Design of Computer Simulation Experiments, Analysis of Simulation Data, Formulation of Simulation Problems in Traffic Engineering and Validation.; Basic concepts of simulation modelling application for Signalised Intersections, Pedestrian Crossings and Transit scheduling.

REFERENCES:

1. Traffic Flow Theory: A Monograph , TRB Special Report 165
2. Fundamentals of Transportation Engineering – C.S.Papacostas, Prentice Hall India Publication
3. Principles of Highway Engineering and Traffic Analysis – F.L.Mannering & W.P.Kilareski, John Wiley Publishers.
4. Traffic Flow Fundamentals – A.D.May, , Prentice Hall India Publicatio
5. Fundamentals of Traffic Engineering – McShane & Rogers

I Year II Semester	LAND USE AND REGIONAL TRANSPORTATION PLANNING	L	P	C
		4	0	3

UNIT-I

URBAN REGIONAL DYNAMICS: Population, Urbanization and Migration, Urban Forms and Structures, Sector theory, Urban nodes, Multi nuclei, Concept of Region, Hierarchy of activities, Issues related to Regional Planning, Methods of Delineation Regions, Hierarchy of Regions, Findings of Commission on Urbanization, Introduction to Micro Economic Theories of Land Use, Concepts by Van Thunan, Christaller and Losch.

UNIT-II

LAND USE TRANSPORTATION MODELS: Classification of LUT Models, Economic Base Mechanism, Allocation Mechanism and Spatial Allocation and Employment Relationships, Garin Lowry Models, Contribution by Putman and Wilson, Issues related to Land Use Transport-Interaction, Case Study Examples.

UNIT-III

REGIONAL TRAVEL DEMAND ESTIMATION: Factors affecting Goods and Passenger Flows, Use of Mathematical Models to estimate Freight and Passenger Demand, Abstract Mode Models, Mode Specific Models, Direct Demand Models, IVF Models, IO Model, Case Studies, Truck Terminal Location-Planning.

UNIT-IV

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.

UNIT-V

POLICY FORMULATION AND EVALUATION: Application of Land Use Forms and Structures at Urban and Regional Levels, Use of Multi –objective and Goal Programming Techniques, Small Area Management, Residential Neighbourhood and Structure Planning.

REFERENCES

1. TomasDela Barra, Integrated Land Use and Transporation Modelling, Cambridge University Press.
2. Chari S.R. Land Use Transportation Planning, Lecture Notes, REC Warangal.
3. Baxter et al, Urban Development Models, Construction Press.
4. Wilson, A.G., Regional and Urban Models in Geography and Planning, Pion Press.

5. Blundon WR, Land Use Transport Models, Vol. 2, Pergamon Press.
6. Morlok EK, Introduction to Transportation Engineering and Planning, McGraw Hill Kogekusha Ltd.

I Year II Semester	TRANSPORTATION SYSTEM MANAGEMENT	L	P	C
		4	0	3

UNIT-I

TRAFFIC REGULATIONS: Purpose and Scope, One way streets; reversible lanes and road ways; Turn regulations, Transit and Carpool lanes, Bicycle lanes and Bikeways, Pedestrian only streets, Speed Regulations, Passing and No Passing Regulations; Stop and yield controls.

UNIT-II

TRAFFIC MANAGEMENT: Need for Traffic Management, Basic Traffic Management Activities, Traffic Management Strategies and their Co-ordination; Access Management, Congestion Management, Traffic Calming, Evaluation of Traffic Management Systems.

UNIT-III

TRANSPORTATION SYSTEM MANAGEMENT: Objectives, Need for TSM Long – Range vs. TSM Planning; TSM Actions, Traffic Management Techniques for improving Vehicular Flows, Preferential Treatment for High Occupancy Modes; Promoting Non- Auto and High Occupancy Vehicles; Transit and Intermediate public Transport service improvements, Demand Management Techniques for Reduced Intermediate Public Transport service improvements, Demand Management Techniques for Reduced Traffic Demand, Staggered Working Hours, Vehicular Restrictions, Intersection management techniques- Signal Progression – Optimization.

