School of Engineering and Technology
Programme Structure & Syllabus

M.Tech (Transportation Engineering)

2024-25

K.K. University
Bihar Sharif, Nalanda - 803115

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School of Engineering & Technology
Department of Civil Engineering
Master of Technology in Transportation Engineering

Objective of the Program:

The objectives of an M.Tech (Master of Technology) program in Transportation Engineering typically include:

- Developing Expertise: To equip students with comprehensive knowledge of transportation systems, including planning, design, operation, and management.
- Problem Solving: To enable students to analyze and solve complex transportation engineering problems using scientific principles and engineering techniques.
- Innovation and Research: To foster innovation and encourage research in transportation technologies, policies, and practices.
- Sustainable Practices: To promote sustainable transportation solutions that minimize environmental impact, enhance safety, and improve accessibility.
- Professionalism: To prepare students for professional practice in transportation engineering, emphasizing ethical standards, teamwork, and effective communication skills.
- Continuous Learning: To instill a commitment to lifelong learning and professional development among graduates in response to evolving transportation challenges and technologies.

Overall, an M.Tech program in Transportation Engineering aims to produce highly skilled professionals capable of addressing current and future challenges in transportation infrastructure, systems, and policies through advanced education and research.

Program Education Outcomes:

Program Education Outcomes (PEOs) for an M.Tech program in Transportation Engineering typically include:

PEO-1: Students will demonstrate advanced knowledge and proficiency in transportation engineering principles, practices, and methodologies.

PEO-2: Students will be able to analyze, formulate solutions, and implement strategies for complex transportation engineering problems.

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PEO-3: Graduates will engage in research activities, contribute to the advancement of knowledge in transportation engineering through scholarly publications, and apply innovative approaches to solve practical problems.

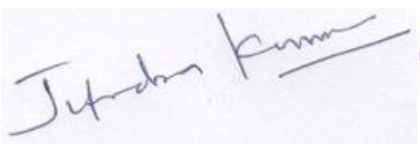
PEO-4: Students will demonstrate the ability to apply ethical principles and professional standards in their practice, considering the societal, environmental, and economic impacts of transportation projects.
PEO-5: Graduates will exhibit leadership qualities and effectively collaborate with multidisciplinary teams in the planning, design, operation, and management of transportation systems.
PEO-6: Students will pursue continuous learning and professional development, keeping abreast of advancements in transportation engineering and related fields.
PEO-7: Graduates will effectively communicate technical information and research findings to diverse audiences, including stakeholders, policymakers, and the general public.

These Program Education Outcomes (PEOs) ensure that graduates of the M.Tech program in Transportation Engineering are well-prepared to excel in their careers, contribute to the field through research and innovation, and address the evolving challenges in transportation infrastructure and systems.

Program Outcomes:

Program Outcomes (POs) for an M.Tech program in Transportation Engineering typically include:

PO1: Advanced Knowledge: Graduates will demonstrate advanced knowledge and understanding of principles, theories, and practices in transportation engineering.
PO2: Problem Solving: Graduates will be able to identify, formulate, and solve complex transportation engineering problems using appropriate tools, techniques, and methodologies.
PO3: Design Capability: Graduates will have the ability to design transportation systems, infrastructure, and solutions that meet specified requirements and consider technical, economic, environmental, and social factors.
PO4: Research and Investigation: Graduates will be able to conduct research, analyze data, and apply findings to improve transportation systems, technologies, and policies.
PO5: Professionalism: Graduates will exhibit professional ethics, responsibility, and effective communication skills in their interactions with stakeholders and in multidisciplinary teams.
PO6: Impact on Society: Graduates will understand the impact of transportation engineering solutions on society, including safety, sustainability, accessibility, and quality of life.
PO7: Lifelong Learning: Graduates will engage in continuous learning, keeping pace with advancements in transportation engineering and related fields, and pursue professional development opportunities.




PO8: Project Management: Graduates will demonstrate the ability to manage transportation projects effectively, including planning, organizing resources, and executing tasks within constraints.

PO9: Innovation and Entrepreneurship: Graduates will apply innovative thinking and entrepreneurial skills to develop new solutions and initiatives in transportation engineering.
PO10: Collaboration: Graduates will collaborate effectively in multidisciplinary teams to address complex transportation challenges and achieve project goals.

These Program Outcomes (POs) ensure that graduates of the M.Tech program in Transportation Engineering possess the necessary knowledge, skills, and attributes to succeed in professional practice, contribute to research and innovation in the field, and make meaningful contributions to society through sustainable and efficient transportation solutions.

Program Specific Outcomes:

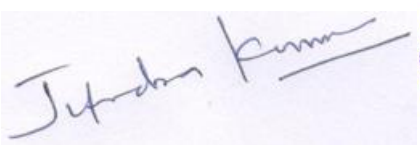
Program Specific Outcomes (PSOs) for an M.Tech program in Transportation Engineering are typically more focused and specific to the program's objectives and curriculum.

PSO1: Transportation Planning: Students will demonstrate an ability to analyze transportation demands, develop comprehensive transportation plans, and evaluate their effectiveness in addressing regional and urban mobility needs.

PSO2: Traffic Engineering: Graduates will have the capability to design and manage traffic flow, including traffic signal systems, intersection design, and intelligent transportation systems (ITS), to optimize efficiency and safety.

PSO3: Pavement Engineering: Graduates will be proficient in designing and maintaining pavement structures, including materials selection, pavement design methodologies, and rehabilitation techniques.

PSO4: Public Transportation Systems: Graduates will understand the principles and practices of public transportation systems, including planning, operations, and management to enhance accessibility and reduce dependency on private vehicles.



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PSO5: Sustainable Transportation: Graduates will demonstrate knowledge and skills in promoting sustainable transportation solutions, including reducing environmental impacts, promoting alternative fuels, and integrating non-motorized transport options.

PSO6: Transportation Safety: Graduates will be able to assess and improve transportation safety measures, including accident analysis, risk assessment, and implementation of safety enhancements.

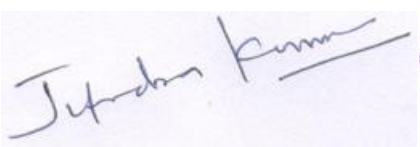
PSO7: Transportation Economics and Policy: Graduates will understand the economic principles and policies influencing transportation decisions, including funding mechanisms, cost-benefit analysis, and regulatory frameworks.

PSO8: Modeling and Simulation: Graduates will use modeling and simulation techniques to analyze transportation systems, predict future demands, and evaluate the impact of proposed interventions.

PSO9: Highway Geometric Design: Graduates will apply geometric design techniques to spatially analyze transportation data, support decision-making processes, and improve planning and management of transportation systems.

PSO10: Planning And Design of Airports: Graduates will effectively learn about planning and design of airports which can be used in real life projects.

These Program Specific Outcomes (PSOs) reflect the specialized skills and knowledge that graduates of the M.Tech program in Transportation Engineering will acquire, ensuring they are well-prepared to address specific challenges and contribute effectively to the field upon completion of their degree.



