M. TECH.TRANSPORTATION ENGINEERING

VISION & MISSION OF INSTITUTE

VISION
To achieve excellent standards of quality education by keeping pace with rapidly changing technologies and to create technical manpower of global standards with capabilities of accepting new challenges.

MISSION
Our efforts are dedicated to impart quality and value based education to raise satisfaction level of all stakeholders. Our strength is directed to create competent professionals. Our endeavour is to provide all possible support to promote research and development activities.

VISION & MISSION OF CIVIL ENGINEERING PROGRAM

VISION
To achieve excellent standards of quality education in Civil Engineering by keeping pace with rapidly changing technologies & to create technical manpower of Global Standards in Civil Engineering with capabilities of accepting new challenges.

MISSION
1. To impart quality and value based education to raise satisfaction of all stakeholders.
2. To serve society and nation for providing professional leadership in Civil Engineering for solving the problems consistent with rapidly changing technologies.
3. To create competent Civil Engineering professionals who are trained in the design and implementation of Civil Engineering systems.
4. To promote Research & Development Activities in the field of Civil Engineering and allied areas.
M. TECH. (TRANSPORTATION ENGG.)

Programme Educational Objectives (PEOs)
The educational objectives of the programme are designed to produce competent engineers who shall:

1. Apply knowledge of Transportation system analysis, design, modeling and simulation to provide solutions to industrial problems in diverse domains.
2. Undertake the professional career by developing system and services to address social, technical and economical challenges and needs.
3. To do research under collaborative and multidisciplinary environments using modern tools, processes and creative efforts.

Programme Outcomes (POs)
On completion of the M. Tech. (Transportation Engineering) programme, the students shall be able to:

PO1: Independently carry out research /investigation and development work to solve practical problems.
PO2: Write and present a substantial technical report/document.
PO3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
PO4: Develop ability to learn reflectively from mistakes, engage in lifelong learning, adapt new developments and participate in continuing education opportunities to foster personal and organizational growth.
PO5: Provide technical solutions to society with integrity, ethical behavior and commitment to code of conduct of professional practices and standards.

PROGRAM SPECIFIC OUTCOMES (PSO's)
PSO1: An ability to recognize the importance of Civil Engineering professional development by pursuing postgraduate studies
PSO2: An ability to apply design, develop and execution of projects in the construction of various Civil Engineering disciplines
PSO3: An ability to face competitive examinations that offer challenging and rewarding careers and demonstrating leadership to emerged as potential entrepreneur.
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<th>Subject Code</th>
<th>Name of the Course</th>
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**List of Elective I**
1. TNSL 551 Advanced Highway Materials
2. TNSL 552 Transportation and Traffic Infrastructure Design
3. TNSL553 Transportation System Analysis and Modeling

**List of Elective-II**
1. TNSL 554 Environmental impact on Various Transportation system
2. TNSL 555 Transportation Safety and management
3. TNSL 556 Bridge Engineering

**List of Elective-III**
1. TNSL 557 Advanced Traffic Management System
2. TNSL 558 Communication Standards used in Transportation
3. TNSL559 Transportation Network Analysis
4. TNSL560 Ground Improvement Techniques
### M.TECH TRANSPORTATION ENGINEERING SCHEME (CIVIL ENGINEERING)

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List of Elective IV
1. TNSL561 Transducers & Sensors
2. TNSL562 Soft Computing
3. TNSL563 Urban Transportation Planning
4. TNSL564 Computer Aided Transportation Engineering

List of Elective V
1. TNSL 565 Highway Traffic Analysis and Pavement Design
2. TNSL 566 Transportation Economics and Finance
3. TNSL 567 Public Transportation Planning and Design
4. TNSL 568 Railway Infrastructure Planning and Design

List of Elective VI
1. TNSL569 Waterway Infrastructure Planning and Design
2. TNSL570 Airport Planning and Design
3. TNSL571 GIS and Remote Sensing
4. TNSL572 Pavement Design and Analysis
5. TNSL573 Project Management
### M.TECH TRANSPORTATION ENGINEERING SCHEME
**(CIVIL ENGINEERING)**

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**SEMESTER-I**

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**Course Outcomes**

- Understand various types of flow distributions in traffic flow theory.
- Understand different tests of significance and correlation of the data.
- Apply various mathematical modelling techniques to traffic engineering problems.
- Understand problems associated to find optimal solutions.
- Solve optimization problems using various methods.
- Perform optimization problems such as route optimization, transit schedule optimization etc.

