ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
M. E. TRANSPORTATION ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
I. To prepare students to excel in research or to succeed in Transportation engineering profession through global, rigorous post graduate education.
II. To enable the students to have a strong analytical and practical knowledge of planning, designing and solving the transportation problems.
IV. To inculcate students in professional, effective communication skills, teamwork skills, ethical and societal responsibility.
V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, continuous learning to harness evolving technologies and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):
On successful completion of the programme,
1. Graduates will demonstrate knowledge of mathematics, science and engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.
3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.
4. Graduate will demonstrate and apply appropriate techniques, resources, and modern engineering tools such as CAD, GIS and ITS including prediction and modeling to complex Transportation Engineering activities with an understanding of the limitations.
5. Graduate will acquire in-depth knowledge of Transportation Engineering, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge.
6. Graduate will analyse complex Transportation Engineering problems critically, apply independent judgement for synthesising information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
10. Graduate will recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

[Signature]
DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025
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|        |       | Elective VI | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|        |       | Practical Training (2 weeks) | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|        |       | Project Work Phase I | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
|        | SEM 2 | Project Work Phase II | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
## ANNA UNIVERSITY, CHENNAI
### UNIVERSITY DEPARTMENTS
### M.E. TRANSPORTATION ENGINEERING
### REGULATIONS – 2015
### CHOICE BASED CREDIT SYSTEM
### CURRICULA AND SYLLABI
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OBJECTIVES:
- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

UNIT I
ONE DIMENSIONAL RANDOM VARIABLES  
Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II
TWO DIMENSIONAL RANDOM VARIABLES  
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III
ESTIMATION THEORY:  

UNIT IV
TESTING OF HYPOTHESES:  
Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V
MULTIVARIATE ANALYSIS:  

TOTAL: 60 PERIODS

OUTCOMES:
- The course aims at providing the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.

TEXTBOOKS:

REFERENCES:
OBJECTIVE:
- To understand the properties and use of various materials and construction
- To study the behaviour of pavements under various loads.
- To design the flexible and rigid pavements using different Empirical, semi-empirical and theoretical approaches
- To understand the concept of Pavement Management System, pavement failures and its evaluation

UNIT I PAVEMENT MATERIALS
Soil in subgrade, subbase and unstabilised base- Basic engineering properties- Soil stabilization-different methods- Use of geosynthetics – Requirements and desirable properties of aggregates-Bituminous binders- emulsion and modified bitumen- Properties, testing and applications- Superpave concept, Bituminous mixes -Design, testing and evaluation-new materials like polymer modified bitumen, geo synthetics- modern materials in pavements.

UNIT II PAVEMENT CONSTRUCTION

UNIT III DESIGN OF FLEXIBLE PAVEMENTS
Factors affecting design and performance - Stresses and deflection in homogenous masses, Burmister’s 2 layer, 3 layer and multi-layer theories, wheel load stresses, ESWL, pavement behavior under transient traffic loads, problems on above.CBR method, principle, advantages and application, testing as per IRC, AASHTO, and asphalt institute, problems on above.

UNIT IV DESIGN OF RIGID PAVEMENTS
Factors affecting design and performance, types of stresses, causes and factors affecting stresses,EWL, Westergaard’s analysis, Bradbury’s coefficient, wheel load stresses, warping-frictional-combined stresses, problems on above. - Types of Joints in Cement Concrete Pavements and their Functions-IRC design chart, design of longitudinal, contraction and expansion joints, and design of slabs.

UNIT V PAVEMENT EVALUATION AND MAINTENANCE
Failures in pavements- methods of measurement of skid resistance, unevenness, ruts and cracks. Pavement surface condition evaluation by physical measurements methods and their application, Calculation of IRI values - devices adopted - Measurement of profile- tolerance standards in quality control- - waves and deformations-Measurements- rebound deflection roughness index- effect of traffic, fuel, chemicals and environmental conditions - Assessing structural strength of highway and airport pavements- Serviceability, structural number and energy concepts- need for conditioning and strengthening -maintenance strategies evaluation by non-destructive tests- Benkelman beam method, overlay design, pavement serviceability concepts, maintenance measures- short term and long term.

TOTAL : 45 PERIODS
OUTCOME:
- The students would have gained knowledge on the Material properties, Design, Evaluation and Management of Pavement Systems.