UNIT-IV

LOCAL AREA TRAFFIC MANAGEMENT: Pedestrian Facilities; Bicycle Facilities; Traffic Planning and Management at Local Level; Individual Sites, Residential Neighbourhoods and local interests, Traffic Effects of Land Use Developments.

UNIT-V

TRAFFIC ADMINISTRATION: Legislative Authority; Functional Responsibilities; Organization-UMTA-State Highway Department; Traffic Records; Research Bodies; Citizen Participation; Asset Management.

REFERENCES:

1. Institution of Transportation Engineers. Traffic Engineering Hand Book, 4th ed., Prentice Hall
2. Transportation System Management ,State of the Art,UMTA,USDOT
3. Khisty CJ and BK Lall, Transportation Engineering: An Introduction Prentice Hall International,Inc
4. Local Area Traffic Management, TRB Special Publications.

I Year II Semester		L	P	C
		4	0	3

**PAVEMENT CONSTRUCTION AND EVALUATION
(ELECTIVE-III)**

UNIT-I

PAVEMENT CONSTRUCTION: Preparation and Construction of Subgrade Soil, Subbase Courses, Base Courses, Bituminous Surface Courses, and Cement Concrete Surface Courses; MORTH specifications, Quality control..

UNIT-II

PAVEMENT INVENTORIES AND EVALUATION: Factors affecting Pavement Deterioration; Functional Condition Evaluation Techniques: Roughness Measurements, Identification of Uniform Sections, Serviceability Concepts: Visual & Ride Rating Techniques, Introduction to Psychometric and Psychophysical Scaling Techniques: Hutchinson's Tracking Task Device Structural Condition Evaluation Techniques: NDT Procedures, Rebound Deflection, Deflection Bowl Measurement and Analysis, Destructive Testing: Remaining Life Concept, Asphaltic Institute's Equivalency Factors

UNIT-III

EVALUATION OF PAVEMENT SAFETY: Importance of Skid Resistance, Factors Affecting Skid Resistance, Skid Resistance Studies, Hydroplaning Reduction with Porous Overlays & Popcorn Friction Overlays; Deterioration Modelling Concepts: Factors Influencing Structural & Functional Condition Deterioration, Examples of Initiation and Progressing Deterioration Models, Use of Deterioration Models by HDM Software

UNIT-IV

PAVEMENT MAINTENANCE & QUALITY CONTROL: Routine, Responsive Maintenance Programmes, Periodic Maintenance, Special Repairs, Rehabilitation and Reconstruction, Objectives & Components of Pavement Maintenance Management System (PMMS), Stages in Implementing PMMS, Total Quality Management (TQM): Quality Assurance/Quality Control Concepts, Sampling, Tolerances and Controls Related to Profile & Compaction, Role of ISO 9000 in TOM.

UNIT-V

PAVEMENT MANAGEMENT SYSTEM (PMS): Phases and Components of System's Approach, Relationship Between System Approach and PMS, Components and Activities of PMS, Inter-relationships between the different components of PMS, Steps in Implementing PMS, Pavement Investment Planning Approaches: Index Ranking, Benefit Maximization & Cost Minimization Methods, Evaluating Alternative Strategies and Decision Criteria Using HDM Package.

REFERENCES:

1. RCC Haas, W. Ronald Hudson, et ai, Modern Pavement Management, Krieger Publishing Company
2. ISTE Summer School Report on PMSS by Bangalore University, ISTE, New Delhi.
3. Mohammed Y. Shahin, Pavement Management for Airports, Roads & Parking Lots, Chapman & Hall Publishers
4. Instructor's Guide-Asphalt Institute, Asphalt Technology and Construction Practices, Educational series
5. AF Stocks, Concrete Pavements, Elsevier Applied Science Publishers, New York
6. Harold N. Atkins, Highway Materials, Soils & Concrete 3rd Edition, Prentice Hall
7. MORTH, GOI, "SpeCifications for Roads & Bridge Works", New Delhi.