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M.Tech Transportation Engineering
Programme/Course Structure

FIRST SEMESTER

S. No	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal Marks	External Marks
1	EMTE1101	Advance Mathematics and Numerical Analysis	4	3	1	0	4	30	70
2	EMTE 1102	Transportation Planning	3	3	0	0	3	30	70
3	EMTE 1103	Highway Material and Testing	3	3	0	0	3	30	70
4	EMTE 1104	Highway Geometric Design	4	3	1	0	4	30	70
5	EMTE 1105	Highway Equipment's & Machinery	4	3	1	0	4	30	70
6	EMTE 1106	Bituminous Concrete Road Construction	3	3	0	0	3	30	70
7	EMTE 1102P	Transportation Planning Lab	2	0	0	2	2	30	70
8	EMTE 1103P	Highway Material and Testing Lab	2	0	0	2	2	30	70
9	EMTE 1106P	Bituminous Concrete Road Construction Lab	2	0	0	2	2	30	70
Total			**27**	**18**	**3**	**6**	**27**	**270**	**630**

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SECOND SEMESTER

S. No	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal Marks	External Marks
1	EMTE 1201	Traffic Engineering & Field Studies	3	3	0	0	3	30	70
2	EMTE 1202	Bridge Engineering	4	3	1	0	4	30	70
3	EMTE 1203	Highway Construction	3	3	0	0	3	30	70
4	EMCE 1204	Analysis and Structural Design of Pavements	3	3	0	0	3	30	70
5	EMTE 1205	Road Safety Engineering	4	3	1	0	4	30	70
6	EMTE 1206	Planning And Design of Airports	4	3	1	0	4	30	70
7	EMTE 1201P	Traffic Engineering & Field Studies Lab	2	0	0	2	2	30	70
8	EMTE 1203P	Highway Construction Lab	2	0	0	2	2	30	70
9	EMTE 1204P	Analysis and Structural Design of Pavements Lab	2	0	0	2	2	30	70
Total			**27**	**18**	**3**	**6**	**27**	**270**	**630**

THIRD SEMESTER

S. No	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal Marks	External Marks
1	EMTE 2101	Railway Engineering	4	3	1	0	4	30	70
2	EMTE 2102	Mass Transit Systems	4	3	1	0	4	30	70
3	EMTE 2103	Computer Aided Transportation Engineering	4	0	0	4	4	30	70
4	EMTE 2104	Minor Project	8	0	0	8	8	30	70
Total			**20**	**6**	**2**	**12**	**20**	**120**	**280**

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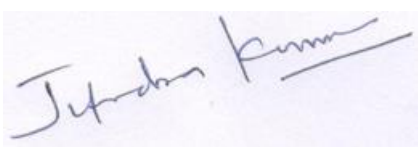
FOURTH SEMESTER

S. No	CODE	TITLE	CREDIT	L	T	P	HOURS PER WEEK	Internal Marks	External Marks
1	EMTE 2201	Major Project	16	0	0	16	16	30	70
Total			**16**	**0**	**0**	**16**	**16**	**30**	**70**



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DEPARTMENT OF CIVIL ENGINEERING

Programme Structure	**M. Tech (Transportation Engineering)**
Semester	**1ST**
Subject Code	**EMTE 1101**
Course Name	**Advance Mathematics And Numerical Analysis**
Course Credits	**3 (L)+1(T) = 4**
Total Course Credit	**90**

Abbreviations: L-Lecture, P-Practical, T- Tutorial

1. **Course Overview:**

   To learn about Advance Mathematics and Numerical Analysis that include the Elementary Concept of Fuzzy logic, Introduction to Linear Programming, Transportation and Assignment Problems, Laplace, Heat & Wave Equations and differential equations.

2. **Prerequisite:** To understand the fundamental of Engineering mathematics and fundamental Calculus and algebra with its applications.

3. **Objective of the Syllabus:**

   This course Advance Mathematics and Numerical Analysis is an essential part of any Higher engineering education. These objectives aim to provide students with a comprehensive understanding of higher mathematics which can help in research oriented studies in different subjects and probabilistic approach. It also helps in designing point of view and for smaller programming in transportation design studies.

4. **Course Outcomes:**

S. No.	**Course Outcomes (Cos)**
CO1	Understands the objectives of Some Elementary Concepts of Fuzzy Set, Algebraic Operations on Fuzzy sets and Use and application of Fuzzy Logic.
CO2	Know about Linear Programming, Solution by Graphical and Simplex Method, Concept of Degeneracy and Duality, Big-M Method, Two Phase Method, Revised simplex Method.
CO3	Understanding about Transportation and Assignment Problems, North-West Corner Method, Mathematical Formulation of Assignment Problem, Job Sequencing.
CO4	Understanding about Numerical Solution of an Ordinary Differential Equations and Partial Differential Equations (Laplace, Heat & Wave Equations), Gauss's Quadrature Formula.
CO5	Know about Difference Equations as a relation among the value of Order, Degree, Solution, Linear Difference Equations, General Solution of Homogeneous Difference Equation of order n, Particular Sol. of the Complete Difference Equations.

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5. Syllabus:

MODULE -I Elementary Concept of Fuzzy logic:- Some Elementary Concepts, Fuzzy Set, and Basic Fuzzy set operations, some fundamental Properties of Fuzzy set; Algebraic Operations on Fuzzy sets, Use of Fuzzy Logic, Application of Fuzzy Logic.

MODULE -II Introduction to Linear Programming: - Solution by Graphical and Simplex Method, Concept of Degeneracy and Duality, Artificial Variable Techniques: Big-M Method, Two Phase Method, Revised simplex Method.

MODULE -III Transportation and Assignment Problems:- North-West Corner Method, Lowest Cost Entry Method, Vogel's Method, Non-Degenerate Basic Feasible Solution, Assignment Model, Mathematical Formulation of Assignment Problem, Hungarian Method for the Assignment Problem, Job Sequencing.

MODULE -IV Numerical Method:- Numerical Solution of an Ordinary Differential Equations, Numerical solutions of Partial Differential Equations (Laplace, Heat & Wave Equations), Gauss's Quadrature Formula.

MODULE -V Difference Equations: - Difference Equations as a relation among the value of yx, Order,Degree, Solution, Linear Difference Equations, Solution of the Eq. Yx+1=AYx+B, Solution as Sequences, Linear Homogeneous Equations with Constants Coefficients, Linearly Independent Solutions, General Solution of Second order homogeneous Difference Equations, General Solution of Homogeneous Difference Equation of order n, Particular Sol. of the CompleteDifference Equations.

BOOKS AND REFERENCES:

1. Rammana, B.V., Higher Engineering Mathematics, Tata McGraw Hill Pub. Company.
2. Potter, Goldberg & Edward, Advanced Engineering Mathematics, Oxford University Press.
3. Shastry, S. S., Engineering Mathematics, PHI Learning
4. Gupta, C.B., Engineering Mathematics I & II, McGraw Hill India.
5. Dean G. Duffy, Advanced Engineering Mathematics with MATLAB, CRC Press.

Additional Learning Sources:-

1. Web links to e-learning: NPTEL.
2. Web links to e-learning: NCTEL.

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DEPARTMENT OF CIVIL ENGINEERING

Programme Structure	**M. Tech (Transportation Engineering)**
Semester	**1ST**
Subject Code	**EMTE 1102**
Course Name	**Transportation Planning**
Course Credits	**3 (L) + 2(P)= 5**
Total Course Credit	**90**

Abbreviations: L-Lecture, P-Practical, T- Tutorial

1. **Course Overview:**

To learn about Transportation planning which help to understand bout transportation planning methodology, hierarchical levels of planning, Travel demand estimation and forecasting, Modal split analysis, network assignment and land-use transport interactions. These are essential parts for any transportation engineering and design point of view.

2. **Prerequisite:** To understand the fundamental of highway engineering and its terminology, applications and uses.

3. **Objective of the Syllabus:**

This course Transportation planning is an essential part of any Transportation engineering. These objectives are to provide students with a comprehensive understanding of Transportation planning, Urban transportation planning & travel characteristics, Modal split analysis-traditional analysis, Traffic assignment and Land-use transport planning.

4. **Course Outcomes:**

S. No.	**Course Outcomes (Cos)**
CO1	Understands the objectives and Principles of Transportation planning methodology, hierarchical levels of planning-statewide, urban, passenger and goods transportation
CO2	Know about Urban transportation planning, urban travel characteristics, private and public, travel behavior analysis. Travel demand estimation and forecasting, Trip classification.
CO3	Understanding about Modal split analysis-traditional analysis, Trip distribution, intervening opportunity and competing opportunity models, Entropy maximizing method and linear programming, method in trip distribution.
CO4	Understanding about network assignment, capacity restrained and simultaneous, distribution assignment methods. Direct demand models of transport planning.
CO5	Know about land-use transport interactions, transport related land-use models, their use in transportation planning, statewide and regional transportation planning.

