VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA

CIVIL ENGINEERING DEPARTMENT

CURRICULUM FOR M. TECH IN TRANSPORTATION ENGINEERING
### First (Autumn) Semester:

<table>
<thead>
<tr>
<th>Sub Code</th>
<th>Subjects</th>
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<th>Credit</th>
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<tbody>
<tr>
<td></td>
<td>Geometric Design of Transportation Facilities</td>
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<td>Pavement Materials</td>
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<td>Elective-I</td>
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<td>Traffic Flow Theory</td>
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<td>Elective - III</td>
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### Third semester (project)

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### Fourth Semester (Project)

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**Grand total** = 96
### Electives – I & II (First Semester):

<table>
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<th>Sub Code</th>
<th>Course Title</th>
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<tr>
<td>1</td>
<td>Analysis of Transportation Systems</td>
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<tr>
<td>2</td>
<td>Transport and Environment</td>
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<tr>
<td>3</td>
<td>GIS Applications in Transportation Engineering</td>
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<tr>
<td>4</td>
<td>Bridge Engineering</td>
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<tr>
<td>5</td>
<td>Advanced Numerical Methods</td>
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<tr>
<td>6</td>
<td>Optimisation Methods</td>
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<td>7</td>
<td>Applied Soil Mechanics</td>
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<tr>
<td>8</td>
<td>Rock Mechanics and Tunnelling</td>
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<td>9</td>
<td>Computational and Statistical Methods</td>
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### Electives – III & IV (Second Semester):

<table>
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<tr>
<td>1</td>
<td>Mass and Multimodal Transportation Systems</td>
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<tr>
<td>2</td>
<td>Highway Construction practice</td>
</tr>
<tr>
<td>3</td>
<td>Pavement Evaluation, Rehabilitation and Maintenance</td>
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<tr>
<td>4</td>
<td>Environmental Impact Assessment and Auditing</td>
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<tr>
<td>5</td>
<td>Transportation Economics</td>
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<tr>
<td>6</td>
<td>Ground Improvement Techniques</td>
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<tr>
<td>7</td>
<td>Airport Planning and Design</td>
</tr>
<tr>
<td>8</td>
<td>Structural Optimization</td>
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DETAILED SYLLABUS
Geometric Design of Transportation Facilities


Ref Books:-
  i. Principles & Practice of Highway Engg –Dr. L.R. Kadiyali & Dr.N.B.Lal – Khanna Publishers
  ii. IRC codes

Pavement Materials


Ref Books:-
  i. Principles & practice of Highway Engg.–Dr. L. R. Kadiyali & Dr. N. B. Lal - Khanna Publishers
  ii. Principle of Transpotation Engg.- Partha Chakraborty & Animesh Das – Prentice Hall

Traffic Flow Theory


  iii. Traffic Flow Theory and Control - Donald R. Drew- TMH
  v. Traffic Flow Fundamentals- Adolf D. May-Prentice Hall
Analysis of Transportation Systems  (3-1-0)

Introduction to Transportation systems, Transportation innovations, Social and Economic impacts of Transportation, Decision makers and their options, Demand modeling and prediction, Supply and equilibrium flows, Modelling and transportation technology, Analysis of network flows, Transportation network, Network theory, Concepts in transportation models and location models, Analysis of utility maximizing systems such as entropy Concepts, Major transportation technologies, Cost functions and estimation, Urban transport economic policy, Models for selecting network investments and operation planning, Case Studies.

Ref book:
iii. Urban Transportation Networks - Yosef Sheffi - PRENTICE-HALL.

Transport and Environment  (3-1-0)

Modes of Transportation, Mixed traffic flow, Transport related pollution, Road transport related air pollution, Sources of air pollution, Effects of Weather Conditions, Vehicular emission parameters, Pollution standards, Measurement and analysis of vehicular emission, Mitigative Measures. Urban and non-urban traffic noise sources, Noise level factors, Effects of traffic noise, Propagation and measurement of traffic noise, Prediction and control measures, Noise studies, Noise standards. EIA requirements of highway projects, EIA procedures, guidelines, EIA practices in India.

Ref book:

GIS Applications in Transportation Engineering  (3-1-0)

Remote sensing: Physics of remote sensing, Ideal remote sensing system, Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC, Interpretation of remote sensing images.

Digital image processing : Satellite image – characteristics and formats, Image histogram, Introduction to image rectification, Image enhancement, Land use and land cover classification system.

