

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Scheme of Teaching & Examination

M.TECH. (Civil) with Specialization in Transportation Engg.

II SEMESTER

S. No.	Board of Study	Subject Code	Subject	Periods per Week			Scheme of Examination			Total Marks	Credit L+(T+P)/2
				L	T	P	Theory / Practical				
				ESE	CT	TA					
1	Civil Engg.	598211 (20)	Traffic Engineering And Management	3	1	-	100	20	20	140	4
2	Civil Engg.	598212 (20)	Transportation System Planning	3	1	-	100	20	20	140	4
3	Civil Engg.	598213 (20)	Advanced Soil Mechanics in Highway engineering	3	1	-	100	20	20	140	4
4	Civil Engg.	598214 (20)	Road Safety Engineering	3	1	-	100	20	20	140	4
5	Refer Table – II		Elective II	3	1	-	100	20	20	140	4
6	Civil Engg.	598221 (20)	Advanced Transportation Lab II	-	-	3	75		75	150	5
7	Civil Engg.	598222 (20)	CAD for Transportation Engineering Lab	-	-	3	75		75	150	5
Total				15	5	6	650	100	250	1000	30

L- Lecture T- Tutorial
P- Practical , ESE- End Semester Exam
CT- Class Test TA- Teacher's Assessment

Table -II

ELECTIVE II			
S.No.	Board of Study	Subject Code	Subject
1	Civil Engg.	598231 (20)	Remote Sensing and GIS and their Application
2	Civil Engg.	598232 (20)	Bridge Engineering
3	Civil Engg.	598233 (20)	Ground Improvement Technique
4	Civil Engg.	598234 (20)	Pavement Management System

Note (1) - 1/4th of total strength of students subject to minimum of twenty students is required to offer an elective in the college in a Particular academic session.

Note (2) - Choice of elective course once made for an examination cannot be changed in future examinations.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Traffic Engineering and Management

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598211 (20)**

Total Tutorial Periods: **12**

UNIT I: TRAFFIC CHARACTERISTICS

Physical, Physiological, Psychological, Environmental Characteristics, Traffic Stream Characteristics, Vehicle Characteristics – Static and Dynamic, Urban Road and Road Characteristics – Geometric Design – An Overview

UNIT II: SURVEYS AND STUDIES IN TRAFFIC ENGINEERING

Conventional and Modern Methods of Traffic Survey and Studies – Volume and Capacity – Headway concepts and applications – Speed and Delay – Origin and Destination, Parking, Accident – Level of Services (LoS)

UNIT III: DESIGN OF TRANSPORT INFRASTRUCTURE

Sight Distance, Design of Cycle Tracks, Pedestrian Facilities, Parking Facilities – On Street, Off Street Multi level Street Lighting

UNIT IV: INTERSECTION DESIGN

Design of Intersection – At grade intersection – Uncontrolled, Channelisation, Rotary, Traffic Signal Control, Signal Co-ordination, Grade Separated Intersection - Types and Design

UNIT V: TRAFFIC OPERATION AND MANAGEMENT

Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture - Traffic Regulation, Cost Effective Management Measures – Traffic Systems Management and Travel Demand Management - Congestion Management, Traffic Calming and Pricing

Text Books:

1. Kadiyali, L.R., „Traffic Engineering and Transport Planning“, Khanna Publishers, Delhi, 2002
2. Nicholas T.Garber, Lester A Hoel, „Traffic and Highway Engineering“, Revised Second Edition, ITP, California, USA, 1999

Reference Books:

1. Wolfgang S.Homburger et.al., „Fundamentals of Traffic Engineering“ 15th Edition, Institute of Transportation Studies, University of California, Berkely, 2001
2. Thomas Curinan, „An Introduction to Traffic Engineering – A Manual for Data Collection and Analysis“, Books Cole, UK, 2001

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Transportation System Planning

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598212 (20)**

Total Tutorial Periods: **12**

UNIT I: TRANSPORTATION SYSTEM STATUS

Status of existing Transportation System – Systems Approach to Transport Planning - Interdependence of the Landuse and Traffic – Stages in Transportation Planning – Transport Systems and Planning Considerations.

