JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR ANANTHAPURAMU-515002 (A.P) INDIA

ACADEMIC REGULATIONS COURSE STRUCTURE AND DETAILED SYLLABI OF MASTER OF TECHNOLOGY IN HIGHWAY ENGINEERING

Regular Two Year P.G. Degree Course (Applicable for the batches admitted from 2013-14)

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Academic Regulations For The Award Of Full Time M.Tech. P.G. Degree
(WITH EFFECT FROM THE ACADEMIC YEAR 2013-14)

The Jawaharlal Nehru Technological University Anantapur shall confer M.Tech. Post Graduate degree to candidates who are admitted to the Master of Technology Programs and fulfill all the requirements for the award of the degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each programme, from time to time.

Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE / PGECET score, subject to reservations prescribed by the University or Government policies from time to time.

2.0 **COURSE WORK:**

2.1 A Candidate after securing admission must pursue the M.Tech. course of study for Four semesters duration.

2.2 Each semester shall be of 20 weeks duration including all examinations.

2.3 A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

3.0 ATTENDANCE:

3.1 A candidate shall be deemed to have eligibility to write end semester examinations if he has put in atleast 75% of attendance on cumulative basis of all subjects/courses in the semester.

3.2 Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.

3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.

3.4 If the candidate does not satisfy the attendance requirement he is detained for want of attendance and shall reregister for that semester. He / she shall not be promoted to the next semester.

4.0. 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.

4.1 For the theory subjects 60% of the marks will be for the External End Examination. While 40% of the marks will be for Internal Evaluation, based on the better of the marks secured in the two Mid Term-Examinations held, one in the middle of the Semester (I-IV units) and another immediately after the completion of instruction (V-VIII) units with Three questions to be answered out of four in 2hours, evaluated* for 40 marks.

*****Note: All the Questions shall be of equal weightage of 10 marks and the marks obtained for 3questions shall be extrapolated to 40 marks, any fraction rounded off to the next higher mark

4.2 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance.

4.3 For Seminar there will be an internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of IV semester instruction.

4.4 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 Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

4.5 In case the candidate does not secure the minimum academic requirement in any of the subjects (as specified in 4.4.) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

5.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

5.1 The candidate should have completed the course work and obtained examinations results for I & II semesters.

5.2 He should have passed all the subjects for which the Internal evaluation marks secured are more than 50%.

5.3 Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of **three** Theory subjects for Improvement of Internal evaluation marks.

5.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

5.5 For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the

Registrar, JNTUA payable at Anantapur along with the requisition through the Principal of the respective college.

5.6 In the event of availing the Improvement of Internal evaluation marks, the internal evaluation marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

6.0 EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ institute.

6.1 Registration of Project work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Sem)

6.2 An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor and one internal senior expert shall monitor the progress of the project work.

6.3 The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained from the Head of the Institution.

6.4 The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C before submission of the Project Report.

6.5 A candidate shall be allowed to submit the thesis / dissertation only after passing in all the prescribed subjects (both theory and practical) and then take viva voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.

6.6 Three copies of the Thesis / Dissertation certified in the prescribed from by the supervisor & HOD shall be presented to the HOD One copy is to be forwarded to the University and one copy to be sent to the examiner.

6.7 The college shall submit a panel of three experts for a maximum of 5 students at a time. However, the thesis / dissertation will be adjudicated by one examiner nominated by the University.

6.8 If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis / dissertation. The board shall jointly report candidates work as:

1.	Very Good	Grade A
2.	Good	Grade B
3.	Satisfactory	Grade C
4.	Not satisfactory	Grade D

If the report of the viva-voce is not satisfactory (Grade D) 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 the candidate is permitted to revise and resubmit the thesis.

7.0 AWARD OF DEGREE AND CLASS:

A candidate shall be eligible for the award of respective degree if he satisfies the minimum academic requirements in every subject and secures 'satisfactory' or higher grade report on his thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

First class with Distinction:	70% or more
First class	below 70% but not less than 60%
Second class	below 60% but not less than 50%

8.0 WITH – HOLDING OF RESULTS:

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

9.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 4.5 and 2.3 sections. Whereas they continue to be in the academic regulations they were first admitted.

10.0 GENERAL:

i. **The academic regulations should be read as a whole for purpose of any interpretation**.
ii. **Disciplinary action for Malpractice / improper conduct in examinations is appended**.
iii. **There shall be no places transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.**
iv. **Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".**
v. **In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.**
vi. **The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the University.**

******

APPROVED REVISION OF RULES FOR DISCIPLINARY ACTION FOR MALPRACTICES / 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 marks on 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 for four 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.** **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 shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for four consecutive semesters from class work and all University examinations, if his involvement is established. Otherwise, The candidate is 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. **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 only.
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 his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or	**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. If the candidate physically assaults the invigilator/ officer-in-charge of the Examinations, then the candidate is also debarred and forfeits his/her seat. In case of outsiders, they will be handed over to the police and a police case is registered against**

	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.	**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 only or in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations, depending on the recommendation of the committee.**
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 to award 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 specific period of not less than one year.

