JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH. (HIGHWAY ENGINEERING)
COURSE STRUCTURE AND SYLLABUS

I Year – I Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course I	Urban Transportation Planning	25	75	4	--	4
Core Course II	Traffic Engineering	25	75	4	--	4
Core Course III	Pavement Material Characterization	25	75	4	--	4
Core Elective I	Engineering of Ground Bridge Engineering Road Safety Engineering	25	75	4	--	4
Core Elective II	Highway Infrastructure Design Advanced Concrete Technology Transportation System Management	25	75	4	--	4
Open Elective I	Applied Statistics Project Management Remote Sensing & GIS	25	75	4	--	4
Laboratory I	Transportation Engineering Lab - I	25	75	--	4	2
Seminar I	Seminar	50	--	--	4	2
Total Credits				**24**	**8**	**28**

I Year – II Semester

Category	Course Title	Int. marks	Ext. marks	L	P	C
Core Course IV	Pavement Construction, Maintenance & Management	25	75	4	--	4
Core Course V	Pavement Analysis and Design	25	75	4	--	4
Core Course VI	Traffic Analysis	25	75	4	--	4
Core Elective III	Highway Project Formulation and Economics Land use and Transportation Modeling Environmental Impact Assessment	25	75	4	--	4
Core Elective IV	Intelligent transportation systems Rural Roads Airport Engineering	25	75	4	--	4
Open Elective II	Optimization Techniques Disaster Management Finite Element Method	25	75	4	--	4
Laboratory II	Transportation Engineering Lab - II	25	75	--	4	2
Seminar II	Seminar	50	--	--	4	2
Total Credits				**24**	**8**	**28**

II Year - I Semester

Course Title	Int. marks	Ext. marks	L	P	C
Comprehensive Viva-Voce	--	100	--	--	4
Project work Review I	50	--	--	24	12
Total Credits			--	24	**16**

II Year - II Semester

Course Title	Int. marks	Ext. marks	L	P	C
Project work Review II	50	--	--	8	4
Project Evaluation (Viva-Voce)	--	150	--	16	12
Total Credits			**--**	**24**	**16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

URBAN TRANSPORTATION PLANNING

Objectives: The course introduces students to the fundamentals of urban transportation planning and the types of skills and knowledge that transportation planners need. It further familiarizes students with contemporary transportation planning issues and methods of analysis. The course is highly relevant regardless if students intend to focus on transportation itself, or other aspects of urban planning.
The basically deals with data collection urban transportation planning. The travel demand issues & planning of demand & supply.
To discuss the preparation & evaluation of alternative strategy of transportation facilities.
Relationships between transportation and urban land use systems and new tools to address environmental and quality of life impacts of transportation are presented. Transportation investment decisions (or lack thereof) have been held accountable for increased economic prosperity or spiraling economic decline.

Unit I:
Introduction: Role of transportation in the economic development of nations, overview of transport modes, growth trends, National Transport Policy of India – Case studies, transportation planning in the developing world; and comparative international transportation policies; Fundamentals of transportation , Principles of planning, evaluation, selection, adoption, financing, and implementation of alternative urban transportation systems; formulation of community goals and objectives, inventory of existing conditions; transportation modeling trip generation, distribution, modal choice, assignment

Unit II:
Data Collection And Inventories: Collection of data – Organization 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:
Travel Demand issues: Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Detailed approach on 4 step travel demand estimation; Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

Unit IV:
Demand and supply planning : Planning for sustainable urban mobility, positive and negative externalities in urban transport, congestion pricing, parking policy, demand management , Urban travel and transportation system characteristics - a systems perspective, Data management and use in decision making , Demand analysis , Urban activity analysis, Supply analysis; 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.

Unit V:
Metropolitan cities: Design issues in urban mobility, integrating land use and transport planning; , Overview of urbanization process, city structure and urban activity and infrastructure systems, Economic and social significance of urban infrastructure systems; Transport's Role in tackling Social Inclusion, Economic Impacts of Transport Policy

Learning outcomes
Urban Transportation Policy and Planning
Course Outcomes: At the end of the course, the student will be able to:
CO1 Identify urban transportation problems.
CO2 Estimate urban travel demand.

