DEPARTMENT OF CIVIL ENGINEERING

M.Tech. HIGHWAY ENGINEERING
(CURRICULUM 2015-16)
### DEPARTMENT OF CIVIL ENGINEERING
### CURRICULUM 2015-16
### M.Tech. HIGHWAY ENGINEERING

#### SEMESTER – I

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### ELECTIVES

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### ELECTIVES

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OBJECTIVES

- To introduce the students with the principles and practices of Highway Engineering.
- To enable the students to have a strong analytical and practical knowledge of Planning, Designing and solving the Highway problems.
- To strength the students knowledge and technical know how to be efficient highway engineers.

OUTCOME

- The students after completion of this course will have an in depth knowledge in Traffic Engineering, Transport Planning, Highway Design and Construction, Sustainable Urban and Transport Development and will be efficient enough to take up field projects.
- As the students have an hands on experience in working with the Transportation Engineering Software, live projects, field visits to various organizations and training sessions during the course of study, they will be a full-fledged Transport and Highway Planner/Engineer.
GOAL
The course will help the students to understand the concepts of probability and statistics and its applications in the field of Traffic and Highway Engineering.

OBJECTIVES
The course should enable the students to:
1. Understand the basic concepts of sampling distributions and estimation.
2. Learn about the testing of hypothesis.
3. Gain the knowledge in Analysis of variance.
4. Know the probability functions and the Random variables.
5. Learn about the basic concepts of linear programming.

OUTCOME
The students should be able to:
1. Use the sampling principles in the field of Traffic and Highway Engineering.
2. Find the significance of large samples by using hypothesis testing.
3. Implement the variance design principles in sampling.
4. Interpolate data’s by using probability theories.
5. Explain linear programming in the field of Traffic and Highway Engineering.

UNIT I SAMPLING DISTRIBUTIONS AND ESTIMATION
Sampling distributions - Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments.

UNIT II TESTING OF HYPOTHESIS
Basic definitions of statistical hypothesis - Tests of significance for large samples - single proportion, Difference of proportion, single mean and difference of mean - Small samples – t, Chi-square and F Distributions.
UNIT III DESIGN OF EXPERIMENTS

Analysis of variance - One way and Two way Classifications. Completely randomized design - Randomized block design - Latin square design.

UNIT IV PROBABILITY AND RANDOM VARIABLES

Discrete and Continuous random variables - Moments - Moment generating functions – Standard distributions - Binomial, Poisson, Geometric, Negative Binomial, Uniform, Normal, Exponential, Gamma and Weibull distributions - Two dimensional random variables - Joint, Marginal and Conditional distributions. Multiple and partial correlation and Regression.

UNIT V LINEAR PROGRAMMING

Basic concepts - Graphical and Simplex method - Applications.

TOTAL: 60 PERIODS

REFERENCES:
2) Dr.A.Singaravelu, Dr.S.Siva Subramanian and Dr.C.Ramachandran, "Probability and QueuingTheory", Meenakshi agency, 20th edition, January 2013.
OBJECTIVE:
The students are expected to understand the properties and use of various materials and
construction, analysis of stress distribution, evaluation and maintenance of flexible and rigid
pavements

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

UNIT I PAVEMENT COMPONENTS AND ITS FUNCTION
Road Pavements and pavement layers - types, functions, choice Factors affecting design and
performance of flexible and rigid pavements – Pavement design factors, loads – axle load
distribution, ESWL, EWL, VDF due to varying loads and CSA , Subgrade support - CBR and
plate bearing tests, Resilient Modulus, fatigue tests, permanent deformation Pavement
material Characteristics, climatic, drainage and environmental factors, their effects and
evaluation.

UNIT II BEHAVIOUR OF FLEXIBLE PAVEMENT
Stresses and Deflection / strain in flexible pavements: Application of elastic theory, stresses,
deflections / strains in single, two and three layer system, Applications in pavement design.
Problems.