REFERENCES:
4. Specifications for "Road and Bridge works", Fourth Revision, MoSRT&H (India), 2001.
9. Relevant IRC Codes

TE7102 TRAFFIC ENGINEERING DESIGN AND MANAGEMENT  L T P C  3 0 0 3

OBJECTIVE:
- To be aware of various methods of collecting traffic data.
- To understand the basics of highway planning and design, and workout problems in design of road geometrics.
- Provides a basic understanding on Traffic Engineering – Planning, Design, Operation and Management.

UNIT I TRAFFIC CHARACTERISTICS

UNIT II SURVEYS AND STUDIES IN TRAFFIC ENGINEERING
  Conventional and Modern Methods of Traffic Survey and Studies – Volume and Capacity – LOS for uninterrupted traffic flow – Headway concepts and applications – Speed and Delay – Origin and Destination, Parking, Accident – Level of Service (LoS)

UNIT III DESIGN OF TRANSPORT INFRASTRUCTURE
  Design of roads – Design Speed, Terrain, Gradient curves – Horizontal and Vertical, Superelevation, Sight Distance – Stopping Sight Distance, Overtaking Sight Distance, Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture

UNIT IV INTERSECTION DESIGN AND ANALYSIS
  Design of Intersection – At grade intersection – Uncontrolled, Channelisation, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types , Design and Analysis.
UNIT V  TRAFFIC OPERATION AND MANAGEMENT


OUTCOME:
• Students would be aware of the basic Principles and Design, Planning and Management of Transportation system.

REFERENCES:
2. James L. Pline (Edr) „Traffic Engineering Hand Book“, Institute of Transportation Engineers,
5. Analysis, National Urban Transport Policy 2006, National Policy for Urban street vendors 2009- Programme objectives and salient features of Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Urban infrastructure development scheme for small and medium towns (UIDSSMT), Rajiv Awas Yojana (RAY),

TE7103  URBAN AND REGIONAL PLANNING  L T P C
3 0 0 3

OBJECTIVES:
• Provides a basic knowledge on Urbanization and its trend.
• Deals with different types of plan, its implementation, regional development and management for sustainable Urban growth.

UNIT I  BASIC CONCEPTS POLICIES AND PROGRAMMES
Definitions and Concept- Urbanization, Towns, Cities, Metropolis, Megalopolis, Satellite and New towns, CBD, Peri urban areas, Suburban areas, Census Definition, Classification of urban settlements, TOD, National policies, National Urban Transport Policy 2006, National Policy for Urban street vendors 2009- Programme objectives and salient features of Jawaharlal Nehru National Urban Renewal Mission (JNNURM), Urban infrastructure development scheme for small and medium towns (UIDSSMT), Rajiv Awas Yojana (RAY),

UNIT II  PLANNING PROCESS
Steps in Planning Process- Plans; levels; objectives, content, and data requirement-regional plan, master plan, detail development plan, city development plan, development control regulation, Zoning Regulation, Layout and Building Regulations.

UNIT III  SOCIO ECONOMIC AND SPATIAL PLANNING
Economic and social concepts in urban and regional planning and their relevance, Economic principals of zoning, Components of sustainable development, Inclusive development, Compact cities, Quality of life-Form of cities, issues related to inner city fringe areas, and suburban areas, Application of Remote sensing and GIS in Urban and Regional planning.
UNIT IV  PROJECT FORMULATION AND EVALUATION


UNIT V  URBAN GOVERNANCE AND MANAGEMENT

Planning laws; Town and Country planning act: Urban Development authorities Act, Constitutional (74th Amendment) Act 1992- Local bodies, Functions, powers and Interfaces-development of small town and smart cities-case studies

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be aware of various Acts, Policies and Programmes related to Urban Planning and Development.
- Students will be in a position to formulate, appraise and conduct feasibility studies on urban projects

REFERENCES:

1. CMDA, Second Master Plan for Chennai, Chennai 2008
4. Singh V.B, "Revitalised Urban Administration" in India, Kalpaz publication, Delhi 2001

TE7111  TRAFFIC SURVEYS AND ANALYSIS LABORATORY

OBJECTIVE:

- Provides clear understanding on conducting various types of traffic surveys data collection, analysis, inference and presentation

LIST OF EXERCISES:

Conduct of the following surveys related to Transport Development, Analysis, Inferences and Proposals.