CO3 Plan urban transport networks.
CO4 Identify urban transport corridors.
CO5 Prepare urban transportation plans

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.
5. Metropolitan transportation planning – John W. Dickey, Tata Mc Graw Hill, New Delhi,1975.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

TRAFFIC ENGINEERING

Objectives: This module focuses on *traffic*, its properties, measurement, simulation and control. It deals with traffic flow variables and their measurement. Traffic flow and queuing theory is introduced. Survey methods and data analysis techniques required by traffic engineers are presented.
Interdiction to highway capacity & level of service is dealt.
Parking analysis & road safety issues are discussed.
The polluting due to traffic & its collect on environment are discussed.

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. Sustainable Transportation: Sustainable modes, Transit Oriented Development, ITS based benefits for Environment.

Course outcomes
1. As the end of the course the stad would be able to
2. Analysis design issues related to parking & signal.
3. To understand the detrimental effect of traffic on environment.

On successfully completing this course, students will possess a good understanding of traffic engineering, know basic quantitative methods required by traffic engineers, understand how different road user groups interact and the consequences for traffic engineering. Examples relating to current industrial practice will be used to illustrate these key concepts.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

PAVEMENT MATERIAL CHARACTERIZATION

Objectives: The main objective of this course is to provide students with a thorough understanding of the important factors in pavement design and analysis. The focus will be on practices of pavement design highway agencies.

Unit I:
Subgrade Soil Characterization: Properties of subgrade layers; different types of soils, Mechanical response of soil; Soil Classification; Index and other basic properties of soil; A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. SPT, DCPT, CPT, CBR, Plate Load test & resilient modulus; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Dynamic properties of soil: FWD test.

Unit II:
Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control. Introduction to Ground improvement techniques; Introduction to Geo textiles and synthetics applications.

Unit III:
Aggregate Characterization: Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation, Fuller and Thompson's Equation, 0.45 power maximum density graph; Use of locally available materials in lieu of aggregates.

Unit IV:
Bitumen and Bituminous Concrete Mix Characterization: Bitumen sources and manufacturing, Chemistry of bitumen, bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test, stiffness modulus of bitumen mixes using shell nomographs; Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties.Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Introduction to emulsified bitumen and its characterization; Long term and short term ageing and its effect on bitumen performance, Tests to simulate ageing of bitumen viz. RTFOT and PAV.
Desirable properties of bituminous mixes, Design of bituminous mixes: Modified Marshall's specifications, Hubbard Field method of mix design, Hveem's method of mix design; Introduction to super pave mix design procedure

Unit V:
Cement and Cement Concrete Mix Characterization:
Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties; Introduction to advanced concretes like self compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; IS method of cement concrete mix design with case studies; Role of different admixtures in cement concrete performance; Joint fillers for Jointed Plain Cement Concrete Pavements and their characterization; Nano technology applications in cement concrete.

Learning outcomes
Pavement Material Characterization
Course Outcomes: At the end of the course, students will be able to
CO1 Determine the proportions of ingredients required for the mix design of both asphalt mixtures and cement concrete.
CO2 Characterize the pavement materials including soil, aggregate, asphalt, cement, asphalt mixtures, cement concrete.

CO3 Select appropriate asphalt binder for construction of a flexible pavement depending upon the traffic and climatic conditions.
CO4 Choose appropriate stabilization technique for pavement
CO5 Understand the basic of cement & cement concrete clean colorization.

REFERENCE BOOKS:

1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
2: Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971.
3. Relevant IRC and IS Codes of Practices (Separate List will be given).
4. Read, J. And Whiteoak, D., "*The Shell Bitumen Handbook*", Fifth edition, Shell Bitumen, Thomas Telford Publishing, London 2003
5 Relevant IRC and IS codes

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

ENGINEERING OF GROUND
(Core Elective I)

Objectives:
This course will provide a introduction to the design and philosophy of geotechnical site investigations and a legislation element incorporating contaminated land. Students will learn about the range of exploration and testing techniques available to geotechnical engineers. Students will also learn how investigations are planned and how the results of investigations relate to the design process.

UNIT-I
Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, in situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, and their applications.

UNIT-II
Mechanical Modification – Deep Compaction Techniques- Blasting Vibrocompaction, Dynamic Tamping and Compaction piles.