(iv) **<u>Note:</u> Whenever the performance of a student is cancelled in any subject/subjects due to Malpractice, he has to register for End Examinations in that subject/subjects consequently and has to fulfill all the norms required for the award of Degree.**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
Course Structure and syllabi for
M.Tech- Highway Engineering
Offered by Department of Civil Engineering
for affiliated Engineering Colleges 2013-14

I YEAR I Semester

S. No	Course code	Subject	Theory	Lab.	Credits
1.	13D93101	Highway Infrastructure Design	4		4
2.	13D93102	Urban Transportation Planning	4		4
3.	13D93103	Traffic Engineering	4		4
4.	13D93104	Pavement Material Characterization	4		4
5.	13D93105 13D93106 13D93107	Elective – I 1. Applied Statistics 2. Project Management 3. Bridge Engineering	4		4
6.	13D93108 13D93109 13D93110	Elective – II 1. Remote Sensing & Global Positioning Systems 2. Engineering of Ground Modification 3. Advanced Concrete Technology	4		4
7.	13D93111	Highway Engineering Lab		3	2
		Total Credits			26

I YEAR II Semester

S. No	Course code	Subject	Theory	Lab.	Credits
1.	13D93201	Highway Project Formulation and Economics	4		4
2.	13D93202	Pavement Construction, Maintenance & Management	4		4
3.	13D93203	Pavement Analysis and Design	4		4
4.	13D93204	Traffic Analysis	4		4
5.	13D93205 13D93206 13D93207	Elective – III 1. Road Safety Engineering 2. Land use and Transportation Modeling 3. Transportation System Management	4		4
6.	13D93208 13D93209 13D93210	Elective – IV 1. Environmental Impact Assessment for Transportation Projects 2. GIS Applications in Transportation Engineering 3. Optimization Techniques	4		4
7.	13D93211	Traffic Engineering Lab		3	2
		Total Credits			26

II YEAR (III & IV Semesters)

S. No	Course code	Subject		credits
1	13D93401	Seminar		2
2	13D93402	Project work		16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

Th	C
4	4

(13D93101) HIGHWAY INFRASTRUCTURE DESIGN

UNIT-I:
Highway Cross Section Elements and Geometric Design Of Highways: Functional Classification of Highway System; Design Controls – Topography, Driver characteristics, Vehicle Characteristics, Traffic, Capacity and Level of Service, Design Speed. Objectives of Geometric Design. Carriageway, Shoulders, Formation, Right of way; Kerbs, foot paths, Medians- design specifications.

UNIT-II:
Pavement Surface characteristics – Skid Resistance, factors affecting Skid resistance, Measurement of Skid Resistance; Road Roughness, measurement of Road roughness; Camber, Objectives of Camber, design standards.

UNIT-III:
Sight Distances: Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance. Importance of Sight Distances in Horizontal and Vertical curves, Horizontal curves – Objectives, Super elevation, need for

UNIT-IV:
Horizontal and Vertical Alignment: Objectives of horizontal curves; Super elevation – Need for Super elevation; Method of computing super elevation; Minimum Radius of Curve; Methods of attainment of super elevation; Extra widening on Curves; Transition Curves – Objectives and Design. Gradients – Types of Gradients, Design Standards; Vertical Curves – Summit Curves, Valley Curves and Design criteria for Vertical Curves; Combination of Vertical and Horizontal Curves – Grade Compensation.

UNIT-V:
Intersection Design: Types of Intersections; Design Principles for Intersections; Design of At- grade Intersections – Channelisation, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept and Design, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

UNIT-VI:
Traffic Signs and Road Markings : Types of Road Signs; Guidelines for the provision of Road
Signs; Cautionary Signs, Regulatory Signs, Information Signs – Design standards; Road markings.

UNIT-VII:
Objectives of Road Markings; Types of Road Markings; Role of Road markings in Road Safety and Traffic Regulation; Specification for Road Markings. Highway Appurtenances – Delineators, Traffic Impact Attenuators, Safety Barriers.

UNIT-VIII:
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.

REFERENCES:
1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna Publications
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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (HE)

Th	C
4	4

(13D93102) URBAN TRANSPORTATION PLANNING

UNIT-I:

Urban Transportation Problem Travel Demand: Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach. Travel Demand: Trends, Overall Planning process, Long term Vs Short term planning.

UNIT-II:

Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

UNIT-III:

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 Ownership.

UNIT-IV:

Trip Generation and Distribution : UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates.

UNIT-V:

Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models. By- pass Trips.

UNIT-VI:

Mode Choice and Traffic Assignment: Mode Choice Behaviour, Competing Modes, Mode Split Curves, Models and Probabilistic Approaches.