ENVIRONMENTAL IMPACT ASSESSMENT (ELECTIVE-III)

UNIT-I

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 Limitations

UNIT-II

Environmental Indicators - Indicators for climate - Indicators for terrestrial subsystems - Indicators for aquatic subsystems - Selection of indicators - Socio-economic indicators - Basic information - Indicators for economy - Social indicators - Indicators for health and nutrition - Cultural indicators - Selection of indicators.

UNIT-III

Environmental issues in water resource development - Land use - Soil erosion and their short and long term effects - Disturbance and long term impacts - Changes in quantity and quality of flow →Sedimentation →Environmental impact assessment of water resource development structures – Case studies, Water Quality Impact Assessment - Attributes, Water Quality, Impact Assessment of Water Resources Projects, Data Requirements of Water Quality Impact Assessment for Dams, Impacts of Dams on Environment, Case Studies.

UNIT-IV

Environmental Issues in Industrial Development: On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Green house effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining and Energy development

UNIT-V

Methodologies for Carrying Environmental Impact Assessment: Overview of Methodologies .Ad hoc,Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing A Methodology, Review Criteria.

REFERENCES:

1. Jain, R.K., Urban, L.V., Stracy, G.S., (1991), “Environmental Impact Analysis”, Van Nostrand Reinhold Co., New York
2. Rau, J.G. and Wooten, D.C., (1996), “Environmental Impact Assessment”, McGraw Hill Pub. Co.,New York
3. UNESCO, (1987), “Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources Development”, UNESCO/UNEP, Paris
4. Canter, L.W., (1997), “Environmental Impact Assessment”, McGraw Hill Pub. Co., New York.

I Year II Semester	L	P	C
	4	0	3

**INTELLIGENT TRANSPORTION SYSTEMS
(ELECTIVE-IV)**

UNIT-I

Fundamentals of ITS: Definition of ITS s, The historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS

UNIT-II

Sensor technologies and Data requirements of ITS: Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection

UNIT-III

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).

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

UNIT-IV

ITS Architecture – Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system

design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning

UNIT-V

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems-

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

REFERENCES:

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel Wadid Sadek
2. Lawrence A. Klein , Sensor technologies and Data requirements of ITS
3. ITS Hand Book 2000: *Recommendations for World Road Association (PIARC)* by Kan Paul Chen, John Miles.
4. Sussman, J. M., *Perspective on ITS*, Artech House Publishers, 2005.
5. National ITS Architecture Documentation, US Department of Transportation, 2007

GROUND IMPROVEMENT TECHNIQUES (ELECTIVE-IV)

UNIT- I

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

UNIT-II

Stabilisation- Mechanical Stabilisation, Lime Stabilisation, CementStabilisation, Bitumen Stabilisation, Thermal Stabilisation and Chemical Stabilisation.

UNIT:-III

Dewatering and Grouting: - Dewatering methods – open sumps and ditches – gravity flow wells – Vacuum dewatering – Electro – kinetic dewatering – electrosmosis - 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 – Sandwicks – 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.

REFERENCE:

1. Construction and Geotechnical Methods in Foundation Engineering By R.M. Koerner, McGraw – Hill Book Co.
2. Current Practices in Geotechnical Engineering Vol.1, Alam Singh and Joshi, International Book Traders, Delhi, & Geo-Environ Academia.
3. Foundation Analysis and Design (1V Ed.) By J.E. Bowles, McGraw – Hill Book Co.,
4. Ground Improvement Techniques by P. Purushotham Raj, Laxmi Publications (P) Ltd., New Delhi.
5. Ground Improvement – Edited by M.P. Moseley, Blackie Academic & Professional.
6. Soil Mechanics for Road Engineers, H.M.S.O, London.
7. Ground Improvement Techniques by Bergado et al.

I Year II Semester	TRANSPORTATION ENGINEERING LAB-II	L	P	C
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1. Volume Studies – Straight Roads and at Intersections
2. Speed Studies - Spot Speed Studies by Stop Watch, Enoscope and Radar Speed Meter
3. Journey Time and Delay Studies - Floating Car Method
4. Parking Surveys and Parking Turnover Studies
5. Study of Gaps and Lags – Critical Gaps and Lags at Intersections
6. Delay Measurement at Signalised and Unsignalised Intersections