UNIT-III
Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Electro-kinetic dewatering.
Filtration, Drainage and Seepage control with Geosynthetics, Preloading and vertical drains,

UNIT-IV
Physical and Chemical Modification – Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

UNIT-V
Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

Elective – 1 : Engineering of Ground
Course Outcomes: At the end of the course, students will be able to
CO1 Identify ground conditions and suggest method of improvement
CO2 Design and assess the degree of improvement
CO3 Understand the principles of soil reinforcement and confinement in engineering Constructions
CO4 Design reinforced soil structures

TEXT BOOKS
1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications

2. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis.

REFERENCES:
1. Koerner, R. M (1994) – Designing with Geosynthetics – Prentice Hall, New Jersey
2. Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
3. Xianthakos, Abreimson and Bruce - Ground Control and Improvement
4. K. Krisch & F. Krisch (2010) - Ground Improvement by Deep Vibratory Methods, Spon Press, Taylor and Francis
5. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

BRIDGE ENGINEERING
(Core Elective I)

UNIT-I:

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Sesmic loads-Frictioal resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of raodway and footway-General Design Requirements.

UNIT-II:

Solid slab, Girder Bridges & Continuous Bridges: Introduction-Method of Design. Girder Bridges - Introduction-Method of Design-Courbon's Theory. Continuous Bridges - Introduction- Span lengths-Analysis of Continuous bridges-Decking of Girders with constant Moment of Inertia-Continuous bridges with variable Moment of Inertia-Method of Analysis -Girders with Parabolic Soffit-Method of plotting Influence lines-Girders with Straight Haunches-Design steps for Continuous Bridges.

UNIT-III:

Pre-Stressed Concrete Bridges: Basic principals- Method of Pre-srtessing-Pretensioning and Post-tensioning- Comparision-Freyssinet Method-Magnel-Blanet System-Lee-Mc call system-Basic Assumptions-Losses in Prestress-Equation based on Initial and final stress conditions-Cable Zone-Design of selections-Condition of first crack- Ultimate load design-Shear-Vertical Prestressing-Diagonal Tension in I-section-End Block-Magnel's method-Emperical Method-General Design requirements-Mild steel reinforcement in prestessed concrete member-Concrete cover and spacing of pre-stressing steel-Slender beams-Composite Section-Propped-Design of Propped Composite Section-Unproped composite section-Two-stage Prestressing-Shrinking stresses-General Design requirements for Road Bridges.

UNIT-IV:

Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM.

UNIT-V:

Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions- Design loads for piers-Abutments- Design loads for Abutments.

REFERENCES:

1. Design of Concrete Bridges by M.G.Aswani, V.N.Vazirani and M.M.Ratwani.
2. Bridge Deck Behaviour by E.C.Hambly.
3. Concrete Bridge Design and Practice by V.K.Raina.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

ROAD SAFETY ENGINEERING
(Core Elective I)

Objectives:

This module on the fundamental of traffic engg & some of the statistics methods to analysis the traffic safety.

The accident interrogations 7 risk involved with measures to identity the causes are dealt.

The role of road safety in planning the urban infrastructures design is discussed.

The varies traffic management system for safety & safety improvement strategies are dealt.

Unit I:

Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

Unit II:

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: 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:

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 Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

Out comes: The student be able to

1. To Understand fundamental of Traffic Engg.
2. To investigate & determine the collective factors & remedies of accident involved.
3. To design & planning various road geometrics.
4. To massage the traffic system from road safety point of view.

REFERENCES:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall
4. Fundamentals of Traffic Engineering, Richardo G Sigua
5. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
6. Road Safety by NCHRP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

HIGHWAY INFRASTRUCTURE DESIGN
(Core Elective II)

Objectives: This module seeks to cover the principles of transportation infrastructure design in the wider context of the civil engineering profession. The design and execution of large transport infrastructure projects is a multi-layered exercise, with this module aiming to provide an overview of the key stages involved. Students attending this module will develop a good command of the concepts involved in geometric design of intersections, horizontal & vertical alignment of roads & pedestrian facilities.
Recognize the history and evolution of transportation in cities. Describe the urban street hierarchy and functional classification system. Formulate a functional design process that accommodate the needs of all users and allows for street designs that are compatible with the surrounding area.
Identify the factors that influence urban street design. Demonstrate the relationship between mobility and access. Identify and define the elements of a roadway cross-section. Discuss concepts related to the roadway design speed.
Recognize design elements including street user; design vehicles; design speed. Discuss alignment and grade elements including sight distance; horizontal andverticalcurves; and terrain and acceptance grades for urban local and collector streets. Describe usage of traffic control devices on urban local and collector streets Identify the factors important in the design of driveways, shoulders and sidewalks for urban local and collector streets.
Define the functional area of an intersection. Identify key design elements for intersections. Describe benefits and disadvantages of turn lanes and turn lane geometric characteristics. Identify pedestrian street crossing issues. Recognize design features outside of the travel way that can affect intersection design. List signal components that affect intersection design.

