



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Civil Engineering (Transportation Engineering)

Subject Code: ME02069131

Subject Name: Transportation Infrastructure Design

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

<b>Prerequisite:</b>	Urban Transportation System Planning and Traffic Engineering
<b>Rationale:</b>	The design of transportation infrastructure is integral to economic development, connectivity, safety, and sustainability. By optimizing cost efficiency, facilitating seamless mobility, and integrating multimodal transport systems, it enhances accessibility and elevates the quality of life. Strategic and sustainable planning fosters urban development, promotes inclusivity, and minimizes environmental impacts. Moreover, robust infrastructure ensures disaster resilience, reduces long-term maintenance costs, and incorporates innovative technologies to address evolving future demands

## Program Outcomes

No	
01	Engage in critical thinking and research to develop solutions to multifold real-world problems.
02	Communicate effectively with the engineering community at large level on complex design tasks & write and present technical reports.
03	Demonstrate a high level of professionalism in handling multidisciplinary and complex engineering problems.
04	Plan, assess, create, integrate, carry out, and oversee complex engineering projects in a sustainable local and global context.
05	Address societal issues by offering technologically advanced, reasonably priced solutions while upholding high standards of ethics and professionalism.

## Course Outcome:

After Completion of the Course, Student will be able to:

No	Course Outcomes	RBT Level
01	Design the geometric elements of highways based on performance analysis.	C
02	Appraise the requirements in terminal facility planning.	A
03	Assess the justification and design of at-grade intersections and grade-separated interchanges.	E



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04	Plan and design facilities for non-motorized modes of transport and wayside amenities.	C
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\*Revised Bloom's Taxonomy (RBT)

### Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

### Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	<b>Design of Highways:</b> Hierarchy of highway system, functions, design designations, concepts in horizontal & vertical alignment, integration, optical design, geometrical standards for mobility & accessibility components, walkway design, cycle track design, bridge architect, landscaping and safety considerations, evaluation and design of existing geometrics.	10	25
2.	<b>Performance analysis of geometric design:</b> Introduction, Guiding principles, Stakeholder considerations, Geometric design elements v/s performance categories, Geometric design performance measurements, Process Framework, Introduction to road design software.	8	15
3.	<b>Terminal Planning &amp; Design:</b> Terminal functions, analysis of terminals, process flow charts of passenger & goods terminals, terminal processing time, waiting time, capacity & level of service concept, study of typical facilities of highway, railway, airport and waterway terminals, Introduction to container terminals, concept of inland port.	9	20
4.	<b>Design of Intersections:</b> Types and Principles - At grade intersection: design elements, channelization, Rotary: Design and Capacity, Signalized intersection: warrants, design, Signal Co-ordination, Grade separated intersections:	9	20



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	warrants, types, geometric standards, Ramp design: entry and exit, Gore area design.		
5.	<b>Non-motorized transport and wayside amenities:</b> Design of facilities: non-motorized transport and pedestrians: design considerations, Design of Footpath, Zebra crossings, Foot over bridge, Under pass, Pedestrian precincts, Pedestrian actuated signals, wayside amenities, service area: site spacing, size and service facilities, bus-bays and truck lay-byes.	9	20
<b>Total</b>		<b>45</b>	<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	10	10	20	20	30

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

1. Kadiyali, L.R., Traffic Engineering and Transport Planning, Khanna publishers.
2. Salter, R J., Highway Traffic Analysis and Design, ELBS.
3. Edward K. Morlock, Introduction to Transportation Engineering & Planning, International Student Edition, Mc-Graw Hill Book Company, New York.
4. Khanna S.K., Arora M.G., Jain S.S., Airport Planning & Design, Nemchand Bros., Roorkee
5. Horenjeff Robert, The planning & Design of Airports, McGraw Hill Book Co.
6. Saxena S.C., Railway Engineering, Dhanpat Rai & Sons, 1995
7. Vukan R. Vuchic, Urban Transit : Operations, Planning and Economics, Wiley Sons Publishers.
8. Bindra S.P., Docks & Harbour Engineering, Dhanpat Rai Publications
9. Srinivasan R., Harbours, Docks & Tunnel Engineering, Charotar Publishing House, Anand, 1999.
10. Bose J. W., Handbook of Terminal Planning, Springer, 2020.
11. IRC 73: Geometric design standards for rural (non-urban) highways
12. IRC 86: Geometric design standards for urban roads and streets
13. IRC 92: Guidelines for the design of interchanges in urban areas
14. IRC 93: Guidelines for design and installation of road traffic signals
15. IRC: MORTH Guidelines for expressways, Volume II: Design



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16. IRC-SP41: Guidelines for the design of at-grade intersections in rural and urban Areas
17. IRC-38-1988: Guidelines for Design of horizontal curves for Highway and design tables
18. IRC-103-2012: Guidelines for Pedestrian Facilities (First Revision)
19. IRC-11-2015: Recommended Practice for the Design and Layout of Cycle Tracks (First Revision)
20. Morlock, E. K., Introduction to Transportation Engineering and Planning, International Student Edition, McGraw-Hill Book Company, New York, 1992.
21. NCHRP Report 659: Guide for the geometric design of driveways.
22. Transportation Research Board, Airport Passenger Terminal Planning and Design, Volume 1: Guidebook, 2010.

**(b) Open source software and website:**

1. <https://nptel.ac.in/courses/105101087/>
2. <https://nptel.ac.in/courses/105101008/>
3. <https://nptel.ac.in/courses/105101008/47>
4. <https://nptel.ac.in/courses/105104098/>
5. <https://freevideolectures.com/subject/civil-engineering/>
6. <https://freevideolectures.com/course/2673/transportation-engineering-ii>

**Suggested Course Practical List:**

The practical may include study of existing traffic facility which includes various surveys, Data Collection for design, Study of various codes of practice and implementation. The students will work in group for the design work based on syllabus such as

1. Design of at-grade intersections, signalized intersection and/or grade separated intersections.
2. Design of facilities required for non-motorized transport and pedestrians.
3. Design of terminals for passengers and goods on highway, railway, and airport and waterway port.
4. Design of horizontal and vertical alignment of highways with landscaping and safety aspects.
5. Performance analysis of existing geometric design.

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