UNIT-VII:

Traffic Assignment: Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment, Diversion Curves.

UNIT-VIII:

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, Economic Impacts of Transportation.

REFERENCES:

1. Introduction to Transportation Planning by C.J. Chisty.
2. Transportation Engineering & Planning by C.S. Papacostas.
3. Traffic Engineering and Transport Planning - Kadiyali L.R., Khanna Publishers
4. Lecture notes on UTP - Prof. S. Raghavachari , R.E.C.Warangal.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (HE)

Th	C
4	4

(13D93103) TRAFFIC ENGINEERING

UNIT-I:

Traffic Characteristics Measurement And Analysis:

Basic traffic Characteristics - Speed, Volume and Concentration. Relationship between Flow, Speed and Concentration. Traffic Measurement and Analysis - Volume Studies - Objectives, Methods.

UNIT-II:

Speed studies – Objectives, Definition of Spot Speed, time mean speed and space mean speed; Methods of conducting speed studies; Presentation of speed study data; Head ways and Gaps; Critical Gap; Gap acceptance studies.

UNIT-III:

Highway Capacity And Level of Service: Basic definitions related to capacity; Level of service concept; Factors affecting capacity and level of service; Computation of capacity and level of service for two lane highways, Multilane highways and freeways.

UNIT-IV:

Parking Analysis And Traffic Safety : Types of parking facilities – On-street parking and Off-street Parking facilities; Parking studies and analysis- Parking Inventory Study, Parking Usage Study By Patrolling, Questionnaire Survey, Cordon Surveys; Evaluation of parking parameters; Parking accumulation, Parking Load, Parking Turnover, Parking Index, Parking Volume.

UNIT-V:

Traffic Safety -Accident studies and analysis; Causes of accidents - The Road, The vehicle, The road user and the Environment; Engineering, Enforcement and Education measures for the prevention of accidents.

UNIT-VI:

Traffic Control, Regulation Signal Coordination: Traffic Signals –Types of Signals; Principles of Phasing; Timing Diagram; Design of Isolated Traffic Signal by Webster method, Warrants for signalization.

UNIT-VII:

Signal Coordination-Signal Co-ordination methods, Simultaneous, Alternate, Simple progression and Flexible progression Systems.

UNIT-VIII:

Intelligent Transportation Systems (ITS):

Introduction to ITS – Use of ITS in vehicle detection – Enforcement – Commercial Vehicle Operations – Public Transportation system Operations – Incident Management – Traveller Information systems – Electronic Payment Systems.

REFERENCES:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers.
2 Principles of Highways Engineering and Traffic Analysis – Fred Mannering & Walter Kilareski, John Wiley & Sons Publication
3. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication.
4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
5. I.T.E. Traffic Engineering HandBook.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

Th	C
4	4

(13D93104) PAVEMENT MATERIAL CHARACTERIZATION

UNIT-I:

Subgrade Soil Characterization: Properties of subgrade layers; different types of soils, Mechanical response of soil; Soil Classification; Index and other basic properties of soil; A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. SPT, DCPT, CPT, CBR, Plate Load test & resilient modulus; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Dynamic properties of soil;FWD test.

UNIT-II:

Introduction To Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen.

UNIT-III:

Grouting: Categories of grouting, Art of grouting, Grout materials, Grouting techniques and control. Introduction to Ground improvement techniques; Introduction to Geo textiles and synthetics applications.

UNIT-IV:

Aggregate Characterization: Origin, Classification, Types of aggregates; Sampling of aggregates; Mechanical and shape properties of aggregates, Aggregate texture and skid resistance, polishing of aggregates; Proportioning and Blending of aggregates: Super pave gradation, Fuller and Thompson's Equation, 0.45 power maximum density graph; Use of locally available materials in lieu of aggregates.

UNIT-V:

Bitumen And Bituminous Concrete Mix Characterization: Bitumen sources and manufacturing, Chemistry of bitumen, bitumen structure, Rheology of bitumen, Elastic modulus, Dynamic modulus, visco-elastic and fatigue properties, creep test, stiffness modulus of bitumen mixes using shell nomographs; Resilient, Diametral Resilient and Complex (Dynamic) Moduli of Bituminous Mixes, Permanent Deformation Parameters and other Properties.

UNIT-VI:

Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Introduction to emulsified bitumen and its characterization; Long term and short term ageing and its effect on bitumen performance, Tests to simulate ageing of bitumen viz. RTFOT and PAV. Desirable properties of bituminous mixes, Design of bituminous mixes: Modified Marshall's specifications, Introduction to super pave mix design procedure.

UNIT-VII:

Cement And Cement Concrete Mix Characterization: Types of cements and basic cement properties, Special cements; Quality tests on cement; Tests on cement concrete including compressive strength, flexural strength, modulus of elasticity and fatigue properties.