UNIT III DESIGN OF FLEXIBLE PAVEMENT
Flexible pavement design: Empirical, semi empirical and theoretical design approaches,
principle, advantages and application. Design steps by CBR method as per IRC, outline of
other common design methods such as AASHTO and Asphalt Institute methods, Problems

UNIT IV DESIGN OF RIGID PAVEMENT
Rigid pavement design: General design principle, Stresses in rigid pavements, stresses due to
wheel loads and temperature variations, design of cement concrete pavements (joints and
slab thickness) as per IRC guidelines. Design features of CRCP, SFRC and ICBP, Problems.

UNIT V AIRPORT PLANNING AND DESIGN
Design of Airfields – Introduction to Runways, characteristics Design of airfields, Federal
aviation authority, International Civil Aviation organization, taxiways design, lighting &
marking Factors affecting design and performance of airport pavements.

TOTAL: 45 PERIODS

REFERENCE BOOKS
1. David Croney, Paul Croney, —Design & Performance of Road Pavements”- Mcgraw
hill Book Co.
2. Specifications for" Road and Bridge works", Fourth Revision, MoSRT&H(India),
2001
Concrete Roads"
Congress
Highways, Indian Roads Congress
OBJECTIVE:
To give the students to in depth knowledge on the various testing procedures of pavement materials as per the IRC standards.

OUTCOME:
The students on completion of the course would have knowledge on properties and testing procedures of various pavement materials and the method of construction of pavements.

UNIT I PROPERTIES OF SUBGRADE SOIL AND AGGREGATES
Subgrade soil – Soil composition and structure – Soil classification for engineering purposes - Origin, Classification, requirements, properties and tests on road aggregates

UNIT II PROPERTIES OF BITUMEN
Origin, preparation, properties and tests, constitution of bituminous road binders, requirements – Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests.

UNIT III CHARACTERISTIC OF BITUMINOUS MIXES
Bituminous Mixes: Mechanical properties – Resilient modulus, dynamic modulus and fatigue characteristics of bituminous mixes.

UNIT IV DESIGN OF BITUMINOUS MIX
Weathering and Durability of Bituminous Materials and Mixes – Performance based Bitumen Specifications – Super pave mix design method.

UNIT V DESIGN OF CEMENT CONCRETE MIX
Cement Concrete for Pavement Construction: Requirements, design of mix for CC pavement, joint filler and sealer materials.

THEORY: 45 PERIODS
LAB: 15 PERIODS

List of Experiments for Lab
1. Tests on Bitumen
2. Tests on Aggregates
3. Tests on Soil Sub-Grade

REFERENCE BOOKS
OBJECTIVES:
To make the student to know about various bridge structures, selection of appropriate bridge structures and design it for given site conditions.

OUTCOMES:
- To develop an understanding of an appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality.
- To help the student develop an intuitive feeling about the sizing of bridge elements, i.e., developing a clear understanding of conceptual design.
- To understand the load flow mechanism and identify loads on bridges.
- To carry out a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.

UNIT I INTRODUCTION

UNIT II DESIGN OF SUBSTRUCTURE

UNIT III DESIGN OF SUPERSTRUCTURE

UNIT IV ELEMENTS OF PRESTRESSED CONCRETE BRIDGE DESIGN
Size, prestressed force, eccentricity, design of cables, end blocks. Features and Design Consideration Of Bridges: Suspension bridges, cable stayed bridges and their components; bearings – types – design of rocker and roller bearings.

UNIT V CONSTRUCTION AND MAINTENANCE

TOTAL: 60 PERIODS
REFERENCES
5. IS and IRC Codes
OBJECTIVE:
Provides basic understanding on Highway Engineering - Planning, Design, Analysis and Operation.

OUTCOME:
On completion of the course, the students would have gained knowledge on highway design and traffic analysis.

UNIT I BASIC CONCEPTS OF TRAFFIC ENGINEERING

UNIT II SURVEYS AND STUDIES IN TRAFFIC ENGINEERING
Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, Parking studies, Accident studies.

UNIT III GEOMETRIC DESIGN OF HIGHWAYS

UNIT IV DESIGN OF INTERSECTIONS

UNIT V HIGHWAY INFRASTRUCTURE AND SAFETY AUDIT

TOTAL: 45 PERIODS

REFERENCE BOOKS
3. AASHTO A Policy on Geometric Design of Highway and Streets
OBJECTIVE:
To impart knowledge in Traffic Flow Characteristics, Flow Modeling and Computer Simulation

OUTCOME:
Students would have gained knowledge on Traffic Flow characteristics, modeling and simulation that would help them to develop an efficient transport system.