UNIT II: INVENTORIES AND SIMULATION MODELING

Concepts of Zoning – Transportation Surveys – Inventory of Transport and other activities – Travel Forecasting Process – Basics of Systems Simulation Modeling - Application in Travel Forecasting – Critical issues in Travel forecasting.

UNIT III: FOUR STAGE MODELING PROCESS

Conventional and Four Stage Modeling Process – Trip Generation Models – Trip Distribution Models and Calibration – Methods of Trip Assignment Models –Multi Modal Trip Assignment – Mode Choice and Modal Split Models.

UNIT IV: ADVANCED TRAVEL FORECASTING

Advanced Travel Demand Forecasting Methods - Activity Based Modeling – Comparison of Conventional and Activity Based Modeling – Integration of Systems Simulation Modeling and Transportation Network Planning for Sustainability.

UNIT V: LAND USE TRANSPORT MODEL (LUT)

Accessibility Measures and Basic Theories – Lowry Derivatives Model- Garin Model –Approach and Simulation Modeling in LUT Model - Multimodal Transportation Planning.

Text Books:

1. Papacostas C.S., Prevedouros, "Transportation Engineering and Planning, 3rd Edition, Prentice Hall of India, New Delhi, 2002
2. O'Flaherty C.A, "Transport Planning and Traffic Engineering", Elsevier Publications, New Delhi, 1997

Reference Books:

3. John Khisty C, Kent Lall B, "Transportation Engineering – An Introduction, 3rd Edition, Prentice Hall of India, New Delhi, 2002
4. John D.Edwards (Edr.), "Transportation Planning Hand Book", 2nd Edition, Institute of Transportation Engineers, Prentice Hall Inc., Washington DC, USA, 1999

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Advanced Soil Mechanics in Highway Engineering

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598213 (20)**

Total Tutorial Periods: **12**

UNIT I: CLASSIFICATION OF SOILS

IS Classification, AASHO Classifications, CAA Classifications. Introduction to Geotechnical Investigations, different methods of investigation, trial pits, rotary drilling, percussion drilling, geophysical methods. Introduction to rock engineering, core recovery, Rock quality designation, joint condition, joint orientation Rock Mass Rating, crushing strength, point load index, rock durability test, pressure meter test, percolation tests.

UNIT II: COMPACTION

Theory of compaction, factors affecting compaction, effect of compaction on soil, properties, measurement of field compaction and field methods of compaction and control.
CBR and group index: Laboratory and field determination of CBR value, effect of soaking, modulus of sub-grade reaction.

UNIT III: BEARING CAPACITY

Skempton's analysis, Plate Load Test, penetration tests, General bearing capacity equation, effect of water table on bearing capacity.
Stability of slopes: Types of slope failure, Bishop's slope stability analysis, Stability number.

UNIT IV : EARTH PRESSURES

Classical theories, effect of submergence and seepage.

UNIT V : SOIL STABILIZATION

Mechanics of stabilization, Mechanical, Electrical, cement, lime, Bitumen and Chemical Stabilization.
DRAINAGE: Vertical and sand drains, Surface and sub-surface drainage for highways, Drainage for Hill roads.

Text Books:

1. Singh Alam, Soil Engineering in Theory and Practice, Asia Publication House.
2. Khanna S.K., and Justo, C.G., Highway Engineering.
3. Punmia B.C., Soil Mechanics and Foundation Engineering.

Reference Books:

1. IRC-49-1973, Recommended Practice for the Pulverization of B.C. for lime Stabilization.
2. IRC-50-1973, Recommended Design for the use of Cement-Modified Soil in Road Constructions.
3. IRC-51-1992, Guideline for the use of Soil Lime Mixing Road Construction

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Road Safety Engineering

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598214 (20)**

Total Tutorial Periods: **12**

UNIT I :

Introduction to safety

Road accidents, Trends, causes, Collision and Condition diagrams, Highway safety, human factors, Vehicle factors

UNIT II : Road Safety Management System

Multi-causal dynamic systems approach to safety, crash vs accident, road safety improvement strategies, elements of a road safety plan, Safety Data Needs.