UNIT-VIII:

Introduction to advanced concretes like self compacted concrete, Light weight concrete, Roller Compacted Concrete for pavement application; IS method of cement concrete mix design with case studies; Role of different admixtures in cement concrete performance; Joint filers for Jointed Plain Cement Concrete Pavements and their characterization

REFERENCES:

1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice-Hall.
2: Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, 1971.
3. Relevant IRC and IS Codes of Practices.
4. Read, J. And Whiteoak, D., "*The Shell Bitumen Handbook*", Fifth edition, Shell Bitumen, Thomas Telford Publishing, London 2003.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (HE)

Th	C
4	4

(13D93105) APPLIED STATISTICS

(ELECTIVE - I)

UNIT-I:

Introduction & Sampling Techniques: Frequency distribution; Mean; Standard deviation; Standard error, Skewness; Kurtosis; Definitions and Applications; Simple random sampling; Stratified sampling; Systematic sampling; Sample Size determination; Applications in Traffic Engineering,

UNIT-II:

Statistical Distributions and Probability: Binomial, Poisson, Exponential and Normal distributions; Moments of random variable: Fitting of distributions: Chi-square test of goodness-of-fit; Applications in Traffic Engineering. Probability.

UNIT-III:

Laws of Probability; Conditional probability and Independent events; Laws of expectation.

UNIT-IV:

Regression And Correlation: Linear regression and correlation; Multivariate Regression; Multiple correlation coefficient; Standard error of estimate; Analysis of Variance; Curvilinear regression; Applications in Transportation Engineering.

UNIT-V:

Multivariate Data Analysis and Exact Sampling Distributions : Types of data; Basic vectors and matrices; Simple estimate of centroid, Standard deviation: Dispersion, Variance and covariance; Correlation matrices.

UNIT-VI:

Principal component analysis; Time series analysis. Exact Sampling Distributions – Chi-square distribution; Students t-distribution; Snedecors F-distribution.

UNIT-VII:

Tests of Significance & Confidence Interval – Large sample and small sample tests; Tests for single mean, Means of two samples, Proportions, two variances, two observed correlation coefficients, paired T-tests, Applications.

UNIT-VIII:

Tests of Significance & Confidence Interval-Intervals for mean, variance and regression coefficients; Applications in Traffic Engineering problems.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

Th	C
4	4

(13D93106) PROJECT MANAGEMENT
ELECTIVE - I

UNIT-I:
Introduction to Project Management: A systems Approach, Systems Theory and Concepts, Organisation, Management Functions, Overview of Management Objectives, Tools and Techniques.

UNIT-II:
Project Management – Processes and Organisational Structures – Team Management – Project Manager as a Team Leader – Leadership Qualities, PMIS

UNIT-III:
Construction Cost and Value Engineering: Types of Estimates, Implementation of Cost Controls, Project Cost Forecasting, Cost Optimisation and Resources Planning -Value Engineering.

UNIT-IV:
Techniques for Project Selection, Break-Even Analysis, Cost Modelling, Energy Modelling, Life Cycle Cost Approach.

UNIT-V:
Contract Management Safety in Construction Industry : Tendering and Contracting, Laws of
Contracts, subcontracts, Potential Problems, Post Contract Problems, Documents, Conditions, Arbitration, Special Features of International Contracts.

UNIT-VI: 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.

UNIT-VII:
Project Scheduling and Analysis Methods:CPM, PERT, Linear programming, queuing concept, simulation, bidding models, game theory.

UNIT-VIII:
Human Resource Management and Construction Management Practices : 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. Construction Management Practices - Implementation of Procedures and Practices – International Experiences – Case Studies – Examples.

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 McGraw-Hill Publishing Company Ltd. Sengupta B and Guha H, Construction Management and Planning, Tata McGraw-Hill Publishing Company Limited, New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

Th	C
4	4

(13D93107) BRIDGE ENGINEERING
(Elective - I)

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.

UNIT-II:
Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

UNIT-III:
Solid slab, Girder Bridges & Continuous Bridges: Introduction-Method of Design. Girder Bridges - Introduction-Method of Design-Courbon's Theory. Continuous Bridges - Introduction- Span lengths- Analysis of Continuous bridges-Decking of Girders with constant Moment of Inertia.

UNIT-IV:
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-V:
Pre-Stressed Concrete Bridges: Basic principals- Method of Pre-srtessing-Pretensioning and Post-tensioning – Comparision-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-Emperical Method.

UNIT-VI:
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-VII:
Analysis of Bridge Decks: Harmonic analysis and folded plate theory-Grillage analogy-Finite strip method and FEM.

UNIT-VIII:

Sub-structure of bridges: Substructure-Beds block-Piers- Pier Dimensions- Design loads for piers- Abutments- Design loads for Abutments.