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5. Syllabus:

MODULE-I. Transportation planning: - Transportation planning methodology, hierarchical levels of planning-statewide, regional, urban, passenger and goods transportation. General concept and process of transport planning.

MODULE –II Urban transportation planning, urban travel characteristics: private and public, travel behavior analysis. Travel demand estimation and forecasting. Trip classification and socio- economic variables in trip making, trip generation: multiple regression analysis, category analysis, comparative study.

MODULE -III Modal split analysis-traditional analysis: - Modal split analysis-traditional analysis, behavioral approach to mode choice, two-stage modal split models. Trip distribution: Growth factor method, gravity model, intervening opportunity and competing opportunity models, comparative study. Entropy maximizing method and linear programming method in trip distribution.

MODULE -IV Traffic assignment: - network assignment, capacity restrained and simultaneous, distribution assignment methods. Direct demand models of transport planning.

MODULE -V Land-use transport planning: - land-use transport interactions, transport related land-use models, their use in transportation planning. Corridor type travel planning, statewide and regional transportation planning.

BOOKS AND REFERENCES:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
3. Sharma, S.K., "Principles and Design of Highway Engineering", S. Chand & Co.
4. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros.Roorkee, India.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

TRANSPORTATION PLANNING LAB

SUB-CODE: EMTE 1102 P **CREDIT: 2**

Course Objective:

- To be know about basics of planning survey.
- Investigate the characteristics and applications of various types of planning survey and their uses.
- Gain experience through laboratory experiments, design of small projects to reinforce theoretical concepts and develop practical skills.

Course Outcomes:

At the end of the course the students are able to:

- Ability to implement the characteristics and applications of various types of planning survey.
- Ability to design and develop practical skills.
- Ability to simulate and implement Gain experience through laboratory experiments, and design projects.

Syllabus:

List of Experiment:-

Week 1:- To study about Speed and Delay Study.

Week 2:- Economic Studies of a particular area for planning survey.

Week 3:- Traffic or road use Studies of a particular area for planning survey.

Week 4:- Financial Studies of a particular area for planning survey.

Week 5:- Engineering studies of a particular area for planning survey.

Week 6:- Estimation of possible developments in all aspects due to the proposed highway development in a particular area.

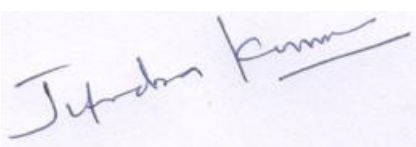
Week 7:- Finalising the Layout of different possible routes of any highway and choose the best of them

REFERENCE BOOKS:

1. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros.Roorkee, India.
2. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

Additional Learning Sources:-

6. Web links to e-learning: NPTEL.
7. Web links to e-learning: NCTEL.



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School of Engineering & Technology.

DEPARTMENT OF CIVIL ENGINEERING

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Programme Structure	M. Tech (Transportation Engineering)
Semester	1ST
Subject Code	EMTE 1103
Course Name	Highway Material and Testing
Course Credits	3 (L) + 2(P)= 5
Total Course Credit	90

Abbreviations: L-Lecture, P-Practical, T- Tutorial

1. **Course Overview:**
   To learn about Highway Material and its Testing which help to understand bout the properties and behaviour of highway materials for their uses in highway construction. These are essential parts for any transportation engineering and design point of view.
2. **Prerequisite:** To understand the fundamental of highway engineering and different terminology related to highway engineering.
3. **Objective of the Syllabus:**
   This course Highway Material and Testing is an essential part of Transportation engineering. These objectives are to provide students with a comprehensive understanding about highway materials used and their testing for uses in highway construction and planning.
4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Understands about of Highway Materials, Aggregates, Blending of aggregates by Rothfutch, Triangular Chart, Trial and error and mathematical proportioning methods.
CO2	Know about Bituminous Materials, tar and bitumen, uses and application of different bituminous materials in highway construction, grades of bitumen and tar, foam asphalt.
CO3	Understanding about Bituminous Mixes, Requirements of bituminous mixes, Design of bituminous mixes by Marshall, Hubbard Field, Hveem and Triaxial test methods.
CO4	Understanding about Materials for Low-Cost Roads, Stabilized soils, Lime Fly Ash, Soil-cement and soil bitumen stabilization. Soft aggregates,low Cement Concrete.

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CO5	Know about Cement Concrete Mixes, Proportioning of concrete mixes by absolute volume method, Kennedy's method, and design method for vibrated concrete.

5. Syllabus:

Module-I Highway Materials: Aggregates, Blending of aggregates by Rothfutch, Triangular Chart, Trial and error and mathematical proportioning methods. Classification, nomenclature, quality and manufacture of aggregates with respect to W.B.M., bituminous and concrete roads.

Module -II Bituminous Materials: Classification and various terms used related to tar and bitumen, uses and application of different bituminous materials in highway construction. Origin and preparation of different grades of bitumen and tar used for road construction. The Rheology of bituminous binders, Adhesion of binders to road aggregates and mechanism of stripping and adhesion failures, Weathering of bituminous road materials, Admixtures, rubber, tar bitumen and foam asphalt.

Module -III Bituminous Mixes: Requirements of bituminous mixes. Methods of bituminous mix design and their suitability, advantages and disadvantages. Design of bituminous mixes by Marshall, Hubbard Field, Hveem and Triaxial test methods.

Module -IV Materials for Low-Cost Roads: Stabilized soils, Lime Fly Ash, Soil-cement and soil bitumen stabilization. Soft aggregates, low Cement Concrete.

Module -V Cement Concrete Mixes: -Proportioning of concrete mixes by absolute volume method, Road Note No. 4 method, Kennedy's method, Talbot Richart method and design method for vibrated concrete.

BOOKS AND REFERENCES:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
3. Sharma, S.K., "Principles and Design of Highway Engineering", S. Chand & Co.
4. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros.Roorkee, India.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

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HIGHWAY MATERIAL AND TESTING LAB

SUB-CODE: EMTE 1103 P **CREDIT: 2**

Course Objective:

- To be know about basics of Highway materials and their testing.
- Investigate the characteristics and applications of various types of highway materials and their uses.
- Gain experience through laboratory experiments, design of small projects to reinforce theoretical concepts and develop practical skills.

Course Outcomes:

At the end of the course the students are able to:

- Ability to implement the characteristics and applications of various types of Highway materials.
- Ability to design and develop practical skills.
- Ability to simulate and implement Gain experience through laboratory experiments, and design projects.

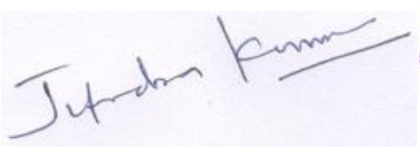
Syllabus:

List of Experiment:-

Week 1. Aggregate durability test.
Week 2. E.V.T. test for tar and bitumen.
Week 3. Modulus of deformation by Triaxial test.
Week 4. Marshall test for bituminous mix design.
Week 5. Hubbard Field test.
Week 6. Hveem Stabilometer and Cohesiometer test.
Week 7. Triaxial test.
Week 8. Compaction test on Cement mix.
Week 9. Unconfined compression strength test on Cement.
Week 10. Wetting and Drying test on Cement.
Week 11. Freezing and Thawing test on Cement.
Week 12. C.B.R. test on Cement.

REFERENCE BOOKS:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.



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2. Kadiyali, L.R., “Traffic Engineering and Transportation Planning”, Khanna Publishers.