UNIT I 
TRAFFIC FLOW FUNDAMENTALS 12

UNIT II 
TRAFFIC FLOW CHARACTERISTICS 12
Macroscopic models - Heat flow and fluid flow analogies - Shock waves and bottleneck control approach.

UNIT III 
QUEUING THEORY 12
Microscopic models - Application of queuing theory - regular, random and Erlang arrival and service time distributions - Waiting time in single channel queues and extension to multiple channels.

UNIT IV 
CAR FOLLOWING MODELS 12
Linear and non-linear car following models - Determination of car following variables - Acceleration noise.

UNIT V 
ADVANCED TECHNIQUES 12

TOTAL: 45 PERIODS

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

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

I PAVEMENT MATERIAL TESTING
- Testing on Bitumen:
  - Specific Gravity of Bitumen.
  - Penetration Test.
  - Softening Point Test.
  - Ductility of Bitumen.
- Tests on Road Aggregates:
  - Specific Gravity of Aggregates.
  - Los Angeles Abrasion Test.
  - Aggregate Impact Test.
  - Sieve Analysis, Flakiness and Elongation Index.

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, travelling, edge breaking and cracking.
- Skid resistance measurements.
- Texture Depth.
- MERLIN
- Benkelman Beam Deflection test.

TOTAL: 60 PERIODS
OBJECTIVE:
To identify the role of various modes of Mass Transportation like Bus and Rail and its Planning and Management.

OUTCOME:
The students would have gained knowledge on Public Transit Infrastructure Planning, Operation 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 MASS TRANSPORT

TOTAL: 60 PERIODS

REFERENCES:
1. Michael J. Bruton, An Introduction to Transportation Planning, Hutchinson.
3. F.D. Hobbs, Traffic Planning and Design, PoargamonOress
OBJECTIVE:

The students are expected to understand the properties and use of various materials and construction, analysis of stress distribution, evaluation and maintenance of flexible and rigid pavements.

OUTCOME:

The students would have gained knowledge on the Material properties, Design, Evaluation and Management of Pavement Systems.

UNIT I COMPONENTS OF PAVEMENT
Subgrade system, functions, requirements and sequence of construction operations. Plants and equipment for production of materials - crushers, mixers, bituminous mixing plants, cement concrete mixers – various types, advantages and choice.

UNIT II CONSTRUCTION OF DRAINAGE
Drainage – Assessment of drainage requirements for the road and design of various components, drainage materials, Construction of surface and subsurface drainage system and design of filter materials for roads. Drainage for urban roads.

UNIT III CONSTRUCTION EQUIPMENTS
Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice. Problem on equipment usage charges; Pre-construction surveys and marking on ground - Specifications and steps for the construction of road formation in embankment and cut, construction steps for granular sub-base, quality control tests.

UNIT IV PAVEMENT LAYERS AND SPECIFICATIONS
Different types of granular base course – WMM, CRM, WBM; specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses; their specifications (as per IRC and MORTH); construction method and quality control tests. Different types of sub-base and base course for cement concrete (CC) pavement and construction method. Construction of cement concrete (PQC) pavements joints quality control during construction. Construction details of interlocking concrete block pavements.

UNIT V QUALITY CONTROL AND MAINTENANCE
Principle of construction planning, application of CPM and PERT( Problems not included) Road maintenance works – day to day and periodic maintenance works of various components of road works and road furniture. Preparation of existing pavement – patching, profile correction, Special measures to deal with reflection cracks in pavement layers, slipperiness of surface, etc. Special problems in construction & maintenance of hill roads, land slide, causes, investigation, and preventive and remedial measures, protection of embankment and cut slopes.
REFERENCES

3. Freddy L Roberts, Prithvi S Kandhal et al, —Hot Mix Asphalt Materials, mixture design and construction—(2nd Edition), National Asphalt Pavement Association Research and Education Foundation, Maryland, USA.
5. “Hand Book on Cement Concrete Roads”—Cement Manufacturers Association, New Delhi
OBJECTIVE:

To impart knowledge in the rudiments and advancements in Transportation Planning and Travel Demand Forecasting.