UNIT III : Statistical Interpretation and Analysis of Crash Data

Before-after methods in crash analysis, Advanced statistical methods, Black Spot Identification & Investigations, Case Studies.

UNIT IV : Road Safety Audits

Key elements of a road safety audit, Road Safety Audits & Investigations, Crash investigation and analysis, Describe methods for identifying hazardous road locations, Case Studies.

UNIT V : Crash Reconstruction

Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.

Text Books:

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.
2. Ogden, K.W. Safer Roads: A Guide to Road Safety Engineering. Avebury Technical, 1996.

Reference Books:

1. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
2. J. Stannard Baker, Traffic Collision Investigation, Northwestern University Center for Public Safety, 2002.
3. Rune Elvik and Truls Vaa, The Handbook of Road Safety Measures, Elsevier, 2004.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Remote Sensing and GIS and their Application

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598231 (20)**

Total Tutorial Periods: **12**

UNIT I: INTRODUCTION TO REMOTE SENSING

Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body – Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Electromagnetic Radiation – EMR Spectrum

UNIT II: INTRODUCTION TO GIS

Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial – Georeferencing – Map Projection – Types of Projection – Simple Analysis – Data retrieval and querying

UNIT III: DATA STRUCTURES AND ANALYSIS

Database – Raster and Vector data structures – Data storage – Run length, Chain and Block coding – Vector data storage – Topology – GIS Modelling - Raster and Vector data analysis – Buffering and overlaying techniques – Network Analysis – Spatial Analysis

UNIT IV: BASIC APPLICATIONS IN TRANSPORTATION

Highway and Railway Alignment, location of transport terminals and roadside facilities, bus stops – Route optimization – Bus route rationalization – Accident analysis – Applications of Aerial Photography and Satellite Imageries

UNIT V: ADVANCED APPLICATIONS

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

Text Books:

1. Burrough P.A, "Principles of GIS for Land Resources Assessment", Oxford Publication, 1994.
2. Anji Reddy, "Remote Sensing and Image Interpretation", John Wiley and Sons Inc. New York, 1987.

Reference Books:

1. M.G.Srinivas, "Remote Sensing Applications", Narosa Publishing House, 2001.
2. Jeffrey Star and John Ester, Geographical Information System – An Introduction, Prentice Hall Inc., Englewood Cliffe, 1990.
3. Marble, D.F, Calkins, H.W and Penquest, Basic Readings in GIS, Speed System Ltd., New York, 1984.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**
Subject: Bridge Engineering
Total Theory Periods: **40**
Total Marks in End Semester Exam: **100**
Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**
Code: **598232 (20)**
Total Tutorial Periods: **12**

UNIT I: Types of bridges, Consideration of loads and stresses in bridges, bridge loading as per IRC and IRS specifications,, traffic lanes, footway, kerbs, railing and parapet loading, impact, wind load, longitudinal forces, temp effects, secondary stresses, erection stresses, earth pressure, effect of live load on back fill and on the abutment.

UNIT II: Design of RC bridges, slab culvert, box culvert, pipe culvert, T-beam bridge, superstructure, design examples, brief introduction to rigid frame, arch and bow string girder bridges. Design of pre-stressed concrete bridges, pre-tensioned and post tensioned concrete bridges, analysis and design of multi-lane prestressed concrete T-beam bridge super structure.

UNIT III: Steel bridges, types, economical span, loads, permissible stresses, fluctuation of stresses, secondary stresses, plate girder bridges, general arrangement, bridge floors, plate girder railway bridges, deck type plate girder bridges, design example. Truss bridges, types, wind force on lattice girder bridge, bracings, truss bridge for railway – through type truss bridge.

UNIT IV: Foundations, types, general design criterion, design of well and pile foundations for piers and abutments.