Additional Learning Sources:-

3. Web links to e-learning: NPTEL.
4. Web links to e-learning: NCTEL.

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Department of Civil Engineering.

Programme Structure	M. Tech (Transportation Engineering))
Subject Code	EMTE1104
Course Name	Highway Geometric Design
Course Credits	3(T) +1 (T)= 4
Total Course Credit	90

Abbreviations: T-Theory, P-Practical

1. Course Overview:

Highway geometric design focuses on creating safe, efficient, and comfortable roadways for vehicular traffic. This course typically covers principles of alignment, cross-section elements, and intersections. Students learn about horizontal and vertical alignments to ensure smooth vehicle movement and safety. Cross-section elements, such as lane widths, shoulders, and medians, are studied to optimize traffic flow and accommodate varying road users.

2. Prerequisite:

Students are generally expected to have completed comprehensive traffic surveys and analyses are essential to understand current and projected traffic volumes, vehicle types, and speeds. These surveys help determine design criteria such as lane width, shoulder width, and curvature requirements.

3. Objective of the Syllabus:

To equip students with the knowledge and skills necessary to plan, design, and analyze the geometric elements of highways and roads. This includes understanding principles of alignment, cross-section, and intersections to ensure safe and efficient transportation of vehicles. Students learn to apply engineering principles, standards, and guidelines to create designs that accommodate various factors such as traffic volume, speed, terrain, and environmental considerations.

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4.Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Students will grasp the essential design controls and criteria necessary for highway geometric design. They will learn to assess the influence of topography and physical features on road layout, understand the impact of various traffic characteristics on geometric design, and prioritize speed and safety considerations.
CO2	Focuses on cross-section elements essential for highway design. Students will gain proficiency in designing pavement surfaces with appropriate characteristics like cross slope and lane width.
CO3	Delves into horizontal alignment principles, where students will master the design of horizontal curves. This includes determining maximum curvature, calculating super elevation rates, incorporating transition curves, and ensuring proper super elevation runoff.
CO4	Focus to vertical alignment, where students will learn about gradients and how to compensate for grades at curves. They will develop skills in designing climbing lanes and shaping vertical curves to ensure smooth transitions on the roadway.
CO5	Addresses the geometric aspects of at-grade intersections and grade separations. Students will master the design of geometric elements at intersections, including alignment profiles, median openings, and median lanes.

5. **Syllabus:**

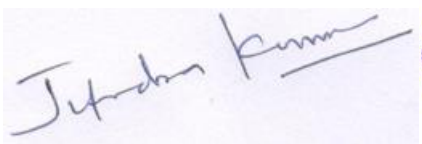
Unit-I

Design controls and Criteria: Topography and physical features, traffic, impact of vehicular characteristics on road geometrics, speed and safety.

Roadway Capacity Analysis and Design of Lane Requirements: 2 lane, 4 lane divided and undivided, multilane, freeway, expressways.

Unit-II

Cross-section Elements : Pavement surface characteristics, cross slope, lane width, Curbs, shoulders, drainage channels and side slopes, medians, frontage roads and outer separations. Single lane, 2-lane, 3-lane and multilane highways, freeway and expressways.



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Sight Distance: Analysis of stopping and passing sight distance, discussions of factors involved, discussion on I.R.C. specifications for measurements of sight distances.

Unit-III

Horizontal Alignment: Principles of horizontal curve design, maximum curvature, super elevation rates, transition curves, super-elevation runoff, attainment of super elevation for undivided and divided highways, distribution of e and f, IRC specifications. Pavement widening on curves, sight distance on horizontal curves.

Unit-IV

Vertical Alignment : Gradients, compensation of grade at curves, design of climbing lanes, shape of vertical curves, procedure for design of summit and valley curves, design of humps. Combination of horizontal and vertical alignment.

Unit-V

Geometrics of At-grade intersection: Geometric elements, alignment and profile at intersections, median openings, median lanes. Rotary, intersection. Geometrics of grade separation and interchanges. Geometric Design for Parking-Parking space design for on street and off-street parking, layout of parking garages

BOOKS AND REFERENCES

Reference Books

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
3. Sharma, S.K., "Principles and Design of Highway Engineering", S. Chand & Co.
4. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros. Roorkee, India.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

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Department of Civil Engineering.

Programme Structure	**M. Tech (Transportation Engineering))**
Subject Code	**EMTE 1105**
Course Name	**Highway Equipment's and machinery**
Course Credits	**3 (L)+ 1(T)= 4**
Total Course Credit	**90**

Abbreviations: L-Theory Lecture, P-Practical, T- Tutorial

1. Course Overview:

A course on highway equipment and machinery focuses on the essential tools and machines used in the construction, maintenance, and management of highways and other road infrastructures. It covers a wide range of equipment including excavators, bulldozers, graders, pavers, compactors, and milling machines. The course typically begins with an introduction to the types of projects that require such machinery, followed by detailed discussions on the functionalities, operational techniques, and maintenance practices for each type of equipment.

2. Prerequisite:

Essential prerequisites include heavy-duty vehicles such as bulldozers, excavators, and graders for earthmoving and leveling tasks. Asphalt pavers and compactors are crucial for laying and smoothing road surfaces, while milling machines are needed for removing old pavement.

3. Objective of the Syllabus:

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To provide students with a comprehensive understanding of the various types of equipment and machinery used in the construction, maintenance, and management of highways. This includes an in-depth study of the operational principles, capabilities, and limitations of different machinery, such as excavators, bulldozers, graders, and asphalt pavers. The syllabus aims to equip students with the knowledge required to select appropriate machinery for specific tasks, understand maintenance procedures, and ensure safety and efficiency in highway construction projects.

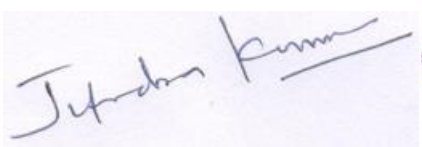
4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Students will gain a foundational understanding of various types of highway construction equipment. They will be able to identify and explain the purpose of different machinery used in highway construction, including bulldozers, graders, and excavators.
CO2	Students will learn about the different types of earthmoving and excavation equipment such as scrapers, loaders, and backhoes. They will understand the selection criteria for these machines based on site conditions and project requirements.
CO3	Students will explore the various types of compaction equipment including rollers and compactors. They will understand the principles of soil compaction and the significance of achieving desired compaction levels for pavement durability.
CO4	Students will delve into the machinery used for paving operations such as asphalt pavers and concrete paving machines. They will learn about the operational principles, calibration, and maintenance of paving equipment.
CO5	Students will gain knowledge on the types of maintenance required for highways and the machinery used to perform these tasks efficiently. They will also understand the importance of regular maintenance to extend the lifespan of highway infrastructure.

5.Syllabus:

Unit-I

Selection of highway equipment's:- Operating cost; depreciation cost, calculation by different



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methods; economic life of Highway equipment; manual and mechanical method of Highway construction; Tractors, uses and types, gradability; bulldozers, types, operation; Ripping of rock, types of rippers, economy of ripping rock.

Unit-II

Soil compaction:- Soil compaction, types of compacting equipment's & their output; scrapers, types, operation, cycle time, output, load growth curve; Power shovels, size of power shovel, basic parts and operation, factors affecting output of power shovel; draglines basic parts and operation, factors affecting its output.

Unit-III

Trucks and Wagons:- General features, types, matching of size of truck and power shovel; Belt Conveyor, its economy, idlers, power required to drive, driving equipment, hold backs, feeders, trippers; Crushers, Jaw crusher, Roll crusher Road and Ball Mill, selection of crushing equipment, screening aggregate, handling crushed stone aggregate.

