GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Civil and Infrastructure Engineering
Subject Code: 3154008
Semester – V
Subject Name: Highway and Traffic Engineering

Type of course: Professional Core Course

Prerequisite: Nil

Rationale: For the overall development of any country, road transportation plays an important role. Efficient road network is necessary for safe, economic and timely conveyance of passengers and freight. The study of this subject enables to impart knowledge to the civil engineering students about highway planning; it's geometric and structural design, methods of construction, quality control, traffic parameters, traffic control, accident causes and remedies, maintenance and economy.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction** Scope of transportation engineering, Historical development of transport in India – 20 year Road Plans, National Transportation Policy Recommendations, IRC, CRRI, Vision 2021, NHDP, and PMGSY. Classification of rural and urban roads, Road patterns, Planning and alignment surveys. Characteristics of different modes of transport and their integrations and interactions.	4
2	**Geometric design** Cross sectional elements – Carriageway, Right of Way, Camber, Building and Control line, Surface and subsurface drainage, Sight distance Elements - SSD, OSD, ISD, HSD, Design of horizontal alignment - curves, super-elevation, Extra widening, Design of Vertical Alignment: Gradients, summit and valley curves- Design based on comfort criteria and sight distance criteria	8
3	**Highway materials** Subgrade soil, aggregates, binder materials, bituminous materials, bituminous paving mixes: WBM, DBM, BC, SDBC, Marshall Method of Mix Design cement and cement concrete - their engineering and physical properties, basic tests. IRC and MORTH requirements.	4

4	**Pavement Analysis, Design and Maintenance** Pavement design factors, Design of flexible (GI, IRC and CBR method) and rigid pavements (fatigue concept), Construction of earthen, Gravel, WBM, Bituminous, Cement concrete, RCC and Pre-stressed concrete roads, Soil stabilized roads. IRC and MORTH procedural requirements. Pavement failures, Maintenance, Surface and sub-surface drainage, Hill roads - alignment, construction, drainage and maintenance. Road side development - arboriculture, street lighting. Highway administration, economics and finance, road safety audit. IRC and MORTH requirements.	**11**
5	**Traffic Engineering and ITS** Traffic engineering: basic elements, road users - vehicles - traffic flow characteristics, speed-volume studies, travel-time studies, origin and destination studies, Traffic Stream Models: Greenshield's model, Greenberg's logarithmic model, Underwood's exponential model, parking studies, Accident studies: collision and condition diagrams, preventive measures, Concept of Capacity and Level of Service, Traffic control: markings, signs, signals, intersections, rotaries, Design of Signalized Intersections, need of coordination of signals, pedestrian actuated signals. IRC requirements. Indo-HCM analysis. Intelligent Transport System (ITS): Components of ITS, Working principles, Applications of ITS, Adaptive traffic signals.	**15**
		42

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	**30**	**20**	**15**	**15**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. L.R. Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi.
2. L.R. Kadiyali, "Traffic Engineering and Transport Planning," Khanna Publishers, New Delhi.
3. Dr. S.K. Khanna and Dr. C.E. G. Justo, "Highway Engineering", Nem Chand & Bros., Roorkee.
4. S.K. Sharma, "Principles, Practice and Design of Highway Engineering", S. Chand & Co., New Delhi.
5. IRC - 37 "Guidelines for Design of flexible Pavements", IRC, New Delhi, 2001.
6. IRC - 67 "Code of Practice for Road Signs", IRC, New Delhi - 2001.
7. IRC: 58, 2002: "Guidelines for the Design of Plain Jointed Rigid Pavements for Highways", IRC, N. Delhi, December, 2002.
8. Dr. Hariharan K. V. (Author), Container & Multimodal Transport Management, Shroff Publishers
9. Slim Hammadi, Mekki Ksouri, Multimodal Transport Systems, Wiley-ISTE

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Know about highway planning, its classification and geometric design	25
CO-2	Perform laboratory tests on highway materials like aggregates and bituminous materials	15
CO-3	Accomplish the preliminary design of flexible and rigid pavement and know about pavement failures, its maintenance, importance of drainage, hill roads and their challenges	25
CO-4	Carry out survey of classified traffic volume count and spot speed study on highway and know about importance and working of different traffic control devices.	35

List of Experiments:

- Introduction to Highway Engineering Laboratory Equipment.
- California Bearing Ratio (CBR) Test.
- Aggregate crushing Test
- Aggregate Impact Test.
- Flakiness Index and Elongation Index Test for Aggregate.
- Los Angeles Abrasion Test / Deval Abrasion Test
- Marshall Stability test on Bitumen mix.
- Specific gravity and Water Absorption test for Aggregate.
- Penetration test for Bitumen.
- Softening point test for Bitumen.
- Ductility test for Bitumen.
- Flash and Fire Point test for Bitumen.

- Specific gravity test for Bitumen
- Viscosity Test for Bitumen.
- Classified traffic volume count on mid-block of link
- Spot-speed survey
- Classified traffic volume count on intersection

Major Equipment:

- CBR testing machine
- Los-Angeles abrasion testing machine
- Aggregate Impact testing machine
- Marshall stability testing machine
- Bituminous material's ductility testing machine
- Standard penetrometer for bituminous materials

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/