OUTCOME:

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

UNIT I  PRINCIPLES OF URBAN TRANSPORT PLANNING  12

Urban Transportation Planning - Goals and objectives - Hierarchical levels of transportation planning - Forecast - Implementation - Constraints. UTP survey – Inventory of land use.

UNIT II  FOUR STAGE MODELING PROCESS  12

Trip generation - Trip classification - productions and attractions - Multiple regression models - Category analysis - Trip production models - Trip distribution models – Linear programming approach.

UNIT III  MODELING PROCESS AND ANALYSIS  12


UNIT IV  LANDUSE TRANSPORT MODEL  12


UNIT V  EVALUATION OF LUT  12

Preparation of alternative plans - Evaluation techniques - Plan implementation - Monitoring - Financing of Project – Case studies.

REFERENCES

OBJECTIVE:

To Provide knowledge in vehicle scheduling, designing of transport infrastructure, economic evaluation and financing of road infrastructure projects.

OUTCOME:

Students would be equipped in designing Depots & Terminals and analyzing the projects economically.

UNIT I TRANSPORT PLANNING AND SCHEDULING 12
Motor Vehicles Act - statutory provision for road transport and connected organisations. Route scheduling, Freight transport, Vehicle scheduling, Optimum fleet size, Headway control strategies, Crew scheduling.

UNIT II DESIGN OF TRANSPORT INFRASTRUCTURE 12
Depots and Terminals - Principles and types of layout, Depot location, Twin depot concept, Crew facilities. Design of parking facilities – Bus terminal, bus stops and bus bays.

UNIT III TRANSPORT DEMAND SUPPLY CONCEPT 12
Transportation costs - Supply and demand - elasticity of demand; Supply of transport services - Economics of traffic congestion - Pricing policy. Vehicle operating costs – Fuel costs - Maintenance and spares - Depreciation - Crew costs - Value of travel time savings - Accident costs.

UNIT IV ECONOMIC EVALUATION 12
Economic analysis of projects - Methods of evaluation - Cost-benefit ratio, first year rate of return, net present value, and internal-rate of return methods; Indirect costs and benefits of transport projects.

UNIT V HIGHWAY FINANCING 12

REFERENCES
3. CRRI, Road User Cost Study in India, New Delhi, 1982
OBJECTIVE

To provide knowledge in the usage of GIS and Mx software in Transportation related projects.

OUTCOME

The students would gain an understanding on computer aided design of roads such as data acquisition from maps in an effective manner.

ArcGIS

Exercise 1: Exploring your data
Exercise 2: Working with geographic features
Exercise 3: Working with tables
Exercise 4: Editing features
Exercise 5: Working with map elements

Mx Road

Exercise 6: Introduction to Mx Road
Exercise 7: Alignment design
Exercise 8: Carriageway design
Exercise 9: Earthworks design
Exercise 10: Visibility
Exercise 11: Sections and Volumes

Lab Requirements:

ArcGIS License for 10 systems
MX Road license for 10 systems

Total 60 Periods
ELECTIVES
SEMESTER II

PHE701 ROAD SAFETY ENGINEERING  L T P C
3 0 0 3

UNIT I TRAFFIC SAFETY ANALYSIS  9

UNIT II ACCIDENT ANALYSIS  9
Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

UNIT III ROAD SAFETY IN PLANNING AND GEOMETRIC DESIGN  9
Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care

UNIT IV URBAN INFRASTRUCTURE DESIGN  9
Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their Safety.

UNIT V TRAFFIC MANAGEMENT SAFETY AUDIT  9

REFERENCES:
3. Transportation Engineering – An Introduction, C.Jotinkhisty, B. Kent Lall
4. Fundamentals of Traffic Engineering, Ricardo G Sigua
6. Road Safety by NCHRP.
OBJECTIVE:

To create awareness among students about the recent techniques of Remote Sensing and GIS and its application in Traffic and Transportation Engineering.

OUTCOME:

The students would be able to understand the GIS applications in the field of transportation engineering projects.