Pier, abutment and wing walls, types of piers, forces on piers, stability, abutments, bridge code provisions for abutments, wing walls, design examples.

UNIT V: Bearings, functions, bearings for steel and concrete bridges, bearings for continuous span bridges, IRC provisions for bearings, fixed bearings, expansion bearings, materials and specifications, permissible stresses, design considerations for rocker and roller cum rocker bearings, sliding bearings.

Text Books:

1. Victor DJ, Essentials of Bridge Engineering, Oxford & IBH Pub Co.
Rowe RE, Concrete ridge Design

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Ground Improvement Techniques

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598233 (20)**

Total Tutorial Periods: **12**

UNIT I :

Need of ground improvement; Shallow compaction, Deep compaction.

UNIT II:

Preloading, Drainage, Vibrofloatation, Sand drains and geosynthetic drains.

UNIT III:

Mechanical stabilization; Chemical stabilization; Thermal improvement methods.

UNIT IV:

Stone columns; Grouting; Geosynthetics and other soil reinforcement methods.

UNIT V:

Soil nailing; Improvement by confinement; Effect of environment on soil properties; Case histories.

Text Books:

1. Purushotham Raj, *Ground Improvement Techniques*, Laxmi Publications, New Delhi
2. Sharma.S.K., *Principles, Practice and Design of Highway Engineering*, S.Chand & Co. New Delhi, 1985.

Reference Books:

1. Hausmann, M.R., *Engineering Principles of Ground Modification*, McGraw – Hill International Editions, 1990.
2. Jones C. J. F. P, *Earth Reinforcement and Soil Structures*, Butterworths, London

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech- II**

Subject: Pavement Management System

Total Theory Periods: **40**

Total Marks in End Semester Exam: **100**

Minimum number of class tests to be conducted: **02**

Branch: **Civil Engineering**

Code: **598234 (20)**

Total Tutorial Periods: **12**

UNIT I: PAVEMENT MANAGEMENT PROCESS

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

UNIT II: EVALUATION AND PERFORMANCE

General concepts – economic and functional evaluation – evaluation of pavement performance – evaluation of structural capacity – pavement distresses – condition surveys – safety evaluation

UNIT III: DESIGN STRATEGIES

Framework for pavement design – design objectives and constraints – basic structural response models – characterization of physical design inputs – generating alternative pavement design – economic evaluation of alternative design – analysis of alternative design strategies – selection of optimal design strategy.

UNIT IV: PERFORMANCE PREDICTION MODELS

Techniques for developing prediction models – AASHO, CRRI and HDM models – computer applications – Identification of alternatives –deterioration modeling- priority programming Methods

UNIT V: REHABILITATION

Repair of pavement defects – maintenance of flexible and rigid pavements – bituminous and cement concrete overlays – system analysis

Text Books:

1. Ralph Haas, W.Ronald Hudson and John Zaniewski, Modern Pavement Management, Kreigar Publishing Company, New York, 1994
2. M.Y.Stalin, Chapman and Hall Pavement Management for Airports, Roads and Parking Lots , New York, 1992.

Reference Books:

1. Michael Sargious, Pavements and Surfacing for Highways and Airports, AppliedScience Publishers Limited, London, 1975

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech – II**

Branch: **Civil Engineering**

Subject: **Advanced Transportation–II Lab**

Code: **598221 (20)**

Total Marks in End Semester Exam: **75**

Experiments to be performed (Minimum 10 experiments to be performed)