Unit-IV

Instrument Used for Road Construction: - Cement concrete mixers, proportioning of concrete mixtures, fresh concrete, batching of concrete materials. Tilting concrete mixer, concrete batching plant, Transit mixer, ready mixed concrete, placing of concrete; vibrators, types, cold water & hot water curing of concrete, slip form pavers.

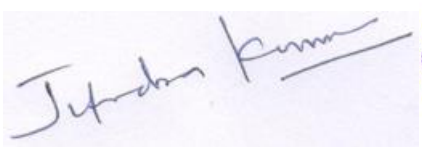
Unit-V

Drilling:- Drilling rock and earth, types of drilling machines, selection of drilling method and machine, selecting drilling pattern, rate of drilling rock; Blasting of rock, dynamite, ammonium nitrate explosives, slurries, stemming, firing charges, safety fuse, electric blasting cap, delay blasting caps, handling misfire, presplitting rock, spacing of blast holes.

BOOKS AND REFERENCES

Reference Books

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
3. Sharma, S.K., "Principles and Design of Highway Engineering", S. Chand & Co.
4. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros.Roorkee, India.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.



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Programme Structure	**M. Tech (Transportation Engineering))**
Subject Code	**EMTE1201**
Course Name	**Traffic Engineering & Field Studies**
Course Credits	**3 (T) + 2 (P)= 5**
Total Course Credit	**90**

Abbreviations: T-Theory, P-Practical

1. Course Overview:

This course provides an in-depth exploration of traffic engineering principles and practices, with a focus on field studies and real-world applications. It covers the fundamental concepts of traffic flow, traffic control devices, traffic signal systems, and data collection methods. Students will gain hands-on experience through field studies, data analysis, and practical projects.

2. Prerequisite:

A foundational course covering the basics of transportation systems, transportation planning, and traffic flow theory.

3. Objective of the Syllabus:

The syllabus for the Traffic Engineering and Field Studies course aims to provide students with a comprehensive understanding of traffic engineering principles and practices, emphasizing both theoretical knowledge and practical application. It seeks to equip students with detailed knowledge of various traffic control devices and the skills to design and evaluate traffic signal systems.

Course Outcomes:

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S. No.	Course Outcomes (Cos)
CO1	Understand the principles of traffic engineering and its importance in transportation systems.
CO2	Describe different types of traffic flow characteristics such as speed, volume, and density. Analyze factors influencing traffic flow, including road geometry and traffic control devices.
CO3	Demonstrate proficiency in collecting traffic data using various methods such as manual counts, automatic counters, and video surveys.
CO4	Evaluate the effectiveness of traffic management and control measures in optimizing traffic flow and safety.
CO5	Understand the principles of traffic safety and accident causation.

5.Syllabus:

Unit-I

Introduction to probability, statistics and regression; Macroscopic and microscopic traffic parameters: distance headway, time headway, speed, flow, density.

Unit-II

Traffic flow models: macroscopic and microscopic; car-following models; Shock waves, Scope of traffic engineering, Traffic characteristics, Vehicular characteristics.

Unit-III

Capacity and level of service: Indian and American practice; Traffic capacity studies.

Unit-IV

Design of traffic facilities: un-signalized and signalized intersections, inter changes, expressways, parking areas, traffic signs & Signal Design; Simulation of traffic streams. Traffic operation,

Unit-V

Traffic surveys: Speed, volume, delay, origin and destination, Design of parking, accident studies, Traffic islands, Design of intersections.

BOOKS AND REFERENCES

Reference Books

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.

2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.

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3. Sharma, S.K., “Principles and Design of Highway Engineering”, S. Chand & Co.

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5. Papacostas, C.S. and Prevedouros, P.D., “Transportation Engineering and Planning”, Prentice Hall.

Traffic Engineering & Field Studies Lab SUB-CODE: EMTE1201 P CREDIT: 2

Course Objective:

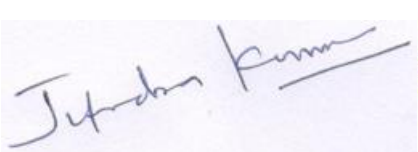
- Enable students to apply theoretical concepts learned in traffic engineering courses to real-world situations through laboratory experiments and field studies.
- Equip students with practical skills in traffic data collection, including the use of manual and automated methods for measuring traffic flow, speed, and other relevant parameters.
- Teach students how to analyze and interpret traffic data using statistical and computational tools, leading to meaningful insights and solutions to traffic problems.
- Familiarize students with traffic simulation and analysis software, enabling them to model traffic scenarios and evaluate the impacts of various traffic management strategies.

Course Outcomes:

At the end of the course the students are able to:

Students will have the ability to apply fundamental traffic engineering principles to real-world scenarios through practical field studies and laboratory experiments. They will be proficient in using manual and automated methods for traffic data collection, such as traffic counts and speed measurements, and will effectively analyze and interpret this data using statistical and computational tools. Students will be capable of assessing the effectiveness of various traffic control devices and signal systems, designing and optimizing traffic signal timing plans, and utilizing traffic simulation software to model traffic scenarios and propose effective solutions.

Syllabus:



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Week 1: Traffic surveys like traffic volume count, speed study, parking study, intersection turning movements, speed & delay study.

Week 2: Moving observer survey.

Week 3: Origin–destination surveys.

Week 4: Road side and house hold interviews.

Week 5: Road lighting.

Week 6: Traffic noise measurement.

Week 7: Measurement of road user characteristics.

Week 8: Use of automatic traffic recording equipment

REFERENCE BOOKS:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.

2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers

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Programme Structure	M. Tech (Transportation Engineering))
Subject Code	EMTE1202
Course Name	Bridge Engineering
Course Credits	3 (T) + 1(T)= 4
Total Course Credit	90

Abbreviations: T-Theory, P-Practical

1. **Course Overview:**
   Bridge engineering is a specialized field within civil engineering that focuses on the design, construction, and maintenance of bridges. The course typically covers a wide range of topics, including the principles of structural analysis, material science, and the mechanics of various bridge types such as beam, truss, arch, suspension, and cable-stayed bridges. Students learn about load calculations, stress analysis, and the impact of environmental factors on bridge integrity.
2. **Prerequisite:**

Students are usually required to have completed coursework in basic civil engineering, structural analysis, and mechanics of materials.

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3. Objective of the Syllabus:

To equip students with a comprehensive understanding of the theoretical and practical aspects of bridge design and construction. It aims to develop their skills in structural analysis and the application of engineering principles to ensure the safety, functionality, and durability of bridges. The syllabus seeks to familiarize students with various types of bridges, their structural components, and the materials used in their construction.

4. Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Students will develop a foundational understanding of bridge engineering, including the historical development of bridges, their importance in transportation infrastructure, and the role of bridge engineers.
CO2	Will focus on the principles of structural mechanics and materials science as they relate to bridge engineering.
CO3	Students will explore the various types of bridge structures, including beam bridges, arch bridges, suspension bridges, and cable-stayed bridges.
CO4	Students will learn the principles and methodologies of bridge design and analysis.
CO5	Will focus on the construction and maintenance of bridge structures.

5. Syllabus:

Unit-I

Introduction, historical review, engineering and aesthetic requirements in bridge design; Introduction to bridge codes; Economic evaluation of a bridge project; Site investigation and planning; Scour - factors affecting and evaluation.

Unit-II

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs.

Unit-III

Girder bridges - types, load distribution, design; orthotropic plate analysis of bridge decks. Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges.

Unit-IV

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Methods of construction of R.C Bridges, Prestressed concrete bridges and steel bridges Fabrication, Launching & creation;

Unit-V

Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

BOOKS AND REFERENCES

Reference Books

1. V. K. Raina, Concrete Bridges Practice – Analysis, Design and Economics, Shroff Publications, New Delhi 2nd Ed. 2005.
2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, Khanna Publishers, 2nd Ed. 2008.
3. IRC codes for Road bridges- IRS Sec –I , II, III
4. IRS Codes of Practice for Railway bridges.
5. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

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Department of Civil Engineering.