UNIT I BASIC CONCEPT OF REMOTE SENSING

UNIT II COMPONENTS OF REMOTE SENSING
Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial – Georeferencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying

UNIT III DATA ANALYSIS

UNIT IV GIS IN TRANSPORTATION ENGINEERING
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 Imageries

UNIT V INTEGRATION OF GIS
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

REFERENCES:
UNIT I  TYPES OF PAVEMENT  
Introduction- Highway and airport pavements, Types and component parts of pavements, their differences - Factors affecting design and performance of pavements.

UNIT II  PAVEMENT BEHAVIOUR AND ITS PERFORMANCE  
Stresses and Deflections in Flexible & Rigid Pavements-Stresses and deflections in homogeneous masses. Wheel load stresses, various factors in traffic wheel loads; ESWL and EWL factors. Pavement behaviour under transient traffic loads; Factors affecting design and performance of pavements. Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, EWL, wheel load stresses, warping stresses, frictional stresses, combined stresses.

UNIT III  PAVEMENT DISTRESS  
Structural and functional requirements of flexible and rigid pavements; Pavement distress; different types of failures & its causes.

UNIT IV  EVALUATION OF SURFACE CONDITION  
Methods of measurement of skid resistance, unevenness, ruts and cracks. Pavement surface condition evaluation by physical measurements, by riding comfort and other methods; their applications.

UNIT V  EVALUATION OF STRUCTURAL CONDITION  
Evaluation by non-destructive tests such as FWD, Benkelman Beam rebound deflection using BBD for flexible overlay design, Plate load test, wave propagation and other methods of load tests; evaluation by destructive test methods, and specimen testing.

TOTAL: 45 PERIODS

REFERENCES  
5. Relevant IRC Publications
6. CMA Hand Book 30
OBJECTIVES:
To make the student to know about queuing theory and simulation concepts.

UNIT I  TRANSPORTATION SYSTEM APPROACH  9
Introduction to systems approach – Typical transportation systems – Mathematical models. Fundamentals of simulation – Monte Carlo method – Analog and digital simulation Continuous and discrete models – Simulation languages – Introduction to CSMP.

UNIT II  CONCEPTS OF ARRIVAL PATTERN  9

UNIT III  EVENT SCHEDULING  9
Creating and moving transactions – Queues and facilities – Event scheduling – Internal logic of GPSS processor – Program control statements.

UNIT IV  STATISTICAL REPORT PREPARATION  9

UNIT V  SIMULATION AND VALIDATION  9

TOTAL: 45 PERIODS

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

- The objective of this course is to make students to gain knowledge on designing roads in hilly and rural areas.
- By the end of this course, students should be able to apply their theoretical skills to design roads in various terrains.

OUTCOMES:

At the completion of this module, students should be able to:

- design elements such as sight distance, horizontal curvature, super elevation, grades, visibility on vertical curves etc.
- Use go green concepts for pavements.
- Use eco friendly materials and recycled wastes in the road construction works.
- Conduct quality control tests at different stage of road construction.

UNIT I INTRODUCTION
Importance of Rural roads, Classification of rural roads, Terrain classification, Socio-economic impact of rural roads. Planning and Alignment: Data base for master plan, Concept of network planning, Rural Roads plan, Road alignment, Governing factors for route selection, Factors controlling alignment, Special considerations while aligning hill roads, Surveys, Detailed project report, Environmental issues.

UNIT II GEOMETRIC DESIGN
Introduction, Design speed, Basic principles of geometric design, Elements, Horizontal and vertical alignment, Alignment compatibility, Lateral and vertical clearances. Road Materials: General, Soil and material surveys, Soil as road construction material, Stabilized soils, Aggregates for pavement courses, New materials and stabilizers, Materials for bituminous construction, Materials for semi-rigid and rigid pavement, Materials for special pavements Climatic suitability of concrete materials.

UNIT III PAVEMENT DESIGN
Introduction, Design parameters, Pavement components, Design of flexible pavement, Design of semi-rigid pavement, Design of rigid pavement, Design of special pavements, Drainage and Shoulders Specifications and Construction: General, Selection of construction materials and methodology, Earthwork, Sub-base, Base course, Bituminous constructions, Semi-rigid pavement construction, Concrete pavements, Construction of special pavements, Equipment required for different operations.