UNIT-I:
Highway Cross Section Elements and Geometric Design Of Highways: Functional Classification of Highway System; Design Controls – Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design. Carriageway, Shoulders, Formation, Right of way; Kerbs, foot paths, Medians- design specifications; Pavement Surface characteristics – Skid Resistance, factors affecting Skid resistance, Measurement of Skid Resistance; Road Roughness, measurement of Road roughness; Camber, Objectives of Camber, design standards.

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 At-grade 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.

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
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

ADVANCED CONCRETE TECHNOLOGY
(Core Elective II)

Objectives:

This course will provide the students with state-of-the art knowledge on durable and sustainable cement and concrete, on the various mineral additions and chemical admixtures to enhance the workability, strength, durability and sustainability of concrete, and will empower them in the decision making process regarding the various concrete products, construction procedures and performance test methods that will improve the durability and sustainability of concrete civil infrastructure.

This course will empower students to become technical leaders in the concrete .The materials science aspects of concrete production will be explored in the context of various performance criteria with emphasis on durability and sustainability. The process of material selection, proportioning, mixing, transporting, placing and curing concrete will be the main focus, augmented with technology of admixtures use; green cements and concrete products.

This comprehensive course is designed to provide students with an in-depth understanding of the fundamentals of concrete. Covered in detail is information about constituent materials, specification and production, concrete properties and performance as well as basic practical applications. The course is widely acknowledged by industry as the first step in obtaining a recognized qualification for candidates with some prior knowledge or experience in the field.

UNIT-I

Concrete Making Materials : Cement – Bogus Compounds – Hydration Process – Types of Cement – Aggregates – Gradation Charts – Combined Aggregate – Alkali Silica Reaction – Admixtures – Chemical and Mineral Admixtures.

UNIT-II

Fresh and Hardened Concrete: Fresh Concrete – workability tests on Concrete – Setting Times of Fresh Concrete – Segregation and bleeding.

Hardened Concrete: Abrams Law, Gel space ratios, Maturity concept – Stress strain behavior – Creep and Shrinkage – Durability Tests on Concrete – Non Destructive Testing of Concrete.

UNIT-III

High Strength Concrete – Microstructure – Manufacturing and Properties – Design of HSC Using Erintroy Shaklok method – Ultra High Strength Concrete.

High Performance Concrete – Requirements and Properties of High Performance Concrete – Design Considerations

UNIT-IV

Special Concretes: Self Compacting concrete, Polymer Concrete, Fibre Reinforced Concrete – Reactive Powder Concrete – Requirements and Guidelines – Advantages and Applications.

Concrete Mix Design: Quality Control – Quality Assurance – Quality Audit - Mix Design Method – BIS Method – DOE Method – Light Weight Concrete, Self Compacting Concrete.

UNIT-V

Form work – materials – structural requests – form work systems – connections – specifications – design of form work – shores – removal for forms - shores – reshoring – failure of form work.

Learning outcomes

Elective-1 : Advanced Concrete Technology

CO1 Identify Quality Control tests on concrete making materials
CO2 Understand the behavior of fresh and hardened concrete
CO3 Design concrete mixes as per IS and ACI codes
CO4 Understand the durability requirements of concrete
CO5 Understand the need for special concretes
CO6 Design form work

REFERENCES:

1. Special Structural concretes by Rafat Siddique, Galgotia Publications 2000.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications, 2000.
3. Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.
4. Properties of Concrete by A.M.Neville, ELBS publications Oct 1996.
5. Concrete Technology by A.R. Santhakumar, Oxford University Press Oct 2006.
6. Concrete Technology by M.S.Shetty, S.Chand & Co 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

TRANSPORTATION SYSTEMS MANAGEMENT
(Core Elective II)

Objectives:

- Discuss various principle types of bus and rail transit vehicles, their differing operating Environments and how they affect urban street design.
- Discuss existing guidelines for urban street geometric design for bus and rail transit services.
- Identify specific geometric design considerations, design requirements and impacts for on-street running bus, LRT and streetcar operations.
- Describe considerations for off-street bus and rail operation including trackway width and clearance requirements, street crossings, and access to and from stations.