1. Volume count
2. Spot speed
3. Speed and delay studies
4. Parking studies
5. Origin and destination studies
6. Physical inventory using total station survey equipment.
7. Environmental impact – Noise studies and vehicular emission measurement
8. Lighting studies

TOTAL: 60 PERIODS
OUTCOME:
- The students would have an understanding on conducting various types of traffic surveys involving data collection, its analysis, and the inference and way of presentation.

TE7201 TRAFFIC FLOW THEORY L T P C
3 0 0 3

OBJECTIVE:

UNIT I TRAFFIC FLOW FUNDAMENTALS 10

UNIT II TRAFFIC FLOW CHARACTERISTICS 10

UNIT III QUEUING MODELS 8

UNIT IV TRAFFIC DELAYS 8
Delay at Intersections - Type of delays - Manual measurement – Saturated and oversaturated intersections – Arrival Pattern.

UNIT V INTELLIGENT TRANSPORT SYSTEM 9

TOTAL: 45 PERIODS

OUTCOME:
- Students would have knowledge of Traffic Flow characteristics and the theory of Traffic Flow that would help them to develop an efficient transport system.

REFERENCES:
OBJECTIVE:
- Provides knowledge in economic evaluation and Public private partnership in developing road infrastructure projects and application of systems simulation techniques in modeling transport economic systems.

UNIT I  ECONOMIC EVALUATION  9

UNIT II  MODELING OF ROAD USER COSTS  8
Components of vehicle operating cost – Factors affecting vehicle operating cost – Value of Travel Time Saving - Accident Cost – Concept of Route Switching Mechanism. - Ripple effects in developing new infrastructure – Simulation Modeling exercise.

UNIT III  TRANSPORT DEMAND SUPPLY CONCEPT  8

UNIT IV  TRANSPORT PRICING  10

UNIT V  FINANCING TRANSPORT SYSTEM  10

TOTAL: 45 PERIODS

OUTCOME:
- Students would be equipped with the economic principles in dealing with transport supply and demand.

REFERENCES:
OBJECTIVE:
- To impart knowledge in the rudiments and advancements in Transportation Planning and Travel Demand Forecasting

UNIT I TRANSPORTATION SYSTEM STATUS

UNIT II TRIP GENERATION AND DISTRIBUTION
Trip Generation Models-Trip classification - productions and attractions – Trip rate analysis - Multiple regression models - Category analysis - Trip distribution models – Growth factor models, Gravity model and Opportunity modes

UNIT III MODAL SPLIT
Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models - Utility functions - Logit models - Two stage model.

UNIT IV TRAFFIC ASSIGNMENT
Traffic assignment – Transportation networks – Minimum Path Algorithms - Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior.

UNIT V LAND USE TRANSPORT MODEL (LUT)
Accessibility Measures and Basic Theories – Lowry Derivatives Model- Garin Model –Approach and Simulation Modeling in LUT Model - Multimodal Transportation Planning.

TOTAL: 45 PERIODS

OUTCOME:
- Students would be aware of the Principles and Planning of Transportation Infrastructure.

REFERENCES:
TE7211  CAD IN TRANSPORTATION ENGINEERING LABORATORY  L  T  P  C  
0 0 4 2

OBJECTIVE:
- Helps in formulation and evaluation of Transportation Engineering projects using software

COURSE CONTENT
1. Transportation Software – VISSIM, CUBE, TRANSCAD, TRANSYT Mx Road, HDM4,
2. GIS and Remote Sensing Packages – ArcGIS, Geo-Concept, GPS
4. Computer Aided Drafting - DBMS concepts - Civil Engineering Databases – Data entry & Reports. Spreadsheet concepts – Worksheet calculations in Civil Eng, - Regression & Matrix Inversion, SPSS.

TOTAL : 60 PERIODS

OUTCOME:
- The students would have gained knowledge on various Transportation software tools and their application in solving transportation problems on a real time basis.

TE7212  PAVEMENT MATERIALS AND EVALUATION LABORATORY  L  T  P  C  
0 0 4 2

OBJECTIVE:
- To give the students to hands on experience on the various testing procedures of pavement materials as per the IRC standards.