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.
4. Prestressed Concrete bridges by N. Krihnam Raju
5. Prestress Concrete – A fundamental Approach. Edward Navy

Note: This subject must be taught by M-Tech. Structural Engineering, faculty only

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (HE)

	Th	C
	4	4

(13D93108) REMOTE SENSING & GLOBAL POSITIONING SYSTEMS
(Elective – II)

UNIT-I:
Remote Sensing Technology : 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.

UNIT-II:
Remote Sensing. Platforms & Sensors - Introduction, Characteristics of imaging remote sensing instruments, satellite remote sensing system – a brief over view , other remote sensing satellites.

UNIT-III:
Pre-Processing and Enhancement Techniques for Remotely Sensed Data: Introduction, cosmetic operation; Geometric connection and registration, atmospheric correction.

UNIT-IV:
Enhancement Technique - Introduction, human visual system, contrast enhancement; Pseudo color enhancement.

UNIT-V:
Image Transforms: Introduction, arithmetic operations, empirically based image transforms, Principal component analysis , Multiple discriminant analysis etc.

UNIT-VI:
Filtering Technique Classification: Low-pass (smoothing filters) High pass (sharpening) filters, edge detection, frequency domain filters.

UNIT-VII:
Geometrical basis, classification, Unsupervised and supervised classification, classification accuracy.

UNIT-VIII:G.P.S.:
Introduction, Elements of satellite surveying, e global positioning system, GPS satellites, Adjustment computations, GPS observables, Application of GPS technology in Highway alignment, Network planning.

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech I semester (HE)

Th	C
4	4

(13D93109) ENGINEERING OF GROUND MODIFICATION

(ELECTIVE – II)

UNIT-I:

Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In situ and laboratory tests to characterise problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods, and their applications.

UNIT-II:

Mechanical Modification – Deep Compaction Techniques- Blasting Vibrocompaction, Dynamic Tamping and Compaction piles.

UNIT-III & IV:

Hydraulic Modification – Objectives and techniques, traditional dewatering methods and theirchoice, Design of dewatering system, Electro-osmosis, Electro-kinetic dewatering.

Filtration, Drainage and Seepage control with Geosynthetics, Preloading and vertical drains,

UNIT-V & VI:

Physical and Chemical Modification – Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing.

UNIT-VII & VIII:

Modification by Inclusions and Confinement - Soil reinforcement, reinforcement with strip, and grid reinforced soil. In-situ ground reinforcement, ground anchors, rock bolting and soil nailing.

REFERENCES:

1. Hausmann, M. R. (1990) – Engineering Principles of Ground Modifications, McGraw Hill publications
2. M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis
3. Koerner, R. M (1994) – Designing with Geosynthetics – Prentice Hall, New Jersey
4. Jones C. J.F.P. (1985) – Earth Reinforcement and soil structures – Butterworths,London.
5. Xianthakos, Abreimson and Bruce - Ground Control and Improvement
6. K. Krisch & F. Krisch (2010) - Ground Improvement by Deep Vibratory Methods, Spon Press, Taylor and Francis
7. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

Th	C
4	4

(13D93110) ADVANCED CONCRETE TECHNOLOGY
(Elective-II)

UNIT-I:
Cement: Portland cement - chemical composition – Bogues compounds - hydration - structure of hydrated cement - mechanical strength of cement gel - water held in hydrated cement paste - heat of hydration of cement - influence of compound composition on properties of cement - different types of cements.

UNIT-II:

Admixtures:
Admixtures - Classification – Mineral and chemical admixtures - Classification of mineral admixtures – properties – dosage - uses – Chemical admixtures – classification – properties – uses – High range water reducing agents – effect of dosage – multiple dosage of admixtures and their effects – effects of admixtures in RMC.

UNIT-III:

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 - deleterious substance in aggregate – soundness of aggregate - alkali-aggregate reaction - thermal properties - sieve analysis - fineness modulus - grading curves - grading of fine and coarse aggregates - gap graded aggregate - maximum aggregate size – combined a grading – BIS grading.

UNIT-IV:

Fresh 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 – revibration – setting times of fresh concrete – steps in manufacture of concrete – quality of mixing water.

UNIT-V:

Hardened Concrete:

Hardened Concrete - 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 - autogenous 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 - codal provisions.

UNIT-VI:

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 – Codal provisions – Rheology of creep.

UNIT-VII:

Concrete Mix Design and Special Concrete Issues : 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.

UNIT-VIII:

Special Concrete - Light weight concrete – Light weight aggregates – Light weight concrete mix design – Cellular concrete – Fiber reinforced concrete – Different types of fibres – Factors affecting properties of F.R.C. – Applications – Polymer concrete – Types of polymer concrete – Properties of polymer concrete – Applications – High Performance Concrete -Self Compacting concrete – smart concrete.