UNIT IV GREEN ROAD CONCEPT AND USE OF WASTE MATERIALS
UNIT V MAINTENANCE
General, Distresses/defects in pavements, Definitions of maintenance activities, Inventory of road and inspection, Types of maintenance, Classification of maintenance activities, Maintenance norms, maintenance cost.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE:
1. IRC ‘Specifications for Rural Roads’, MoRD, 2004
2. CRRI ‘Various Reports on Use of Waste Materials’
OBJECTIVES:

To Provide an exposure to various Environmental Laws and its importance in Transportation Projects.

OUTCOME:

Students would have understood the importance of environmental impact assessment, methods of predicting pollution levels at various stages of construction and methods to mitigate it.

UNIT I  ENVIRONMENTAL LAWS

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.

UNIT II  ENVIRONMENTAL IMPACT ASSESSMENT


UNIT III  POLLUTION MEASUREMENTS AND ITS IMPACT

Measurement of Air and Noise Pollution, Land Acquisition, Rehabilitation, Collection, Compilation and Presentation of Pollution and Impact Data, Measuring Impact before construction, at the time of construction and after construction, Prediction, Modeling and Validation

UNIT IV  MITIGATING MEASURES

Mitigating Measures for Air and Noise Pollution Policies and Strategies, Involvement of Stakeholders, Public Participation, Institutional Arrangements

UNIT V  TRAFFIC IMPACT


TOTAL: 45 PERIODS

REFERENCES:

3. David Banister; Transport Policy and Environment E&FN Spain, 1999
OBJECTIVES:
- To identify the causes of road accidents and analysing it based on various factors.
- Emphasis the need for road safety audit in existing roads.

UNIT I FACTORS INFLUENCING ACCIDENTS
Causes of accidents – Human factors – Vehicles – Road and its condition –
Environmental Studies

UNIT II ACCIDENT ANALYSIS
Collision Diagram – Preparation, Spatial Analysis of Accidents – Methods - GIS in
Accident Analysis - Black Spot, Black Route and Area Identification

UNIT III EVALUATION OF ACCIDENT PREDICTION MODELS
Accident Prediction Models – Development – Empirical Bayees Approach – Before and
After Evaluation – Case Studies

UNIT IV SAFETY AUDIT
Need for Safety Audit – Concept and Elements of Safety Audit – Safety Audit for existing
roads – Legal requirements – Provisions of Motor Vehicle Act and role of NGO’s in
prevention of accidents.

UNIT V ACCIDENT INVESTIGATION
Accident data – Identification of Accident Prone Location – Prioritisation – Investigation –
Problems and Remedies

TOTAL : 45 PERIODS

REFERENCES:
Engineers in India, Government of India, 2001
Wiley and Sons.
ELECTIVES  
SEMESTER 3

PHE708  HIGHWAY PROJECT MANAGEMENT  LTPC
3003

OBJECTIVE:

To make the students to understand the highway project formulation, investment appraisal in various highway projects etc.

OUTCOME:

Students will be aware of various finance policies and programmes related to Urban Planning and Development and the students will be in a position to formulate, appraise and conduct feasibility studies on urban projects.

UNIT I  HIGHWAY PROJECT FORMULATION  9
Project formulation – detailed project report – agencies involved in projects – design consultants – supervision consultants – contractors for implementation – Govt agencies – linkages among organizations – environment and social issues – responsibilities of various agencies – discussion on various models

UNIT II  TYPES OF FINANCING  9
Types of financing – financial institutions – internal generation of funds – international commercial borrowings – collaborator’s equity participation – share subscription by overseas investors – other sources

UNIT III  INVESTMENT APPRAISAL  9
Motor vehicle operation cost – value of time of travel – accident cost – other cost – annual highway cost – economic analysis – Indian and International practices of investment appraisal – risk analysis and selection of a project

UNIT IV  PROJECT PLANNING  9
Time and resources planning – project control methodology – resources productivity control – project cost control – project time control – codification of the planning system – network techniques

UNIT V  CONTRACT FORMATION  9

TOTAL : 45 PERIODS

REFERENCES:

OBJECTIVE:

To make students to understand the causes of accidents and measures to reduce it through accident reduction techniques.