I PAVEMENT MATERIAL TESTING
- Test on Soil
- Tests on Road Aggregates.
- Testing on Bitumen

II TESTS ON BITUMINOUS MIXTURE.
- Design of Bituminous Mixes.
- Marshal Stability Test.

III PAVEMENT EVALUATION – ROUGHNESS AND DISTRESS EVALUATION
- Visual pavement condition survey - patches, potholes, ravelling, edge breaking and cracking.
- Skid resistance measurements.
- Texture Depth.
- MERLIN
- Benkelman Beam Deflection test.

TOTAL : 60 PERIODS

OUTCOME:
- The students on completion of the laboratory classes would have knowledge on properties and testing procedures of pavement materials.
OBJECTIVES:

- To work on a specific technical topic in Transportation Engineering in order to acquire the skills of oral presentation.
- To acquire technical writing abilities for seminars and conferences.

TOTAL: 30 PERIODS

SYLLABUS:

The students will work for two hours per week guided by a group of faculty members. They will be asked to select on any topic of their choice related to transportation engineering. Students are asked to submit the brief report of their seminar topic. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.

TE7301 MASS TRANSIT SYSTEM PLANNING

OBJECTIVES:

- To identify the role of various modes of Mass Transportation like Bus and Rail and its Planning and Management

UNIT I TRANSIT SYSTEM AND ISSUES


UNIT II PUBLIC TRANSIT SYSTEM


UNIT III BUS TRANSIT PLANNING AND SCHEDULING


UNIT IV RAIL TRANSIT TERMINALS AND PERFORMANCE EVALUATION

UNIT V IMPACT OF TRANSIT


OUTCOME:
- The students would have knowledge on planning of various transit systems like bus and rail, their scheduling and management strategies.

REFERENCES:
1. Michael J. Bruton, "An Introduction to Transportation Planning", Hutchinson, 1985
3. Hobbs F.D., "Traffic Planning and Design", Poargamon Oress

TE7311 PRACTICAL TRAINING (2 Weeks) L T P C 0 0 0 1

OBJECTIVES:
- To train the students in the field work so as to have a firsthand knowledge of practical problems related to Transportation Engineering.
- To develop skills in facing and solving the problems experiencing in the field.

SYLLABUS:
The students individually undertake training in reputed engineering companies doing transportation projects during the summer vacation for a specified duration of four weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal faculty members.

TE7312 PROJECT WORK (PHASE I) L T P C 0 0 12 6

OBJECTIVES:
- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To develop the methodology to solve the identified problem.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

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SYLLABUS:
The student individually works on a specific topic approved by the Head of the Division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of Transportation Engineering. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOME:

- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

TE7411 PROJECT WORK (PHASE II) L T P C 0 0 24 12

OBJECTIVES:
- To solve the identified problem based on the formulated methodology.
- To develop skills to analyze and discuss the test results, and make conclusions.

SYLLABUS:
The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the Head of the Department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOME:
- On completion of the project work students will be in a position to take up any challenging practical problems in the field of transportation engineering and find better solutions to it.

TE7001 ADVANCED SYSTEM DYNAMICS MODELING IN TRANSPORTATION ENGINEERING L T P C 3 0 0 3

OBJECTIVE:
- To provide advanced level of knowledge in System Dynamics Modeling in Transportation Engineering

UNIT I COMPLEXITY AND SYSTEMS THINKING 8
UNIT II ADVANCED MODELING EFFORTS 8

UNIT III ADVANCED SIMULATING TECHNIQUES 10

UNIT IV MODELING PROCESS 10

UNIT V SOPHISTICATED DYNAMICS MODELING 9

TOTAL: 45 PERIODS

OUTCOME:
• The students would have gained knowledge the simulation techniques in System Dynamics Modeling in Transportation Engineering

REFERENCES:
2. Thirumurthy A.M., Environmental Facilities and Urban Development in India – A System Dynamics Model for Developing Countries, Academic Foundations, India, 1992

TE7002 AIRPORT SYSTEM PLANNING AND DESIGN L T P C 3 0 0 3

OBJECTIVE:
• Provides a basic understanding on Airport Systems Planning and Operation

UNIT I AIRPORT PLANNING 10

UNIT II AIRPORT COMPONENTS 10
Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar-Passenger Terminals- Geometric design of runway and taxiways–Runway pavement Design-Difference between Highway and airport pavements- Introduction to various design methods-Airport drainage.
UNIT III AIRPORT PLANNING AND AIRLINE ECONOMICS
Demand driven dispatch – Airline Fleet Planning Models – Network Revenue Management – Airport Performance, Slot Issues, Hub Operation, Demand Management, Multi-airport Systems- Pricing – Privatization and Deregulation, Willingness to pay and Competitive Revenue Management

UNIT IV PASSENGER CHOICE, SCHEDULING AND FLEET ASSIGNMENT
Load Factor Analysis, Airline Schedule Development, Introduction to PODS Passenger Choice Models, Decision Window Model, Fleet Assignment

UNIT V CASE STUDIES
Multi airport system – location of airport with respect to urban growth- case studies.

OUTCOME:
- Students would have understood the basics of air route Planning, Network revenue Management.

REFERENCES:

TOTAL: 45 PERIODS

TE7003 COMPUTATIONAL TECHNIQUES IN TRANSPORTATION ENGINEERING L T P C 3 0 0 3

OBJECTIVES
- To be introduced to systems approach.
- To learn the fundamentals of simulation and the GPSS language.
- To be introduced to advanced computational techniques such as GA and ANN.

UNIT I INTRODUCTION

UNIT II FUNDAMENTALS OF SIMULATION
UNIT III APPLICATION OF SIMULATION CONCEPTS 9
Applications of GPSS - Simple queuing problems - Inventory problems - Simulation of ports - Railway platforms and level crossings - Traffic signals. Analysis of simulation results - Model validation - Replication of random conditions - Time series analysis.

UNIT IV APPLICATION OF GENETIC ALGORITHM IN SIMULATION 9

UNIT V APPLICATION OF ARTIFICIAL NEURAL NETWORKS IN SIMULATION 9

OUTCOME:
Upon completion of this course, the students should have:
• a working knowledge of simulation and GPSS programming.
• a good understanding of GA applications
• the ability to apply ANN

REFERENCES:
2. GPSS/PC, User Manual, Minuteman Software, USA, 2005

TE7004 ENVIRONMENTAL IMPACT ASSESSMENT OF TRANSPORTATION PROJECTS L T P C 3 0 0 3

OBJECTIVE:
• To expose the students to the need, methodology, documentation and requirements of environmental and social impact assessment of Transportation Projects.

UNIT I ENVIRONMENTAL REGULATIONS AND EIA 10
Laws concerned with protection of the environment such as Environmental Protection Act, Air and Noise Pollution Act, Motor Vehicle Act, Town and Country Planning Act, Development Control Regulation, Coastal Regulation Zone - Ambient Air Quality and noise Standards - EIA in Project Cycle- Impact of Traffic and transport on Environment-EIA Notification- EIA process and terms of reference for EIA of transportation Projects.

UNIT II ENVIRONMENTAL IMPACT IDENTIFICATION AND PREDICTION 10

UNIT III SOCIAL IMPACT ASSESSMENT 8
UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

UNIT V CASE STUDIES 8
Case studies on Environmental and social Impact assessment of Transportation projects such as Highways, Railways, Airports, Flyovers, Bridges, Ports and Harbor,

TOTAL: 45 PERIODS

OUTCOME:
- Students would have understood the impact of Transportation projects on the environment and are able to develop and implement mitigation measures.
- They will also know about the legal requirements of Environmental Assessment for projects.

REFERENCES:
3. David Banister; "Transport Policy and Environment” Routledge, UK, 2002

TE7005 GEOSPATIAL TECHNIQUES

OBJECTIVE:
- Introduce the students, the recent techniques of Remote Sensing and GIS and Its application in Traffic and Transportation Engineering

UNIT I INTRODUCTION TO REMOTE SENSING 10

UNIT II INTRODUCTION TO GIS 10
Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial – Geo-referencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying
UNIT III  DATA STRUCTURES AND ANALYSIS  9
Database – Raster and Vector data structures – Data storage – Run length, Chain and Block coding –
Vector data storage – Topology – GIS Modelling - Raster and Vector data analysis – Buffering and
overlaying techniques – Network Analysis – Spatial Analysis