UNIT-I:
TSM Philosophy: Systems approach to Transportation Planning; Long Term Strategies and Short term Measures; TSM actions – Objectives and Philosophy; Relevance of TSM actions to Indian Urban Context. Broad spectrum of TSM actions. Measures for Improving Vehicular Flow – One Way Streets, Signal Improvements, Transit Stop Relocation, Parking Management, Reversible lanes; Reducing Peak Period Traffic – Staggering of Working hours, Congestion Pricing, differential Toll Policies

UNIT-II:
Measures to Promote Transit: Preferential Treatment to High Occupancy Vehicles; Car Pooling; Transit Service Improvement Measures; Transit management Improvement Measures; Transit and Para Transit Integration; Para-transit Role in Urban Areas; Multi-modal coordination.

UNIT-II:
Bus Route Network Planning And Management: Types of Bus Route Net works; Suitability for a given Urban Area; Types of Routes – Corridor Routes, Activity Routes and Residential Routes; Issues in Route Network Evaluation – Number of Routes, Length of Routes; Route Alignment Methods; Service Coverage and Accessibility Index.

UNIT-IV:
Promotion of Non-Auto Modes: Measures to Promote Non-Auto modes - Pedestrianisation; Bicycle Transportation – Advantages; planning Bicycle facilities – Class I, Class II and Class III Bikeways; Junction Treatments for Cycle Tracks; LOS criteria for Pedestrian and Bicycle facilities.

UNIT-V:
Advanced Transit Technologies: Conventional and Unconventional Systems; Rapid Transportation Systems; New Technologies – LRT, Monorail, Automated Highways, Hovercraft; System characteristics and suitability.

Learning Outcomes
Elective-II: Transportation Systems Management
Course Outcomes: At the end of the course, the student will be able to:
CO1 Understand TSM, the need for TSM and the objectives of TMS.
CO2 Understand the types of TSM strategies.
CO3 Apply a strategy based on a TSM goal or objective.
CO4 Recommend methods to manage a transit system to improve its management efficiency.
CO5 Understand transportation demand management (TDM), various TDM strategies and their applicability.
CO6 Recommend a detailed transport demand management strategy for a transportation system based on a goal or objective.

REFERENCES:
1.Transportation System Management Notes, S.R.Chari, REC, Warangal
2. Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill
3.The Bicycle Planning, Mike Hudson, Open Books, UK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

APPLIED STATISTICS
(Open Elective – I)

Objectives:

Statistics is the science in which we make inferences about some specific random process based upon a sample of data which is sometimes quite limited. The application of statistical methods to solve problems in a particular field of study is termed as Applied Statistics.

UNIT-I

Introduction to Sampling Techniques and Statistical Distributions:

Frequency distribution; Mean; Standard deviation; Standard error, Skewness; Kurtosis; Definitions and Applications; Simple random sampling; Stratified sampling; Systematic sampling; Sample Size determination; Applications in Traffic Engineering ; Statistical Distributions: Binomial, Poisson, Exponential and Normal distributions; Fitting of distributions; Mean and variance; Chi-square test of goodness-of-fit; Chi-square distribution; Students T-distribution; Snedectors, F- Distribution. Applications in Traffic Engineering.

UNIT-II

Probability:

Laws of Probability; Conditional probability and Independent events; Laws of expectation. Theorem of total probability and Baye's theorem

UNIT-III

Regression and Correlation:

Linear regression and correlation; Multiple correlation; Multiple correlation coefficient; Standard error of estimate; Curvilinear regression models; Applications in Transportation Engineering.

UNIT-IV

Multivariate data analysis:

Types of data; Basic vectors and matrices, Dispersion, Variance and covariance, Analysis of Variance; Correlation matrices; Principal component analysis, Time series analysis.

UNIT-V

Tests of Significance & Confidence Interval:

Large sample and small sample tests; Tests for single mean, Means of two samples, Proportions, two variances, two observed correlation coefficients, Applications. Intervals for mean, variance and regression coefficients; Applications in Traffic Engineering problems.

Learning outcomes

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

CO1 Understand and Analyse probability distributions
CO2 Carry out multivariate data analysis and identify correlations
CO3 Develop Time Series Models
CO4 Estimate Parameters using appropriate techniques
CO5 Test hypothesis using goodness of fit measures
CO6 Understand & analysis the traffic problem.

REFERENCES:

1. Basic Statistics - Simpson and Kafks; Oxford and IBH Calcutta, 1969.
2. Fundamentals of Mathematical Statistics – Gupta, S.C and Kapoor, K.V.Sultanchand.
3. Multivariate Data Analysis –Cootey W.W & Cohens P.R;John Wiley &Sons.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

PROJECT MANAGEMENT
(Open Elective – I)

Objectives:

1. Students will be able to demonstrate the role of project management and will learn estimation and approvals of project
2. Students will have the knowledge about critical construction management estimation and approvals of, BOOT & PP projects.

UNIT-I

Introduction to Project Management: A systems Approach, Systems Theory and Concepts, Organization, Management Functions, Overview of Management Objectives, Tools and Techniques, Project Management – Processes and Organizational 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 Optimization and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.

UNIT-III

Contract Management: Tendering and Contracting, Laws of Contracts, subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts. ; Human Resource Management: 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

UNIT-IV

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; Construction Management Practices: Implementation of Procedures and Practices – International Experiences – Case Studies – Examples

UNIT-V

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

Learning outcomes

Elective -1: Project Management:

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

CO1 Develop organisation structure for construction company
CO2 Estimate project cost and develop cost models
CO3 Prepare tendering and contract documents
CO4 Prepare quality control plans and safety plans
CO5 Estimate construction project duration
CO6 Prepare plans for human resource and resource management

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

REMOTE SENSING AND GIS
(Open Elective – I)

Objectives

To impart knowledge on interpretation of aerial and satellite images and use these images for urban and transportation planning.

UNIT-I

Remote sensing for detection of urban features-Scale and resolution-Scope and limitations-interpretation from Aerial and satellite images-digital image are processing techniques-image fusion.

UNIT-II

Classification and settlement-settlement structure-segmentation of built-up areas-classification algorithms-land use/land cover mapping-change detection-high resolution remote sensing.

UNIT-III

Urban morphology-housing typology-population estimation from remote sensing-infrastructure demand analysis-urban renewal land suitability analysis-plan formulation-regional, master and detailed development-Use of remote sensing and GIS in plan preparation-urban information system-web GIS.

UNIT-IV

Mapping transportation network-classification-optimum route/shortest route-alignment planning-traffic and parking studies-accident analysis

UNIT-V

Urban growth modeling-Expert systems in planning-3D city models-ALTM-Land use transportation interaction models-intelligent transportation systems.

Outcomes : The learner will be able to use satellite images for effective preparation of urban development and transportation network.

TEXT BOOKS:

1. Juliana Maantay,john Ziegler,john pickles,GIS for the Urban environment, Esri press 2006.
2. Allan Brimicombe, GIS Environmental modeling and Engineering,CRC;1 edition 2003.
3. Paul Longley,Michael Batty,spatial Analysis: Modeling in a GIS Eniveronment Wiley,1997.
4. Michael F. Goodchild,Louis T.Steyaert,Bardely O.Parks,Carol Johnston,David Maidment, Michael crane,Sandi Glendinning,GIS and Environmental modeling: Progess and Research issues(Handover) by, Publisher; Wiely; 1 edition, 1996.
5. Roland Fletcher, The limits of settlement Growth: A Theoretical Outline(New.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Highway. Engg.)

HIGHWAY ENGINEERING LAB – I.

1. Test on soil – i) Soil Consistency test, Sieve Analysis
ii) CBR test
iii) Compaction of Soil
iv) Standard Proctor test

2. Test on Aggregate – i) Shape test
ii) Impact and crushing tests on aggregate
iii) Abrasion and Attrition test
iv) Soundness test

3. Tests on Bitumens – i) Viscosity, Penetration, Ductility tests
ii) Flash and fire point tests
iii) Rolling thin film test, Bitumen extraction tests

4. Test on Bitumen & Concrete mix – i) Design of Cement Concrete Mix for Highway
ii) Marshal Stability Mix Design