**Unit 1.** [7 Hrs]
Collection and presentation of data; Measures of central tendency;Elementary probability theory; Random events; Baye's theorem; Random variables and distributions; Derived Distributions; Moments and Expectations;

**Unit 2.** [7 Hrs]
Common probabilistic models; Statistical inference; Estimation of parameters; Tests of hypotheses and significance; Goodness of fit tests; Regression and correlation analysis;

### Reference Books


**TNSL422**

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Course Outcomes
After the course students should be able to:
1. Understand the fundamental traffic flow theories and identify basic traffic variables and their relationships including speed, density and flow.
2. Analyze a variety of traffic facilities and evaluate capacity and level of service (LOS).
3. Design signalized intersections including isolated, coordinated and roundabouts.
4. Assess, evaluate and justify methods of traffic management and control.
5. Understand the use of advanced simulation methods for the analysis of traffic systems and software tools for the design of traffic control strategies.
6. Understand the implementation of recent advances in traffic engineering for the society benefits.

Unit 1.[10 Hrs ]
Driver behaviour, traffic information and control systems Traffic studies- volume, speed and delay studies

Unit 2.[08 Hrs ]
Elements of traffic flow theory ,Characteristics of uninterrupted traffic ,Capacity and LOS of ninterrupted facilities

Unit 3.08 Hrs ]
Characteristics of interrupted traffic Traffic characteristics at un-signalized intersections Design of signalized intersections Capacity and LOS of signalized intersections

Unit 4.[08 Hrs ]
Actuated signal control, signal coordination, Ramp Metering, Design of parking, lighting and terminal facilities

Unit 5.[08 Hrs ]
Simulation of traffic systems, Trends in traffic engineering

Reference Books
2. Fred Mannering, Walter Kleraski and Scott Washburn, Principles Of Highway Engineering And Traffic Analysis, 3rd Ed, Wiley India, 2007
4. Highway Capacity Manual 2000, MORTH Codes, All relevant IRC codes

TNSP423 TRAFFIC AND HIGHWAY ENGINEERING LABORATORY

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1. Traffic inventory surveys – Classified Volume count surveys, Speed studies, Headway studies, Delay studies, Gap acceptance studies, Parking studies, Accident investigation studies
2. Road geometric design – Cross sectional elements design, Horizontal and vertical alignment design, Intersection design, Overview of MX roads
3. Pavement design for flexible and rigid pavements – Soil characterization, Pavement material characterization tests, Traffic characterization
4. Quality control and Quality assurance issues: Blending of aggregates, Job Mix formula design, Pre-construction, During construction and Post construction quality control tests
5. Traffic impact assessment on mixed land use environment

Reference Books
1. MORTH Specifications of Road Construction and Bridge Works

TNSL551 ADVANCED HIGHWAY MATERIALS

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Course Outcomes
After the course students will be able to:
1. Select the appropriate materials for use in different road layers.
2. To select appropriate binder for flexible pavement depending upon the traffic and climatic conditions
3. Determine the proportions of ingredients required for the mix design of both asphaltmixtures and cement concrete.
4. To carry out tests on cement and cement concrete
5. Demonstrate application of geosynthesis in pavements
6. Demonstrate application of waste materials in pavements

Unit-1.(8 Hrs)

Unit-2.(8 Hrs)
Bituminous Materials: conventional and modified binders – production – types and grade –physical and chemical properties and uses – types of asphalt
pavement construction – principles of bituminous pavement construction – tests on bituminous materials. Bituminous

Unit-3. (6 Hrs)

Unit-4. (6 Hrs)
Behaviour – Performance – Tests on Cement and Concrete mixes. High Performance Concrete – low shrinkage – increased strength. Composites,

Unit-5. (6 Hrs)

Unit-6. (6 Hrs)

REFERENCE BOOKS:
2. RRL, DSIR, Soil Mechanics for Road Engineers, HMSO, London, 1995

TNSL552 TRANSPORTATION AND TRAFFIC INFRASTRUCTURE DESIGN

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Course Outcomes
After the course students should be able to:
1. Understand driver, vehicular and pavement surface characteristics.
2. Design road alignment manually and using MX road for hilly region.
3. Design an intersection by considering advantages and disadvantages of each and every element of intersection.
4. Design pedestrian facility and cycle tracks for road users.
5. Design different types of parking systems.
6. Understand the concept behind the runway design and railway alignment.

Unit 1. [10 Hrs]
Functional Classification of Highway System; Design Controls Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design, Cross Section Elements: Design specifications; Pavement Surface characteristics Skid Resistance, Road Roughness; Camber, Objectives, design standards. Specifications for hill roads

Unit 2. [10 Hrs]
Horizontal Alignment and Vertical Alignment of roads: Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance; Objectives of horizontal curves; Super elevation; Extradwinding on Curves; Transition Curves – Objectives and Design. Transition Curve setting methods and calculations, Introduction to MX Roads software; Vertical Alignment: Grades – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Importance of Sight Distances for Horizontal and Vertical Curves; Combination of Vertical and Horizontal Curves – Grade Compensation

Unit 3: [10 Hrs]
Geometric Design of Intersections: Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections – Channelization, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

Unit 4: [10 Hrs]
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.; Design of Ramp

Unit 5: [10 Hrs]
Airport and Railway Infrastructure Design – Runway orientation, Site selection, Wind rose analysis Geometric design standards for runways, taxiways, aprons, Airport capacity analysis, Terminal design; GEOMETRIC DESIGN OF RAILWAY TRACK: Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – Crossings and Turn outs.

REFERENCE BOOKS:
1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.
Course Outcomes
After the course students will be able to:
1. Optimize using classical methods and evolutionary algorithms for transportation system.
2. Design Route, Stop location for highway
3. Apply current practices for design of Transportation demand; Transportation models
4. Collect field data using different method and analyse it get key parameters for traffic study.
5. Calibrate the parameters using optimization techniques
6. Predict transportation system model using key parameters.

Unit 1 (8Hrs)
Introduction to optimization: classical methods and evolutionary algorithms;

Unit 2 (8Hrs)
Transit systems: street transit systems, rapid transit systems and para-transit systems;

Unit 3 (8Hrs)
Route development; Stop location and stopping policy; Schedule development; capacity of transit systems;

Unit 4 (8Hrs)
Transportation demand analysis; Transportation models;

Unit 4 (8Hrs)
Data collection and calibration of models. Essential Reading:

Reference Books:
8. Kanafani, Transportation Demand Analysis, McGraw-Hill Book Company

Elective II and Elective III
TNSL554 ENVIRONMENTAL IMPACT ON VARIOUS TRANSPORTATION SYSTEM

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Course Outcomes
After the course students should be able to:
1. Understand the different aspects of impacts of different transportation system on environment
2. Perform cost benefit analysis of transportation facility.
3. Describe GIS applications, and clearance problems in India.
4. Different techniques to promote non-motorized transport systems.
5. Write a brief Environmental Impact Assessment report.
6. Study towards the reduction of noise and air pollution related to transportation systems.

Unit 1. (7Hrs)
Evolution of EIA; EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping Criteria; Rapid and comprehensive EIA;

Unit 2. (7Hrs)
Specialized areas like environmental health impact assessment; Environmental risk analysis; Economic valuation methods; Cost-benefit analysis;

Unit 3. (7Hrs)
Expert system and GIS applications; Uncertainties. Legislative and environmental clearance procedures in India and other countries Sitting criteria; CRZ;

Unit 4. (7Hrs)
Public participation; Resettlement and rehabilitation. Practical applications of EIA; EIAmethodologies;

Unit 5. (7Hrs)
Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment; Environmental management plan; Post project monitoring, EIA report and EIS; Review process.

Unit 6. (5Hrs)
Case studies on project, regional and sectoral EIA. Risk assessment fundamentals and methodology, case studies

Reference Books:
3. R. Therirvel, E. Wilson, S. Thompson, D. Heaney, D. Pritchard, Strategic Environmental Assessment
Course Outcomes

After the course students should be able to:

1. Understand safety parameters for different transportation facilities.
2. Investigate the reasons of road crashes and respective counter-measures to reduce them.
3. Perform safety audits for transportation facilities at different levels of operation.
4. Design safety elements for pedestrians and cyclists.
5. Understand law enforcement methods to increase road traffic safety.
6. Prepare effective action report for risk management.

Unit 1. [08 Hrs]
Transportation Safety scenario in India and World, Accident Characteristics, Distribution among different modes. Need of Planning for Network, Land Use and Road Environment for Safety, Designing for Safety: Road Link Design, Junctions. Introduction to Road Safety Engineering and Crash Investigation, Human Factors Relating to Crashes/Accidents, Crash/Accident Unit 2. [06 Hrs]

Unit 3. [08 Hrs]
Road Safety Auditing: An Introduction, Concept and need of Road Safety Audit (RSA). Procedures in RSA, design standards, audit tasks, stages of road safety audit, Road Safety Audit Types, key legal aspects, process, audit team and requirements, Checklist, how to use Checklists Road Safety inspection.

Unit 4. [06 Hrs]

Unit 5. [07 Hrs]
Safe System Approach: A Global Perspective, Speed Management & safety, Safe System and Speed & Assessing speed limit, Type of speed limit & Speed zone signing. Infrastructure to support safe speed feedback and enforcement.

Unit 6. [07 Hrs]

Reference Books

2. Road Safety Audit Manual

Reference Books

## Course Outcomes

After the course students will be able to:

1. Understand principles for design, management and control of operation of transport systems
2. Analyse various measure of effectiveness for a highway corridor
3. Modify intersection design to control various parameters like LOS and delay.
4. Investigate and analyse accidents for a system
5. Design traffic safety management system
6. Suggest a system with low cost traffic management techniques

### Unit 1: [8Hrs]

**Basic concepts of traffic characteristics:** Speed, Volume and concentration – their basic relationship, Traffic measurement surveys like volume studies, speed studies, headway studies, delay studies, gap acceptance studies, intersection studies, travel time studies, accident studies, parking studies etc – Methods of computation, their presentation of data and analysis, Traffic studies for planning bypasses around towns

### Unit 2: [8Hrs]

**Highway Corridor analysis:** Traffic capacity analysis concepts, segment capacity, Queue delay, travel time sub period analysis, bus stop capacity for transit and highway corridors , performance measures

### Unit 3: [8Hrs]

**Intersection control and analysis:** Roundabouts , Signal design- Methods, types, LOS and capacity determination, Uniform and incremental delay, Adjustment factors, Saturation flow rate, lane grouping analysis, signal coordination, signal controllers, ITS application and system architecture, timing plan design for pretimed control and traffic actuated control, queue accumulation polygons, coordinated semi actuated operation unsignalised intersection, 2 way Stop controlled intersection, LOS criteria, critical gap, potential and movement capacity, All way stop controlled intersection, overview with planning and design applications

### Unit 4: [8Hrs]

**Traffic safety Management:** Accident investigation and analysis, Road accident collection and record system, Post accident reconstruction, Road safety auditing , Traffic impact analysis of landuse, Approaches to highway safety , Traffic calming measures , analysis of accident data and mathematical formulation , traffic control devices, Markings, Signs, Access management

### Unit 5: [8Hrs]

**Transportation System Management:** Guidelines for low cost traffic management techniques for urban areas – IRC Specifications, Advanced transit technologies, Bus route network planning and management

### Reference Books:

2. IRC Codes
5. Transportation Engineering - An Introduction - C.JotinKhisty, Prentice Hall Publication Fff
8. Fundamentals of Traffic Engineering – McShane & Rogers

## TNSL 558 COMMUNICATION STANDARDS USED IN TRANSPORTATION

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### Course Outcomes

After the course students should be able to:

1. Understand the communicating standards and concept related to transportation engineering
2. Implement the communicating standards for development of transportation infrastructural planning
3. Understand the Manual simulation of simple queuing system
4. Learn to prepare report, event scheduling, create transactions, etc
5. Learn the application of GPSS
6. Solve the inventory problems in railway ports, level crossing, etc.

### Unit 1: [10Hrs]

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 2. [10Hrs]
Probability concepts - Random numbers - Pseudo random generators - Arrival patterns - Service time distributions, Queue discipline – Manual simulation of simple queuing system

Unit 3. [10Hrs]

Reference Books:

TNSL559 TRANSPORTATION NETWORK ANALYSIS

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Course Outcomes
After the course students will be able to:
1. Simulate new ways of thinking about the dynamics of network development.
2. Enhance the ability to draw implications of alternative policies on transportation network form
3. Develop understanding of transportation network development process, the influencing factors and players.
4. Understand travel demand modeling process
5. Do minimum cost network assignment
6. Do the analysis using computer software like TRIPS, SATURN, EMME/2, CUBE, etc.

Unit 4. [10Hrs]
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, label correcting algorithms and optimality conditions, detecting negative cycles, all-pair shortest path algorithms; pre-flow push polynomial time algorithms, capacity scaling techniques.

Unit 5. [8Hrs]
Minimum cost network assignment: optimality conditions, cycle-canceling algorithm, Successive shortest path algorithm, other polynomial time variants; Network equilibrium analysis; principles and optimisation formulations, Frank-Wolfe algorithm; Special cases and variants.

Reference Books:

TNSL560 GROUND IMPROVEMENT TECHNIQUES

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Course Outcomes
After the course students should be able to:
1. Understand basic principles of various ground improvement techniques.
2. To demonstrate the use of verticle draining
3. Understand the significance of various ground improvement techniques in Highway engineering.
4. To demonstrate various premixing method used in Highway Engineering
5. Understand principle Grouting Technique
6. Understand in-sit method of ground reinforcement

Unit 1.: [7Hrs]
INTRODUCTION - Introduction, Need for Ground Improvement, Classification of ground Improvement Techniques


Unit 2.: [7Hrs]
PRELOADING AND THE USE OF VERTICAL DRAINS - Need for Preloading, Preloading without
Vertical Drains, Preloading with Vertical Drains, Effect of Smear, Assessment of Ground Conditions
Unit3 . [7Hrs]
THE PREMIXING METHOD-Introduction, Factors Influencing the Increase in Strength , Engineering Properties of Treated Soil , Design Methods
Unit5 : [7Hrs]
MODIFICATION BY GROUTING-Introduction, Categories of Grouting, Grout Materials, Grouting with Cement, Jet Grouting , Compaction Grouting, Chemical Grouts, Grouting Theory, Grouting Technology, Field Equipment, Applications of Grouting,
Unit6 : [5Hrs]
IN-SITU GROUND REINFORCEMENT
Introduction, Ground Anchors , Rock Blots , Soil Nailing , Elastic Models of Soil behavior

REFERENCE BOOKS:
2. Purushotham Raj, Ground Improvement Techniques, Laxmi Publications, New Delhi

TNSL424 SEMESTER- II TRAFFIC FLOW THEORY

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Course Outcomes
After the course students should be able to:

1. Understand aspects of measurement, statistical distributions, models, information processing, noise and simulations.
2. Develop the application /various methods of measurement currently available to the traffic flow characteristics..
3. Understand, delays at intersections and unsignalized intersections.
4. Understand the car following models and its analysis
5. Conduct the queuing analysis at different location on different road networks
6. Perform simulation of traffic flow by digital computers in detail.