UNIT IV  BASIC APPLICATIONS IN TRANSPORTATION  8
Highway and Railway Alignment, location of transport terminals and roadside facilities, bus stops –
Route optimization – Bus route rationalization – Accident analysis – Applications of Aerial
Photography and Satellite Imagery

UNIT V  ADVANCED APPLICATIONS  8
GIS as an integration technology – Integration of GIS,GPS and Remote Sensing Techniques –
Advanced Traveler Information System (ATIS) – Automatic Vehicle Location System (AVLS)

TOTAL: 45 PERIODS

OUTCOME:
- The students would have knowledge on the basics of Remote Sensing and GIS techniques and their application in the Transport sectors.

REFERENCES:

TE7006  INTELLIGENT TRANSPORTATION SYSTEMS  L T P C
  3 0 0 3

OBJECTIVE:
- To learn the fundamentals of ITS.
- To study the ITS functional areas
- To have an overview of ITS implementation in developing countries

UNIT I  INTRODUCTION TO INTELLIGENT TRANSPORT SYSTEM  8
Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities –
Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection –
Critical issues – Security – Safety

UNIT II  ITS ARCHITECTURE AND HARDWARE  9
Dynamic Message Sign – GPRS – GPS – Toll Collection
UNIT III  ADVANCED TRANSPORT MANAGEMENT SYSTEM  10
Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management –
Control Centre – Junction Management Strategies - ATMS – Advanced Traveler Information Systems
Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.

UNIT IV  ADVANCED TRAVELLER AND INFORMATION SYSTEM  9
Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System –
Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of
Information – Business Opportunities

UNIT V  CASE STUDIES  9
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.

TOTAL: 45 PERIODS

OUTCOME:
On completion of the course the students should be able to
• Understand the sensor and communication technologies.
• Apply the various ITS methodologies
• Define the significance of ITS under Indian conditions

REFERENCES:
York, 1986.
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul
Chen, John Miles.

TE7007 LOGISTICS IN TRANSPORTATION ENGINEERING  L T P C
3 0 0 3

OBJECTIVE:
• Provides an understanding on Freight Transport, Modeling, Location of the Facility and its
Management

UNITI LOGISTICS  7

UNITII FREIGHT TRANSPORT  10
Econometric Models for Freight Forecasting – Input Output Models – Regional Network Systems –
Graph Theory Application in Network Planning.

UNIT III DISTRIBUTION MANAGEMENT  10
Supply Chain – Warehousing – Facility Location, Inventory – Mode Choice – Distribution System,
Vehicle Routing and Scheduling- Monitoring of overloaded commercial vehicles
UNIT IV LOGISTICS MANAGEMENT
Logistics outsourcing – IT Application in Freight Logistics – Technology in Logistics Management – Intermodal Transportation

UNIT V ITS APPLICATION IN FREIGHT TRANSPORT
Commercial Fleet Management, Toll Plaza Analysis- E commerce - E tailing – City logistics Evaluating Schemes – case studies

TOTAL : 45 PERIODS

OUTCOME:
- Students will have a knowledge on the principles and practice of Freight Transport Modeling and provision of the Facilities

REFERENCES

TE7008 PAVEMENT MANAGEMENT SYSTEM

OBJECTIVE:
- To introduce the concepts of design, evaluation and performance of existing and new flexible and rigid pavements with due emphasis on systems approach and performance prediction models.

UNIT I PAVEMENT MANAGEMENT PROCESS
Historical background – general nature and applicability of systems methodology – basic components of Pavement Management System – Network and Project level of PMS - PMS functions- planning pavement investments.

UNIT II EVALUATION AND PERFORMANCE
UNIT III  PAVEMENT STRUCTURE & ITS EVALUATION  
Factors affecting Structural Condition of Flexible and Rigid Pavements- Effects of Subgrade Soil, Moisture, Pavement Layers, Temperature, Environment and Traffic on Structural Stability, Pavement Deterioration- Evaluation by Non-Destructive Tests such as FWD, Benkelman Beam Rebound Deflection, Plate Load Test, Wave Propagation and other methods of Load Tests- Evaluation by Destructive Test Methods, and Specimen Testing

UNIT IV  PERFORMANCE PREDICTION MODELS  

UNIT V  REHABILITATION  
Repair of pavement defects – maintenance of flexible and rigid pavements system analysis - Pavement Overlays, Design of Flexible Overlay over Flexible Pavement by Benkelman Beam Deflection and other Methods, Flexible Overlays and Rigid Overlays over Rigid Pavements, Use of Geo synthetics in Pavement Overlays.

TOTAL: 45 PERIODS

OUTCOME:
• The students would have knowledge on the concepts of design, evaluation and performance of flexible and rigid pavements

REFERENCES:

TE7009  RAIL TRANSPORTATION SYSTEMS – PLANNING AND DESIGN  
L T P C
3 0 0 3

OBJECTIVE:
• To expose the various aspects of planning and design of Rail Transportation Systems.

UNIT I  INTRODUCTION  
Railway Industry – Privatization – Financing – Competition with Road Transport

UNIT II  DEPENDABILITY ASPECTS  
Regularity, Reliability, Punctuality and Safety – Modern tools to improve dependability – Time Table – Development – Scheduling - Restoring

UNIT III  MANAGEMENT OF RAILWAY OPERATIONS  
Demand based Railway Planning – Freight and Passenger Train Services – Asset Maintenance and Management
UNIT IV URBAN RAIL TRANSIT PLANNING
Transit and Rail Tunnels- MRTS – LRTS, Metro Rail – Monorail – High speed trains- cable railway system for steep gradients- Tubular Rail-Tramways- Case Studies

UNIT V RAILWAY INFRASTRUCTURE
Modern Transit Facilities - Railway Track – Transfer Station – Structures – Bridges – Tunnels – Planning and Design aspects

OUTCOME:
- The students would have gained knowledge on Rail Infrastructure Planning, Operation and Management.

REFERENCES:
1. Brain Richards, Transport in Cities

TE7010 ROAD SAFETY SYSTEM L T P C
3 0 0 3

OBJECTIVES:
- Helps in identifying the reasons for road accidents and scientific Investigation.
- Provides knowledge on road safety audit and its methodology

UNIT I INTRODUCTION

UNIT II ACCIDENT DATA COLLECTION

UNIT III ACCIDENT ANALYSIS TECHNIQUES

UNIT IV ROAD SAFETY AUDIT
UNIT V  ACCIDENT STUDIES AND INVESTIGATION  
Accident data – Identification of Accident Prone Location – Prioritisation – Investigation Safety considerations on completed roads and in work zone- Mitigation measures.

TOTAL : 45 PERIODS

OUTCOME:

- The students would have gained knowledge on different aspects of road safety audit and its methodology

REFERENCES:

4. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE.
5. Road Safety manuals by various organisations in India and other developed countries.

TE7011  SUSTAINABLE URBAN AND TRANSPORT DEVELOPMENT  
L T P C  3 0 0 3

OBJECTIVE:

- Helps in understanding the basic concept of Sustainable Urban and Transport Development and its influence on region, city and built environment.

UNIT I  SUSTAINABLE URBAN AND TRANSPORT PRINCIPLES  

UNIT II  URBAN PLANNING AND ENVIRONMENT  
Environment and Resources, Sustainability Assessment, Future Scenarios, Form of Urban Region, Managing the change, Integrated Planning, Sustainable Development

UNIT III  THE URBAN BUILT ENVIRONMENT  
Urban Form, Land Use, Compact Development, Principles of street design- complete streets, Transport Integrated Urban land use Planning, Guidelines for Environmentally sound Transportation

UNIT IV  SUSTAINABLE TRANSPORTATION MODES PLANNING  

UNIT V  TRAVEL AND TRANSPORT  

TOTAL: 45 PERIODS
OUTCOME:
- Students would have learnt the importance of sustainable urban and transport planning and its benefits to the human community.

REFERENCES:
6. IUT toolkit.

TE7012 TRANSPORTATION MODELING AND SIMULATION

OBJECTIVE:
- Offers basic and fundamental principles of Systems Approach and its application in simulating and modeling the complex and dynamic traffic and transportation systems.

UNIT I SYSTEMS APPROACH CONCEPT 9

UNIT II MODEL CONCEPTUALISATION 9

UNIT III MODEL DEVELOPMENT AND SCENARIO ANALYSIS 10

UNIT IV MODEL VERIFICATION AND VALIDATION 7
Concepts of Model Verification – Model Calibration – Model Validation - Sensitivity and Dimensional Analysis – Methods of SD Model Validation – Comparison of Conventional Model Validation with Simulation Model Validation efforts.

UNIT V MODELING TRANSPORTATION SYSTEMS 10

TOTAL: 45 PERIODS

OUTCOME:
- Students would have the knowledge in system Dynamics simulation Modeling efforts.
REFERENCES:

TE7013 URBAN INFRASTRUCTURE AND ASSET MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:
- The course will emphasize the use of emerging technologies, information systems, and decision making tools that support the various elements of the asset management framework.

UNIT I ROAD ASSET MANAGEMENT
Road Asset management- designing and developing rigid (or flexible) pavement with integrated structure for underground utilities & services- Network of underground road system, need for and planning and development.

UNIT II INNOVATIVE TRANSPORT MODES
straddling bus concept and development (eg China)- e-rickshaws- Alternate (renewable) energy options for powering transport system- solar powered aircraft -bio-bus and its impact on solid waste management - solar-powered traffic signals and street lights- all-electric bus route with wireless charging -buses park over metal plates buried in the road.

UNIT III TELECOMMUNICATION & ITS IMPACT ON TRANSPORT
e-commerce- e-tailing-mobile application in trade &commerce- internet-banking- internet and mobile phone in governance-services ranging from e-billing & payment for services- EB/telephone/income tax/ municipal tax & service charges/cooking gas booking &payment-booking and payment of air, train &train tickets; booking and payment of cinema tickets- teleshopping of groceries-tele-checking at airports- obtaining birth and death certificates-booking and payment for call taxis & autorickshaws; carpooling thro’ net and mobile phones-global meets through teleconferencing- case studies

UNIT IV CLOUD-COMPUTING AND ITS IMPACT ON TRANSPORT
The contribution of transport planning & development in conceptualization of smart cities-advances in capturing and processing traffic data in real time and managing traffic congestion- role of SCOOT & SCAT in reducing and minimizing traffic congestion- establishment of a sensor-networked and monitored city communication infrastructure, efficiently phasing traffic lights, and providing real-time guidance to drivers, can aid in reducing congestion. Digitally monitored parking spaces, able to dynamically alter prices according to available spaces, help control time spent cruising for parking.
UNIT V ROLE OF SMART CARD AND COMMUTING
Electronic Road Pricing (ERP) and congestion pricing- Innovative financing- carbon credit -case studies

TOTAL: 45 PERIODS

OUTCOME:
- Students would have the knowledge of innovative transport modes, telecommunication and cloud-computing impacts on transportation.

REFERENCES:

TE7014 WATERWAYS TRANSPORTATION SYSTEM
– PLANNING AND DESIGN

OBJECTIVE:
- To expose the various aspects of planning and design of Water Transportation Systems.

UNIT I INTRODUCTION
Fresh Water and Salt Water Navigation – Ocean, Currents and Tide – Canals and Waterways – Ports - Types of Ships

UNIT II LOGISTICS AND MULTIMODAL TRANSPORT
Containers – Distribution and Collection by Road and Rail – Vehicles and Equipment used – Trade Routes- liquid cargo

UNIT III PORT PLANNING
Traffic Forecast, Demand, Users, Capacity – Berth occupancy – Service time – Waiting time – Principles of Planning Port Layout – Handling characteristics – Voyage Estimating

UNIT IV PORT AND TERMINAL MANAGEMENT
Role of ports in trade and transport – Port facility for handling liner, dry bulk and liquid trade – Basics of Port Business – Customs – Immigration, Port Health – Marine Safety – Pricing – Traffic Management in Port Premises

UNIT V INLAND WATER WAYS AND OTHER MODES OF TRANSPORT
Inland Water Transport – Planning, limitations and advantages – Case Studies –Pipelines – Ropeways – Beltways – other means of transport – Characteristics and Applications

TOTAL: 45 PERIODS

OUTCOME:
- Students would have gained knowledge on various aspects of planning and design of Water Transportation Systems.

REFERENCES:
1. Leslie A.Bryan, “Principles of Water Transportation”, University of Chicago Press
3. “Shipping and Inland Water Transport for Eleventh Five Year Plan” – Report by Planning Commission