REFERENCE BOOKS:

1. Properties of Concrete by A.M.Neville, ELBS publications.
2. Concrete Technology by M.S.Shetty, S.Chand & Co.
3. Special Structural concretes by Rajat Siddique, Galgotia Publications.
4. Design of Concrete Mixes by N.Krishna Raju, CBS Publications.
5. Concrete Micro Structure by P.K.Mehta, ICI, Chennai.
6. Concrete Technology by A.M.Neville – Pearson publication
7. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
8. Non-Destructive Test and Evaluation of materials by J.Prasad & C.G.K. Nair, Tata Mcgraw Hill Publishers, New Delhi

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech I semester (HE)

L	C
3	2

(13D93111) HIGHWAY ENGINEERING LAB.

1. Test on soil – i) Soil Consistency tests, Sieve Analysis
ii) Compaction of Soil
iii) CBR test

2. Test on Aggregate – i) Shape test
ii) Impact and crushing tests on aggregate
iii) Abrasion and Attrition test
iv) Soundness test

3. Tests on Bitumens – i) Viscosity, Penetration, Ductility tests
ii) Flash and fire point tests
iii) Bitumen extraction tests

4. Test on Bitumen & Concrete mix – i) Design of Cement Concrete Mix for Highway
ii) Marshal Stability Mix Design

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (HE)

Th	C
4	4

(13D93201) HIGHWAY PROJECT FORMULATION & ECONOMICS

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

Unit II:

Transport Projects Formulation and Economic Evaluation of Transportation Plans :

A) Development of cash flow diagrams, Cost and benefit components, Discounting criteria, Preparation of Project, Highway Planning, Traffic infrastructure, Project formulation, Road Network project development.

Unit III:

B) Economic evaluation of Transportation plans; Need for Economic Evaluation; Principles of economic evaluation; Welfare economics; Social costs, Vest change, Rate of return.

Unit IV:

Value of Travel time Savings and Accident Costs :

A) 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.

Unit V:

B) Accident costs; Methodologies foreconomic evaluation of an accident ; Factors involved.

Unit VI:

Basic methods of economic analysis and Project Appraisal :

A) 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.

B) **Unit VII:**

Project appraisal by shadow pricing with case studies.

Unit VIII:

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.

REFERENCES:

1. Economic Analysis for Highways - Winfrey.R; International Text Book Company.
2. Traffic Engineering and Transport Planning - L.R Kadiyali, Khanna Publishers.
3. Road User Cost Study, CRRI
4. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons.
5. a). Chisty Fundamental of T.P. Engineering, by C.J. Chisty.
   b). Transportation Engineering & Planning by C.S. Papacostas.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93202) PAVEMENT CONSTRUCTION MAINTENANCE AND MANAGEMENT

Unit I:
Pavement Management System:

A) Components of PMS and their activities; Major steps in implementing PMS; Pavement Maintenance Management Components of Maintenance-Management and Related Activities

Unit II:

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

Unit III:
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 IV:
Pavement Maintenance and Quality Control : Causes of Deterioration, Traffic and Environmental Factors, 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 V:
Construction of Base, Subbase, Shoulders and Drain :

A) 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;

Unit VI:

Drainage Surface, Turfing Sand Drains; Sand Wicks; Rope Drains, Geo- Textile Drainage; Preloading Techniques

Unit VII:
Bituminous Pavement Construction and Cement Concrete Pavement Construction:

A) 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.

Unit VIII:

B) Cement Concrete Pavement Analysis - Construction of Cement Roads, Manual and Mechanical Methods, Joints in Concrete and Reinforced Concrete Pavement and Overlay Construction –Related Equipment

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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93203) PAVEMENT ANALYSIS AND DESIGN

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:

A) 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;

B) **Unit III:**

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 IV:
Material and Characteristics:

A) CBR and Modulus of Subgrade Reaction of Soil, Mineral aggregates – Blending of aggregates, binders, polymer and rubber modified bitumen, Fibre Reinforced Concrete, Resilient, Diametral, Resilient and Complex (Dynamic) Moduli of Bituminous Mixes,

Unit V:

B) Permanent Deformation Parameters and other Properties, Effects and Methods of Stabilisation and Use of Geo Synthetics.Non destructing testing.

Unit VI:
Design Of Flexible and 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, 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 VII:

Runway Design :

A) Aircraft configurations, Flexible airport pavements - IS specifications and design, Corps of Engineers, FAA methods, AI methods.

Unit VIII:

B) Rigid airport pavements – IS specifications, PCA method, Corps of Engineers method, FAA method.

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93204) TRAFFIC ANALYSIS

UNIT-I:
Traffic Flow Description: Types of Statistical distributions; Discrete and continuous distributions; Counting and Interval Distributions used in Traffic Analysis; Poisson's distribution for vehicle arrivals; Headway Distributions – Exponential Distribution; shifted Exponential distribution; Erlang Distribution; composite Distribution.

UNIT-II:
Queueing Theory:M/M/1 & D/D/I System:

A) Introduction to queuing Theory; notation used for describing a queue system; 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.

UNIT-III:

B) Queueing Theory - D/D/1 System: Traffic Interruptions like Accidents or Bottlenecks; 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 & VI:
Shockwave Theory: Concept of Shockwave; causes for Traffic Interruptions and Shockwaves; 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;

UNIT-VII:
Traffic Simulation:

A) Introduction to Simulation; Need for Simulation Modelling; Steps in Simulation; Interval Oriented and Event Oriented Simulation; Use of Random Numbers in Simulation; Random Number generation methods; Computing headways and arrival times based on random numbers;

B) **UNIT-VIII:**

Basic concepts of simulation modelling application for Signalised Intersections, Pedestrian Crossings and Transit scheduling.

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (HE)

Th	C
4	4

(13D93205) ROAD SAFETY ENGINEERING
(Elective III)

Unit I:
Fundamentals of Traffic Engineering - Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities.

Unit II:
Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

Unit III:
Accident Investigations and Risk Management, Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention,

Unit IV:
Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction

Unit V:
Road Safety in Planning And Geometric Design: Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

Unit VI:
Role of Urban infrastructure design in safety: Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections.

Unit VII:
Road Safety in Urban Transport, Sustainable Modes and their Safety.

Unit VIII:
Traffic Management Systems for Safety, Road Safety Audits and Tools for Safety Management Systems, Road Safety Audit Process, Approach to Safety, Road Safety Improvement Strategies, ITS and Safety.

REFERENCES:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.
3. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall
4. Fundamentals of Traffic Engineering, Richardo G Sigua
5. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
6. Road Safety by NCHRP

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Tech II semester (HE)

Th	C
4	4

(13D93206) LAND USE AND TRANSPORTATION MODELLING
(Elective-III)

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, Modeling and decision making, Issues in Transportation modeling and structure of the classic transport model.

UNIT-II:

Land Use Transportation 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.

UNIT-III & IV:

General Travel Demand Models: Aggregate, Disaggregate models ; Behavioural models; Recursive and direct demand Models; Linear, Non-Linear models; Logit, discriminate and probit models; Mode split models - Abstract mode and mode specific models.

.

UNIT-V & VI:

Regional Transport Models: Factors affecting goods and passenger traffic; Prediction of traffic; Growth factor models; Time function iteration models; Interna1 volume forecasting models.

UNIT-VII:

Regional Network Planning:

A) Problems in Developing Countries, Network Characteristics - Circuitry, Connectivity, Mobility, Accessibility and Level of Service Concepts.

UNIT-VIII:

B) Network Structures and Indices – Network Planning – Evaluation - Graph Theory – Cut sets – Flows & Traversing – Optimum Network - Inter-modal Co-ordination. – Rural Road Network Planning.

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. Behavioural Travel Demand Models - Peter R. Stopher ARNIM.H.MEYBURG.
8. Introduction to Transportation Engineering and Planning, Morlok EK, McGraw Hill

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93207) TRANSPORTATION SYSTEMS AND MANAGEMENT
(Elective-III)

UNIT-I:
TSM Philosophy: Systems approach to Transportation Planning; Long Term Strategies and Short term Measures; TSM actions – Objectives and Philosophy; Relevance of TSM actions to Indian Urban Context. Broad spectrum of TSM actions.

UNIT-II & III:
Traffic Management Measures: Measures for Improving Vehicular Flow – One Way Streets, Signal Improvements, Transit Stop Relocation, Parking management, Reversible lanes; Reducing Peak Period Traffic – Staggering of Working hours, Congestion Pricing, differential Toll Policies.

UNIT-IV:
Measures To Promote Transit and Non-Auto Modes:
A) Preferential Treatment to High Occupancy Vehicles; Car Pooling; Transit Service Improvement Measures; Transit management Improvement Measures; Transit and Para Transit Integration; Para-transit Role in Urban Areas; Multi-modal coordination.

UNIT-V:
B) Measures to Promote Non-Auto modes - Pedestrianisation; Bicycle Transportation – Advantages; planning Bicycle facilities – Class I, Class II and Class III Bikeways; Junction Treatments for Cycle Tracks; LOS criteria for Pedestrian and Bicycle facilities.

UNIT-VI:
Bus Route Network Planning And Management:
A) Types of Bus Route Net works; Suitability for a given Urban Area; Types of Routes – Corridor Routes, Activity Routes and Residential Routes;

UNIT-VII:
B) Issues in Route Network Evaluation – Number of Routes, Length of Routes; Route Alignment Methods; Service Coverage and Accessibility Index.

UNIT-VIII
Advanced Transit Technologies: Conventional and Unconventional Systems; Rapid
Transportation Systems; New Technologies – LRT, Monorail, Automated Highways, Hovercraft; System characteristics and suitability.

