

APJ Abdul Kalam Technological University

Cluster 4: Kottayam

**M. Tech Program in
Civil Engineering
(Transportation Engineering)**

Scheme of Instruction & Syllabus: 2015 Admissions



Compiled By

Rajiv Gandhi Institute of Technology, Kottayam

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APJ Abdul Kalam Technological University
(Kottayam Cluster)
M. Tech Program in Transportation Engineering

Scheme

Credit requirements : 67 credits (22+19+14+12)
Normal Duration : Regular: 4 semesters; External Registration: 6 semesters;
Maximum duration : Regular: 6 semesters; External Registration: 7 semesters.
Courses: Core Courses: Either 4 or 3 credit courses; Elective courses: All of 3 credits

Allotment of credits and examination scheme:-

Semester 1 (Credits: 22)

Exam Slot	Course No:	Name	L - T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CE 6201	Applied Statistics and Probability	3-1-0	40	60	3	4
B	04 CE 6203	Traffic Engineering	3-1-0	40	60	3	4
C	04 CE 6205	Pavement Analysis and Design	3-0-0	40	60	3	3
D	04 CE 6207	Highway Analysis and Design	3-0-0	40	60	3	3
E	04 CE 6XXX*	Elective - I	3-0-0	40	60	3	3
	04 GN 6001	Research Methodology	0-2-0	100	0	0	2
	04 CE 6291	Seminar - I	0-0-2	100	0	0	2
	04 CE 6293	Highway Engineering Lab	0-0-2	100	0	0	1
		Total	23				22

**See List of Electives-I for slot E*

List of Elective - I Courses

Exam Slot	Course No.	Course Name
E	04 CE 6209	Intelligent Transportation Systems
E	04 CE 6211	Environmental Impact Assessment
E	04 CE 6213	Ground Improvement & Reinforced Earth Techniques
E	04 CE 6215	Public Transport Planning

Semester 2 (Credits: 19)

Exam Slot	Course No:	Name	L - T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CE 6202	Transportation Economics	3-1-0	40	60	3	4
B	04 CE 6204	Urban Transportation Planning	3-0-0	40	60	3	3
C	04 CE 6206	Pavement Evaluation and Rehabilitation	3-0-0	40	60	3	3
D	04 CE 6XXX*	Elective - II	3-0-0	40	60	3	3
E	04 CE 6XXX^	Elective - III	3-0-0	40	60	3	3
	04 CE 6292	Mini Project	0-0-4	100	0	0	2
	04 CE 6294	Transportation Engineering Lab	0-0-2	100	0	0	1
		Total	22				19

*See List of Electives -II for slot D

^See List of Electives -III for slot E

List of Elective - II Courses

Exam Slot	Course Code	Course Name
D	04 CE 6208	Traffic Flow Theory
D	04 CE 6212	Transportation Facility Design
D	04 CE 6214	Road Safety And Environment
D	04 CE 6216	Pavement Management System

List of Elective - III Courses

Exam Slot	Course Code	Course Name
E	04 CE 6218	Computer Simulation Applications in Transportation Engineering
E	04 CE 6222	Advanced Highway Materials
E	04 CE 6224	Bridge Engineering
E	04 CE 6226	Decision Models in Management

Summer Break

Exam Slot	Course No:	Name	L - T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
NA	04 CE 7290	Industrial Training	0-0-4	NA	NA	NA	Pass /Fail
		Total	4				0

Semester 3 (Credits: 14)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	End Semester Exam		Credits
					Marks	Duration (hrs)	
A	04 CE 7XXX*	Elective - IV	3-0-0	40	60	3	3
B	04 CE 7XXX^	Elective - V	3-0-0	40	60	3	3
	04 CE 7291	Seminar - II	0-0-2	100	0	0	2
	04 CE 7293	Project (Phase - I)	0-0-12	50	0	0	6
		Total	20				14

*See List of Electives-IV for slot A

^See List of Electives-V for slot B

List of Elective - IV Courses

Exam Slot	Course Code	Course Name
A	04 CE 7201	GIS and GPS Applications in Transportation
A	04 CE 7203	Urban Planning
A	04 CE 7205	Highway Construction
A	04 CE 7207	Transportation System Management

List of Elective - V Courses

Exam Slot	Course Code	Course Name
B	04 CE 7209	Transportation System Analysis
B	04 CE 7211	Traffic Management and Control
B	04 CE 7213	Project Management
B	04 CE 7215	Soil Exploration Techniques

Semester 4 (Credits: 12)

Exam Slot	Course No:	Name	L- T - P	Internal Marks	External Evaluation Marks		Credits
NA	04 CE 7294	Project (Phase -II)	0-0-21	70	30	NA	12
		Total	21				12

Total: 67

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6201	APPLIED STATISTICS AND PROBABILITY	4-0-0:4	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Knowledge regarding the fundamental concepts, theories of Probability distributions.
- Idea to evaluate a data sequence using the principles of time series analysis.
- The ability to develop mathematical models from the data sequences using the theory of regression and correlation.
- Knowledge to apply statistical test procedures in their respective areas and inferring the conclusion

Syllabus

Fundamental concepts and overview of probability distributions, Concepts of regression and correlation; Tests for significance; applications of time series analysis and ANOVA.

Course Outcome:

The student should be enable to students to apply statistics in various areas of engineering like Transportation, Environmental etc.

Text Books:

1. Gupta. S. C. and Kapoor.V.K, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, 1978.
2. M T Bali., Fundamentals of Statistics

References:

1. Benjamin, Jack.R and Comell.C, Allin, Probability, Statistics and Decision for Civil Engineers, Mc-Graw Hill.
2. Kadiyali.L.R, Traffic Engineering and Transport Planning, Khanna Publishers.
3. Wohl, Martin and Martin, Brian.V, Traffic Systems analysis for Engineers and Planners, Mc-Graw Hill.
4. Richard A. Johnson: Miller and Friends, Probability and Statistics for Engineers (6th edition) Pearson.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6201	APPLIED STATISTICS AND PROBABILITY	3-1-0:4	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Frequency distribution: mean, standard deviation, moments, skewness and kurtosis- definition and applications. Time series analysis and Monte Carlo Techniques.		8	15
MODULE 2: Probability Distributions: Probability mass functions and probability density function, mean and variance. Binomial, Poisson distribution. Exponential and normal distribution: Fitting of the distributions.(Binomial and Poisson)		10	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Regression and correlation: Linear Regression and correlation, multiple correlation coefficient. Standard error of estimate, curvilinear regression- Applications.		8	15
MODULE 4: Graphical presentation techniques. Statistical inference: Intervals estimation, Confidence interval for mean, variances and regression coefficients. Sampling Distribution.		10	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: 5 Test of significance of (i) Means (ii) Mean of two samples (iii) Proportions (iv) Variance(v) Two variances (vi) Two observed correlation coefficients (Fishers' z-transformation), (vii) Paired T-test(viii) Regression coefficients (ix) Chi-square test of goodness of fit, Skewness and Kurtosis tests.		10	20
MODULE 6: Applications: Analysis of variance (i) Completely randomized designs (ii) Randomized block designs Latin squares. Grecco Latin square design. Factorial experiments		10	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6203	TRAFFIC ENGINEERING	3-1-0: 4	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Basic concepts of the components of road traffic and its characteristics.
- Idea to conduct, analyse and interpret various traffic surveys.
- Ability to describe the fundamental flow relationships and applications of traffic flow theory.
- Ability to design different traffic engineering control systems like signals and traffic islands.

Syllabus

Objectives and scope of traffic engineering, Components of road traffic - the vehicles, Application of sampling methods for traffic studies. Fundamental flow relationship and their applications. Traffic Control Devices: Traffic signs, markings, islands and signals.

Course Outcome:

The student will be able to analyse and interpret fundamental stream characteristics and its applications in traffic engineering.

Text Books:

1. Roger P Roess, Elena S Prassas "Traffic Engineering" 3rd Edition, Pearson Prentice hall
2. Kadiyali, L.R. "Traffic Engineering and Transport Planning", Khanna Publishers

References:

1. Matson, Smith & Hurd 'Traffic Engineering', McGraw Hill Book Co.
2. Drew, D.R., "Traffic Flow Theory and Control", McGraw Hill Book Co.
3. Barenbag, 'Traffic Flow Theory' – Monograph
4. Wells, G.R. "Traffic Engineering and Hand Book", Institution of Engineers, U.S.A.
5. RRL, DSIR Research on Road Traffic', HMSO Publication
6. IRC and IS Publications.
7. Institute of Transportation Engineers, Manual of Transportation Engineering Studies, Prentice Hall
8. Salter, R.J., and N. B. Hounsell, "Highway Traffic Analysis & Design", Mac Millan
9. Fred C. Mannering and Walter P Kilaraski, "Principles of Highway Engineering and Traffic Analysis", John Wiley and Sons.
10. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers.
11. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6203	TRAFFIC ENGINEERING	3-1-0:4	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Objectives and scope of traffic engineering, Components of road traffic - the vehicle, driver and road, Road user characteristics; human and vehicle characteristics. Factors affecting road traffic; methods of measurement		8	15
MODULE 2: Sampling in traffic studies; adequacy of sample size Application of sampling methods for traffic studies, objectives, traffic surveys, equipment, data collection Analysis and interpretation of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - destination (v) Parking and (vi) Accident studies.		10	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Fundamental flow relationship and their applications Traffic flow theories and applications; Shock waves.		10	15
MODULE 4: Queuing theory and applications. Probabilistic Aspects of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models		10	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Traffic Control Devices: Traffic signs, markings, islands and signals.		8	20
MODULE 6: Different methods of signal design; redesign of existing signal including case studies. Delay models. Signal system and co-ordination.		10	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6205	PAVEMENT ANALYSIS AND DESIGN	3-0-0:3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Ability to analyse and design flexible pavements based on Empirical, Semi-empirical and Theoretical methods.
- The idea to apply Westergaard's concept and temperature changes in concrete pavements and design joints.
- Knowledge regarding design of air field pavements using Co E and FAA method

Syllabus

Types and Component parts of Pavements; Subgrade stabilization ; Applications of Pavement Design Software; Types, Functions and Spacing of Joints in Cement Concrete Pavements; Air field design.

Course Outcome:

The student will able to design different types of highway and air field pavements.

Text Books:

1. Yoder and Witezak, "Principles of Pavement Design", John Wiley and sons.
2. Rajib B Malick and Tahar El Korchi, "Pavement Engineering Principles and Practice" , Second Edition, CRC Press, New York.

References:

1. Yang, Design of functional pavements, McGraw-Hill.
2. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers,2003
3. IRC: 37-2012, "Guidelines for the Design of Flexible Pavements (Second Revision)".
4. IRC: 58-2012, "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Second Revision)".
5. AASHTO – Design of pavement Structures
6. Yang H. Huang - Pavement Analysis and Design, Prentice Hall.
7. Khanna S.K., Justo C.E.G. and Veeraraghavan A, "Highway Engineering", Nem Chand & Bros., Roorkee, 2014

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6205	PAVEMENT ANALYSIS AND DESIGN	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Types and Component parts of Pavements: Flexible, rigid and semi-rigid pavements Factors affecting design and performance of Pavements .Functions and significance of subgrade properties - Methods of assessment of subgrade strength.		8	15
MODULE 2: Subgrade stabilization – Wheel loads – ESWL – EWLF. Influence of environment on pavement - Frost, Sub grade moisture. Drainage of Pavements: Surface and sub surface drainage systems – Estimation of flow.		10	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Sampling in traffic studies; adequacy of sample size. Applications of Pavement Design Software. Introduction to Superpave. Types, Causes and Analysis of Stresses in Rigid pavements		10	15
MODULE 4: Types, Functions and Spacing of Joints in Cement Concrete Pavements. Design of Slab Thickness. Dowel bar and tie bar. Design of continuously reinforced concrete pavements.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Empirical, Semi-empirical and Theoretical Methods of McLeod, Kansas and California Resisting Value Method - Problems Flexible Pavement Design such as CBR, GI Method - Problems		10	20
MODULE 6: Factors affecting design of airfield pavement – Gear configuration and aircraft loading. CoE and FAA methods of Flexible and Rigid airfield pavements.		10	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6207	HIGHWAY ANALYSIS AND DESIGN	3-0-0:3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

1. Ability to understand basic concepts of highway geometric design
2. Idea to design horizontal alignment and vertical alignment of highways.
3. Knowledge to estimate the capacity and level of service of different highway facilities.
4. Concepts to design various traffic control facilities like intersections, ramps, etc.

Syllabus

Objectives and requirements of highway geometric design; Horizontal alignment - design considerations; Sight distances; Combination of vertical and horizontal alignment including design of hair pin bends; Different types of islands, channelization; median openings

Course Outcome:

The student will able to design various geometric features of a highway.

Text Books:

1. AASHTO, A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, Wshinton D. C.
2. Khanna S.K. and Justo, C.E.G., Highway Engineering', Nem Chand and Bros.
3. Yoder and Witezak, "Principles of Pavement Design", John Wiley and sons.
4. Rajib B Malick and Tahar El Korchi, "Pavement Engineering Principles and Practice" , Second Edition, CRC Press, New York.

References:

1. Kadiyali, L.R., Principles & Practice of Highway Engineering, Khanna Publishers.
2. Kadiyali, L.R. Traffic Engineering and Transport Planning, Khanna Publishers
3. IRC: 86-1983, IRC: 52- 1973, IRC: 64-1990, IRC: 3-1984, IRC: 38-1988, IRC:66-1976, IRC: 65-1976, IRC: 92-1985, IRC: 103-1988, IRC SP: 41
4. Jack E Leish and Associates, Planning and Design Guide: At-Grade Intersections.Illinois.
5. Yang, Design of functional pavements, McGraw-Hill.
6. IRC: 37-2012, "Guidelines for the Design of Flexible Pavements (Second Revision)".
7. IRC: 58-2012, "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Second Revision)".
8. AASHTO – Design of pavement Structures
9. Huang - Pavement Analysis - Elsevier Publication

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6207	HIGHWAY ANALYSIS AND DESIGN	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Objectives and requirements of highway geometric design, cross section elements, highway classification, terrain classification, importance of traffic data in geometric design.		6	15
MODULE 2: Design hour volume, directional distribution of traffic, traffic composition, traffic forecasting, design vehicle, design speed., Horizontal alignment - design considerations, stability at curves, super elevation		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Sight distances - types, analysis, factors affecting, measurements Factors affecting capacity and level of service		6	15
MODULE 4: Widening, transition curves; curvature at intersections, vertical alignment - grades, ramps, design of summit and valley curves Combination of vertical and horizontal alignment including design of hair pin bends, design of expressways, IRC standards and guidelines for design problems		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Characteristics and design considerations of at-grade intersections Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections		8	20
MODULE 6: Different types of islands, channelization; median openings; design of rotary intersections Grade separations and interchanges - types, warrants, adaptability and design details, Interchanges - different types, ramps		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6209	ENVIRONMENTAL IMPACT ASSESSMENT	3-0-0:3	2015

Pre-requisites:

Course Objectives:

To give the Student:-

- Concepts for development of EIA
- Knowledge about the strategies and methodologies for EIA
- Ability to assess and predict the impacts of various environmental pollution.

Syllabus

Introduction to Environment and Environmental Impact Assessment, EIA methodologies, Environmental protection Acts Environmental Protection Acts, Assessment and prediction of Impacts on Water Environment, Socio-economic impacts in EIA studies , Assessment and prediction of Impacts on Air Environment:, Assessment and prediction of Impacts on Air Environment

Course Outcome:

The student will able to assess and implement EIA for a real small scale system.

Text Books:

1. Canter L.W., Environmental Impact Assessment, McGraw-Hill, 1997
2. Betty Bowers Marriott, Environmental Impact Assessment: A Practical Guide, McGraw-Hill Professional, 1997.

References:

1. Peter Morris & Riki Therivel, Methods of Environmental Impact Assessment, Routledge, 2001.
2. Denver Tolliver, Highway Impact Assessment, Greenwood Publishing Group, 1993.
3. R. K. Jain, L. V. Urban, G. S. Stacey, H. E. Balbach, Environmental Assessment, McGraw-Hill Professional, 2001.
4. Relevant IRC & CPCB codes.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6209	ENVIRONMENTAL IMPACT ASSESSMENT	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Introduction to Environment and Environmental Impact Assessment (EIA) Objectives and Needs- development of EIA - National Environmental Policy Act (NEPA) – Key features of NEPA. Rapid EIA – Comprehensive EIA – Strategic EIA- EIA in India		8	15
MODULE 2: EIA methodologies - Screening – Scoping - checklist, matrix and network methodologies - Identification of Impacts – Collection of baseline data Prediction – Mitigation Measures.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Environmental protection Acts Environmental Protection Acts – Application of EIA in Transportation. Public participation in Environmental decision making - techniques for conflict management and dispute resolution.		6	15
MODULE 4: Assessment and prediction of Impacts on Water Environment: Basic water quality, sources and effects of water pollution, assessment and prediction of impacts, mitigation measures, legislations.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Assessment and prediction of Impacts on Air Environment: air quality, sources and effects of air pollution, assessment and prediction of impacts, mitigation measures, legislations. Assessment of Impacts of Noise – Basic information, sources and effects . Assessment and prediction of Impacts on Water Environment Assessment and prediction of Impacts on Air Environment: of noise pollution, control measures, legislations		8	20
MODULE 6: Socio-economic impacts in EIA studies - Ecological impacts – Ecological Foot-prints– Environmental Indices. Introduction to Environmental Management Systems - Cost Benefit Analysis - Environmental Audit - Life cycle Assessment – Environmental Risk assessment.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6211	GROUND IMPROVEMENT & REINFORCED EARTH TECHNIQUES CREDITS	3-0-0:3	2015

Pre-requisites:

Course Objectives:

To give the Student:-

- Knowledge about the properties and classification of subgrade soil.
- Idea of various laboratory experiments for soil strength evaluation.
- Concepts of methods of ground improvement.

Syllabus

Course Outcome:

The student will be able to evaluate properties of site soil and determine suitable techniques for ground improvement.

Text Books:

References:

1. Terzaghi K., Peck R. P., "Soil Mechanics in Engineering Practice", Asia Publishing House, New Delhi, 1962
2. Alam Singh, "Text Book of Soil Mechanics", S Chand Publication, New Delhi
3. Relevant IS Codes

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6211	GROUND IMPROVEMENT & REINFORCED EARTH TECHNIQUES CREDITS	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Subgrade, functions, Importance of Subgrade soil properties on pavement performance Soil survey procedure for highways and ground water investigation. Identification and significance of soil characteristics		6	15
MODULE 2: Soil classification for highway engineering purpose, Effect of water in soils swelling/shrinkage, Cohesion and plasticity in soil. Moisture movement-ground water, Gravitational water, held water, soil suction		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Drainage: General principles, Subsoil drainage. Frost Action Soil: Frost susceptible soils, Air and soil temperature Heat flow through soils, Depth of frost penetration, Loss of strength during frost melting.		8	15
MODULE 4: Strength Evaluation of subgrade soil. Compaction of soils; field and Laboratory methods and equipment.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Theories of elastic and plastic behaviour of soils. Function: Stability of embankments Methods of reducing settlement due to consolidation in foundations of road embankment		6	20
MODULE 6: Vertical Sand Drains: Design criteria, constriction and uses. Ground Improvement Techniques: Reinforcing embankment and fibers.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6213	INTELLIGENT TRANSPORTATION SYSTEMS	3-0-0:3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Ability to describe different ITS user services and its components.
- Basic ideas to understand the ITS design concepts.
- Basics of AHS and its impact on highway system

Syllabus

Definition of ITS and Identification of ITS; ITS Data collection techniques; Advance vehicle control and safety systems; ITS user services; Evolution of AHS and Current Vehicle Trends; ITS for road network- System Design - Sensor technologies and data requirements for ITS; Communication Technologies for AHS - The Effects of AHS on the Environment.

Course Outcome:

The student will able to understand the fundamental concepts of ITS.

Text Books:

1. Joseph M. Sussman, "Perspectives on Intelligent Transport Systems", Springer Publishers
2. Roger R. Stough, "Intelligent Transport Systems – Cases and Policies", Publisher: Edward Elgar, 2001.

References:

1. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
2. Chris Drane and Chris Rizos, "Positioning Systems in Intelligent Transportation Systems", Artech House Publishers, London.
3. National ITS Architecture Documentation, US Department of Transportation, 2007 (CDROM)

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6213	INTELLIGENT TRANSPORTATION SYSTEMS	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS Developments – Worldwide and Indian Scenario, Metropolitan and Rural ITS.		8	15
MODULE 2: ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: ITS user services: Travel and traffic management, Public transportation operations, Electronic payment, Commercial vehicle operations		6	15
MODULE 4: Advance vehicle control and safety systems, Emergency management, Information management, Maintenance and construction management ITS design-components and requirements and Evaluation.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: ITS for road network- System Design - Sensor technologies and data requirements for ITS. Positioning systems in ITS, Mobile phone location and its impact on ITS - Telecommunication in ITS, Application of GIS in ITS.		6	20
MODULE 6: Evolution of AHS and Current Vehicle Trends - Vehicles in Platoons – Aerodynamic Benefits - Integration of Automated Highway Systems – System Configurations - Step by Step to an Automated Highway System. Communication Technologies for AHS - The Effects of AHS on the Environment – Regional Mobility - Impact Assessment of Highway Automation.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6215	PUBLIC TRANSPORT PLANNING	3-0-0:3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Ability to understand the objectives, principles and geometric characteristics of transit networks.
- Concepts and Principles to plan design and evaluate the transit networks and infrastructure facilities.
- Idea to perform economic analysis and management of public transit system.

Syllabus

Modes of public transport and comparison; Public transport travel characteristics; Transit Network Planning; Transit lines – types, geometry and characteristics; Transit Scheduling; Transit Agency and Economics ,

Course Outcome:

The student will able to plan, design and develop the public transit infrastructure.

Text Books:

1. Khisty, C J., “Transportation Engineering – An Introduction”, Prentice-Hall, NJ
2. Peter White, “Public Transport”, UCL Press

References:

1. Vukan R. Vuchic, “Urban Transit : Operations, Planning and Economics”, Wiley Sons Publishers.
2. Kadiyali L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers
3. TCRP Report 30, TCRP Report 95, TCRP Report 100
4. Papacostas, C. S and P.D. Prevedouros., “Transportation Engineering and Planning” , Pearson.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6215	PUBLIC TRANSPORT PLANNING	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Historical Growth, Modes of public transport and comparison. Public transport travel characteristics, technology of bus, rail, rapid transit systems, basic operating elements.		8	15
MODULE 2: Transit Network Planning: Objectives, principles, Intercity and Regional transit system, considerations		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Transit lines – types, geometry and characteristics, transit routes and their characteristics Timed transfer networks, prediction of transit usage, network evaluation, accessibility considerations.		8	15
MODULE 4: Transit Scheduling: Components, determination of service requirements, scheduling procedure, marginal ridership, crew scheduling		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Transit Infrastructure Facilities: Design of bus stops, design of terminals – principles of good layout, types of layout, depot location, twin depot concept, crew facilities and amenities.		6	20
MODULE 6: Transit Agency and Economics: Organizational structure of transit agency, management and personnel Transit system statistics, performance and economic measures, operations, fare structure.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P-C	YEAR
09 GN 6001	RESEARCH METHODOLOGY	0-2-0:2	2015

Pre-requisites: Nil

Course Objectives:

To enable the students:

- To get introduced to research philosophy and processes in general.
- To formulate the research problem and prepare research plan
- To apply various numerical /quantitative techniques for data analysis
- To communicate the research findings effectively

Syllabus

Introduction to the Concepts of Research Methodology, Research Proposals, Research Design, Data Collection and Analysis, Quantitative Techniques and Mathematical Modeling, Report Writing.

Course Outcome:

Students who successfully complete this course would learn the fundamental concepts of Research Methodology, apply the basic aspects of the Research methodology to formulate a research problem and its plan. They would also be able to deploy numerical/quantitative techniques for data analysis. They would be equipped with good technical writing and presentation skills.

Text Books:

1. Research Methodology: Methods and Techniques', by Dr. C. R. Kothari, New Age International Publisher, 2004
2. Research Methodology: A Step by Step Guide for Beginners' by Ranjit Kumar, SAGE Publications Ltd; Third Edition

References:

1. Research Methodology: An Introduction for Science & Engineering Students', by Stuart Melville and Wayne Goddard, Juta and Company Ltd, 2004
2. Research Methodology: An Introduction' by Wayne Goddard and Stuart Melville, Juta and Company Ltd, 2004
3. Research Methodology, G.C. Ramamurthy, Dream Tech Press, New Delhi
4. Management Research Methodology' by K. N. Krishnaswamy et al, Pearson Education

COURSE CODE:	COURSE TITLE	CREDITS	
09 GN 6001	RESEARCH METHODOLOGY	0-2-0: 2	
MODULES		Contact Hours	
MODULE : 1 Introduction to Research Methodology: Concepts of Research, Meaning and Objectives of Research, Research Process, Type of research: Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical		5	
MODULE :2 Criteria of Good Research, Research Problem, Selection of a problem, Techniques involved in definition of a problem, Research Proposals – Types, contents, Ethical aspects, IPR issues like patenting, copyrights.		4	
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE: 3 Research Design : Meaning, Need and Types of research design, Literature Survey and Review, Identifying gap areas from literature review, Research Design Process, Sampling fundamentals, Measurement and scaling techniques, Data Collection – concept, types and methods, Design of Experiments.		5	
MODULE 4: Quantitative Techniques: Probability distributions, Fundamentals of Statistical analysis, Data Analysis with Statistical Packages, Multivariate methods, Concepts of correlation and regression - Fundamentals of time series analysis and spectral analysis.		5	
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE: 5 Report Writing: Principles of Thesis Writing, Guidelines for writing reports & papers, Methods of giving references and appendices, Reproduction of published material, Plagiarism, Citation and acknowledgement.		5	
MODULE: 6 Documentation and presentation tools – LaTeX, Office Software with basic presentations skills, Use of Internet and advanced search techniques.		4	

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6293	HIGHWAY ENGINEERING LAB	0-0-2:2	2015

Pre-requisites:

Course Objectives: Nil

To give the Student:-

- Knowledge to conduct different tests to find various properties of sub grade soil and aggregate and to assess their suitability in pavement construction.
- Ability to assess suitability of bitumen for use under different climatic conditions and type of pavement construction.
- Principles of design a bituminous mix and to assess the strength and flexibility of given mix.

Syllabus

Tests on sub grade soil, aggregates, bitumen, modified binders - Pavement evaluation – skid resistance and roughness measurements, deflection measurement.

Mix Design: Granular Sub-base, Bituminous – DBM, SDBC, BC.

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6202	TRANSPORTATION ECONOMICS	4-0-0: 4	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- The fundamental concepts and need for economics in transportation.
- The ability to conduct economic analysis for different projects in transportation field.
- Knowledge to apply the principles of economic theory in transportation planning process.

Syllabus:

Fundamental concepts and overview of economic evaluation; Accounting prices of goods and services; Benefits due to Transport Improvements; Transport Costs; Economic Analysis: The generation and screening of project ideas; Application of economic theory in traffic assignment problem.

Course Outcome:

The student will able to conduct economic analysis of transportation infrastructure projects.

Text Books:

1. Winfrey R, "Highway Economic Analysis", International Textbook Company.
2. Kenneth J. Button, "Transport Economics", Edward Elgar Publishing.

References:

1. David A. Hensher, Ann M. Brewer, "Transport : An Economics and Management Perspective", Oxford University Press
2. Emile Quinet, Roger Vickerman, "Principles Of Transport Economics", Edward Elgar Publishing
3. Road User Cost Study, Central Road Research Institute
4. Ian G. Heggie, Transportation Engineering Economics, McGraw Hill.
5. IRC:SP:30-1993, Manual on Economic Evaluation of Highway Projects in India
6. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers,2003
7. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee, 2001
8. Woods, K.B., Berry, D.S. and Goetz, W.H., 'Highway Engineering', McGraw Hill Book Co.

COURSE PLAN

COURSE CODE:	COURSE TITLE:	CREDITS:	
04 CE 6202	TRANSPORTATION ECONOMICS	4-0-0:4	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Need for economic evaluation, costs and benefits of transport project, time horizon, basic principles, interest rate, time value of money. Supply and demand Models, Consumer's surplus and social surplus criteria, framework of social accounting: accounting rate of interest, social opportunity cost, rate of interest, social time preference rate of interest.		10	15
MODULE 2: Accounting prices of goods and services, measuring input costs, applications of social accounting frame work.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Benefits due to Transport Improvements: Direct Benefits: Reduced vehicle operation costs, value of travel time savings, value of increased comfort and convenience, cost of accident reduction, reduction in maintenance cost. Negative benefits due to increased noise and air pollution, Indirect Benefits: Increased land values, increased development and demand.		10	15
MODULE 4: Transport Costs: Fixed and Variable costs, cost of improvement, maintenance cost and other related costs, cost estimating methods, accounting for inflation, theory of transport supply and road planning.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Economic Analysis: The generation and screening of project ideas. Different methods of economic analysis - Annual cost and benefit ratio methods, discounted cash flow method, determination of IRR and NPV. Examples of economic analysis of (i) different types of road surfaces (ii) different options for intersection improvement (iii) proposals for bypass to a city (iv) different strategies of pavement maintenance		10	20
MODULE 6: Application of economic theory in traffic assignment problem - user optimal assignment and system optimal assignment. Economic analysis of projects - Financing of road projects - methods Private Public Partnership (PPP) - Toll collection Economic viability of Build-Operate-Transfer Schemes – Risk Analysis - Case Studies.		10	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6204	URBAN TRANSPORTATION PLANNING	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- The fundamental concepts of transportation planning process.
- Ability to develop the models for four stage planning process.
- Idea to describe land use models and its application.

Syllabus:

Role of transportation in a society; Inventory, model building, forecasting and evaluation stages; Fundamental concepts of Trip Generation, Trip Distribution, Modal split analysis, Land use and its interaction, Ekistics.

Course Outcome:

The student will be able to develop and work with tools and models for comprehensive transportation planning process.

Text Books:

1. C. S. Papacostas and P.D. Prevedouros (2002), "Transportation Engineering and Planning", Prentice Hall.
2. Michael D Mayer and Eric J Miller (1974), "Urban transportation planning A Decision Oriented Approach", McGraw Hill.

References:

1. Bruton M J (1981), "Introduction to transportation planning", Hutchinson of London
2. Oppenheim, Norbert, "Urban Travel demand modelling: From individual choices to general equilibrium", John and Wiley Sons.
3. Hutchinson B G (1974), "Principles of urban transportation system planning", McGraw Hill.
4. Kadiyali, L.R. "Traffic Engineering and Transport Planning", Khanna Publishers
5. Dickey J W (1980), "Metropolitan Transportation Planning", Tata McGraw Hill

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6204	URBAN TRANSPORTATION PLANNING	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Role of transportation in a society - Goal, objectives and constraints in transportation planning process, Inventory, model building, forecasting and evaluation stages. Urban activity systems and travel patterns - Trip-based and Activity-based approaches		6	15
MODULE 2: Definition of study area; zoning, types and sources of data, methods of O-D Survey- passenger, goods Sampling techniques, expansion factors, accuracy checks; use of secondary data.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Trip Generation- Zonal models, category analysis, household models, trip attraction of work centres and commercial trips.		6	15
MODULE 4: Trip Distribution-Growth factor models, Gravity models and opportunity models.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Modal split analysis- Mode choice behaviour, competing models, mode split models, probabilistic and two stage mode split analysis Route split analysis- traffic assignment, basic elements of transportation networks, coding, diversion curves, minimum path trees, all- or- nothing assignments, capacity restraint techniques		10	20
MODULE 6: Land use and its interaction: Lowry derivative models, Quick response techniques - Non-Transport solutions for transport problems Ekistics - Science of human settlements - Characteristics of urban structure. Town planning concepts - Neighbourhood planning.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6206	PAVEMENT EVALUATION AND REHABILITATION	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the student:-

- The techniques for structural and functional evaluation of pavements
- Principles of design overlay to strengthen the pavement structure.
- Ability to apply the concepts of pavement management system.

Syllabus

Fundamental concepts and overview of Structural and functional requirements of flexible and rigid pavements; Methods of pavement surface conditions; Factors affecting pavement structural condition; Testing of model pavements under controlled conditions; Evaluation models

Course Outcome:

The student will be able to apply tools and techniques of pavement evaluation

Text Books:

1. Yoder and Witczak, "Principles of Pavement Design", John Wiley and Sons
2. Shahin M Y, Pavement management for Airports, Roads and Parking Lots, Second edition

References:

1. Woods K B, "Highway Engineering Handbook", McGraw Hill
2. David Croney, The design and performance of Road Pavements HMSO Publications
3. HRB/TRB/IRC Publications.
4. Haas and Hudson, 'Pavement management system', McGrawHill BookCo. Newyork
5. Per Ullitz, Pavement analysis, Elsevier, Amsterdam

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6206	PAVEMENT EVALUATION AND REHABILITATION	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Structural and functional requirements of flexible and rigid pavements, pavement distress, different types of failures and causes. Various factors affecting the surface condition, skid resistance and roughness measurements, causes and measures to reduce pavement slipperiness, unevenness, ruts, pot holes, cracks, strengthening of existing pavement		8	15
MODULE 2: Design of flexible and rigid overlay. Methods of pavement surface conditions evaluation by physical measurements, by riding comfort and other methods, their applications.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Factors affecting pavement structural condition, effects of subgrade soil, moisture, pavement layers, temperature and environment on structural stability		6	15
MODULE 4: Evaluation of pavement structural condition by non-destructive tests such as FWD, BBD, plate load tests and other methods Evaluation by destructive test method and specimen testing		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Testing of model pavements under controlled conditions, test setup and instrumentations. Importance of PMS, objectives, project and network level management		8	20
MODULE 6: Evaluation models – AASHTO, CRRI, HDM, Road Transport Investment Model.		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6208	TRAFFIC FLOW THEORY	3-0-0:3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

1. The definitions of the traffic stream characteristics and fit their distributions
2. Concepts of different theories of traffic flow.
3. Ability to estimate the capacity and level of service of different traffic facilities.
4. Knowledge to analyse and formulate the problems in simulation of traffic engineering.

Syllabus

Fundamental concepts of Traffic stream characteristics and Description using distributions; Fluid Flow Analogy Approach; Fundamentals of Queuing Theory; Philosophy of Simulation Modelling; Design of computer Simulation Experiments.

Course Outcome:

The student will able to analyse and evaluate traffic stream performance.

Text Books:

1. Wohl M. and Martin, B.V., "Traffic System Analysis for Engineers and Planners", McGraw-Hill, New York.
2. McShane W R & Roess R P, "Traffic Engineering", Prentice-Hall, NJ

References:

1. TRB-SR No.165-Traffic Flow Theory, Transportation Research Board, Washington-D.C.
2. May, A.D, Traffic Flow Fundamentals, Prentice-Hall, NJ
3. Drew D.R, Traffic Flow Theory and Control, McGraw-Hill, New York.
4. TRB Special Report 209: Highway Capacity Manual, Transportation Research Board, Washington DC, 1985.
5. Mannering F.L & Kilareski, W.P., "Principles of Highway Engineering and Traffic Analysis", John Wiley & Sons.
6. Neylor, T. H , "Computer Simulation Techniques", John Wiley.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6208	TRAFFIC FLOW THEORY	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Traffic stream characteristics and Description using distributions: Measurement, Microscopic and Macroscopic study of Traffic Stream, fundamental diagrams. Use of counting, Interval and Translated Distributions for describing Vehicle Arrivals, Headways, Speeds, Gaps and Lags; Fitting of Distributions.		8	15
MODULE 2: Fluid Flow Analogy Approach, shock Wave Theory, Platoon Diffusion and Boltzman like Behaviour of Traffic Flow. Car-Following Theory, Linear and Non linear Car Following Models, Acceleration Noise		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Fundamentals of Queuing Theory, Demand Service Characteristics. Deterministic Queuing Models, Stochastic Queuing Models, Multiple Service Channels, Models of Delay at Intersections and Pedestrian Crossings.		8	15
MODULE 4: Concepts, Factors affecting Capacity and Level of Service, Capacity Analysis of Different Highway Facilities, Passenger Car Units, Problems in Mixed Traffic Flow		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Philosophy of Simulation Modelling, Formulation of Simulation Model, Methodology of System Simulation Simulation Languages, Generation of Random Numbers, Generation of Inputs-Vehicle Arrivals, Vehicle Characteristics, Road Geometrics.		8	20
MODULE 6: Design of computer Simulation Experiments, Analysis of Simulation Data, Formulation of Simulation Problems in Traffic Engineering and Validation		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6212	TRANSPORTATION FACILITY DESIGN	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Principles of design of different highway components.
- Ability to plan and analyse different terminal facilities
- Concepts of design of traffic control facilities

Syllabus:

Fundamental concepts of Design of highways, design of at-grade intersections; Terminal Planning & Design; Capacity & level of service concept; Design of Highways Geometrical standards for mobility & accessibility components; Design of Intersections

Course Outcome:

The student will be able to design, analyse and evaluate highway and related structures based on accessibility and mobility, safety considerations and geometrical standards

Text Books:

1. Kadiyali, L.R., "Traffic Engineering and Transport Planning", Khanna Publishers
2. Salter, R J., Highway Traffic Analysis and Design, ELBS.

References:

1. IRC-SP41: Guidelines for the Design of At-Grade Intersections in Rural & Urban Areas
2. Edward K. Morlock, "Introduction to Transportation Engineering & Planning, International Student Edition", Mc-Graw Hill Book Company, New York.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6212	TRANSPORTATION FACILITY DESIGN	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Design of highways, design of at-grade intersections Design of signalized intersection, design of grade separated intersection. Terminal design and design of facilities for non- motorised transport.		6	15
MODULE 2: Terminal Planning & Design: Terminal functions, analysis of terminals, process flow charts of passenger & goods terminals, terminal processing time, waiting time		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Capacity & level of service concept, study of typical facilities of highway, transit, airport and waterway terminals, concept of inland port.		8	15
MODULE 4: Design of Highways: Hierarchy of highway system, functions, design designations, concepts in horizontal & vertical alignment, integration, optimal design		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Geometrical standards for mobility & accessibility components, landscaping and safety considerations, evaluation and design of existing geometrics		8	20
MODULE 6: Design of Intersections: Review of design of at-grade intersections, signal coordination – graphic methods & computer techniques. Grade separated intersections – warrants for selection, different types & geometric standards, spacing & space controls Ramps and gore area design		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6214	ROAD SAFETY AND ENVIRONMENT	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Ability to analyse road accidents and to develop crash models
- The applications of ITS in Road safety
- Awareness about the various types of pollution from transportation and the strategies to control it.

Syllabus

Fundamental concepts of Traffic Safety – Principles and practices; Strategies adopted in various countries; Safety at intersections; Role of intelligent transportation systems in road safety; Measurement and analysis of vehicular emission; Road safety audit.

Course Outcome:

The student will be able to conduct a road safety audit and understand various measures to reduce road accidents.

Text Books:

1. Evans S.K., Traffic Engineering Handbook, Institute of Traffic Engineers, USA
2. Wohl M., Martin B.V., "Traffic system analysis of Engineers & Planners", McGraw Hill, New York.

References:

1. C Jotin Khisty, B Kent Lall., "Transportation Engineering an introduction" Prentice Hall of India Pvt. Ltd. New Delhi.
2. Babkov V.F., "Road Conditions & Traffic Safety", MIR Publishers, Moscow, 1975
3. Kadiyali L.R., "Traffic Engineering & Transport Planning", Khanna Publishers, 2003
4. Little A.D., "The state of art of Traffic Safety", Paraeger Publishers, New York, 1970
5. Relevant IRC codes.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6214	ROAD SAFETY AND ENVIRONMENT	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Traffic Safety – Principles and practices. Causes of Road accidents - Accident Analysis – Pre-crash and Post-crash models, Black Spot Identification & Investigations, Case Studies. Accident Control measures – 3E Concept (Engineering, Enforcement and Educational measures). Mixed traffic flow; Traffic calming Measures.		8	15
MODULE 2: Strategies adopted in various countries. Traffic management measures and their influence on accident prevention. Highway Safety improvement programme – frame work, Traffic safety along links.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Safety at intersections, Highway Safety Measures during construction. Counter-measures – Evaluation of counter-measures, Safety Index.		6	15
MODULE 4: Role of intelligent transportation systems in road safety, electronic enforcement of traffic regulations. Road transport related air pollution - sources and effects, sources of vehicular emissions, vehicle emission parameters, control.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Measurement and analysis of vehicular emission, emission factor, emission standards, traffic pollution modelling. Road transport related noise pollution, urban and non urban traffic noise sources, noise barriers, control measures.		6	20
MODULE 6: Road safety audit, stages of auditing, key elements of a road safety audit, crash investigation and analysis, methods involved, case studies. EIA requirements of highway projects, procedure for EIA for highways – case studies.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6216	PAVEMENT MANAGEMENT SYSTEM	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Definition of the components of pavement management.
- Ability to predict the pavement performance using various modelling techniques.
- Principles to perform economic evaluation of various pavement management alternatives.
- Concepts of identification and implementation of suitable expert systems for the pavement management.

Syllabus:

Fundamental concepts and overview of Components of pavement management systems; Pavement Performance Prediction; Comparison of different deterioration models; Design Alternatives and Selection; Reliability concepts in pavement engineering; Role of computers in pavement management.

Course Outcome:

The student will be able to analyse the pavement based on its performance and adopt appropriate techniques and expert systems for the management purpose.

Text Books:

1. Ralph Haas and Ronald W. Hudson, "Pavement Management System", McGraw Hill Book Co. 1978
2. Ralph Haas, Ronald Hudson and Zanieswki , "Modern Pavement Management", Kreiger Publications OECD, Pavement Management Systems, O E C D 1987.

References:

1. Shahin M. Y., "Pavement Management for Airport, Roads and Parking Lots", Chapman and Hall, 1994.
2. Susan Brown, Pavement Management Systems, Transportation Research Board, 1993.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6216	PAVEMENT MANAGEMENT SYSTEM	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Components of pavement management systems, pavement maintenance measures, planning investment, research management. Recent developments, sample size selection, economic optimisation of pavement maintenance and rehabilitation		8	15
MODULE 2: Pavement Performance Prediction: Concepts, modelling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Comparison of different deterioration models. Functional condition deterioration models, unevenness prediction models and other models, comparison Modelling in rehabilitation budget planning, case studies.		6	15
MODULE 4: Design Alternatives and Selection: design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Reliability concepts in pavement engineering, life cycle costing, analysis of alternate pavement strategies based on distress and performance, case studies Road Asset Management, Pavement Preservation Programmes, Techniques and Tools		8	20
MODULE 6: Role of computers in pavement management, applications of expert systems for managing pavements Expert system for pavement evaluation and rehabilitation, knowledge-based expert systems, case studies Implementation of pavement management systems		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6218	COMPUTER SIMULATION APPLICATIONS IN TRANSPORTATION ENGINEERING	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Knowledge about the need, steps involved, advantages and disadvantages of computer simulation process.
- Ability to develop and validate the simulation models.
- Concepts to apply simulation models in the most appropriate and effective way.

Syllabus:

Fundamental concepts about the need of simulation, advantages and disadvantages, areas of application; Statistical models, terminology and concepts, discrete and continuous distributions; Modelling in rehabilitation budget planning; Analysis of simulation data; Model building, verification, calibration and validation; Applications of Simulation

Course Outcome:

The student will able to develop, analyse and validate the computer simulation models for applications in Transportation engineering.

Text Books:

1. Martin Whol, Brian V. Martin, "Traffic System Analysis for Engineers and Planners", Mc Graw Hill Book Company.
2. Geoffrey Gordon, "System Simulation", 2nd Edition, Prentice Hall, India, 2002.

References:

1. Narsingh Deo, "System Simulation with Digital Computer", "Prentice Hall, India, 2001
2. Jerry Banks and John S. Carson, Barry L. Nelson, David M. Nicol, "Discrete Event System Simulation", 3rd Edition, Prentice Hall, India, 2002
3. Shannon, R.E. "Systems Simulation, The Art and Science", Prentice Hall, 1975
4. Thomas J. Schriber, "Simulation using GPSS", John Wiley, 1991.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6218	COMPUTER SIMULATION APPLICATIONS IN TRANSPORTATION ENGINEERING	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Need of simulation, advantages and disadvantages, areas of application, system approach, components of system, discrete and continuous systems. Model of system, types, discrete – event system simulation, steps involved, simulation examples, general principles, and simulation softwares.		8	15
MODULE 2: Statistical models, terminology and concepts, discrete and continuous distributions Poisson process, empirical distributions, queuing models, characteristics, notation, measures of performance, networks of queues.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Modelling in rehabilitation budget planning, case studies. Pseudo random numbers, generation, techniques for generating random numbers Tests for random numbers, random – variate generation, inverse-transform technique, acceptance – rejection technique, special properties.		8	15
MODULE 4: Analysis of simulation data: Input modeling, data collection, distribution identification, parameter estimation Goodness – of –fit tests, fitting selecting input models, multi variate and time series input models.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Model building, verification, calibration and validation, output analysis. Measure of performance, comparison and evaluation of alternate system designs, meta modeling, and optimization via simulation.		6	20
MODULE 6: Applications of Simulation: Simple queuing problems - Inventory problems Simulation of ports - Railway platforms and level crossings - Traffic signals.		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6222	ADVANCED HIGHWAY MATERIALS	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Knowledge about the properties of subgrade, aggregate, bitumen and bituminous mixes.
- Explanation of the mechanical properties of bitumen mixes.
- Description about the performance of pavement based on bitumen specifications.
- Principles of design of the pavements using advanced design methods.

Syllabus:

Subgrade soil, road aggregates, Bitumen, Bituminous Emulsions and Cutbacks; Weathering and Durability of Bituminous Materials and Mixes; Cement Concrete for Pavement Construction.

Course Outcome:

The student will be able to assess the quality of various materials and their suitability for highway construction.

Text Books:

1. Rajib B Malick and Tahar El Korchi, "Pavement Engineering Principles and Practice" , Second Edition, CRC Press, New York.

References:

1. RRL, DSIR, Bituminous Materials in Road Construction ', HMSO Publication.
2. RRL, DSIR, Soil Mechanics for Road Engineers', HMSO Publication.
3. ISI and IRC Publications on relevant topics.
4. Freddy L. Roberts, Prithvi S. Kandhal, Ray Brown, Dah-Linn Lee, Thomas W. Kennedy, Hot Mix Asphalt Materials, Mixture Design and Construction, NAPA Education Foundation, Lanham, Maryland
5. Asphalt institute, The Asphalt Hand Book'
6. Kadiyali L.R., "Traffic Engineering & Transport Planning", Khanna Publishers, 2003
7. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers, 2003
8. Khanna S.K., Justo C.E.G., "Highway Engineering", Nem Chand & Bros., Roorkee,

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6222	ADVANCED HIGHWAY MATERIALS	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Subgrade soil - Soil composition and structure - Soil classification for engineering purposes. Origin, Classification, requirements, properties and tests on road aggregates		6	15
MODULE 2: Bitumen: Origin, preparation, properties and tests, constitution of bituminous road binders, requirements.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Bituminous Emulsions and Cutbacks; Preparation, characteristics, uses and test.		6	15
MODULE 4: Bituminous Mixes: Mechanical properties: Resilient modulus, dynamic modulus. Fatigue characteristics of bituminous mixes.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Weathering and Durability of Bituminous Materials and Mixes - Performance based Bitumen Specifications. Super pave mix design method		8	20
MODULE 6: Cement Concrete for Pavement Construction: Requirements, and design of mix for CC pavement. Joint filler and sealer materials		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6224	BRIDGE ENGINEERING	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- The loading standards and fundamental concepts in bridge design
- Concepts of design bridge – super structure and foundation.
- Knowledge about the bridge construction techniques.
- The basics tests for safe carrying capacity of bridges.

Syllabus:

Fundamental concepts of Bridge Hydrology, Standards of loadings; Bridge Super structure; Bridge bearings; Bridge Foundation & Substructure; Foundation failures; Erection of steel girder bridges

Course Outcome:

The student will able to design a bridge – super structure, foundation and bearings.

Text Books:

1. Ponnuswamy, S., “Bridge Engineering”, Tata McGraw - Hill, New Delhi, 1997
2. Victor, D.J., “Essentials of Bridge Engineering”, Oxford & IBH Publishers Co., New Delhi, 1980.

References:

1. Bindra S.P., “Bridge Engineering”, Dhanpat Rai & Sons
2. Relevant IRC code
3. MORT&H Specifications & Standards for Roads & Bridges

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6224	BRIDGE ENGINEERING	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: History of Bridge Development: Classification of bridges, Selection of bridge sites, Bridge alignment, Sub-surface investigations, Bridge Hydrology, Flood discharge, waterways, scour depth, depth of foundation		6	15
MODULE 2: Standards of loadings, types of loads, impact effect, wind loads, seismic forces, buoyancy, earth pressure, loadings on various bridges, traffic requirements		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Bridge Super structure: Superstructure elements, Bridge flooring, design of slab bridges & girder bridges Prestressed concrete bridges, plate girder bridges, Suspension bridges (Theory only)		8	15
MODULE 4: Bridge bearings, joins in bridges, Cable stayed bridges, Truss bridges Bridge Foundation & Substructure- Settlements, Allowable soil pressures, types of foundations, Design of pile foundation		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Foundation failures, Design of piers and abutments, wing walls and approaches and cofferdams (Theory only)		8	20
MODULE 6: Erection of steel girder bridges, truss bridges, suspension bridges, maintenance of bridges, Bridge testing for safe carrying capacity, strengthening of bridges, aesthetical treatments.		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6226	DECISION MODELS IN MANAGEMENT	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- The concepts of operations research in management decisions.
- Concepts to apply the LP concepts in transportation engineering problems.
- Knowledge to develop suitable simulation models for decision making.

Syllabus:

Fundamental concepts of Management Decisions - Operation research; Non linear programming; Transportation LP problems; Markov decision processes; Discrete event simulation; Integer programming.

Course Outcome:

The student will able to identify and develop the decision models in transportation management.

Text Books:

1. Ravindran, D.T. Philips and J.J.Solberg, "Operations Research; Principles and Practice", John Wiley, 2nd Edition 1987
2. S. Bazzarra, J.J. Jarvis and H.D. Sherali, "Linear Programming and Network Flows", 2nd Edition , John Wiley, 1990

References:

1. N.D.Vora. Quantitative Techniques in Management, S.Chand Publications
2. L. Winston, "Operations Research; Application and Algorithms", Kent P.W.S. 2nd Edition, 1991
3. A. Taha, "Operations Research; An Introduction", MacMillan, 1982
4. Kapoor, "Computer Assisted Decision Models" Tata McGrw-Hill, New Delhi, 1991.
5. Neylor, T.H. et al., "Computer Simulation Techniques", John Wiley

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 6226	DECISION MODELS IN MANAGEMENT	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Management Decisions: Concepts, Operation research. Decision environment, Decision making processes. Linear Programming: Advanced Methods- Heuristics, Simplex method, duality, post- optimality analysis		8	15
MODULE 2: Non linear programming, Sensitivity analysis, Unconstrained and constrained optimization. Kuhn- Tucker theory; Quadratic programming applications		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Transportation LP problems: Assignment problems, Queuing theory, Queuing Models.		8	15
MODULE 4: Markov decision processes; Applications to inventory management and Replacement processes.		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Discrete event simulation; Generation of random variables, simulation processes and languages. Network models. Shortest path method, maximum flow. Minimum spanning tree problem.		6	20
MODULE 6: Integer programming, goal programming, dynamic programming. Decision theory. Role of knowledge; Deterministic and probabilistic situation, Single and multiple person decision making		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6292	MINI PROJECT	0-0-4: 2	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

1. Capability to select and analyze a specific problem in Transportation Engineering and offer solution individually.
2. A general idea to present and communicate the solution individually.

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 6294	TRAFFIC ENGINEERING LAB	0-0-2:1	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

1. Ability to conduct various traffic studies for design and management of road facilities.

Syllabus

Traffic Surveys: Volume count, Speed study, Parking study, Intersection turning movements, Speed and Delay study, Moving observer survey, Traffic noise measurement, Vehicle emission testing, Road lighting, Driver reaction time.

Road side and house hold interviews.

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7201	GIS AND GPS APPLICATIONS IN TRANSPORTATION	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

To give the Student:-

- The knowledge on remote sensing and its applications.
- Explanation about the basic concepts of GIS & GPS.
- Knowledge about data processing, analysis and modelling in GIS.
- Ability to apply GIS and GPS in transportation engineering.

Syllabus

Fundamental concepts of Geoinformatics; Structure of GIS: Cartography, Geographic mapping process, transformations, map projections; Raster data representation; Spatial analysis; GPS: Basic concepts, component, applications

Course Outcome:

The student will able to apply the concepts of remote sensing, GIS and GPS for various transportation engineering problems.

Text Books:

3. Kennedy M., "The Global Positioning System & GIS: An Introduction", Ann Arbor Press, 1996
4. Anji Reddy, M., "Remote Sensing and Geographical Information Systems", B.S. Publications, Hyderabad, 2001.

References:

5. Burrough, P.A., "Principles of Geographical Information Systems", Oxford Publication, 1998.
6. Clarke, K., "Getting Started with Geographic Information Systems", Prentice Hall, New Jersey, 2001.
7. DeMers, M.N., "Fundamentals of Geographic Information Systems", John Wiley & Sons, New York, 2000.
8. Lo, C.P. and Yeung A.K.W., "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India, New Delhi, 2002.

COURSE PLAN

COURSE CODE:	COURSE TITLE:	CREDITS	
04 CE 7201	GIS AND GPS APPLICATIONS IN TRANSPORTATION	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1- Geoinformatics Remote Sensing-Principles, Concepts, air-photo interpretation.Data acquisition, Basic concepts of GIS & GPS		8	15
MODULE 2:Structure of GIS Cartography, Geographic mapping process, transformations, map projections. Geographic Data Representation, Storage, Quality and Standards, database management systems		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3:Data Representation Raster data representation, Vector data representation, Assessment of data quality, Managing data errors, Geographic data standards. GIS Data Processing, Analysis and Modelling: Raster based GIS data processing – Vector based GIS data processing – Queries		8	15
MODULE 4:Spatial analysis Descriptive statistics – Spatial autocorrelation – Quadrant counts, and nearest neighbour analysis – Network analysis – Surface modeling – DTM. GIS Applications: Case studies.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5:GPS Basic concepts, components, factors affecting, GPS setup, accessories, segments-satellites & receivers,		6	20
MODULE 6:GPS applications, Case studies		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7203	URBAN PLANNING	3-0-0: 3	2015

Pre-requisites:

Course Objectives:

To give the Student:-

- Ability to understand the spatial standards for various land use activities.
- Knowledge to prepare base plan and town development plan
- Suggestions regarding various policies and strategies for urban renewal.
- Concepts about trends and practices followed in various countries for planning new towns.

Syllabus

Fundamental concepts Land use Activities, Spatial standards; Techniques of Preparation of Base Maps; Town Development Plan; Plan implementation ; Process of urban renewal; Concept of New Towns; Indian and British experience of planning and development of new towns

Course Outcome:

The student will able to adopt various policies and strategies for urban renewal and planning of new towns.

Text Books:

1. Margaret Roberts, "Town Planning Techniques", Hutchinson Educational Publication.
2. Modak N.V., Ambedkar V.N., "Town and Country Planning and Housing", Orient Longman Limited

References:

1. C. S. Papacostas and P.D. Prevedouros (2000), "Transportation Engineering and Planning", Prentice Hall
2. Gupta R.G., Planning and Development of Towns, New Delhi.
3. Ramegouda K.S., "Urban and Regional Planning", Mysore University

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7203	URBAN PLANNING	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1:Land use Activities: Analysis and prediction of important land use activities like population, employment, housing, shopping, leisure, transport. Spatial standards: Spatial standards for residential, industrial, commercial and recreational areas, space standards for facility areas and utilities, Process of implementation, Provisions of Town Planning Act, zoning, subdivision practice, metro region concept.		8	15
MODULE 2:Techniques of Preparation of Base Maps: Drawing size, scale, format, orientation, reduction and enlargement of base maps. Town Development Plan: Scope, contents and preparation. A case study of development plan, scope, content and preparation of zonal development plans.		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3:Plan implementation: Organizational legal and financial aspects, public participation in plan formulation and implementation. Urban Renewal: Meaning, significance, scope and limitations, urban renewal as a part of metropolitan plan.		6	15
MODULE 4:Process of urban renewal, identification of renewal areas, renewal policies and strategies and management of renewal areas, central areas and their renewal.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5:Concept of New Towns: Meaning, role and functions: Special planning and development considerations, scope and limitations of new town development.		8	20
MODULE 6: Indian and British experience of planning and development of new towns. Recent Trends & Practices: In planning and development system in India, Outline of planning and development system in U.K., U.S.A. and U.S.S.R.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7205	HIGHWAY CONSTRUCTION	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Knowledge about different equipments used in Highway Construction.
- Idea of various steps in construction of Flexible and Cement Concrete Pavement Layers.
- Basic principles of design and construct surface and sub-surface drainage system for highways and airports.
- Description about maintenance methods for pavements under different topographic conditions.

Syllabus

Equipment in Highway Construction; Subgrade: Earthwork grading, compaction and construction of embankments and cuts for roads, Specifications of materials, construction method and field control checks for various types of flexible pavement materials; Cement Concrete Pavement Layers; Design factors, mix design, construction control and quality control checks for mechanical; Design and construction of surface and sub-surface drainage system for highways and airports.

Course Outcome:

The student will be able to select appropriate materials and techniques for construction and maintenance of highway and airfield pavements.

Text Books:

1. Peurifoy, R.L., "Construction, Planning, Equipment and Method" - McGraw Hill Book Co.
2. Cedergren, H.R., "Drainage of Highway and Airfield Pavements", John Wiley and Sons

References:

1. DSIR - Soil Mechanics for Road Engineers', HMSO – London
2. Leonards, G.A., Foundation Engineering', McGraw Hill Book Co.
3. DSIR - Bituminous Materials in Road Construction', HMSO London
4. DSIR - Concrete Roads, Design and Construction', HMSO London
5. Woods, K.B., Berry D.S. and Goetz, W.H., "Highway Engineering Hand Book", McGraw Hill Book Co.
6. Relevant IRC standards.
7. Sharma, S.C., "Construction Equipment and its Management", Khanna Publishers
8. Gahlout and Gupta, Treatise on Hill Roads', Standard Book House
9. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers, 2003

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7205	HIGHWAY CONSTRUCTION	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
<p>MODULE 1: Equipment in Highway Construction: Various types of equipment for excavation, grading and compaction - their working principle, advantages and limitations. Special equipment for bituminous and cement concrete pavement, stabilised soil road construction.</p>		6	15
<p>MODULE 2: Subgrade: Earthwork grading, compaction and construction of embankments and cuts for roads, problems in embankment construction on weak and compressible foundation. Preparation of subgrade, quality control tests as per MoRTH specifications. Flexible Pavements: Specifications of materials, construction method and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers and their choice.</p>		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
<p>MODULE 3:Cement Concrete Pavement Layers: Specifications and method of cement concrete pavement construction; Compaction of interlocking block pavements, Quality control tests; Construction of various types of joints. Soil Stabilized Pavement Layers: Principles of gradation/proportioning of soil-aggregate mixes and compaction.</p>		8	15
<p>MODULE 4:Design factors, mix design, construction control and quality control checks for mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods. Use of additives, Numerical problems on mix design and application of Rothfutch method.</p>		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
<p>MODULE 5: Drainage: Design and construction of surface and sub-surface drainage system for highways and airports. Drainage materials, design procedures and IRC Guidelines for Drainage of Urban Roads. Maintenance: Methods of Maintenance of different types of pavements.</p>		6	20
<p>MODULE 6:Special problems in high rainfall areas and wet /water logging condition, maintenance of drainage system. Hill Roads: Special problems in construction and maintenance of hill roads; landslides, causes, investigation and remedial measures, protection of embankment and cut slopes, Numerical problems on slope stability.</p>		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7207	TRANSPORTATION SYSTEM MANAGEMENT	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Description about different methods for data collection for transportation system management.
- Knowledge to analyse traffic problems and plan transportation system management actions.
- Fundamentals of management systems for parking and non-motorised transport.

Syllabus

Fundamental concepts of Methodology & Data Collection; Area wide data collection methodology, corridor data collection methodology; TSM Actions; Public transportation & HOV treatment; Priority at ramp terminals; Traffic Operations Improvement; Parking Management

Course Outcome:

The student will be able to analyse transportation systems and implement suitable management strategies.

Text Books:

1. D, Arlington, Transportation System Management in 1980: State of the Art and Future Directions, Transportation Research Board, 1980.
2. Manheim M, "Fundamentals of Transportation system approach", MIT press, Cambridge, MA, 1985.

References:

1. Institute of Transportation Engineers, Transportation and Traffic Engineering. Hand Book, Prentice Hall, 1982
2. John G. Schoon, "Transportation Systems and Service Policy", Chapman & Hall, New York.
3. Meyer, Michael D. and Eric J. Miller, "Urban Transportation Planning – A decision oriented Approach", Mc Graw Hill, New York, 1984.
4. TRB Publications.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7207	TRANSPORTATION SYSTEM MANAGEMENT	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Methodology & Data Collection: Methodological frame work, objectives and problems, conflicts resolution, strategic categories and action elements. Travel behaviour impact and response time, TSM actions combinations and interactions, impact assessment and evaluation, monitoring and surveillance		6	15
MODULE 2: Area wide data collection methodology, corridor data collection methodology. TSM Actions: Study of following TSM actions with respect to problems addressed, conditions for applications, potential implementation problems, evaluation & impact analysis		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Public transportation & HOV treatment - Toll discounts for car pools during peak periods, park and ride, car pooling, exclusive lanes.Priority at ramp terminals, bus transfer stations, limited and skip-stop bus services, shared ride.		6	15
MODULE 4: Priority at ramp terminals, bus transfer stations, limited and skip-stop bus services, shared ride. Demand Management: Staggered work hours, flexible work hours, high peak period tolls, shuttle services, circulation services, extended routes.		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Traffic Operations Improvement: On-street parking ban, freeway ramp control & closure, travel on shoulders, one-way streets, reversible lanes Traffic calming, Right turn phase, right turn lanes, reroute turning traffic.		8	20
MODULE 6: Parking Management: Short term reserved parking, increased parking rates, time duration limits, expanded off-street parking Non Motorized Transport- pedestrian only streets, Dial a ride for elderly & handicapped.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7209	Transportation System Analysis	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

1. Ability to compare the characteristics and to plan different modes of transportation.
2. Knowledge to evaluate transport systems using microeconomic concepts.
3. Capability to develop various travel demand models.
4. The concepts of traffic networks and how to apply optimization algorithms for solutions.

Syllabus

Fundamental concepts of Different modes of transport; Airport Planning; Planning of Harbours and ports, Transportation Systems Overview, Evaluation of urban transport investments; Activity based travel demand modelling; Utility theory, Traffic Assignment; Network representation

Course Outcome:

The student will able to perform evaluation of transportation network systems.

Text Books:

1. John w Dickey., “Metropolitan Transportation Planning”, Taylor and Francis Publishers.
2. Yosef sheffi, “Urban Transportation Networks”, Prentice – Hall, in., Englewood Cliffs, New Jersey.

References:

1. Hutchinson B.G., “Principles of Urban Transport Systems Planning”, Mc Graw Hill Company.
2. Magnanti T.L. and Goldin B L., “Network Optimization”, John 1Wiley and Sons, New York.
3. Manheim M L., “Fundamentals of Transportation Systems Analysis”, MIT Press.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7209	Transportation System Analysis	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Different modes of transport - Characteristics of different modes - integration of modes and interactions - impact on environment - Planning of railway systems – Functional planning of passenger and goods terminals		6	15
MODULE 2: Airport Planning - requirements and components - Layout of runways taxiways and aprons - parking configuration - terminal requirements - Airport marking and lighting - Air traffic control. Planning of Harbours and ports – harbour structures - port facilities - Navigation aids - Inland waterways – Cargo transport - Containerization - Pipeline transportation		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Transportation Systems overview - Transportation issues and challenges – Basic steps in systems planning process – principles governing transportation planning and investment		6	15
MODULE 4: Evaluation of urban transport investments – Traffic system evaluation – Microeconomic concepts central to transportation systems – Pricing theory – Congestion pricing. Activity based travel demand modelling - Review of Discrete choice models - modeling of mode choice		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Utility theory – modal split with a behavioural basis - Modal split in mixed traffic Traffic Assignment - Definitions of network equilibrium – mathematical formulation of traffic equilibrium - User Equilibrium, System Optimal and Stochastic User Equilibrium - equilibrium between modes.		8	20
MODULE 6: Network representation – Link performance functions – Shortest Path algorithms – Overview of Label Setting and Label Correcting algorithms. Overview of Optimization Algorithms – Method of convex combinations - Solution algorithms – Frank Wolfe algorithm and Method of Successive Averages.		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7211	TRAFFIC MANAGEMENT AND CONTROL	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- The knowledge about various traffic management measures at a site.
- Ability to evaluate traffic operations on a roadway.
- Principles to design traffic control devices and parking facilities.

Syllabus

Fundamental concepts of Traffic management; Need and scope of traffic regulations- Motor Vehicle Act; Environmental Effects of the different Transportation System; Traffic Operations: Factors in Operation-Levels of Service and Performance Criteria - Quality of Service; Traffic Control Devices; Parking Management

Course Outcome:

The student will be able to assess traffic performance and implement suitable management and control measures to improve the performance.

Text Books:

1. Salter, R J., and N. B Hounsell, "Highway Traffic Analysis and Design", Mac Millan
2. Manheim M, "Fundamentals of Transportation system approach", MIT press, Cambridge, MA, 1985.

References:

1. Alshaer, H., Demanding Traffic Control and Management in Next Generation Networks, Lambert Academic Publishing, 2010.
2. Kutz, M., Handbook of Transportation Engineering, McGraw-Hill Publishers, 2004
3. Kadiyali L.R., "Principles & Practice of Highway Engineering", Khanna Publishers.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7211	TRAFFIC MANAGEMENT AND CONTROL	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Traffic management - scope of traffic management measures - restrictions to turning movements - one way streets - tidal flow operation - regulation of traffic.		6	15
MODULE 2: Need and scope of traffic regulations- Motor Vehicle Act. Speed limit at different locations- regulation of the vehicle - regulations concerning the driver rules of the road enforcement.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Traffic Operations: Factors in Operation-Levels of Service and Performance Criteria - Quality of Service. Capacity and Levels of Service of different Transportation Systems; Safety and Dependability-Flexibility-Speed, Acceleration, Deceleration-Comfort		8	15
MODULE 4: Environmental Effects of the different Transportation System, air pollution and noise pollution modelling		6	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Traffic Control Devices: Traffic signs, markings, islands and signals. Different methods of signal design. Delay models., Signal system and co-ordination.		6	20
MODULE 6: Parking Management: Design of Parking lots - Factors involved, design elements, different types of parking, design of ramps. Multi-storied parking, Automated Car parking.		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7213	PROJECT MANAGEMENT	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Knowledge to develop organisation structure for construction company
- Ability to estimate project cost and develop cost models
- Concepts to develop construction project scheduling
- Capability to prepare plans for resource management

Syllabus

Fundamental concepts of Project Management, Processes and Organisational Structures; Construction Cost and Value Engineering, Project Scheduling and Analysis Methods: CPM, PERT, Linear programming, queuing concept, simulation, bidding models, game theory; Construction Management Practices, Human Resource Management, Resource Management and Inventory

Course Outcome:

The student will be able to develop cost models and prepare contract documents and plans for resource management.

Text Books:

1. Choudhary, S. Project Management, Tata McGraw Hill Publishing Co., Ltd., 1988.
2. AnghelPatrascu, Construction Cost Engineering Handbook, 1st Edition, CRC Press, 1988

References:

1. A Guide to the Project Management Body of Knowledge (PMBOK), Draft Copy, 1994. A Publication of the Project management Institute, USA.
2. Alphonse J. Dell'Isola - Value Engineering in the Construction Industry, 3rd Edition, Smith, Hinchman&Grylls; 1988
3. HeroldKerzner - Project Management - A systems approach to Planning, Scheduling and Controlling, second edition, CBS Publishers and Distributors, 2004.
4. Kwaku A. Tenah and Jose M. Guevara; Fundamentals of Construction Management and Organisations, Reston Pub Co., 1985.
5. Raina V.K., Construction Management Practices – The inside story, 2nd Edition, Shroff Publishers and Distributors Pvt. Ltd., 2009.
6. Sengupta B and Guha H, Construction Management and Planning, McGraw Hill Education India Pvt Ltd, New Delhi, 1995.

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7213	PROJECT MANAGEMENT	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Introduction to Project Management: A systems Approach, Systems Theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques.		6	15
MODULE 2: Project Management – Processes and Organisational Structures – Team Management – Project Manager as a Team Leader – Leadership Qualities, PMIS		6	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Construction Cost and Value Engineering: Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimisation and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.		8	15
MODULE 4: Project Scheduling and Analysis Methods: CPM, PERT, Linear programming, queuing concept, simulation, bidding models, game theory. Quality Management and Safety in Construction Industry: Quality control by statistical methods, sampling plan, control charts, ISO 14000		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Safety Measures, Safety Programmes, Safety Awareness and Implementation of Safety Plan - Compensation. Construction Management Practices: Implementation of Procedures and Practices – International Experiences – Case Studies – Example		6	20
MODULE 6: Human Resource Management: Man Power Planning – Training – Motivation – Industrial Relations – Welfare Measures – MIS – Components and Structure – Personal Management. Resource Management and Inventory: 31 Basic concepts, labour requirements & productivity, non-productive activities, site productivity, equipment and material management, inventory control		8	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7215	SOIL EXPLORATION TECHNIQUES	3-0-0: 3	2015

Pre-requisites: Nil

Course Objectives:

To give the Student:-

- Ability to understand the principles and different methods of soil exploration.
- Knowledge about the sampling of soil samples using various equipments and prepare reports.
- Fundamentals of instrumentation in soil engineering.

Syllabus

Objectives of soil exploration, Different methods of exploration; Sounding methods -Dynamic Cone Penetration Test, Soil sampling, Handling and transportation of samples, Investigation below sea/river bed, Instrumentation in soil engineering

Course Outcome:

The student will able to conduct comprehensive investigation of soil condition at a site.

Text Books:

1. GopalRanjan& A.S.R Rao, 'Basic and Applied Soil Mechanics', New Age International (P) Limited, New Delhi, 2002
2. K.R. Arora, 'Geotechnical Engineering', Standard Publishers Distributors, New Delhi, 2006

References:

1. Venkatramaiah, 'Geotechnical Engineering', Universities Press (India) Limited, Hyderabad, 2000
2. Joseph E. Bowles, 'Foundation Analysis and Design', Mc. Graw Hill Inc., New York, 1988
3. Dunicliff, J. and Green, G.E., "Geotechnical Instrumentation for Monitoring Field Performance", John Wiley & Sons, New York, N.Y., USA.
4. GopalRanjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", Wiley Eastern Limited, New Delhi.
5. Lunne, T., Robertson, P.K. and Powell, J.J.M., "Cone Penetration Testing in Geotechnical Practice", Blackie Academic & Professional, London

COURSE PLAN

COURSE CODE:	COURSE TITLE	CREDITS	
04 CE 7215	SOIL EXPLORATION TECHNIQUES	3-0-0:3	
MODULES		Contact Hours	Sem. Exam Marks (%)
MODULE 1: Objectives of soil exploration – Planning of a sub-surface exploration programme – Collection of existing information – Reconnaissance – Detailed investigation - Number, size, spacing and depth of boreholes		6	15
MODULE 2: Different methods of exploration - Open pits and borings – Modern methods of boring and drilling, exploration techniques, non-displacement and displacement methods, drilling in difficult subsoil conditions, stabilization of boreholes, bore logs.		8	15
INTERNAL TEST 1 (MODULE 1 & 2)			
MODULE 3: Sounding methods – Standard Penetration Test – Procedure – Various corrections to be applied to observed N values – Factors influencing the SPT results and precautions to obtain reliable results – Merits/drawbacks of the test Correlations of N value with various engineering and index properties of soils Static Cone Penetration Test – Procedure – Merits/drawbacks – Correlation of static CPT results with various soil properties		8	15
MODULE 4: Dynamic Cone Penetration Test – Procedure – Merits/drawbacks – Critical comparison of SPT, static CPT and dynamic CPT Plate load test – Procedure, uses and limitations - Pressure meter test - Procedure – Uses Soil sampling – Undisturbed, disturbed, and representative samples – Chunk and tube samples – Factors affecting sample disturbance and methods to minimize them – Area ratio – Inside clearance – Outside clearance – Recovery ratio – Ball check valve		8	15
INTERNAL TEST 2 (MODULE 3 & 4)			
MODULE 5: Handling and transportation of samples – Extrusion of samples Types of samplers – Thin walled sampler – Piston sampler – Split spoon sampler. Core retainers – Liners – Rock cores – Types of drill bits – Rock Quality Designation – Bore log – Soil profile – Sub-soil investigation report.		6	20
MODULE 6: Investigation below sea/river bed – methods and equipments – interpretation of offshore exploration. Instrumentation in soil engineering - strain gauges - resistance and inductance type - load cells, earth pressure cells - settlement and heave gauges - piezometers and slope indicators - inclinometer, case studies, data and report preparation.		6	20
END SEMESTER EXAM			

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7291	SEMINAR	0-0-2: 2	2015

Course Objectives:

1. Improve the technical presentation skills of the students.
2. To train the students to do literature review.
3. To impart critical thinking abilities.

Methodology

Individual students are required to choose a topic of their interest from related topics to the stream of specialization, preferably from outside the M. Tech syllabus. The students are required to do a moderate literature review on the topic and give seminar. A committee consisting of at least three faculty members (preferably specialized in the respective stream) shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two copies of a write up of his seminar topic. The seminar report shall not have any plagiarised content (all sources shall be properly cited or acknowledged). One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other shall be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation. It is encouraged to do simulations related to the chosen topic and present the results at the end of the semester.

COURSE CODE	COURSE NAME	L-T-P:C	YEAR
04 CE 7293	PROJECT PHASE - I	0-0-12: 6	2015

Course Objectives:

The project work aims to develop the work practice in students to apply theoretical and practical tools/techniques to solve real-life problems related to industry and current research.

The project work can be a design project/experimental project and/or computer simulation project on any of the topics related to the stream of specialisation. The project work is chosen/allotted individually on different topics. Work of each student shall be supervised by one or more faculty members of the department. The students shall be encouraged to do their project work in the parent institute itself. If found essential, they may be permitted to carry out their main project outside the parent institute, subject to the conditions specified in the M. Tech regulations of the APJ Abdul Kalam Technological University. Students are encouraged to take up industry problems in consultation with the respective supervisors.

The student is required to undertake the main project phase-1 during the third semester and the same is continued in the 4th semester (Phase 2). Phase-1 consist of preliminary work, two reviews of the work and the submission of a preliminary report. First review would highlight the topic, objectives, methodology and expected results. Second review evaluates the progress of the work, preliminary report and scope of the work which is to be completed in the 4th semester.

COURSE CODE	COURSE NAME	L-T-P: C	YEAR
04 CE 7294	PROJECT PHASE - II	0-0-21: 12	2015

Main project phase II is a continuation of project phase-I started in the third semester. There would be two reviews in the fourth semester, first in the middle of the semester and the second at the end of the semester. First review is to evaluate the progress of the work, presentation and discussion. Second review would be a pre -submission presentation before the evaluation committee to assess the quality and quantum of the work done. It is encouraged to prepare at least one technical paper for possible publication in journals or conferences. The project report (and the technical paper(s)) shall be prepared without any plagiarised content and with adequate citations, in the standard format specified by the Department /University.