Geographic information system (GIS) : Basic concept of geographic data, GIS and its components, Data acquisition, Raster and vector formats, Topography and data models, Spatial modeling, Data output, GIS applications. Global positioning system (GPS) : Introduction, Satellite navigation system, GPS- space segment, Control segment, User segment, GPS satellite signals, Receivers; Static, Kinematic and Differential GPS. Applications in Transportation Engineering

Ref Book:
i. Basics of Remote Sensing & GIS- S Kumar- Laxmi Publication
ii. GIS – Kang – T.Sung – TMH Publication

Bridge Engineering  (3-1-0)

Reinforced concrete slab bridge decks, Tee beam and slab bridge deck, Plate girder bridges, Composite bridges, Pre-stressed concrete bridges, Steel trussed bridges; Orthotropic plate theory, Determination of rigidity parameters. Load distribution in different girders Courbon s method, Morice-Little method. Box girder bridges - finite element and finite strip analyses, finite difference analysis of deck slab, grillage analysis; Cable stayed and suspension bridges; Bridge
Reference Books:
(i) Principles and Practice of Bridge Engineering- S.P. Bindra - Dhanpat Rai & Sons, New Delhi

**Advanced Numerical Methods**


Ref book: -
i. Numerical Methods & Computational Technique - S.S. Shastri

**Optimization Methods**


Ref books:
i. Optimisation Technique – Kalyanmay Dey - Mc Graw Hill Publication

**Applied Soil Mechanics**


(2) Advanced Soil Mechanics- Braja M. Das, Taylor & Francis
Rock Mechanics and Tunneling


Reference Book-

(4) Rock Mechanics for Engineers- B.P. Verma, Khanna Publishers
(5) Engineering in Rocks for Slopes, Foundation and Tunnels, Editor T.Ramamurthy, Prentice Hall India Pvt. Ltd.
(7) Tunnel Engineering- S.C. Saxena, - Dhanpat Rai & Sons, New Delhi

Analysis and Design of Pavements

Philosophy of design of flexible and rigid pavements, Subsystem of pavement design, Basis of pavement design, Analysis of pavements using different analytical methods, Selection of pavement design input parameters – traffic loading and volume, Material characterization, Drainage failure criteria, Reliability pavement support condition, Properties of components and design tests, Design of flexible and rigid pavements using different Methods for highway and airport pavements, Soil stabilization methods, Quality Control and Tolerance, Comparison of different pavement design approaches, Design of drainage system.
Ref book : i. Pavement Design – E.J.Yodder & Wetzick
   ii. Principles of Transportation Engg. – P.Chakraborty & A.Das – Prentice Hall
   iii. IRC Codes
   iv. Pavement Analysis and Design -Yang H. Huang, Pearson Education
      John Wiley & Sons

Urban Transportation Systems Planning

Hierarchical levels of planning, Passenger and Good transportation, General concept and planning process, Urban Travel characteristics, Private and Public Travel Behaviour Analysis, Travel Demand Estimation and Forecasting, Trip Generation Method and their comparison, Trip Distribution, Modal Split Analysis and Trip Assignment, Behavioural Approach. Trip Generation modeling – variables influencing trip generation, Regression Analysis and Category Analysis, Trip distribution Modeling – factors governing trip distribution, Growth factor Method, Gravity Model, Intervening opportunity and Competing opportunity Models, Modal Split
Modeling – factors influencing Mode choice, Two stage Modal Split Models, Transport behaviour of Individuals and Households, Network and Route Assignment, Capacity Restrains and Simultaneous Distribution, Direct Demand Models, Land – Use Transport Planning, Transport Related Land – use Models, Corridor Type Travel Planning, Statewide and Regional Transportation Planning, Introduction to Urban Freight Transportation.

Ref book:
  iii. Principles Of Urban Transport Systems Planning- B. G. HUTCHINSON- Scripta Book Company

Highway Construction Practice

Embankment Construction: Formation cutting in Soil and hard rock, Preparation of Subgrade, Ground improvement, Retaining and Breast walls on hill roads, Granular and Stabilized, Sub – bases / bases, Water Bound Macadam (WBM), Wet Mix Macadam (WMM), Cement treated bases, Dry Lean Concrete (DLC).

Bituminous Constructions: Types of Bituminous Constructions, Interface Treatments, Bituminous Surfacing and wearing Courses for roads and bridge deck slabs, Selection of wearing Course under different Climatic and Traffic conditions, IRC specifications, Construction techniques and Quality Control. Concrete road construction: Test on Concrete mixes, Construction equipments, Method of construction of joints in concrete pavements, Quality Control in Construction of Concrete pavements, Overlay Construction. Hill Roads Construction: Stability of Slopes, Landslides – Causes and Control measures, Construction of Bituminous and Cement Concrete roads at high altitudes, Hill road drainage, Construction and maintenance problems and remedial measures.