REFERENCES:

1. Transportation System Management Notes, S.R.Chari, REC, Warangal
2. Metropolitan Transportation Planning, John W Dickey, Tata McGraw Hill
3. The Bicycle Planning, Mike Hudson, Open Books, UK
4. Transportation Engineering– An Introduction – C.Jotin Khisty& B. Kent Lall, Prentice Hall.
5. Traffic and Highway Engineering – Nicholas J.Garber and Lester A. Hoel, Cengage Learning, USA, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93208) ENVIRONMENTAL IMPACT ASSESSMENT FOR TRANSPORTATION PROJECTS
(Elective - IV)

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 & III:
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-IV & V:
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- VI & VII:
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-VIII:
Methodologies for Carrying Environmental Impact Assessment: Overview of Methodologies Adhoc, Checklist, Matrix, Network, Overlays, Benefit Cost Analysis, Choosing A Methodology, Review Criteria.

REFERENCES:

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93209) GIS APPLICATIONS IN TRANSPORTATION ENGINEERING
(Elective – IV)

UNIT-I:
Introduction to GIS and Data Input & Output:

A) Introduction, GIS over view, use of GIS in decision making, Data processing, Components of GIS, The GIS and the organization.

UNIT-II:

B) Data Input and Output - Data input - Key board entry, Manual digitizing, Scanning, Remotely and sensed data, existing digital data, census related data sets, Data output - Hard copy and soft, copy devices.

UNIT-III:
Data Quality and Management :

A) Components of data quality - Micro level, Macro level components, Sources of error, A note about data accuracy.

UNIT-IV:

B) Data Management - The data base approach, 3 classic data models, Nature of geographic data, Spatial data models, Databases for GIS.

UNIT-V:
GIS Analysis and Functions: Organizing geographic data for analysis, Maintenance and analysis of the spatial data and non-spatial attribute data and its integration output formatting.

UNIT-VI:
Implementing a GIS: Awareness, Developing system requirements, Evaluation of alternative systems, System justification and Development of an implementation plan, System acquisition and start up, Operation of the system.

UNIT-VII:
Application of GIS in Transportation Engineering :

A) Intelligent information system for road accessibility study, GIS data base design for physical facility planning, Decision support systems for land use planning. GIS applications in environment impact assessment.

UNIT-VIII:

B) GIS based Highway alignment, GIS based road network planning, GIS based traffic congestion analysis and accident investigation.

REFERENCES:

1.GIS for Urban & Regional Planning, Scholten & Stillwen 1990, Kulwer Academie Publisher.
2. GIS A Management, Perspenfi Stan Aronoff, WDL Publisher.
3.GIS By Stonffer

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

Th	C
4	4

(13D93210) OPTIMIZATION TECHNIQUES
(Elective – IV)

Unit-I &II:
Linear Programming: Introduction and formulation of models; Conversity; simplex method; Two phase method; Degeneracy, non - existent and unbounded solutions; Duality in L.P. Dual simplexmethod, Sensitivity analysis; Revised simplex method; transportation and assignment problems.

Unit-III &IV:
Non-Linear Programming: Classical optimisation methods; Equality and inequality constraints; Lagrange multipliers; & Kuhn-Tucker conditions; Quadratic forms; Quadratic programming and seal's methods.

Unit-V & VI:
Search Methods: One dimensional optimisation; Fibonacci search; multi dimensional search methods; Univariate search; gradient methods; steepest descent/ascent methods; Conjugate Gradient method; Fletcher - Reeves method; Penalty function approach.

Unit-VII:
Dynamic Programming: Principle of optimality; Recursive relations; solution of L.P.Problem; simple examples.

Unit-VIII:
Integer Linear Programming: Gomory's cutting plane method; branch and bound algorithm; travelling salesman problem; Knapsack problem; Linear C-1 problem.

REFERENCES:

1. Introduction to Optimisation - J.C.Pant; Jain Brothers; New Delhi.
2. Optimisation Theory and Applications - S.S.Rao; Wiley Eastern Ltd., New Delhi.
3. Optimisation Method - K.V.Mital; Wiley Eastern Ltd.. New Delhi.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
M.Tech II semester (HE)

L	C
3	2

(13D93211) TRAFFIC ENGINEERING LAB

1. Traffic Surveys:

i. Traffic Volume Studies
ii. Spot Speed Studies
iii. Floating Car Technique
iv. Headway and Gap-Acceptance Studies
v. Delay Studies
vi. Pedestrian Survey

2. Parking Surveys:

i. On-Street Parking Studies
ii.Off-Street Parking Studies

3. Applications of MX-Roads Software.

4. Road Safety Auditing.

REFERENCES:

1. Principles and Practice of Highway Engineering, L.R.Kadiyali and N.B.Lal, Khanna, 2007.
2. Traffic Engineering and Transportation Planning, L.R.Kadiyali, Khanna Publications, 2007.
3. MX-Roads Software Manual.