1. Determination of liquid limit, plastic limit, soil classification (dry and wet), maximum dry density and moisture content.
2. CBR Test on Soil.
3. Tests on Bitumen: viscosity, ductility and elastic recovery, specific gravity.
4. Tests on Bitumen: measuring apparent viscosity of bitumen using SC-4-27 spindle in a rotational viscometer from 60 to 150 °C in increments of 10 °C at different shear rates.
5. Tests on Soils: field density using sand replacement method, nuclear density gauge, rapid moisture meter.
6. Tests on Bituminous Mixes: stripping value of aggregate, determination of Gmm of given bituminous mixtures using large capacity vacuum pycnometer, Marshall mix design.
7. Tests on Bituminous Mixes: bitumen content and gradation using centrifuge extractor and NCAT ignition oven.
8. Tests on Bituminous Mixes: roller compaction and permanent deformation using wheel tracking equipment.
9. Field Evaluation: skid resistance using British pendulum, texture depth using sand patch test, stiffness of unbound pavement layers using GeoGauge.
10. Field Evaluation: pavement condition rating, unevenness using MERLIN and Dipstick.
11. Field Evaluation: Dynamic Cone Penetrometer, Clegg Impact Test, determination of modulus and rebound deflection using Portable Falling Weight Deflectometer (Loadman).

Recommended Books:

1. Khanna, S.K., Justo, C.E.G. and A. Veeraragavan *Highway Materials and Pavement Testing*, 5th Edition, Nem Chand and Bros, Roorkee, India, 2009.
2. Huang, Y.H. *Pavement Analysis and Design*, Pearson Prentice Hall, New Jersey, USA, 2004.
3. Relevant IS, IRC, ASTM Codes.

CHHATTISGARH SWAMI VIVEKANAND TECHNICAL UNIVERSITY, BHILAI (C.G.)

Semester: **M.Tech – II**

Branch: **Civil Engineering**

Subject: **CAD for Transportation Engineering Lab**

Code: **598222 (20)**

Total Marks in End Semester Exam: **75**

Experiments to be performed (Minimum 10 experiments to be performed)

Formulation and evaluation of the following Transportation Projects.

1. Rotary Design
2. Traffic signal Design
3. Multi level / Surface level Parking Design
4. Public transport route evaluation
5. Transport Planning for a small area
6. Remote Sensing Packages – ArcGIS ,GRAM++,
7. Study of Geo-Concept
8. ERDAS Imagine Computer Aided Drafting - DBMS concepts
9. Engineering Databases – Data entry & Reports
10. Spreadsheet concepts – Worksheet calculations in Civil Eng
11. Regression & Matrix Inversion
12. Study of ENVI

LABORATORY EQUIPMENT REQUIREMENTS

1. Automatic traffic counter
2. Dopplar radar
3. Road measurement and data acquisition system
4. Noise level meter
5. Five gas analyzer
6. Lux meter
7. Total station
8. Softwares such as TRANSYT, CUBE, ARC GIS, Emme/2, TransCAD and Geomedia

M.Tech (CIVIL) Transportation Engineering

SEMESTER-II

Advanced Transportation–II Lab

Equipment/Machines/Instruments/Tools/Software Required:

1. Casagrande's Apparatus.
2. Plastic Limit Apparatus.
3. Hot Air Oven.
4. CBR Apparatus.
5. Ductility Testing Machine..
6. Rotational Rheometer.
7. Sand Replacement Equipment.
8. Nuclear Density Gauge.
9. Rapid Moisture Meter.
10. Vaccum Pycnometer.
11. Marshall Stability Equipment.
12. Centrifuge Extractor.
13. NCAT ignition oven.
14. Wheel Tracking Equipment.
15. British Pendulum.
16. Geo Gauge.
17. MERLIN and Dipstick.
18. Dynamic Cone Penetrometer.
19. Clegg Impact Soil Tester.
20. Portable Falling Weight Deflectometer.

M.Tech (CIVIL) Transportation Engineering

SEMESTER-II

CAD for Transportation Engineering Lab

Equipment/Machines/Instruments/Tools/Software Required:

1. Automatic Traffic Counter.
2. Dopplar Radar.
3. Road Measurement And Data Acquisition System.
4. Noise Level Meter.
5. Five Gas Analyzer.
6. Lux Meter
7. Total Station.
8. Softwares Such as:
 - i) TRANSYT, CUBE
 - ii) ARC GIS, Emme/2
 - iii) Trans CAD and Geomedia.