Ref Books:
  i. Principles & practice of Highway Engg_-Dr. L. R. Kadiyali & Dr. N. B. Lal - Khanna Publishers
  ii. IRC Codes

Mass and Multimodal Transportation Systems


                iii. Urban Transit Systems and Technology- Vukan R. Vuchic, Willey Publication
Traffic Engineering and Management (3-1-0)


iii. Traffic Flow Theory and Control - Donald R. Drew - TMH

Pavement Evaluation, Rehabilitation and Maintenance (3-1-0)

Types of pavement distress, techniques for functional and structural evaluation of pavements, pavement rehabilitation techniques, Overlay design procedures, recycling of flexible and rigid pavements, maintenance of paved and unpaved roads.

Ref Books:-
i. Principles & practice of Highway Engg - Dr. L. R. Kadiyali & Dr. N. B. Lal - Khanna Publishers
ii. Principle of Transportation Engg.- Partha Chakraborty & Animesh Das – Prentice Hall
iii. Flexible Pavement Rehabilitation and Maintenance- Prithvi S. Kandhal, Mary Stroup- Gardiner ASTM International

Transportation Economics (3-1-0)


Ref Books:-
i. Principles & practice of Highway Engg - Dr. L. R. Kadiyali & Dr. N. B. Lal - Khanna Publishers
iii. Principles of Transport Economics- Quinet, E. Vickerman, R.

Environmental Impact Assessment and Auditing (3-1-0)

Environmental impact assessment (EIA): Environmental statement & target areas fixation, scoping, objectives, water & waste water quality assessment models related to EIA, Air pollutants transport models, noise propagation models, methods for carrying out EIA starting from feasibility studies; case studies of EIA with special emphasis on developmental projects like highways, dams, water supply & sewerage, power plants. Preparation of environmental management plan (EMP) Procedure for obtaining environmental clearance, sitting guidelines for industries. Public participation in carrying out EIA and EMP. Environmental Auditing including resources auditing, water auditing, energy auditing, health auditing: advantages, procedure, case studies.
Ref book:

Ground Improvement Techniques (3-1-0)

Need of ground improvement; Shallow compaction, Deep compaction; Preloading, Drainage, Vibrofloatation, Sand drains and geosynthetic drains; Mechanical stabilization; Chemical stabilization; Thermal improvement methods; Stone columns; Grouting; Geosynthetics and other soil reinforcement methods; Soil nailing; Improvement by confinement; Effect of environment on soil properties; Case histories.

Ref book:
i. GI Technique – Dr. P.Purusattham Raj – Laxmi Publication
ii. Ground Improvement – Edited by Michael P. Moseley & Klaus Kirsh
iii. Ground Improvement - Case histories - Edited by Indraratna & J. Chu – Elsevier Publication

Airport Planning and Design (3-1-0)

Aircraft characteristics, obstruction criteria; air traffic control, runways: orientation, geometric standards, capacity, configuration, taxiway: geometric standards, fillets, high speed exit taxiway, apron-gate area and circulation, terminal building - functional areas and facilities, planning and site selection, pavement design and evaluation, visual aids, drainage, heliports

Reference Book:
(i) Airport Systems: Planning, Design, and Management by Richard de Neufville, Amedeo Odoni
(ii) Planning and Design of Airports by Robert Horonjeff, Francis McKelvey, William Sproule
(iii) Airport Engineering: Planning & Design by Saxena
(iv) Airport Planning & Design S.S. Jain, M.G. Arora, S. K. Khanna Published by Nem Chand & Brothers

Structural Optimization (3-1-0)

Introduction and scope; Simultaneous failure mode and design; Classical external problems and calculus of variation, variational principles with constraints, linear programming, integer programming, nonlinear programming, dynamic programming, geometric and stochastic programming; Applications to structural steel and concrete members, trusses and frames, Design under frequency constraint, design of layouts.

Reference books:
(i) Elements of Structural Optimization- Raphael T. Haftka, Zafer Grdal, Springer Science & Business Media
(ii) An Introduction to Structural Optimization- Anders Klarbring Springer Science & Business Media
(iii) Advances in Structural Optimization- José Herskovits Springer Science & Business Media
COMPUTATIONAL AND STATISTICAL METHODS

Instructions (Hours/Week) Lectures 3-1-0

Module I


Module II


Module III


Module IV

Regression Analysis – Simple Linear Regression, Evaluation of Regression – Confidence Intervals and Tests of Hypotheses – Multiple Linear Regression – Correlation and Regression Analysis

References: