ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS

Transportation Engineering

For

M. Tech. Two Year Degree Course

(Applicable for the batches admitted from 2014-15)
(MR-14 Regulations)

Department of Civil Engineering

MALLA REDDY ENGINEERING COLLEGE

(AUTONOMOUS)

(An Autonomous institution, Autonomy granted by UGC and affiliated to JNTUH, Accredited by NAAC with 'A' Grade, Accredited by NBA (2008-11) & Recipient of World Bank Assistance under TEQIP phase – II S.C.1.1for the period (2011-14))
Maisammaguda, Dhulapally (Post. Via. Kompally), Secunderabad – 500 100.
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MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)
Maisammaguda, Dhulapally (Post via. Kompally), Secunderabad – 500100

ACADEMIC REGULATIONS MR 14 FOR M. TECH. (REGULAR) DEGREE COURSE

(Effective for the students admitted into first year from the academic year 2014-2015)

The M.Tech Degree of Malla Reddy Engineering College, Hyderabad shall be conferred on candidates by the Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad who are admitted to the program and fulfill all the requirements for the award of the Degree.

1.0 ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to the eligibility, qualifications and Specialization as prescribed by the university/college from time to time.

Admissions shall be made on the basis of merit/rank obtained by the qualifying candidate at an Entrance Test conducted by the University/college or on the basis of any other order of merit approved by the University/college (say **PGECET/GATE)** subject to reservations as laid down by the Government from time to time.

2.0 AWARD OF M. TECH. DEGREE

2.1 A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after four academic years of course work.

2.2 A student, who fails to fulfill all the academic requirements for the award of the degree within four Academic years from the year of his admission, shall forfeit his seat in M. Tech. course.

2.3 The student shall register for all 88 credits and secure all the 88 credits.

2.4 The minimum instruction days in each semester are 90.

3.0 COURSES OF STUDY

The following specializations are offered at present for the M. Tech. course of study.

1. Advanced Manufacturing Systems(AMS) - Shift II
2. Computer Science(CSe) - Shift I
3. Computer Science and Engineering(CSE) - Shift I & II
4. Control Systems(CS) - Shift I & II
5. Digital Systems and Computer Electronics(DSCE) - Shift I
6. Electrical Power Systems (EPS) - Shift I
7. Embedded Systems(ES) - Shift I
8. Geotechnical Engineering(GTE) - Shift I
9. Machine Designs (MD) - Shift I
10. Power Electronics and Electrical Drives(PEED) - Shift II
11. Structural Engineering(SE) - Shift I
12. Transportation Engineering(TE) - Shift II
13. Thermal Engineering(THE) - Shift I
14. VLSI System Design(VLSI SD) - Shift I

3.1 Departments offering M. Tech. Programmes with specializations are noted below:

Branch	Specialization	Specialization Code
Civil Engineering	1. Structural Engineering (SE) 2. Transportation Engineering (TE) 3. Geotechnical Engineering (GE)	11 12 13
Electrical and Electronics Engineering	1. Control Systems (CS) 2. Power Electronics and Electric Drives (PEED) 3. Electrical Power Systems (EPS)	22 23 24
Mechanical Engineering	1. Thermal Engineering (TE) 2. Advanced Manufacturing Systems (AMS) 3. Machine Designs (MD)	31 32 33
Electronics and Communication Engineering	1.Digital Systems and Computer Electronics (DSCE) 2. VLSI System Design (VLSI SD) 3. Embedded Systems (ES)	41 42 43
Computer Science and Engineering	1. Computer Science and Engineering (CSE) 2. Computer Science (CSe)	51 52

4.0 ATTENDANCE

The programs are offered on a unit basis with each subject being considered as a unit.

4.1 A student shall be eligible to write University examinations if he acquires a minimum of 75% of attendance in aggregate of all the subjects.

4.2 Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

4.3 Shortage of Attendance below 65% in aggregate shall not be condoned.

4.4 Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class and their registration shall stand cancelled.

4.5 A prescribed fee shall be payable towards condonation of shortage of attendance.

4.6 A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

4.7 A student shall not be promoted to the next semester unless he satisfies the attendance requirements of the previous semester including the days of attendance in sports, games, NCC and NSS activities.

5.0 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

5.1 For the theory subjects 60 marks shall be awarded based on the performance in the End Semester Examination and 40 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **average** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each mid term examination shall be conducted for a total duration of 120 minutes with Part A as 2 questions to be answered out of 4 questions each question for 10 marks and Part B with 4 questions to be answered out of 6 questions each question for 5 marks. If any candidate is absent for any subject of a mid -term examination, an additional exam will be conducted in the deserving cases based on the recommendations of the College Academic Committee. End semester examination is conducted for 60 marks with 5 questions to be answered out of 8 questions, each question carries 12 marks.

5.2 For practical subjects, 60 marks shall be awarded based on the performance in the End Semester Examinations and 40 marks shall be awarded based on the day-to-day performance as Internal Marks.

5.3 There shall be two seminar presentations during I year I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

5.4 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and two Senior Faculty members of the Department. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects he has studied during the M. Tech. course of study. The Comprehensive Viva-Voce is evaluated for 100 marks by the Committee. There are no internal marks for the Comprehensive Viva-Voce.

5.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

5.6 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.5) he has to reappear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided the internal marks secured by a candidate are less than 50% and so has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt stand cancelled.

5.7 Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher and the second examiner shall be another Laboratory Teacher.

6.0 EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation after taking up a topic approved by the Project Review Committee(PRC).

6.1 A Project Review Committee shall be constituted with Principal as chair person, Head of the Department, Coordinator, Supervisor and two other senior faculty members.

6.2 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects (theory and practical subjects).

6.3 After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work to the Departmental Academic Committee for its approval. Only after obtaining the approval of the Departmental Academic Committee can the student initiate the Project work. Departmental Academic Committee(DAC) Consists of Head of the Department as Chairman, along with two Senior Professors and few subject experts too.

6.4 If a candidate wishes to change his supervisor or topic of the project he can do so with approval of Departmental Committee. However, the Departmental Committee shall examine whether the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of topic as the case may be.

6.5 Candidate shall submit status report (in a bound-form) in two stages at least with a gap of 3 months between them.

6.6 The work on the project shall be initiated in the beginning of the second year and the duration of the project is for two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Principal (through Head of the Department) and shall make an oral presentation/demonstration before the PRC.

6.7 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/ Institute.

6.8 The thesis shall be adjudicated by one examiner selected by the College. For this, Head of the Department shall submit a panel of 3 examiners to the Chief Controller of Examinations of the College, who are eminent in that field with the help of the concerned guide and Head of the department.

6.9 If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as described by PRC. If the report of the examiner is unfavorable again, the thesis shall be summarily rejected.

6.10 If the report of the examiner is favourable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work as one of the following:

A. Excellent
B. Good
C. Satisfactory
D. Not Satisfactory

The Head of the Department shall coordinate and make arrangements for the conduct of Viva- Voce examination.

If the report of the viva-voce is unsatisfactory, the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, he will not be eligible for the award of the degree unless he is asked to revise and resubmit by the Board.

7.0 AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	**% of marks to be secured**
First Class with Distinction	70% and above
First Class	Below 70 but not less than 60%
Second Class	Below 60% but not less than 50%
Pass Class	Below 50% but not less than 40%

The marks in internal evaluation and end examination shall be shown separately in the memorandum of marks.

8.0 WITH-HOLDING OF RESULTS

If the candidate has not paid any dues to the university or if any case of in-discipline is pending against him, the result of the candidate will be withheld and he will not be allowed into the next higher semester. The

issue of the degree is liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS

9.1 Discontinued, detained or failed candidates are eligible for admission to two earlier or equivalent subjects at a time as and when offered.
9.2 The candidate who fails in any subject will be given two chances to pass the same subject:otherwise, he has to identify an equivalent subject as per MR14 academic regulations.

10.0 GENERAL

10.1 The academic regulations should be read as a whole for purpose of any interpretation.
10.2 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal is final.
10.3 The College may change or amend the academic regulations and syllabus at any time and the changes and amendments made shall be applicable to all the students with effect from the date notified by the College.
10.4 Wherever the word he, him or his occur, it will also include she, her and hers.
10.5 Wherever the word 'Subject' occurs in the above regulations, it implies the 'Theory Subject' and 'Practical Subject' or 'Lab'.
10.6 Transfers not allowed among group colleges.

MALPRACTICES RULES
DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	**Punishment**
	If the candidate:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any mark son the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shallot be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject tithe academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject

6	Refuses to obey the orders of the Chief Superintendent/Assistant –Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to the person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-incharge,or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police cases registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations.
		The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action toward suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.

2. Punishment for institutions: (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specificperiod of not less than one year.

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)
M.Tech Transportation Engineering
Course Structure

I YEAR I SEMESTER

CODE NO	SUBJECT	L	T	P	C
41201	Traffic Engineering and Management	3	1	0	3
41202	Transport Infrastructure Design	3	1	0	3
41203	Urban Transportation policy and Planning for sustainable development	3	1	0	3
41204	Pavement Analysis and Design	3	1	0	3
	Elective-I	**3**	**1**	**0**	**3**
40M11	Applied Statistics				
412A1	Ground Improvement Methods				
412A2	Project Management				
	Elective-II	**3**	**1**	**0**	**3**
412B1	Remote Sensing and GPS				
412B2	Concrete Technology				
412B3	Principles of Bridge Engineering				
41205	Transportation Engineering lab and studio- I	-	-	3	2
41206	Seminar-I	-	3	-	2
	Total	**18**	**9**	**3**	**22**

I YEAR II SEMESTER

CODE NO	SUBJECT	L	T	P	C
41207	Traffic Analysis	3	1	0	3
41208	Land Use Transportation Modeling	3	1	0	3
41209	Highway Project Formulation & Economics	3	1	0	3
41210	Pavement Construction, Maintenance and Management	3	1	0	3
	Elective-III	**3**	**1**	**0**	**3**
412C1	Intelligent Transportation Systems				
412C2	Mass Transportation System Planning & Management				
412C3	Optimization Techniques				
	Elective-IV	**3**	**1**	**0**	**3**
412D1	GIS Applications in Transportation Engineering				
412D2	Environmental Impact Assessment for Transportation Projects				
412D3	Advanced Travel Demand Modeling				
41211	Transportation Engineering Lab - II	-	-	3	2
41212	Seminar-II	-	3	-	2
	Total	**18**	**9**	**3**	**22**

II Year I & II semester

CODE NO	TITLE OF THE COURSE	L	T	P	C
41213	Comprehensive Viva	-	3	-	4
41214	Project	-	-	-	40
	Total	**-**	**3**	**-**	**44**

MALLA REDDY ENGINEERING COLLEGE
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M.TECH. (Transportation Engineering).	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

TRAFFIC ENGINEERING AND MANAGEMENT

Course Objectives

1. Analyze a variety of traffic facilities and evaluate capacity and level of service (LOS).
2. Design signalized intersections including isolated, coordinated and roundabouts.
3. Assess, evaluate and justify methods of traffic management and control.
4. Evaluate traffic impacts on the environment and safety.
5. Calculate and apply methods for reducing traffic impacts on communities such as traffic calming strategies, accident reductions and parking management.

UNIT 1

BASIC CONCEPTS OF TRAFFIC CHARACTERISTICS: Speed, Volume and concentration – their basic relationship, Traffic measurement surveys like volume studies, speed studies, headway studies, delay studies, gap acceptance studies, intersection studies, travel time studies, accident studies, parking studies etc – Methods of computation, their presentation of data and analysis, Traffic studies for planning bypasses around towns

UNIT II

HIGHWAY CORRIDOR ANALYSIS: Traffic capacity analysis concepts, segment capacity, Queue delay, travel time sub period analysis, bus stop capacity for transit and highway corridors , performance measures.

UNIT III

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

UNIT IV

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

UNIT V

TRANSPORTATION SYSTEM MANAGEMENT: Guidelines for low cost traffic management techniques for urban areas – IRC Specifications, Advanced transit technologies, Bus route network planning and management

Course Outcomes

1. Understand the fundamental traffic flow theories and identify basic traffic variables and their relationships including speed, density and flow.
2. Analyze a variety of traffic facilities and evaluate capacity and level of service (LOS).
3. Design signalized intersections including isolated, coordinated and roundabouts.
4. Assess, evaluate and justify methods of traffic management and control.
5. Understand the use of advanced simulation methods for the analysis of traffic systems and software tools for the design of traffic control strategies

REFERENCES:

1. Traffic Engineering by Roger P.Roess, William R. Mc. Shane, Elena S.Prassas , Prentice hall
2. IRC Codes
3. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication. Mathematical Methods by V. Ravindranath, Etl, Himalaya Publications. 2009-2010.
4. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication.

5. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication
6. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
7. I.T.E. Traffic Engineering Hand Book.
8. Fundamentals of Traffic Engineering – McShane & Rogers
9. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
10. Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

TRANSPORT INFRASTRUCTURE DESIGN

Course Objectives:

1. The objective of this course is to introduce students the principal of transport design, road safety and highway construction materials.
2. By the end of this course, students should be able to start applying these skills to design roads and select material for road construction.

UNIT I

FUNCTIONAL CLASSIFICATION OF HIGHWAY SYSTEM: Design Controls – Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design, Cross Section Elements: Design specifications; Pavement Surface characteristics – Skid Resistance, Road Roughness; Camber, Objectives, design standards. Specifications for hill roads

UNIT II

HORIZONTAL ALIGNMENT AND VERTICAL ALIGNMENT OF ROADS: Sight Distances – Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance ; Objectives of horizontal curves; Super elevation; Extra- widening on Curves; Transition Curves – Objectives and Design. Transition Curve setting methods and calculations , Introduction to MX Roads software ; Vertical Alignment : Gradients – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Importance of Sight Distances for Horizontal and Vertical Curves ; Combination of Vertical and Horizontal Curves – Grade Compensation

UNIT III

GEOMETRIC DESIGN OF INTERSECTIONS : Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections – Channelization, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

UNIT IV

MISCELLANEOUS ELEMENTS: Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays –Types and Guide lines; Design of On-street and Off street Parking facilities – Guidelines for lay out Design.; Design of Ramp

UNIT V

AIRPORT AND RAILWAY INFRASTRUCTURE DESIGN – Runway orientation, Site selection, Wind rose analysis Geometric design standards for runways, taxiways, aprons , Airport capacity analysis, Terminal design; GEOMETRIC DESIGN OF RAILWAY TRACK: Gradients- Grade Compensation-Cant and Negative Superelevation- Cant Deficiency – Degree of Curve – Crossings and Turn outs .

Learning Outcomes:

1. Classify roads based on functional classification, Describe design element: sight distance, horizontal curvature, super elevation, grades,
2. visibility on vertical curves, cross section elements
3. Use fundamental physics and mathematical knowledge in deriving geometric design equations
4. Plan surveys, preparation of survey forms and data collection from field for highway design
5. Construct safety audit at different stage of road construction and Describe the structural elements of highway and causes for structural failures in pavement

REFERENCES:

1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications
3. Highway Engineering, C.E.G.Justo and S.K.Khanna, Nem Chand and Brothers.
4. IRC Codes for Signs, Markings and Mixed Traffic Control in Urban Areas.

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

URBAN TRANSPORTATION POLICY AND PLANNING FOR SUSTAINABLE DEVELOPMENT

Course Objectives:

1. **S**tudent will understand and apply basic concepts and methods of urban transportation planning in the India.
2. Student will learn methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Students will understand and be able to apply travel demand modeling, Mode Choice Modeling and Traffic Assignment Modeling

UNIT I

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

UNIT II

DATA COLLECTION AND INVENTORIES: Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT III

TRAVEL DEMAND ISSUES: Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Detailed approach on 4 step travel demand estimation; Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT IV

DEMAND ANALYSIS AND SUPPLY ANALYSIS PLANNING : Planning for sustainable urban mobility, positive and negative externalities in urban transport, congestion pricing, parking policy, demand management , Urban travel and transportation system characteristics - a systems perspective, Data management and use in decision making , Demand analysis , Urban activity analysis, Supply analysis; Plan Preparation And Evaluation: Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis

UNIT V

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

Learning Outcomes:

Students who successfully complete this course will be able to

1. Design and conduct surveys to provide the data required for transportation planning. Learn and understand zonal demand generation and attraction regression models.
2. Learn and understand demand distribution models (gravity models) and modal split models for mode choice analysis.
3. Develop and calibrate trip generation rates for specific types of land use developments.
4. Make final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization.

REFERENCES:

1 Introduction to Transportation Planning – M.J.Bruton; Hutchinson of London Ltd.
2 Introduction to Urban System Planning - B.G.Hutchinson; Mc Graw Hill.
3 Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers
4 Lecture notes on UTP - Prof. S. Raghavachari , R.E.C.Warangal.
5 Metropolitan transportation planning – John W. Dickey, Tata Mc Graw Hill

MALLA REDDY ENGINEERING COLLEGE
(Autonomous)

M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

PAVEMENT ANALYSIS AND DESIGN

Course Objectives:

1. Understand the basic modeling concepts used to analyze flexible and rigid pavements.
2. Appreciate pavement management concepts to better manage road pavement.
3. Apply the various types of highway appurtenance to enhance the safety of motorists.
4. Learn to estimate traffic noise and the effect of noise attenuation measures

UNIT I

FACTORS AFFECTING PAVEMENT DESIGN: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.

UNIT II

STRESSES IN FLEXIBLE AND RIGID PAVEMENTS: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental

Design Concepts; Stresses In Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, Stresses in Dowel Bars & Tie Bars

UNIT III

MATERIAL CHARACTERISTICS: CBR and Modulus of Subgrade Reaction of Soil, Mineral aggregates – Blending of aggregates, binders, polymer and rubber modified bitumen, Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilisation and Use of Geo Synthetics.Non destructing testing

UNIT IV

DESIGN OF FLEXIBLE PAVEMENTS & RIGID PAVEMENTS: Development of design methods, Flexible Pavement Design Concepts, Asphalt Institute's Methods with HMA and other Base Combinations, AASHTO, IRC Methods for highways and low volume roads, Design Of Rigid Pavements: Calibrated Mechanistic Design Process, PCA, AASHTO & IRC Specifications, Prestressed and Continuously Reinforced Cement Concrete Pavement Design, Rigid Pavement Design for Low Volume Rural Roads and highways. Design Of Overlays: Types & Design of Overlays: IRC Methods of Overlay Design, Importance of Profile Correction Course.

UNIT V

RUNWAY DESIGN: Aircraft configurations, Flexible airport pavements - IS specifications and design, Corps of Engineers, FAA methods, AI methods ; Rigid airport pavements – IS specifications, PCA method, Corps of Engineers method, FAA method.

Learning Outcomes:

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

1. Design flexible and rigid pavements
2. Propose a pavement management system framework
3. Design highway appurtenance and highway drainage
4. Design mitigation measures to attenuate traffic noise

REFERENCES:

1. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
2. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
3. Principles of Pavement Design, Yoder.J. & Witzorac Mathew, W. John Wiley & Sons Inc
4. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
5. Pavement and Surfacings for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
6. IRC Codes for Flexible and Rigid Pavements design

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

APPLIED STATISTICS
(Elective –I)

Course Objectives:

1. Student able to learn Sampling Techniques and Statistical distributions.
2. Student able to learn and understand law of probability and conditional probability.
3. Student able to learn, understand and determine linear, Multiple linear regression Equation and their correlation

UNIT I
INTRODUCTION TO SAMPLING TECHNIQUES AND STATISTICAL DISTRIBUTIONS
Frequency Distribution; Mean, Standard Deviation;, Skewness; Kurtosis; Definitions and Applications; Simple random Sampling; Dispersion, Variance and covariance Standard error Stratified random Sampling; Systematic sampling; Sample size determination; Applications in Traffic Engineering;

Distributions: concept of discrete and continous randomvariables.Binomial,Poisson,Exponential and Normal distributions; Fitting of Distributions; Mean and Variance;Chi-square test of goodness-of-fit; Chi-square distribution; Students T-distribution; Snadectors,F-Distribution. Applications in Traffic Engineering

UNIT II
PROBABILITY: Laws of Probability; Conditional probability and independent events; Laws of expectations.addition,multiplication theorems of probability and Baye's theorem

UNIT III
TESTS OF SIGNIFICANCE & CONFIDENCE INTERVAL: Large sample and small sample tests; Tests for single mean, Means of two samples, Proportions, two variances, observed correlation coefficients, Applications. Intervals for means, Variance and; Application in Traffic Engineering problems.

UNIT IV
MULTIVARIATE DATA ANALYSIS: Types of data; Basic vectors and matrices, Analysis of Variance; Correlation matrices; Principal component analysis, Time series analysis for multi variables

UNIT V
REGRESSION AND CORRELATION: Linear regression and correlation; regression coefficients Multiple correlation; Multiple correlation coefficient; Standard error of estimate; Curvilinear regression models; Application in Transportation Engineering

Learning Outcomes:

Upon Completion of this course student will able to

1. Apply the Concept for determine the different Trip Generation Models and various model in Urban Transport Planning.
2. Apply the concept of Mean, Mode and variance for determining the speed, flow and density.
3. Identify model computed are good or not applicable for existing Urban planning condition

REFERENCES:

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

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

GROUND IMPROVEMENT METHODS
(Elective –I)

Course Objectives:

1. Student able to learn and understand various ground improvement technique.
2. Student will able to learn various method of compaction for ground improvement in it strength.
3. Student will able to learn various physical and chemical modification for ground improvement

UNIT I
INTRODUCTION TO GROUND MODIFICATION: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – suitability and feasibility, Emerging Trends in ground improvement.

UNIT II
MECHANICAL AND HYDRAULIC MODIFICATION: Methods of compaction, Shallow compaction, Deep compaction techniques – Vibro floatation, Blasting, Dynamic consolidation, pre-compression and compaction piles, Field compaction control.; Hydraulic Modification: Methods of dewatering – open sumps and ditches, Well-point system, Electro-osmosis, Vacuum dewatering wells; pre-loading without and with sand drains, strip drains and rope drains.

UNIT III
PHYSICAL AND CHEMICAL MODIFICATION: Stabilisation with admixtures like cement, lime, calcium chloride, fly ash and bitumen. Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control.

UNIT IV
REINFORCED EARTH TECHNOLOGY: Concept of soil reinforcement, Reinforcing materials, Backfill criteria, Art of reinforced earth technology, Design and construction of reinforced earth structures.

UNIT V
SOIL CONFINEMENT SYSTEMS: Concept of confinement, Gabion walls, Crib walls, Sand bags, Evergreen systems and fabric formwork.; Miscellaneous Techniques: Design, Construction and applications of stone columns, lime columns.

Learning Outcomes:

1. Student will be able to select the ground improvement technique which is suitable and economical for soil strengthening.
2. Student will able to select best physical and chemical modification for ground improvement.
3. Student will able to design reinforced earth structures

REFERENCES:
1. Manfred R. Hanusmann - Engineering principles of ground modification - Mc. Graw-Hill pub. Co., New York.
2. Robert M. Koerner - Construction and Geotechnical methods in Foundation Engineering – Mc.Graw-Hill Pub. Co., New York.
3. Winterkorn and Fang - Foundation Engineering Hand Book – Van Nostrand Reinhold Co., New York.
4. Aris C. Stamatopoulos & Panaghiotis C. Kotzios – Soil Improvement by Preloading – John Wiley & Sons Inc. Canada.
5. P. Purushothama Rao – Ground Improvement Techniques – Laxmi Publications (P) Limited.

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

PROJECT MANAGEMENT
(Elective –I)

Course Objectives:

1. Student will role of project management
2. Student will learn on estimation and approvals of project
3. Student will learn on critical construction management
4. Student will learn on BOT, BOOT & PP projects

UNIT I

INTRODUCTION TO PROJECT MANAGEMENT: A systems Approach, Systems Theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques, Project Management – Processes and Organisational Structures – Team Management – Project Manager as a Team Leader – Leadership Qualities, PMIS

UNIT II

CONSTRUCTION COST AND VALUE ENGINEERING: Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimisation and Resources Planning - Value Engineering, Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.

UNIT III

CONTRACT MANAGEMENT: Tendering and Contracting, Laws of Contracts, subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts. ; Human Resource Management: Man Power Planning – Training – Motivation

– Industrial Relations – Welfare Measures – MIS – Components and Structure – Personal Management; Resource Management and Inventory: Basic concepts, labour requirements & productivity, non-productive activities, site productivity, equipment and material management, inventory control

UNIT IV

QUALITY MANAGEMENT AND SAFETY IN CONSTRUCTION INDUSTRY: Quality control by statistical methods, sampling plan, control charts, ISO 14000, Safety Measures, Safety Programmes, Safety Awareness and Implementation of Safety Plan – Compensation; Construction Management Practices: Implementation of Procedures and Practices – International Experiences – Case Studies – Examples

UNIT V

PROJECT SCHEDULING AND ANALYSIS METHODS: CPM, PERT, Linear programming, queuing concept, simulation, bidding models, game theory.

Learning Outcomes:

Students who successfully complete this course will be able to

1. Life cycle techniques
2. Construction equipment, equipment economics
3. Need of PPP, types of PPP, BOT, BOOT, DFBOOT
4. Arbitration and settlement of disputes, arbitration and conciliation Act

REFERENCES:

1. Herold Kerzner - Project Management - A systems approach to Planning, Scheduling and Controlling. CBS Publishers and Distributors.
2. K.Waker A Teraih and Jose M.Grevarn; Fundamentals of Construction Management and Organisations.
3. Anghel Patterson - Construction Cost Engineering Handbook - Marcel Dekken Inc.
4. Dell Isola - Value Engineering in Construction Industry, Van Nostrand Reinhold Co.,
5. Choudhary, S. Project Management, Tata McGraw Hill Publishing Co., Ltd.,
6. Raina UK, Construction management Practices, Tata Mc Grawhill Publishing Company Ltd.
7. Sengupta B and Guha H, Construction Management and Planning, Tata McGraw-Hill Publishing Company Limited, New Delhi.

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	L	T/P/D	C
M.TECH. (Transportation Engineering)			
I YEAR I –SEM	**3**	**1/-/-**	**3**

REMOTE SENSING & G.P.S
(Elective –II)

Course Objectives:

1. The remote sensing serves the purpose of accurate mapping of all features under different spatial and temporal scales of all kinds of terrain and land under water bodies.
2. The remote sensing is advantageous comparatively to traditional surveying techniques in terms of time, accuracy and output.
3. Remote sensing serves the purpose of obtaining abstract data both spatial and temporally (Eg: temperature, atmospheric moisture etc.).
4. Remote sensing serves the purpose of predictions of all scales. (Eg: set of monsoons and its scale of occurrence, floods in downstream etc.).
5. GIS is software which can be used for collecting, storing and analyzing of data which is useful for real world applications.

UNIT I
REMOTE SENSING:
Basic Principles – Introduction, Electromagnetic and its properties, interaction with Earth surface materials, recent developments in Remote sensing, Social and legal implications of Remote Sensing, status of Remote Sensing. Characteristics of imaging remote sensing instruments, satellite remote sensing system – a brief over view, other remote sensing satellites.

UNIT II
PRE-PROCESSING OF REMOTELY SENSED DATA:
Introduction, cosmetic operation; Geometric connection and registration, atmospheric correction. Image Transforms: Introduction, arithmetic operations, empirically based image transforms, Principal component analysis, multiple discriminant analysis etc.

UNIT III
ENHANCEMENT TECHNIQUE AND FILTERING TECHNIQUES:
Introduction, human visual system, contrast enhancement; Pseudo color enhancement. Thematic information extraction, classification and accuracy assessment and change detection. Hyper spectral and radar sensors

Filtering Technique Classification Low-pass (smoothing filters) High pass (sharpening) filters, edge detection, frequency domain filters, geometrical basis, classification, unsupervised and supervised classification, classification accuracy. Rectification of digital land satellite imagery. Image enhancement, spectral and spatial filtering

UNIT IV
GLOBAL POSITIONING SYSTEMS:
Introduction, Elements of satellite surveying, e global positioning system, GPS satellites, Adjustment computations, GPS observables, GPS- space segment, Control segment, User segment, GPS satellite signals, Receivers; Static, Kinematic and Differential GPS .

UNIT V
APPLICATIONS OF REMOTE SENSING AND GPS IN TRANSPORTATION ENGINEERING :
Intelligent Transport System, Urban Transport Planning, Accident Studies, Transport System Management, Road Network Planning

Learning Outcomes:
1. Based on the objective of study a student should have thorough knowledge to choose the remote sensing image from different sensors, resolutions, spatial and temporal scales. 3
2. Remote sensing gives the provision of understanding and to comprehend large tracks of earth surface with less time and cost but more accuracy.
3. In case of dam construction, for a geotechnical engineer it is must to have knowledge of resource richness of an area, flow rates in stream, channel geometry w.r.t time, magnitudes of movement in crust, habitations etc.

4. By GIS the student can communicate to the common man his analysis of different problems developments, benefits by preparing different thematic maps.

REFERENCES:

1. GPS Satellite Surveys, Alfred Leick, Willey & Sons
2. Principles of Remote Sensing, Paul Jumani, ELBS, 1985.
3. Computer processing of remotely sensed Images an Introduction – Paul M.Mather, John Wiley & Sons 1989.

MALLA REDDY ENGINEERING COLLEGE
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	L	T/P/D	C
M.TECH. (Transportation Engineering)			
I YEAR I –SEM	**3**	**1/-/-**	**3**

CONCRETE TECHNOLOGY
(Elective –II)

Course Objectives:

Student will be able to

1. Use different types of cement as per their properties for different field applications.
2. Design economic concrete mix proportion for different exposure conditions and intended purposes.
3. Supervise various concreting operations.
4. Carry out field and laboratory tests on concrete in plastic and hardened stage

UNIT I

CEMENT AND ADMIXTURES PORTLAND CEMENT – Chemical composition - Hydration, setting and fineness of cement – structures of hydrated cement – mechanical strength of cement gel–water held in hydrate cement paste – Heat of hydration of cement – Influence of compound composition on properties of cement – tests on physical properties of cement – I.S. specifications – Different types of cements – Chemical Admixtures

UNIT II

AGGREGATES: CLASSIFICATIONS OF AGGREGATEs - particle shape and texture - bond, strength and other mechanical properties of aggregate - specific gravity, bulk density, porosity, absorption and moisture content of aggregate - bulking of sand - - soundness of aggregate - alkali-aggregate reaction - thermal properties - sieve analysis - fineness modulus - grading–curves - grading of fine and coarse aggregates - - maximum aggregate size – combined aggregate grading – BIS grading.

UNIT III

FRESH CONCRETE AND HARDENED CONCRETE: workability - factors affecting workability - measurement of workability by different tests - effect of time and temperature on workability - segregation and bleeding - Mixing of concrete - different types of mixing – vibration of concrete– setting times of fresh concrete quality of mixing water. water/cement ratio - Abram's law – Gel space ratio Maturity concept - effective water in mix - nature of strength of concrete - strength in tension and compression - Griffith's hypothesis - autogenously healing - curing of concrete - influence of temperature on strength - steam curing - testing of hardened concrete – relation between compressive and tensile strength - factors affecting strength - non-destructive testing methods. Durability of concrete - code provisions.

UNIT IV

ELASTICITY, SHRINKAGE AND CREEP: Modulus of elasticity – static and dynamic modulus of elasticity - Poisson's ratio - early volume changes - swelling - shrinkage - mechanism of shrinkage - factors affecting shrinkage - differential shrinkage - moisture movement - creep of concrete - factors influencing creep - relation between creep and time - nature of creep - effects of creep in structural concrete – Code provisions – Rheology of creep.

UNIT V

CONCRETE MIX DESIGN– factors in the choice of concrete mix proportions – statistical quality control – Acceptance criteria as per IS 456-2000 – various mix design methods for normal concrete – BIS method – Road note no.4 method, ACI method – High strength concrete mix design – durability aspects in concrete mix design as per IS 456-2000.

Learning Outcomes:

On successful completion of this course, it is expected

1. Determine the properties of concrete ingredients i.e. cement, sand, coarse aggregate by conducting different tests.
2. Recognize the effects of the rheology and early age properties of concrete on its long-term behavior.
3. Develop an advanced knowledge of the mechanical performance of cement based materials and how it can be controlled
4. Use various chemical admixtures and mineral additives to design cement based materials with tailor-made properties

5. Use advanced laboratory techniques to characterize cement-based materials.
6. Understand the mix design and engineering properties of special concretes such as high-performance concrete, self-consolidating concrete, fibre reinforced concrete, sprayed concrete, etc.

TEXT BOOKS:

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete Technology by M.S.Shetty, S.Chand

REFERENCES:

1. Special Structural concretes by Rajat Siddique, Galgotia Publications.
2. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
   Concrete: Micro Structure by P.K.Mehta, ICI, Chennai.

MALLA REDDY ENGINEERING COLLEGE
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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**3**	**1/-/-**	**3**

PRINCIPLES OF BRIDGE ENGINEERING
(Elective –II)

Course Objectives:

1. To develop an understanding of and appreciation for basic concepts in proportioning and design of bridges in terms of aesthetics, geographical location and functionality
2. To help the student develop an intuitive feeling about the sizing of bridge elements. ie. Develop a clear understanding of conceptual design.
3. To understand the load flow mechanism and identify loads on bridges
4. To carry out a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements

UNIT I

CONCRETE BRIDGES: INTRODUCTION-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal forces-Seismic loads-Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT II

SOLID SLAB BRIDGES: Introduction-Method of Design. Girder Bridges: Introduction-Method of Design-Courbon's Theory.

UNIT III

CONTINUOUS BRIDGES: Introduction- Span lengths- Analysis of Continuous bridges-Decking of Girders with constant Moment of Inertia-Continuous bridges with variable Moment of Inertia-Method of Analysis - Girders with Parabolic Soffit-Method of plotting Influence lines-Girders with Straight Haunches-Design steps for Continuous Bridges.

UNIT IV

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

UNIT V

ANALYSIS OF BRIDGE DECKS: Harmonic analysis and folded plate theory-Grillage analogy- Finite strip method and FEM. Sub-structure of bridges: Substructure- Beds block-Piers- Pier Dimensions-Design loads for piers- Abutments- Design loads for Abutments.

Learning Outcomes:

1. An ability to apply knowledge of mathematics, science and engineering
2. An ability to design a system, component, or process to meet desired needs such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. An ability to function on multidisciplinary teams
4. An ability to identify, formulate and solve engineering problems
5. An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

REFERENCES:

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

MALLA REDDY ENGINEERING COLLEGE
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M.TECH. (TRANSPORTATION ENGINEERING)	**L**	**T/P/D**	**C**
I YEAR I –SEM	**0**	**/3/**	**2**

TRANSPORTATION ENGINEERING LAB AND STUDIO – I

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

MALLA REDDY ENGINEERING COLLEGE
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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

TRAFFIC ANALYSIS

Course Objectives:

1. Perform maintenance operations for traffic signals and signal systems under County judisdiction.
2. Perform essential operations to fabricate, install and maintain roadway signs and pavement marking.
3. Conduct safety and traffic operations studies to reduce frequency and severity of crashes and improve mobility

UNIT I

TRAFFIC FLOW DESCRIPTION: Traffic Stream Characteristics and Description Using Distributions: Measurement, Microscopic and Macroscopic Study of Traffic Stream Characteristics - Flow, Speed and Concentration; Use of Counting, Interval and Translated Distributions for Describing Vehicle Arrivals, Headways, Speeds, Gaps and Lags; Fitting of Distributions, Goodness of Fit Tests.

UNIT II

TRAFFIC STREAM MODELS: Fundamental Equation of Traffic Flow, Speed-Flow-Concentration Relationships, Normalized Relationship, Fluid Flow Analogy Approach, Shock Wave Theory - Flow-Density diagram use in Shockwave analysis; Use of Time-space diagram for shockwave description; Bottleneck situations and shockwaves; traffic signal and shockwave theory; numerical Examples for application of shockwave theory;, Platoon Diffusion and Boltzman Like Behavior of Traffic Flow, Car-Following Theory, Linear and Non-Linear Car-Following Models, Acceleration Noise, Fuel consumption models

UNIT III

QUEUING ANALYSIS: Fundamentals of Queuing Theory, Demand Service Characteristics, Deterministic Queuing Models, Stochastic Queuing Models, Multiple Service Channels, Analysis of M/M/1 system; Assumptions and Derivation of System State Equations; Application of M/M/1 analysis for parking Garages and Toll Plazas- numerical Examples; Analysis of D/D/1 system for delay characteristics; Traffic Signal analysis as D/D/1 system; Computation of delays and queue dissipation Time – Numerical Examples.

UNIT IV

PEDESTRIAN DELAYS AND GAPS: PEDESTRIAN GAP ACCEPTANCE AND DELAYS; Concept of Blocks, Anti-blocks, Gaps and Non-Gaps; Underwood's analysis for Pedestrian Delays; Warrants for Pedestrian Crossing Facilities – Minimum Vehicular Volume Warrant, Minimum Pedestrian Volume Warrant, Maximum Pedestrian Volume Warrant;

UNIT V

SIMULATION MODELS: 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, Design of Computer Simulation Experiments, Analysis of Simulation Data, Formulation of Simulation Problems in Traffic Engineering and Validation.; Basic concepts of simulation modelling application for Signalised Intersections, Pedestrian Crossings and Transit scheduling.

Learning Outcomes:

Upon completion of this course, students should be able:

1. To understand the human factors in traffic engineering design.
2. To design the cross-section and alignment of highway
3. To use an appropriate traffic flow theory for traffic characteristics
4. To practice the traffic count methods
5. To comprehend the capacity and signalized intersection analysis

REFERENCES:

1. Traffic Flow Theory: A Monograph , TRB Special Report 165
2. Fundamentals of Transportation Engineering – C.S.Papacostas, Prentice Hall India Publication
3. Principles of Highway Engineering and Traffic Analysis – F.L.Mannering & W.P.Kilareski, John Wiley Publishers.
4. Traffic Flow Fundamentals – A.D.May, , Prentice Hall India Publication
5. Fundamentals of Traffic Engineering – McShane & Rogers

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	L	T/P/D	C
M.TECH. (Transportation Engineering)			
I YEAR II –SEM	**3**	**1/-/-**	**3**

LAND USE TRANSPORTATION MODELLING

Course Objectives:

1. Student will understand and apply basic concepts and methods of urban transportation planning in the India.
2. Student will learn methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Students will understand and be able to apply travel demand modeling, Mode Choice
4. Modeling and Traffic Assignment Modeling.

UNIT I
LAND USE AND TRANSPORTATION ENGINEERING:

Transportation modeling in Planning; Models and their role, Characteristics of Transport demand and supply, Equilibrium of supply and demand, Modelling and decision making, Issues in Transportation modeling and structure of the classic transport model.

UNIT II
LAND USE TRANSPORTATION AND ACTIVITY MODELS:

Introduction to Land Use Planning; Relation between Transportation and Land Use Planning; The economic base mechanism and allocation mechanism; Spatial allocation and employment interrelationship; Garin Lowry models.; Activity modelling

UNIT III
GENERAL TRAVEL DEMAND MODELS AND REGIONAL TRANSPORT MODELS:

Aggregate, Disaggregate models ; Behavioral models; Recursive and direct demand Models; Linear, Non-Linear models; Logit, discriminant and probit models; Mode split models - Abstract mode and mode specific models. Regional Transport Models: Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; Time function iteration models; Internal volume forecasting models.

UNIT 4:
REGIONAL NETWORK PLANNING:

Problems in Developing Countries, Network Characteristics - Circuitry, Connectivity, Mobility, Accessibility and Level of Service Concepts - Network Structures and Indices – Network Planning – Evaluation - Graph Theory – Cut sets – Flows & Traversing – Optimum Network - Inter-modal Co-ordination. – Rural Road Network Planning.; User equilibrium concepts

UNIT 5:
ADVANCED SPATIAL ANALYSIS MODELLING : Applications of Artificial Neural networks, Cellular automata, Fuzzy logic systems, Genetic algorithms, artificial intelligence concepts to transportation Modelling

Learning Outcomes:

1. Students who successfully complete this course will be able to
2. Design and conduct surveys to provide the data required for transportation planning.
3. Learn and understand zonal demand generation and attraction regression models.
4. Learn and understand demand distribution models (gravity models) and modal split models for mode choice analysis.
5. Develop and calibrate trip generation rates for specific types of land use developments.
6. Make final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization

REFERENCES:

1. Modelling Transport by Jhan De Dios Ortuzar. Luis E.Willumsen. John Wiley& Sons. 1970/1975.
2. Urban Development Models - Ed. By R.Baxter, M.Echenique and J.Owers; The Institute of Transportation Engineering, University of California.
3. Economic Models and Economic Forecast - Robert S, Pindyek, Daniel L.Rubin Field;McGraw Hill.

4. Land Use Transportation Planning Notes - S.R.Chari, REC Warangal.
5. Regional and Urban Models- A.G.Wilson; Pion, London.
6. Urban Modeling - Michael Batty.
7. Behavioral Travel Demand Models - Peter R. Stopher ARNIM.H.MEYBURG.
8. Introduction to Transportation Engineering and Planning, Morlok EK, McGraw Hill

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	L	T/P/D	C
M.TECH. (Transportation Engineering)			
I YEAR II –SEM	**3**	**1/-/-**	**3**

HIGHWAY PROJECT FORMULATION & ECONOMICS

Course Objectives:

1. This subject will explain the for economic evaluation, preparation of detailed project report
2. This subject will help in understanding computation of road user cost
3. This subject will explain the Basic methods of economic analysis carried for transportation engineering projects
4. The subject will explain the importance of EIA for transportation engineering projects

UNIT I

PROJECT FORMULATION: Requirements in project formulation, Criteria fixation, Components of project, Non-monetary and monetary Criteria in formulation of project, Decision making Criteria input in Project formulation. Preparation of DPR - Guidelines , Transport Projects and development of cash flow diagrams, Cost and benefit components, Discounting criteria, Preparation of Project, Highway Planning, Traffic infrastructure, Project formulation, Road Network project development. Need for Economic Evaluation; Principles of economic evaluation; Welfare economics; Social costs, Vest change, Rate of return

UNIT II

ROAD USER COSTS: Value of Travel time Savings - Economic concept of evaluation of travel time savings; Issues connected with evaluation of travel time savings. Vehicle operating costs- Components of VOC, Road User Cost study in India; Accident costs; Methodologies for economic evaluation of an accident ; Factors involved, Basic methods of economic analysis

Unit III

Basic methods of economic analysis; Equivalent Uniform Annual Cost Method; Present worth of cost method; Equivalent uniform annual net return method; Net present value method; Benefit cost ratio method; Rate of Return Method. Applications of these methods to highway projects.

UNIT IV

PROJECT APPRAISAL BY SHADOW PRICING WITH CASE STUDIES.; Toll system analysis , Financial analysis ; Budgeting

UNIT V

ENVIRONMENTAL IMPACT ASSESSMENT: Basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety and Capacity Impacts – Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement, Environment Audit, Typical case studies

Learning Outcomes:

Upon completion of this course, students should be able

1. To prepare a Detailed Project Report for Transportation Engineering Projects
2. To evaluate a project from different methods of economic analysis
3. To analyze the toll systems for highway projects
4. To carry Environment Audit for highway projects

REFERENCES:

1. Transportation Engineering Economics - Heggie. I. G.; Mc Graw Hill Publishers.
2. Economic Analysis for Highways - Winfrey.R; International TextBook Company.
3. Traffic Engineering and Transport Planning - L.R Kadiyali, Khanna Publishers.
4. Road User Cost Study, CRRI
5. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons.

MALLA REDDY ENGINEERING COLLEGE
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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

PAVEMENT CONSTRUCTION MAINTENANCE AND MANAGEMENT

Course Objectives:

1. Student will able to learn pavement management systems at Network level and project level.
2. Student will able to learn Functional and Structural Evaluation of pavement.
3. Student will able to learn Alternate design strategies of pavement and Economic Evaluation.

UNIT I
PAVEMENT MANAGEMENT SYSTEM

Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance; Rehabilitation and Feedback systems; Examples of HDM and RTIM packages; Highway financing; Fund generation; Evaluating alternate strategies and Decision criteria ; Pavement Maintenance Management Components of Maintenance Management and Related Activities

– Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies

UNIT II
PAVEMENT INVENTORIES AND EVALUATION

Serviceability Concepts ;Visual Rating ;Pavement Serviceability Index; Roughness Measurements ;Distress Modes – Cracking Rutting Etc; Pavement Deflection – Different Methods, Skid Resistance, Roughness, Safety – Aspects; Inventory System – Assessment of Deficiencies

UNIT III
PAVEMENT MAINTENANCE AND QUALITY CONTROL

Causes of Deterioration, Traffic and Environmental Factors, Pavement Performance Modelling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction

UNIT IV
CONSTRUCTION OF BASE, SUBBASE, SHOULDERS AND DRAIN

Roadway and Drain Excavation, Excavation and Blasting, Embankment Construction, Construction of Gravel Base, Cement Stabilised Sub- Bases, WBM Bases, Wet Mix Construction; Crushed Cement Bases, Shoulder Construction; Drainage Surface, Turfing Sand Drains; Sand Wicks; Rope Drains, Geo-Textile Drainage; Preloading Techniques

UNIT V
BITUMINOUS PAVEMENT CONSTRUCTION AND CEMENT CONCRETE PAVEMENT CONSTRUCTION:

Preparation and Laying of Tack Coat; Bituminous Macadam ,Penetration Macadam, Built up Spray Grout, Open Graded Premix, Mix Seal, Semi-Dense Asphalt Concrete-Interface Treatments and Overlay Construction, IRC Specifications, Introducing Mechanical Mixers, Pavers, Finishers ; Cement Concrete Pavement Analysis - Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction –Related Equipment

Learning Outcomes:

1. Student will able identify and select the various Design strategies of pavement using PMS Concept.
2. Student will able to Evaluate the pavement condition using Functional and Structural Evaluation pavement.
3. Student will able Evaluate and Estimate the life cycle cost of Pavement.

REFERENCES:

1. Haas and Hudson , W. R. Pavement management systems –McGraw Hill publications
2. Sargious, M. A. – Pavements and surfacing for highways and airports – Applied Science Publishers ltd
3. Bridge and Pavement maintenance- Transportation Research Record no.800, TRB
4. Shahin M.Y, 1994- Pavement management for airports, roads and parking lots
5. Bent Thagesan, 1996- Highway and Traffic engineering for developing countries

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I YEAR II –SEM	**3**	**1/-/-**	**3**

INTELLIGENT TRANSPORT SYSTEMS
(ELECTIVE –III)

Course Objectives:

1. To develop an understanding of system engineering processes
2. To describe the concepts of system architecture and their evolution
3. Understand the capability of key technologies
4. Understand impact of technology on different modes and movement
5. Understand how to evaluate technologies, applications and services

UNIT I

FUNDAMENTALS OF ITS: Definition of ITS s, The historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS

UNIT II

SENSOR TECHNOLOGIES AND DATA REQUIREMENTS OF ITS: Importance of telecommunications in the ITS system,

Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection

UNIT III

ITS FUNCTIONAL AREAS – Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS).

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT IV

ITS ARCHITECTURE – Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning

UNIT V

ITS APPLICATIONS: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries

Learning Outcomes:

1. Students who follow this course will develop a clear understanding of the role of ITS and understanding policy conflicts and where technology solutions have succeeded and failed.
2. They will develop the ability to assess how technology solutions can be used to deliver a transport policy or address a transport problem.
3. The course will provide the basis to carry out ITS focused special project.

REFERENCES:

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel Wadid Sadek
2. Lawrence A. Klein , Sensor technologies and Data requirements of ITS
3. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
4. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
5. National ITS Architecture Documentation, US Department of Transportation, 2007

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

MASS TRANSPORTATION SYSTEM PLANNING & MANAGEMENT
(ELECTIVE –III)

Course Objectives:

1. Student will understand and apply basic concepts and methods of Mass transportation system planning and management in the India.
2. Student will learn Transit system, types of transit modes, characteristics of transit system for understanding transit system and estimation of transit demand based on origin and destination surveys.
3. Students will understand and be able to apply bus route network planning and route system.
4. Mass transit corridor identification and planning also will learn

UNIT I

TRANSIT SYSTEM: Role of Transit - Types of Transit Modes - Buses - LRT, RTS - Air cushioned and Maglev System – S- Bahn Dual Mode Busses, Para Transit - Dial - a- Ride-Taxi- Jitney and Ridesharing – PRT Networks -DRTS ; System Characteristics: Technological Characteristics – Resistances, acceleration & velocity Profiles – Operational characteristics speed, capacity & payloads – Route capacity – Comfort conditions - Performance relationships - Public and Private Operations - Modes for Intercity Transport.

UNIT II

ESTIMATION OF TRANSIT DEMAND: Data requirements & Collection techniques, Conventional Methods - Destination Survey - Bus Stop Surveys and Analysis - Mode Split Models - Captive and Choice Riders - Attitudes of Travellers - Patronage Determination.

UNIT III

BUS ROUTE NETWORK PLANNING: ROUTE SYSTEMS - Route Location, Route Structure, Route Coding Techniques, Route Capacity - Planning of Transit Network - Different Types - Service Area Coverage - Evaluation - Selection of Optimal Network - Path Building Criteria - Integration with UTPS. Scheduling: Patterns of Bus Services - Frequency of Services - Special Services - Single Route Bus Scheduling - Fleet Requirement, Marginal Ridership Concept - Use of Optimisation Technique - Load Factor - Depot Location - Spacing of Bus Stops; Bus Stops And Terminal Designs: Type Design
– Bus stop capacities – Bus Parking patterns at Terminals and Wayside Stations – Integration.

UNIT IV

MASS TRANSIT CORRIDOR IDENTIFICATION & PLANNING: Corridor identification - Network Compression Method - Planning of Rapid Transit System - System Selection - Supporting and Enclosing Structures - System Evaluation - Track Structures - Power Supply and Distribution - Signal System - Aesthetics and Noise Consideration - Cost of Construction - Station Arrangements - Platform Capacity - Fare Collection, Transit Marketing.

UNIT V

MASS TRANSPORT MANAGEMENT MEASURES: Performance Indicators –- Preferential Treatment to HOV: Exclusive Bus Lanes - Bus Streets - Contra Flows - Reversible Lanes - Bus Bypass - Bus Pre-emption Signals for Bus Operations.

Learning Outcomes:

1. Students who successfully complete this course will be able to understand bus route network plan and corridor identification.
2. Design and conduct surveys to provide the data required for bus route network planning.
3. Learn and understand corridor identification and planning.
4. Learn and understand transit demand and giving bus route plan.

REFERENCES:

1. A. Black, Urban Mass Transport Planning, McGraw Hill
2. V.R. Vuchic, Urban Public Transport System and Technology, Prentice Hall Inc
3. G.E. Gray and CA Hoel: Public Transport Planning Operation and Management, Prentice Hall
4. White PR, Planning for Public Transport, UCL Press Ltd.

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

OPTIMIZATION TECHNIQUES
(ELECTIVE –III)

Learning Objectives:
Student will be able to
1. Define statement of optimization problem
2. Solve optimization problems using linear programming
3. Solve optimization problems using Dynamic programming

UNIT I
LINEAR PROGRAMMING:
Introduction and formulation of models; convexsity ; graphical &simplex method; two phase method; degeneracy, non-existent and unbounded solutions; duality in L.P. Dual simplex method, Big-M Method sensitivity analysis; Revised simplex method; Transportation and Assignment problems.

UNIT II
NON-LINEAR PROGRAMMING:
Classical optimization methods; equality and inequality constraints; Lagrange multipliers; &Kuhn-tucker conditions; quadratic forms; quadratic programming and Beal's methods.

UNIT III
SEARCH METHODS:
One dimensional optimization; Fibonacci search; multi dimensional search methods; univariate search; gradient methods; steepest descent/ascent methods; conjugate gradient method; Fletcher- reeves method; penalty function approach.

UNIT IV
DYNAMIC PROGRAMMING:
Belman's Principle of optimality; recursive relations; solution of L.P. Problem; simple examples.

UNIT V
INTEGER LINEAR PROGRAMMING:
Gomory's cutting plane method; branch and bound algorithm; traveling salesman problem; knapsack problem; linear C-1 problem.

Learning Outcomes:
On successful completion of this course, it is expected that students should be able to
1. Understand Engineering optimization.
2. Classify the optimization problems.
3. Understand various methods of linear programming & Dynamic programming

REFERENCES:

1. Introduction to optimization-J.C.Paint; Jain brothers; New Delhi.
2. Optimisation theory and applications-S.S.Rao; Wiley Eastern Ltd., New Delhi.
3. Optimization method-K.V.Mital; Wiley Eastern Ltd... New Delhi.
4. Introduction to OR J.K. SHARMA Introduction to OR S.D .SHARMA

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

GIS APPLICATIONS IN TRANSPORTATION ENGINEERING
(ELECTIVE –IV)

Course Objectives

1. The aim of this unit is to equip students with the knowledge and skills needed to start using satellite and aerial images.
2. To introduce remote sensing as an important enabling tool for earth surface research problems and applications
3. To examine the basics of remote sensing and the main satellite/sensor systems that is in use.
4. To provide practical experiences of image processing (PC-based) and interpretation.

UNIT I

INTRODUCTION: Definitions of GIS – Components of GIS – Geographic data presentation: maps – mapping process – coordinate systems – transformations – map projections – geo referencing - data acquisition.

UNIT II

GEOGRAPHIC DATA REPRESENTATION, STORAGE, QUALITY AND STANDARDS: Storage - Digital representation of data –Data structures and database management systems – Raster data representation – Vector data representation –Concepts and definitions of data quality – Components of data quality – Assessment of data quality –Managing data errors – Geographic data standards.

UNIT III

GIS DATA PROCESSING, ANALYSIS AND MODELING: Raster based GIS data processing – Vector based GIS data processing – Queries – Spatial analysis – Descriptive statistics – Spatial autocorrelation – Quadrant counts and nearest neighbour analysis – Network analysis – Surface modeling – DTM; Data Management:The data base designs and approaches, 3 classic data models, Nature of geographic data, Spatial data models, Databases for GIS ; Implementation and Maintenance of GIS, Evaluation of alternative systems, System justification and Development of an implementation plan

UNIT IV

APPLICATION OF GIS IN TRANSPORTATION ENGINEERING – I : Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning

UNIT V

APPLICATION OF GIS IN TRANSPORTATION ENGINEERING – II: GIS applications in environment impact assessment and environment monitoring, GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation, Utility management.

Course Outcomes

1. Understand the principles of geographic information systems (GIS);
2. Understand the principles of remote sensing and digital image processing;
3. Gain experience in the applications of remote sensing and GIS to solving problems in the environmental and life sciences;
4. Analyze and explain remote sensing purposes, advantages, and limitations.

REFERENCES:

1. Lo, C.P. & Yeung A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall of India, New Delhi, 2002.
2. Burrough, P.A., Principles of Geographical Information Systems, Oxford Publication, 1998.
3. Clarke, K., Getting Started with Geographic Information Systems, Prentice Hall, New Jersy, 2001.
4. DeMers, M.N., Fundamentals of Geographic Information Systems, John Wiley & Sons, New York,2000.
5. Geo Information Systems – Applications of GIS and Related Spatial Information Technologies,ASTER Publication Co., Chestern (England), 1992
6. Jeffrey, S. & John E., Geographical Information System – An Introduction, Prentice-Hall, 1990
7. Marble, D.F., Galkhs HW & Pequest, Basic Readings in Geographic Information Systems, Sped System Ltd., New York, 1984.
8. GIS for Urban & Regional Planning, Scholten & Stillwen 1990, Kulwer Academie Publisher.
9. GIS A Management, Perspenfi Stan Aronoff, WDL Publisher.
   GIS By Stonffer

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/-**	**3**

ENVIRONMENTAL IMPACT ASSESSMENT FOR TRANSPORTATION PROJECTS
(ELECTIVE –IV)

Course Objectives:

1. Student will be able to learn the concepts of environmental impact assessment and apply in the projects.
2. Student will be able to learn various indicators such as terrestrial subsystems, Indicators aquatic subsystems, Socio-economic and able to Select various indicators for EIA studies.

UNIT I

INTRODUCTION: Environment and its interaction with human activities - Environmental imbalances - Attributes, Impacts, Indicators and Measurements - Concept of Environmental Impact Assessment (EIA), Environmental Impact Statement, Objectives of EIA, Advantages and Limitations of EIA

UNIT II

ENVIRONMENTAL INDICATORS - Indicators for climate - Indicators for terrestrial subsystems - Indicators for aquatic subsystems - Selection of indicators - Socio-economic indicators - Basic information - Indicators for economy - Social indicators - Indicators for health and nutrition - Cultural indicators - Selection of indicators.

UNIT III

ENVIRONMENTAL IMPACT ASSESSMENT FOR TRANSPORTATION PROJECTS: basic Concepts, Objectives, Transportation Related Environmental Impacts – Vehicular Impacts – Safety & Capacity Impacts – Roadway Impacts – Construction Impacts, Environmental Impact Assessment – Environmental Impact Statement, Environment Audit, Typical case studies

UNIT IV

ENVIRONMENTAL ISSUES IN INDUSTRIAL DEVELOPMENT: On-site and Off-site impacts during various stages of industrial development, Long term climatic changes, Green house effect, Industrial effluents and their impact on natural cycle, Environmental impact of Highways, Mining and Energy development

UNIT V

METHODOLOGIES FOR CARRYING ENVIRONMENTAL IMPACT ASSESSMENT: Overview of Methodologies Adhoc, Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing A Methodology, Review Criteria.

Learning Outcomes:

Student will able to:

1. To describe the proposed project and associated works together with the requirements for carrying out the proposed developments;
2. To identify and describe elements of community and environment likely to be affected by the proposed developments and/or likely to cause adverse impacts to the proposed project, including natural and man-made environment;
3. To identify the negative impacts and propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the developments arising from the Study;

REFERENCES:

1. Rau, J.G. and Wooten, D.C., (1996), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York UNESCO, (1987),
2. "Methodological Guidelines for the Integrated Environmental Evaluation of Water Resources 1. Jain, R.K., Urban, L.V., Stracy, G.S., (1991),
3. "Environmental Impact Analysis", Van Nostrand Reinhold Co., New York.Development", UNESCO/UNEP, Paris
4. Canter, L.W., (1997), "Environmental Impact Assessment", McGraw Hill Pub. Co., New York

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M.TECH. (Transportation Engineering)	**L**	**T/P/D**	**C**
I YEAR II –SEM	**3**	**1/-/**	**3**

ADVANCED TRAVEL DEMAND MODELLING
(ELECTIVE –IV)

Course Objectives:

1. Student will understand and apply basic concepts and methods of urban transportation planning in the India.
2. Student will learn methods of designing, conducting and administering surveys to provide the data required for transportation planning.
3. Students will understand and be able to apply travel demand modeling, Mode Choice Modeling and Traffic Assignment Modeling.

UNIT I

QUALITATIVE VARIABLES: Role of Soft variables in Travel Demand Forecasting; Attitudes; Psychometric scaling Techniques – One-dimensional Scaling – Multidimensional Scaling; Basic Rating Scales: Comparative Rating Scales, Non – Comparative Rating scale, Itemised rating scale, graphic rating scale; Specific Attitude scales; Successive Categories; Principal Components Factor Analysis; Attitudinal Models.

UNIT II

DISCRETE CHOICE AND TIME USE ANALYSIS: Utility Concept; Mode choice; Logit Models; Dogit Model; Nested Logit Model; Probit Model; Route Choice Modelling; Combined Travel Demand Modelling; Model Parameter Estimation – Maximum Likelihood and Maximum Entropy Estimates.; Activity patterns; Activity scheduling; Activity Time Allocation studies; Activity Episode Analysis; Travel Duration Analysis

UNIT III

STATED PREFERENCE METHODS: Stated preference vs. Revealed Preferences; Design Issues; Survey Methods, Conjoint Analysis; Functional Measurement; Trade off Analysis, Transfer Price Method

UNIT IV

MODEL AGGREGATION AND TRANSFERABILITY: Aggregation bias and forecasting; Aggregation Methods; Temporal Stability and geographical stability of Models; Transfer Model Updating Procedures – Transferring with Aggregate and Disaggregate sample data; Transferability Measures ; Simplified Transport Demand Models: Sketch planning Methods; Incremental Demand Models; Model estimation from traffic Counts; IVF Models, Marginal and Corridor Models; Gaming Simulation, Quick Response Techniques

UNIT V

ADVANCED MODELLING TECHNIQUES - I: GO Models; Entropy Models; Equilibrium Assignment Techniques, Multipath Assignment – Dial's Algorithm; Knowledge Based Expert System; Neuro –

Fuzzy Application; ANN Techniques; Genetic Algorithms; Object Oriented Programming; Decision Support Systems; Goal Programming

Learning Outcomes:

1. Students who successfully complete this course will be able to
2. Design and conduct surveys to provide the data required for transportation planning.
3. Learn and understand zonal demand generation and attraction regression models.
4. Learn and understand demand distribution models (gravity models) and modal split models for mode choice analysis.
5. Develop and calibrate trip generation rates for specific types of land use developments.
6. Make final decisions among planning alternatives that best integrate multiple objectives such as technical feasibility and cost minimization.

REFERENCES:

1. Orterzar, J. de D. and L.G. Willumasen. Modelling Transport, Wiley Publishers
2. Oppenheim N. Urban Travel Demand Modelling: From Individual Choices to general Equilibrium. John Wiley & sons, Inc
3. Time use Analysis, Special Issue, Transportation, 26, Kluwer Academic Publishers
4. Michael Florian, Economics & Mathematical Systems: Traffic Equilibrium Methods.
5. Wilson A.G., J.D. Coelho, Sm. Macgill and HCWL Williams. Optimisation in Location and Transport Analysis, John Wiley & Sons
6. Ben Akiva, Discrete Choice Analysis: Theory and Application to Travel Demand, MIT Press

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I YEAR II SEM **0 3 2**

TRANSPORTATION ENGINEERING LAB AND STUDIO – II

1. Pavement evaluation using Visual rating, Deflection and Roughness
2. Pavement inventory surveys
3. Pavement asset management
4. DPR preparation ; Overview of HDM - 4
5. Road safety design and auditing; Accident investigation approach using GIS and GPS

SNo	Objective of the study	List of experiments to be conducted	Outcome
1	Pavement evaluation using Visual rating, Deflection and Roughness	a. Benkelman Beam test	Deflection of the pavement
		b. Roughness test	IRI
		c. Field survey by visual assessment of the pavement distress	PCI
2	Pavement inventory surveys	Videography survey	Inventory of the existing pavement, Road network definition, Database creation
3	Pavement asset management	Visual rating tests, Material characterization tests, Structural conditions , Surface condition tests	Maintenance Policy development
4.	DPR preparation ; Overview of HDM - 4	Material characterization studies	CBR, Design mix
		Traffic surveys such as CVC , Speed studies	Estimation of AADT and VOC
		Total station survey	Geometric design of road
		Field surveys for quarry chart preparation	
5	Road safety design and auditing; Accident investigation approach using GIS and GPS	Total station surveys, Videography survey, Road inventory survey; Accident data collection; Survey formats generation; GPS survey	Suggestions for Improvement of road safety