OUTCOMES:

The students will be able to design accident free roads and road infrastructure.

Black spot identification – Rumble Strips – Set back distances
Conflict points in two way roads – two lanes – four lanes – six lanes
Efficient control measures and design of control systems
Signal – rotaries – grade separators.
UNIT I  INTRODUCTION TO INTELLIGENT TRANSPORTATION SYSTEMS (ITS)  9

UNIT II  TELECOMMUNICATIONS IN ITS  9
Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System

UNIT III  ITS FUNCTIONAL AREAS  9

UNIT III  ITS USER NEEDS AND SERVICES  9

UNIT V  AUTOMATED HIGHWAY SYSTEMS  9
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. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
OBJECTIVES:

- To understand and apply basic concepts and methods of urban transportation planning in the India.
- To use Artificial Intelligence techniques for various Transportation Engineering problems.
- To understand and be able to apply travel demand modeling, Mode Choice Modeling and Traffic Assignment Modeling.

OUTCOMES:

Students who successfully complete this course will be able to

- Design and conduct surveys to provide the data required for transportation planning.
- Learn and understand zonal demand generation and attraction regression models.
- Learn and understand demand distribution models (gravity models) and modal split models for mode choice analysis.
- Develop and calibrate trip generation rates for specific types of land use developments.
- Make final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization.

UNIT I  INTRODUCTION TO ARTIFICIAL INTELLIGENCE  
9

Significance of AI in Transportation Engineering and uses of AI for solution of Transportation Engineering problems. Comparison between statistical methods and various AI techniques.

UNIT II  FIZZY LOGIC  
9

Introduction to Fuzzy-logic, merits and limitations of Fuzzy-logic, crisp sets: types and properties of crisp sets, Partition and covering, Fuzzy sets: membership function, basic fuzzy set operations, Fuzzy Relations, Fuzzy Logic applications in Transportation Engineering.

UNIT III  ARTIFICIAL NEURAL NETWORKS  
9

UNIT IV    GENETIC ALGORITHM

Basic concepts of Genetic Algorithms (GA), Working Principle, types of Encoding, cross-over, Fitness function, Methods of Reproduction (in brief) and Applications of GA in Transportation Engineering.

UNIT V      EXPERT SYSTEMS

Introduction to Expert Systems (ES), basic concepts of ES and their Applications in Transportation Engineering.

Text Books:
1. Neural Networks, Fuzzy Logic and genetic Algorithms, Synthesis and Applications, by S.

Reference:
2. Relevant IRC and TRB publications.
UNIT I  INTRODUCTION

Engineering properties of soft – weak and compressible deposits – problems associated with weak deposit – Requirements of ground improvements – introduction to engineering ground modification, need and objectives.

UNIT II  SOIL STABILIZATION


UNIT III  RECENT GROUND IMPROVEMENT TECHNIQUES


UNIT IV  SOIL REINFORCEMENT


UNIT V  GEO-SYNTHETICS


TOTAL: 45 PERIODS

REFERENCES

2. Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, New Delhi
UNIT I  LAND USE AND TRANSPORTATION ENGINEERING  9

Transportation modeling in Planning; Models and their role, Characteristics of Transport demand and supply, Equilibrium of supply and demand, Modeling and decision making, Issues in Transportation modeling and structure of the classic transport model.

UNIT II  LAND USE TRANSPORTATION MODELS  9

Introduction to Land Use Planning; Relation between Transportation and Land Use Planning; The economic base mechanism and allocation mechanism; Spatial allocation and employment interrelationship; Garin Lowry models.

UNIT III  GENERAL TRAVEL DEMAND MODELS  9

Aggregate, Disaggregate models ; Behavioral models; Recursive and direct demand Models; Linear, Non-Linear models; Logit, discriminant and probit models; Mode split models - Abstract mode and mode specific models.

UNIT IV  REGIONAL TRANSPORT MODELS  9

Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; Time function iteration models; Internal volume forecasting models.

UNIT V  REGIONAL NETWORK PLANNING  9


REFERENCES
1. Urban Modeling - Michael Batty.
2. Land Use Transportation Planning Notes - S.R.Chari, REC Warangal.
3. Introduction to Transportation Engineering and Planning, Morlok EK, McGraw Hill
5. Urban Development Models - Ed. By R.Baxter, M.Echenique and J.Owers; The Institute of
8. Behavioral Travel Demand Models - Peter R. Stopher ARNIM.H.MEYBURG.
OBJECTIVE:

To make the students to understand the use of state of the art technologies and the usage of Google maps and GPS for design and drafting.

OUTCOMES:

Students will be able to make use of freeware for accurate Highway design and have knowledge on Digital Terrain Modelling and their application in the Highway design.

OBJECTIVE:

To make the students to understand the effects of Pollution caused by automobiles both while in operation and idling and the variety of techniques to arrest them.

OUTCOMES:

Students will be aware of

- ill effects of pollution,
- carbon rating based on pollution levels and
- methods to control pollution.

UNIT I INTRODUCTION TO INTERNAL COMBUSTION ENGINES

Spark ignition & Compression ignition engines, 4-stroke and 2-stroke engines, engine’s performance parameters, principles of working, other types of engines.

UNIT II SOURCES OF EMISSIONS IN AN IC ENGINE.

UNIT III MECHANISMS OF FORMATION OF EXHAUST POLLUTANTS

CO, HC, NOX, SOX, Particulate Matters, Exhaust gas composition, analysis, important factors affecting exhaust composition, air fuel ratio. Overview of impact of air pollution due to automobiles. Control strategy: primary and secondary.
OBJECTIVE:

To make the students to understand the highway infrastructure elements, their uses and their design.

OUTCOMES:

Students will be aware of various highway infrastructure elements and their design.

UNIT I GEOMETRIC DESIGN OF HIGHWAYS


UNIT II HORIZONTAL AND VERTICAL ALIGNMENT

Objectives of horizontal curves; Super elevation — Need for Super elevation; Method of computing super elevation; Minimum Radius of Curve; Methods of attainment of super elevation; Extra widening on Curves; Transition Curves – Objectives and Design. Gradients – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Combination of Vertical and Horizontal Curves – Grade Compensation; Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Importance of Sight Distances for Horizontal and Vertical Curves.

UNIT III INTERSECTION DESIGN

Types of Intersections; Design Principles for Intersections; Design of Atgrade Intersections – Channelisation, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept and Design, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

UNIT IV TRAFFIC SIGNS AND ROAD MARKINGS

Types of Road Signs; Guidelines for the provision of Road Signs; Cautionary Signs, Regulatory Signs, Information Signs – Design standards; Road markings – Objectives of Road Markings; Types of Road Markings; Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Markings. Highway Appurtenances – Delineators, Traffic Impact Attenuators, Safety Barriers.
UNIT V  MISCELLANEOUS ELEMENTS

Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays – Types and Guide lines; Design of On-street and Off street Parking facilities – Guidelines for lay out Design.

TOTAL: 45 PERIODS

REFERENCES:
1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna Publications
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.
UNIT I  CEMENT AND ADMIXTURES

UNIT II  AGGREGATES AND ITS PROPERTIES
Classifications of aggregates - particle shape and texture - bond, strength and other mechanical properties of aggregate - specific gravity, bulk density, porosity, absorption and moisture content of aggregate - bulking of sand - deleterious substance in aggregate – soundness of aggregate - alkali-aggregate reaction - thermal properties - sieve analysis - fineness modulus - grading curves - grading of fine and coarse aggregates - gap graded aggregate – maximum aggregate size – combined a grading – BIS grading.

UNIT III  FRESH CONCRETE AND HARDENED CONCRETE

UNIT IV  ELASTICITY, SHRINKAGE AND CREEP

UNIT V  CONCRETE MIX DESIGN AND SPECIAL CONCRETE ISSUES

REFERENCES:
1. Concrete Technology by M.S.Shetty, S.Chand& Co.
2. Properties of Concrete by A.M.Neville, ELBS publications.

TOTAL: 45 PERIODS