Unit 1. [8Hrs]

Unit 2. [08 Hrs]
Macroscopic models - Heat flow and fluid flow analogies - Shock waves and bottleneck control approach.

Unit 3 [08 Hrs ]
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 4. [08 Hrs]
Linear and non-linear car following models - Determination of car following variables

Unit 5.[08 Hrs ]
Modeling Signalized Intersections,Simulation and Modeling

Reference Books
2. Adolf May, Traffic Flow Fundamentals

TNSL426 INTELLIGENT TRANSPORTATION SYSTEMS

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Course Outcomes
1. Understand the role of ITS and understand policy conflicts and where technology solutions have succeeded and failed.
2. Develop ability to assess how technology solutions can be used to deliver a transport policy or address a transport problem
3. Learn the travel and traffic management, public transportation management
4. Learn the ITS data collection techniques
5. Learn Advance Vehicle Safety System
6. Learn the application of ITS

Unit 1 [08 Hrs]
Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI),
Geographic Information Systems (GIS), video data collection.

Unit 2. [08 Hrs ]

Unit 3. [08 Hrs ]

Unit 4. [08 Hrs ]

Unit 5. [08 Hrs ]

Reference Books

TNSP427 Transportation System Software Laboratory

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Data processing and graphical presentation using ms excel & access:

Creation of Data Processing Templates, Usage of standard functions, Statistical Analysis, Macros, Graphical Presentation of Data.

Basics of AutoCAD: 2D Drawing and Advance Features, Modeling and Imaging in 3D

Use of MXROAD.Traffic Simulation using TSIS 5.0, VISSIM etc.Introduction to TransCAD.

Project Design

Project Design related to traffic and highway engineering.

Reference Books
1. Thomas A. Stellman, G. V. Krishnan, Harnessing AutoCAD, AutoDesk Progress.
2. TSIS 5.0 User Guide

ELECTIVE – IV, ELECTIVE – VI AND ELECTIVE – VI
(SELECT THREE DIFFERENT SUBJECTS AS ELECTIVE IV , ELECTIVE IV AND ELECTIVE VI)

TNSL561TRANSDUCERS AND SENSORS

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Course Outcomes

After the course students should be able to:
1. To demonstrate various measurement technique for traffic measurement
2. Design and operation of resistive transducer
3. Design and operation of Inductive and resistive transducer
4. Understand the use of various sensors for traffic engineering purpose
5. Understand hall effect and Radiation sensors
6. Understand the application of communication technologies in transportation

Unit 1 [07 Hrs ]
Science of Measurement: Measurement systems – methods of measurement-direct-deflection and null type, definition of sensor/transducer-classification of sensors/transducers-seLECTION criteria-static characteristics-dynamic characteristics

Unit 2. [07 Hrs ]
Resistive transducers: Resistance potentiometer-loading effect-strain gauges-gauge factor-types of strain gauges-rosettes-resistance thermometers-construction,characteristics-thermists-thermocouples-thermowells- hot wire anemometer-constant current and constant temperature operation.

Unit 3. [07 Hrs ]

Unit 4. [07 Hrs ]
Capacitive transducers: Introduction-Variable area type-variable air gap type-variable permittivity type-capacitive level sensor-capacitor microphone-frequency response.

Unit 5. [07 Hrs ]
Piezoelectric, Hall Effect and Radiation Sensors: Introduction of piezoelectricity-piezoelectric crystals-
accelerometer-charge amplifier-Hall Effect transducers-introduction- applications. Basic characteristics of Radiation Sensors-types of photodetectors-photoemissive cell-photovoltaic cell-photo conductive cell-LDR.

Unit 6. (07 Hrs)

Reference Books

TNSL562 SOFT COMPUTING

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Course Outcomes
After the course students should be able to:
1. Perform analysis using computing data for transportation planning and design
2. Implement the knowledge for transportation simulation through various processing methods
3. Apply Artificial Neural Network for Transportation Planning and Management
4. Apply Fuzzy Logic and do fuzzy modelling for Transportation Planning and Management
5. Apply fundamentals of genetic algorithm for Transportation Planning and Management
6. Apply swarm intelligence technique for Transportation Planning and Management

Unit 1. [10Hrs]
Neural Networks: Introduction to Biological Neural Networks: Neuron physiology, Neuronal diversity, specification of the brain, the eye’s Neural Network. Artificial Neural Network Concepts: Neural attributes, Modeling learning in ANN, characteristics of ANN, ANN topologies, learning algorithm.

Unit 2. [08Hrs]
Neural Network Paradigm: McCulloch-Pitts, Model, the perception, Back-propagation networks. Associative Memory, Adaptive Resonance (ART) paradigm, Hopfield Model, Competitive learning Model, Kohonen Self-Organizing Network.

Unit 3. [08Hrs]


Unit 4. [08Hrs]

Unit 5. [08Hrs]
Swarm Intelligence: Introduction to swarm intelligence and key principles (e.g. self organization, stigmergy), neural and artificial examples, Computational and embedded SI, Foraging, trail laying, Open space, multi source foraging experiments: biological data, microscopic experiments. Ant-Colony Optimization, Recent trends in soft computing

Reference Books
1. Introduction to Artificial Neural Systems: Jacek M. Zurada, Jaico Publishing House
2. Fuzzy sets & fuzzy logic, George J Klim, B. Yuan, PHI

TNSL563 URBAN TRANSPORTATION PLANNING

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Course Outcomes
After the course students should be able to:
1. Understand the concept and scenario of urban transportation
2. Determine contemporary issues and approaches in, urban transport planning and policy-making
3. Carry out transport modeling, to plan road networks and public transport
4. To develop a policy framework in which demand management, traffic management and traffic calming approaches and techniques can be implemented.
5. To discuss transport policies and strategies for sustainable cities.
6. understand the different modes of transportation and their interdependency

Unit 1. [10 Hrs ]
Introduction to transportation planning; Systems approach to transportation planning; Types of models;
Unit 2. [08 Hrs]
Concept of travel demand and supply; Socio-economic, land use, network, and transport system characteristics affecting transportation planning;

Unit 3. [08 Hrs]
Study area definition, zoning principles, cordon and screen lines, data collection through primary and secondary sources, sampling techniques; Four-stage sequential modelling approach; trip generation; trip distribution; modal split; trip assignment; land use-transport models;

Unit 4. [08 Hrs]
Activity-Based Modeling, Urban Good Movement

Unit 5. [08 Hrs]
Planning for Non-motorized vehicles. Public transport planning, integration of different modes; Travel demand management

Reference Books
2. Juan De Dios Ort, Luis G Willumsen, and Juan De Dios Ortuzar, Modeling Transport, John Wiley and Sons, 2011

TNSL564 COMPUTER AIDED TRANSPORTATION ENGINEERING

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Course Outcomes:
On successful completion of the course, student shall be able to:
1. Analyze and design the flexible & rigid pavements
2. Design different geometric parameters like superelevation, horizontal curves, vertical curves using softwares
3. Use the simulation software for visualizing the different traffic flow measures before they are adopted.
4. Use different softwares for designing the transportation systems
5. Use different softwares for its application in transportation planning
6. Perform statistical analysis of transportation parameters using softwares

Unit-I: [08 Hrs]
Introduction to software; Synchro 8, SimTraffic

Unit-II: [08 Hrs]
Analysis and Design of flexible pavement using software, Analysis and Design of concrete pavement using software,

Unit-III: [08 Hrs]
Design of horizontal curve, vertical curve and superelevation using software (MX-ROAD), Design of intersections, rotaries and inter changes using software (MX-ROAD), Traffic flow simulation using software

Unit-IV: [08 Hrs]
(CUBE), Planning of transportation systems using software (TransCAD), Statistical analysis softwares, e.g. SPSS, SAS, Statistic

Reference Books

TNSL565 HIGHWAY TRAFFIC ANALYSIS AND DESIGN

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Course Outcomes:
After the course students will be able to:
1. Apply concepts of Vehicle characteristics and IRC standards
3. Use statistical techniques for Horizontal curves - Vertical curves.
5. Understand the concept of street lighting and road furniture.
6. Perform road safety audit.

Unit1. [08 Hrs]
Elements of Traffic Engineering - road user, vehicle and road way. Vehicle characteristics - IRC standards - Design speed, volume. Highway capacity and levels of service - capacity of urban and rural roads.

Unit2. [08 Hrs]
PCU concept and its limitations - Road user facilities – Parking facilities - Cycle tracks and cycleways - Pedestrian facilities.Traffic volume studies, origin destination studies, speed studies, travel time and delay studies,

Unit3. [08 Hrs]

Unit4. [08 Hrs]
diagrams, timing diagram – Signal co-ordination.  
Unit 5. [08Hrs] 

References- 
2. AASHTO A Policy on Geometric Design of Highway and Streets  

TNSL566 TRANSPORTATION ECONOMICS AND FINANCE

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Course Outcomes 
1. Perform cost analysis for highway and road facilities 
2. Understand concepts and methods of auditing transportation safety and economics. 
3. Learn the supply and demand in transport system 
4. Analyses the project economy 
5. Learn to finance road projects 
6. Learn the method of risk analysis

Unit 1 [08Hrs] 
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 2. [08Hrs] 
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 3- [08Hrs] 
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 4 [08Hrs] 
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 5 [08Hrs] 

Reference Books 
1. CRRI, Road User Cost Study in India, New Delhi, 1982  
2. PPP documents of Planning Commission of India  

TNSL567PUBLIC TRANSPORTATION PLANNING AND DESIGN

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Course Outcomes 
Upon successful completion of the course, students will be able to: 
1. To understand public transport planning inputs and data required for transit line headway determination and timetable development. 
2. Utilize mathematical models for predicting passenger demands and assessing the impacts of alternative public transport improvement measures 
3. Apply optimization and analytical techniques for resource allocation and transit network design problems 
4. Exercise professional judgment and engineering sense in design and evaluation of public transit improvement measures. 
5. use knowledge of the case studies referred in real world. 
6. carry out swot analysis of integrated transportation planning

Unit 1.[12Hrs] 
Modes of public transportation and application of each to urban travel needs; comparison of transit modes and selection of technology for transit service; transit planning,  
Unit 2. [10Hrs] 
Estimating demand in transit planning studies, demand modeling, development of generalized cost, RP & SP data and analysis techniques; functional design and costing of transit routes, models for planning of transit routes, scheduling; management and operations of transit systems;  
Unit 3. [08Hrs] 
Integrated public transport planning; operational, institutional, and physical integration; models for integrated planning;  
Unit 4. [10Hrs] 
Case studies.
Reference Books
5. Intermediate Public Transport Manuals.

TNSL568 RAILWAY INFRASTRUCTURE PLANNING AND DESIGN

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Course Outcomes
After the course students will be able to:
1. Understand various water transportation modes
2. Understand the port management and operations.
3. To learn the planning and design of ports and terminals
4. To develop the application of Offshore Structures, Simulation modeling, analytical solutions.
5. To understand Physical planning, location and orientation of major port components, access channels, basins, breakwaters
6. Understand the organization, management and operations, functions of port authority and basic operational principles.

Unit 1 [08Hrs]
Ship characteristics and their influence on ports management and operations. Civil engineers concern about ships and shipbuilding.

Unit 2 [08Hrs]
Syncrolift equipment in ports (General definition consideration and aspects in planning and design of ports and terminals)

Unit 3 [08Hrs]
Physical planning, location and orientation of major port components, access channels, basins, breakwaters, wharfs, quays piers, jetties, fenders.

Unit 4 [08Hrs]
Offshore Structures, Simulation modeling, analytical solutions, Cargo handling systems, economic feasibility, evaluation, economic costs and benefits, least cost solutions.

Unit 5 [08Hrs]
Organization, management and operation, function of port authorities, O and M, MIS, basic operational principles.

Reference Books

TNSL570 AIRPORT PLANNING AND DESIGN

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Course Outcomes
After the course students will be able to:
1. Understand various water transportation modes
2. Understand the port management and operations.
3. To learn the planning and design of ports and terminals
4. To develop the application of Offshore Structures, Simulation modeling, analytical solutions.
5. To understand Physical planning, location and orientation of major port components, access channels, basins, breakwaters
6. Understand the organization, management and operations, functions of port authority and basic operational principles.
After the course students will be able to:
1. Assess the issues relating to regulation and deregulation of airport
2. Understand airport master planning, standards, airport facilities, terminal planning, functions and operations.
3. Apply current practices for airport development.
4. Adopt design principles for critical, semi critical and non-critical pavements
5. Plan & design airport hangars
6. Provide proper guidelines regarding the amenities to be required at airport terminals

Unit 1. (10Hrs)
Classification of airports- ICAO standards ; Planning for airport- Airport components- Zoning laws ; Runways orientation and geometric

Unit 2. (10Hrs)
Design- Runway patterns ; Taxiways- alignment-geometry and turning radius- exit taxiways ; Aprons-planning and design ; Design principles of critical, semi-critical, non-critical airport pavements-

Unit 3. (10Hrs)
FAA and PCA methods ; Airport hangars- their planning and design criteria ; Airport landscaping, grading and drainage- general aspects ;

Unit 4. (10Hrs)
Airport terminal and amenities ; Airport lighting and marking.

Reference Books:

TNSL571 GIS AND REMOTE SENSING

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COURSE OUTCOME
After the course students will be able to:
1. Define GIS, type of data and data structure and learn history of GIS
2. Apply various commands for spacialanaysis such as query, overlay and data analysis
3. Understand the applications of GIS and basic concepts of photogrammetry

4. To learn the concept of remote sensing, element, passive and active remote sensing
5. To understand GIS/GPS in Transportation, Real World Experiences
6. To Learn application of GIS/GIS map in transportation engineering

Unit 1. (7Hrs)
GIS Definition – Map and map analysis – Automated cartography – History and development of GIS – Hardware requirement – Type of data – Spatial and non-spatial data – Data structure – Vector and raster – Files and data formats – Data compression.

Unit 2. (7Hrs)

Unit 3. (7Hrs)
The Global Positioning system and its applications. Concepts and foundations of remote sensing - electromagnetic spectrum - EMR interaction with atmosphere, water vapour, ozone - Basic principles of photogrammetry – Spectral Signature and Spectral Signature curves –

Unit 4. (7Hrs)
Remote sensing platforms and sensors.Satellite system parameters, sensor parameters, earth resources and meteorological satellites,microwave sensors, Data Acquisition and interpretation - Visual Image Interpretation – Visual Image Interpretation Equipment –

Unit 5. (7Hrs)
Digital Image Processing – Classification.Applications in Survey, mapping and monitoring of land use/land cover –

Unit 6. (5Hrs)
Transportation planning - Infrastructure development - Natural resources management - Urban Planning, Environment - Coastal Zone Management – Air Quality - Development of Resources Information Systems.

Reference Books-

TNSL572 PAVEMENT DESIGN AND ANALYSIS

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Course Outcomes
After the course students will be able to:
1. To enable students to understand and differentiate between road pavement structures or layers
2. To understand the different design criteria for flexible pavement
3. Design a flexible pavement using IRC, Asphalt Institute, and AASHTO methods.
4. Design a rigid pavement using IRC, and AASHTO methods
5. Select maintenance technique depending upon the intensity of the distresses
6. Evaluate the pavements based on the functional and structural characteristics

Unit 1. [08 Hrs]
Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements, functions of pavement Components

Unit 2. [08 Hrs]
Pavement Design Factors: Design wheel load, strength characteristics of pavement materials, climatic variations, traffic - load equivalence factors and equivalent wheel loads, aircraft loading, gear configuration and tyre pressure. Drainage – Estimation of flow, surface drainage, sub-surface drainage systems, design of sub-surface drainage structures

Unit 3. [08 Hrs]
Flexible Pavement Design: Empirical, semi-empirical and theoretical approaches, design of highway and airport pavements by IRC, AASHTO Methods, applications of pavement design software

Unit 4. [08 Hrs]
Rigid Pavement Design: Types of joints and their functions, joint spacing; design of CC pavement for roads, highways and airports as per IRC, AASHTO, design of joints. Design of continuously reinforced concrete pavements. Reliability; Use of software for rigid pavement design

Unit 5. [08 Hrs]
Pavement Management: Pavement failures, maintenance of highways, structural and functional condition evaluation of pavements, pavement management system.

Reference Books.
1. Yoder and Witczak, Principles of Pavement Design, John Wiley and Sons
5. Relevant IRC Codes

TNSP573 PROJECT MANAGEMENT

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Course Outcomes:
After successful completion of this course the students will be able to:
1. understand the concept of project life cycle and factors affecting the project life cycle
2. Solve problems related to network and total duration of the project using different network techniques.
3. Prepare capital budget, estimate cost of capital, develop capital structure and allocate resources.
4. Develop an understanding and ability to use basic business financial management concepts in the context of project execution.
5. Analyse and periodically monitor Financial performance of Project.
6. Understand short term and long term financial policies for business and relate capital investment decisions to project performance.

Unit 1. [08 Hrs]

Unit 2. [08 Hrs]

Unit 3. [08 Hrs]
Project Schedule Compression, Project Scheduling Software, Precedence Diagrams, Decision CPM.

Unit 4. [08 Hrs]
Generalized Activity Networks, GERT. Estimation of Project Costs, Earned Value Analysis,

Unit 5. [08 Hrs]
Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project

Reference Books

THIRD SEMESTER
TNSP574 - Industry project/ Research Project (Phase-I)
Course Objectives:
1. To develop the ability to analyze and use scientific approach in solving complex engineering problems.
2. To develop an attitude of continuous and lifelong learning
3. To develop oral and written communication and presentation skills, critical review of the existing literature.
4. To develop design skills and the ability to conduct planned experimentation.

Course Outcomes:
1. Upon successful completion of phase –I of dissertation, students shall be able to:
2. Analyze complex engineering problems, develop action plan and apply appropriate research methodologies to find workable solution.
3. Develop oral and written communication and presentation skills, critical review of the existing literature, experimental and design skills
4. Develop an attitude of continuous and lifelong learning

- **FOURTH SEMESTER**

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TNSP 543- Industry project/ Research Project (Phase-II)

Course Objectives:
1. To develop the ability and skill sets to analyze and solve complex engineering problems, independently or as a team member, using modern tools and computational techniques.
2. To develop oral and written communication and presentation skills, critical review of the existing literature, experimental and design skills
3. To develop an attitude of continuous and lifelong learning

Course Outcomes:
Upon successful completion of the dissertation, students will be able to:
1. Analyze and solve a complex engineering problem posed for investigative study, independently or as a team member, using modern tools and computational techniques.
2. Develop oral and written communication and presentation skills, critical review of the existing literature, experimental and design skills and showcase research findings through publications.
3. Develop an attitude of continuous and lifelong learning.