Programme Structure	M. Tech (Transportation Engineering))
Subject Code	EMTE1203
Course Name	Highway Construction
Course Credits	3 (T) + 3 (P)= 6
Total Course Credit	90

Abbreviations: T-Theory, P-Practical

1. **Course Overview:**

   Highway construction is a vital area within civil engineering that deals with the planning, design, and building of road networks. The course covers a broad spectrum of topics, including the fundamentals of transportation engineering, geometric design, pavement materials, and construction methods. Students are introduced to the principles of soil mechanics, drainage systems, and the environmental impact of highway projects.

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2. Prerequisite:

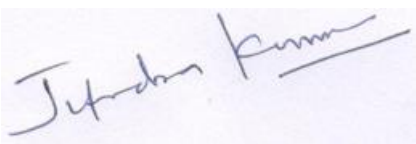
Students are generally expected to have completed introductory courses in civil engineering, which cover basic concepts in structural analysis, materials science, and fluid mechanics. Knowledge of surveying and geomatics is also essential, as these skills are critical for planning and laying out highway routes. A background in soil mechanics and geotechnical engineering is necessary to understand the properties and behavior of soil and other materials used in highway construction.

3. Objective of the Syllabus:

To provide students with a thorough understanding of the planning, design, and construction processes involved in creating and maintaining roadways. The syllabus aims to equip students with the knowledge of modern engineering principles and practices essential for constructing durable, efficient, and safe highways. It covers a broad range of topics, including soil mechanics, pavement design, traffic engineering, drainage systems, and the environmental impact of highway projects.

4. Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	students will gain an understanding of the fundamental principles of highway engineering, including the history, importance, and classifications of highways
CO2	Students will be proficient in identifying and evaluating various materials used in highway construction, such as aggregates, asphalt, and concrete.
CO3	Students will gain a comprehensive understanding of highway geometric design principles, including alignment, cross-section elements, and sight distance considerations.
CO4	Students will be able to design flexible and rigid pavements using appropriate methods and materials.
CO5	Students will learn about the various construction techniques and equipment used in highway construction projects.



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5. **Syllabus:**

Unit-I

Earthwork and soling: - selection of soil construction of embankments excavation and compaction equipment field and laboratory test for quality control a stone soling brick soling current practices. Construction of earth roads gravel Road soil stabilized roads water bound macadam bricks stones

Unit-II

Bituminous construction:- Properties requirements and specifications of materials equipments and plants detailed construction procedure of each type field and laboratory tests for quality control choice of binders under different conditions IRC British and most specifications

Unit-III

Recommendations under Indian conditions:- bituminous surface treatments interface treatments prime coat tack coat surface dressing and Seal coat grouted or penetration macadam bituminous bound macadam Sheet Asphalt bituminous concrete mastic Asphalt dense tar surfacing.

Unit-IV

Cement concrete road construction: - necessity of providing a base course under cement concrete road construction selection of materials constructions methods detailed construction procedure quality control tests (lab and field). Construction Equipment's

Joints in cement concrete pavements classification of various types of joints necessity of providing each type method of construction of joints load transfer devices dowel bars tie bars joint filler and sealer materials IRC specifications.

Unit-V

Reinforced cement concrete road construction:- the city of providing reinforcement in cement concrete pavements continuously reinforced concrete pavement pre-stressed concrete pavements and fiber reinforced concrete pavements pre-stressed concrete pavements and fiber reinforced concrete pavements selection of the mix compaction method and construction procedure for each type recommendations under Indian conditions construction planning and management CPM/PERT in highway construction.

BOOKS AND REFERENCES

Reference Books

1. V. K. Raina, Concrete Bridges Practice – Analysis, Design and Economics, Shroff Publications, New Delhi 2nd Ed. 2005.

2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, Khanna Publishers, 2nd Ed. 2008.

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3. IRC codes for Road bridges- IRS Sec –I , II, III

4. IRS Codes of Practice for Railway bridges.

5. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

Highway Construction Lab **SUB-CODE:EMTE1203P** **CREDIT: 3**

Course Objective:

- Familiarizing students with the properties, testing, and quality control of materials such as asphalt, concrete, aggregates, and soil used in highway construction.
- Developing proficiency in various laboratory testing techniques and equipment to assess material properties, including compaction tests, pavement strength tests, and soil stability tests.
- Applying design principles to create and analyze models of highway components, such as pavements and drainage systems, and evaluating their performance under simulated conditions.
- Gaining practical insights into construction practices, including site preparation, material handling, and equipment operation.

Course Outcomes:

At the end of the course:

Students will have the ability to do practical, hands-on experience and a deeper understanding of the principles and techniques involved in highway engineering. Upon completion of the lab, students will be proficient in conducting various field and laboratory tests to assess the properties and suitability of construction materials such as soil, aggregates, asphalt, and concrete. They will gain practical skills in using modern surveying instruments and techniques to measure and layout highway alignments. Students will also be able to analyze and interpret test data to make informed decisions regarding material selection and construction methods.

Syllabus:

Week 1: Testing of aggregates - fine and coarse as per BIS procedure.

Week 2: Testing of cement with reference to IS specifications and cement grade.

Week 3: Concrete mix design for desired grade from given materials.

Week 4: Study of effect of compaction on strength of concrete

Week 5: Study the effect of plasticizers on workability of concrete.

Week 6: Study the permeability of concrete.

Week 7: Design and testing of workability of concrete for a given C.C proportion.

Week 8: Design and determination of cube strength with given materials and proportions.

REFERENCE BOOKS:

1. V. K. Raina, Concrete Bridges Practice – Analysis, Design and Economics, Shroff Publications, New Delhi 2nd Ed. 2005.

2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, Khanna Publishers, 2nd Ed. 2008.

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DEPARTMENT OF CIVIL ENGINEERING

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Programme Structure	M. Tech (Transportation Engineering)
Semester	2nd
Subject Code	EMTE 1204
Course Name	Analysis and Structural Design of Pavements
Course Credits	3 (L) + 2(P)= 5
Total Course Credit	90

Abbreviations: L-Lecture, P-Practical, T- Tutorial

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1. **Course Overview:**
   To learn about Analysis and Structural Design of Pavements which help to understand bout the design of pavement by structural point of view and their analysis. These are essential parts for any transportation engineering and design.
2. **Prerequisite:** To understand the fundamental of highway engineering terminology and basic mathematics.
3. **Objective of the Syllabus:**
   This course Analysis and Structural Design of Pavements is an essential part of Transportation engineering. These objectives are to provide students with a comprehensive understanding about highway pavement design and their analysis.
4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Understands about Theories of pavement design and the Factors that affecting pavement design.
CO2	Know about Different Methods used for flexible pavement design and the applications of CBR, Burmister, Asphalt Institute, AASHTO and IRC methods.
CO3	Understanding about Load and temperature stresses developed in rigid pavements. Westergaard's, Bradburry's and Picket's concepts that used for calculating stresses.
CO4	Understanding about the different methods used for Design of rigid pavement, like PCA, AASHTO and IRC methods**.**
CO5	Know about Design of joints in rigid pavements, Evaluation of pavement distress,Design aspects of flexible and rigid overlays.

5. **Syllabus:**

MODULE-I Theories of pavement design, Factors affecting pavement design.

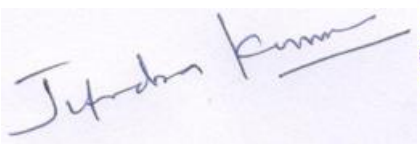
MODULE -II Methods of flexible pavement design applications of CBR, Burmister, Asphalt Institute, AASHTO and IRC methods.

MODULE -III Load and temperature stresses in rigid pavements- Westergaard's, Bradburry's and Picket's concepts.

MODULE -IV Design of rigid pavement by PCA, AASHTO and IRC methods**.**

MODULE -V Design of joints in rigid pavements; Evaluation of pavement distress; Design aspects of flexible and rigid overlays.

BOOKS AND REFERENCES:



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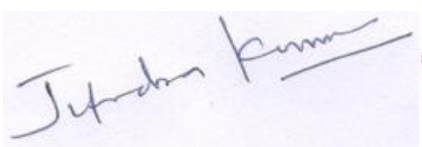
3. IRC codes for Road bridges- IRS Sec –I , II, III
4. IRS Codes of Practice for Railway bridges.
5. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

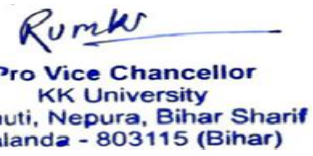
ANALYSIS AND STRUCTURAL DESIGN OF PAVEMENTS LAB

SUB-CODE: EMTE 1204 P **CREDIT: 2**

Course Objective:

- To be know about basics of Structural Design of Pavements and their analysis.
- Investigate the characteristics and applications of various types of highway pavements and their design.
- Gain experience through laboratory experiments, design of small projects to reinforce theoretical concepts and develop practical skills.



Course Outcomes:

At the end of the course the students are able to:

- Ability to implement the characteristics and applications of pavement design.
- Ability to design and develop practical skills.
- Ability to simulate and implement Gain experience through laboratory experiments, and design projects.

Syllabus:

List of Experiment:-

Week 1. C.B.R. test on pavement subgrade materials.
Week 2. Using of Plate bearing test for pavement design.
Week 3. Marshall stability test for optimum content of bitumen binder.
Week 4. Study of Benkelman Beam test for evaluating the wearing course.
Week 5. Tri-axial compression test for checking soil strength of pavement soil.
Week 6. Study of California Resistance value test.
Week 7. Study of Equivalent single wheel load(ESWL).
Week 8. Study of Group index method for design of flexible pavement design.
Week 9. Study of Burmister method for design of flexible pavement design.
Week 10. Study of California Bearing ratio method for design of flexible pavement design.
Week 11. Study of Wheel Load Stress in Rigid pavement.
Week 12. Study of IRC recommendations for Design of Concrete pavement.

REFERENCE BOOKS:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.

Additional Learning Sources:-

6. Web links to e-learning: NPTEL.
7. Web links to e-learning: NCTEL.
8.

Semester	2nd
Subject Code	EMTE 1205
Course Name	Road Safety Engineering
Course Credits	3 (L) + 1(T)= 4
Total Course Credit	90

Abbreviations: L-Lecture, P-Practical, T- Tutorial

1. **Course Overview:**
   To learn about Road Safety Engineering which help to understand bout the Road safety by Engineering point of view and their analysis. These are essential parts for any transportation engineering and design.
2. **Prerequisite:** To understand the fundamental of highway engineering terminology.
3. **Objective of the Syllabus:**
   This course Road Safety Engineering is an essential part of Transportation engineering. These objectives are to provide students with a comprehensive understanding about road safety measures and its impact.
4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Understands about the Road safety management system, Statistical interpretation and analysis of crash data.
CO2	Know about Road safety audits, Safety considerations on completed roads and in work zone, Crash reconstruction, and Mitigation measures.
CO3	Understanding about Accident Analysis and its investigation, Objectives of accident studies, Causes of road accidents and study of Accident statistics.
CO4	Understanding about Accident reconstruction, Poisson impact theory, Energy theory, Angular collision.
CO5	Know about Safety measures related to enforcement and education.

5. **Syllabus:**

MODULE-I Introduction to safety; Road safety management system; Statistical interpretation and analysis of crash data.

MODULE -II Road safety audits; Safety considerations on completed roads and in work zone; Crash reconstruction; Mitigation measures.

MODULE -III Accident Analysis, Accident investigation, Objectives of accident studies, Causes of road accidents, Accident statistics.

MODULE -IV Accident reconstruction, Poisson impact theory, Energy theory, Angular collision.

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MODULE -V Safety measures, Safety measures related to enforcement, Safety measures related to education.

BOOKS AND REFERENCES:

1. V. K. Raina, Concrete Bridges Practice – Analysis, Design and Economics, Shroff Publications, New Delhi 2nd Ed. 2005.
2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, Khanna Publishers, 2nd Ed. 2008.
3. IRC codes for Road bridges- IRS Sec –I , II, III
4. IRS Codes of Practice for Railway bridges.
5. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

Additional Learning Sources:-

1. Web links to e-learning: NPTEL.
2. Web links to e-learning: NCTEL.

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Programme Structure	M. Tech (Transportation Engineering)
Semester	2nd
Subject Code	EMTE 1206
Course Name	Planning and Design of Airports
Course Credits	3 (L) +1 (T)= 4
Total Course Credit	90

Abbreviations: L-Lecture, P-Practical, T- Tutorial

1. **Course Overview:**
   To learn about Planning and Design of Airports which help to understand bout the Planning and Design of Airports by Engineering point of view and their analysis. These are essential parts for any transportation engineering and design.
2. **Prerequisite:** To understand the fundamental of highway engineering terminology.
3. **Objective of the Syllabus:**
   This course Planning and Design of Airports is an essential part of Transportation engineering. These objectives are to provide students with a comprehensive understanding about Airport design and its planning. History and development of aviation. Air traffics trend in India, aviation organizations and their functions.
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4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Understands about the Airport Planning, Aircraft characteristics, airport master plan, Site selection, air traffic demand analysis, obstruction clearance requirements.
CO2	Know about the Geometric design of landing area. Airport classification, runway and taxiway geometric standards, exit taxiways, separation and clearances.
CO3	Understanding about the Capacity and delays, Runway capacity, factors affecting capacity, capacity related and not related with delay, gate capacity.
CO4	Understanding about Terminal area, facilities to be provided at terminal, space requirements, number and size of gate positions. Aircraft Parking System Visual aids.
CO5	Know about the Air traffic control, VASI, enroute air traffic controls. Heliports and STOL Ports, Heliport site selection, Airport Drainage. Design run-off, Inlet size.

5. **Syllabus:**

MODULE-I Airport Planning, Aircraft characteristics related to airport planning and design, airport master plan, Site selection, air traffic demand analysis and planning surveys, obstruction clearance requirements, airport zoning, airport configuration,

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hierarchic planning levels.

MODULE -II Geometric design of landing area. Airport classification, runway and taxiway geometric standards, exit taxiways, separation and clearances.

MODULE -III Capacity and delays, Runway capacity, factors affecting capacity, capacity related and not related with delay, gate capacity.

MODULE -IV Terminal area, facilities to be provided at terminal, space requirements, number and size of gate positions. Aircraft Parking System Visual aids, Airport day time markings, airport lighting, related visual aids, visibility.

MODULE -V Air traffic control, Definition and its importance, flight rule navigational aids, landing aids, VASI, enroute air traffic controls. Heliports and STOL Ports, Heliport site selection, STOL and VTOL aircrafts, STOL ports, obstruction and clearance requirements. Airport Drainage. Design run-off, Inlet size and location design, surface and subsurface drainage.

BOOKS AND REFERENCES:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros.
2. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers.
3. Sharma, S.K., "Principles and Design of Highway Engineering", S. Chand & Co.
4. Khanna, S.K. & Arora, M. G. "Airport Planning and Design", Nemi Chand & Bros.Roorkee, India.
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall.

Additional Learning Sources:-

1. Web links to e-learning: NPTEL.
2. Web links to e-learning: NCTEL.

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Programme Structure	M. Tech (Transportation Engineering)
Semester	3 rd
Subject Code	EMTE2101
Course Name	Railway Engineering
Course Credits	3 (L) + 1(T)= 4
Total Course Credit	90

Abbreviations: L-Theory Lecture, P-Practical, T- Tutorial

1. **Course Overview:**

   Railway engineering is a specialized field within civil engineering that focuses on the design, construction, and maintenance of Railways. The course typically covers a wide range of topics, including the principles of structural analysis, material science, and the mechanics of various Railway construction works. Students learn about load calculations, stress analysis, and the impact of environmental factors on Railway integrity.

2. **Prerequisite:**

   Students are usually required to have completed coursework in basic civil engineering and highway engineering.

3. **Objective of the Syllabus:**

To equip students with a comprehensive understanding of the theoretical and practical aspects of Railway design and construction. It aims to develop their skills in structural analysis and the application of engineering principles to ensure the safety, functionality, and durability of railways. The syllabus seeks to familiarize students with various types of railway construction works, their structural components, and the materials used in their construction.

4. **Course Outcomes:**

S. No.	Course Outcomes (Cos)
CO1	Students will develop a foundational understanding of Principles of Transportation, Transportation by Roads, railways, Airways, Waterways, their importance and limitations, Rails, Sleepers, Rail fastenings, Ballast
CO2	Will focus on the Geometric Design, Station & Yards,Points and Crossings & Signaling and Interlocking, Super elevation,Cant deficiency, Principles of signaling and inter-locking.
CO3	Students will explore the Bridge Site Investigation and Planning, Loading Standards &Component Parts, Hydraulic design, Bridge super structure and sub-structures, return walls, approaches, floors & flooring system.

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CO4	Students will learn the Bridge Foundations, Construction, Testing and Strengthening of Bridges Inspection, Data collection and Bridge failure.
CO5	Will focus on the Tunnels, Selection of route, Engineering surveys, tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining, Mucking Operation, Drainage and ventilation.

5. Syllabus:

MODULE-I

Introduction, Tractive Resistances & Permanent Way:-Principles of Transportation, Transportation by Roads, railways, Airways, Waterways, their importance and limitations, Route surveys and alignment, Railway track development and gauges, Hauling capacity and tractive effort,

Rails: types, welding of rails, wear and tear of rails, rail creep,

Sleepers: types and comparison, requirement of a good sleeper, sleeper density,

Rail fastenings: types, Fish plates, fish bolts, spikes, bearing plates, chain keys, check and guard rails.

Ballast: Requirement of good ballast, various materials used as ballast, quantity of ballast, different methods of plate laying, material trains, calculation of materials required, relaying of track.

MODULE -II

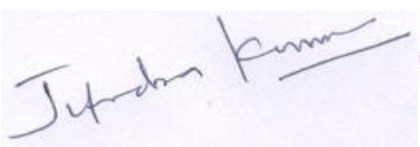
Geometric Design, Station & Yards; Points and Crossings & Signaling and Interlocking:-Formation, cross sections, Super elevation, Equilibrium, Cant and Cant deficiency,Various types of curves, speed on curves, Types, locations, general equipments, layouts, Marshalling yards, Definition, layout details, design of simple turnouts, Types of signals in stations and yards, Principles of signaling and inter-locking

MODULE -III

Bridge Site Investigation and Planning, Loading Standards &Component Parts:-Selection of site, alignment, Collection of bridge design data: essential surveys, Hydraulic design, Scour depth of bridge foundation, Economical span, clearance, afflux, type of road & railway bridges, Design loads and forces, Impact factor, Bridge super structure and sub-structures, abutments, piers, wing walls, return walls, approaches, floors & flooring system.

MODULE -IV

Bridge Foundations, Construction, Testing and Strengthening of Bridges:-Different types of foundation: piles and wells, Sinking of wells, coffer-dams, Choice of bridges and choice of materials, details of construction underwater and above water, Erection of bridges, girders, Equipments and plants, Inspection and Data collection, Strengthening of bridges, Bridge failure.



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MODULE -V

Tunnels:-Selection of route, Engineering surveys, alignment, Shape and size of tunnel, Bridge action, pressure relief phenomenon, Tunnel approaches, Shafts, pilot shafts, Construction, tunnels in soft soil, hard soil and rock, Different types of lining, methods of lining ,Mucking Operation,Drainage and ventilation.

Suggested Reading:-

1. Chakraborty and Das; Principles of transportation engineering; PHI
2. Rangwala SC; Railway Engineering; Charotar Publication House, Anand
3. Rangwala SC; Bridge Engineering; Charotar Publication House, Anand
4. Ponnuswamy; Bridge Engineering; TMH
5. Arora&Saxena, Railway Engineering - DhanpatRai& Sons
6. Antia K.F. , Railway Track
7. Bindra S.P. Principles and Practice of Bridge Engineering - DhanpatRai& Sons
8. Alagia J.S. Bridge Engineering - Charotar Publication House, Anand
9. Saxena S.C. (Dr.) Railway, Bridges & Tunnels
10. R. SrinivasanHarbour, Docks & Tunnel Engineering

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Additional Learning Sources:-

1. Web links to e-learning: NPTEL.
2. Web links to e-learning: NCTEL..

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School of Engineering & Technology.
Department of Civil Engineering.

Programme Structure	**M. Tech (Transportation Engineering))**
Semester	**3rd**
Subject Code	**EMTE 2102**
Course Name	**Mass transit system**
Course Credits	**3(L)+1 (T)= 4**
Total Course Credit	**90**

Abbreviations: L-Theory Lecture, P-Practical, T- Tutorial

1. Course Overview:

Mass Transit Systems focuses on an in-depth exploration of the principles, design, and operations of public transportation systems. It begins with an introduction to the historical development and significance of mass transit in urban planning. Students will learn about various types of transit systems, including buses, trams, light rail, subways, and commuter trains, and their respective roles in enhancing urban mobility. The course covers the planning and design aspects, focusing on route planning, station location, and the integration of transit systems with other modes of transportation.

2. Prerequisite:

Students are generally expected to have completed a comprehensive urban planning framework is essential, incorporating land use, population density, and future growth projections.

3. Objective of the Syllabus:

The primary objective of the syllabus for a course on Mass Transit Systems is to equip students with comprehensive knowledge and practical skills essential for planning, designing, implementing, and managing mass transit systems. The syllabus aims to provide a deep understanding of the fundamental concepts of mass transit, including its role in urban mobility, economic development, and environmental sustainability.

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4. Course Outcomes:

S. No.	Course Outcomes (Cos)
CO1	Understand the concepts of transit system and its operation.
CO2	Estimate transit demand.
CO3	Understand the concepts of bus route network planning and patterns.
CO4	Understand the concepts of Mass transit corridor identification.
CO5	Identify and evaluate Mass Transit corridors efficiently.

5. Syllabus:

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

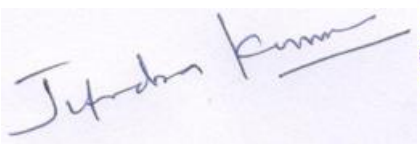
Estimation Of Transit Demand: Data requirements & Collection techniques, Conventional Methods - Destination Survey - Bus Stop Surveys and Analysis - Mode Split Models - Captive and Choice Riders - Attitudes of Travelers - Patronage Determination.

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 Optimization Technique – Load Factor - Depot Location - Spacing of Bus Stops; Bus Stops And Terminal Designs: 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.



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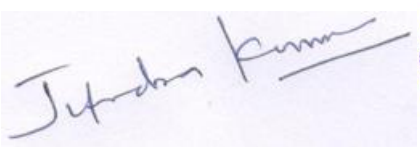
UNIT - V

Mass Transport Management Measures: Performance Indicators –- Preferential Treatment to HOV: Exclusive Bus Lanes - Bus Streets - Contra Flows - Reversible Lanes - Bus Bypass - Bus Preemption at Signals.

BOOKS AND REFERENCES

Reference Books

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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