GUJARAT TECHNOLOGICAL UNIVERSITY

BE (CIVIL & INFRASTRUCTURE ENGINEERING)
HIGHWAY PLANNING AND CONSTRUCTION
SUBJECT CODE:2164008
6th Semester

Type of course: Departmental elective

Prerequisite: Basics of Transportation Engineering

Rationale:

Highway Planning and Construction is providing conceptual understanding and applications highway engineering. With the help of this knowledge students may be able:

- To understand road infrastructure support for India and its importance
- To impart knowledge about highway planning, it's geometric and structural design, methods of construction, quality control
- To aware about essential design parameters like traffic parameters for better traffic management for minimizing accident and also understanding its causes
- To understand the role of designing efficient road network for safe, economic and time conveyance of passengers and freight apart from maintenance of it.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE	PA(M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	2	0	5	70	20	10	30	0	20	150

Contents:

Sr. No	Topics	Hrs.	% Weightage
1	**Module-I Highway geometric design:** Planning and alignment surveys, Cross sectional elements - width, surface, camber, Sight distances - SSD, OSD, ISD, HSD, Design of horizontal and vertical alignment - curves, super-elevation, widening, gradients, summit and valley curves	**8**	**19%**
2	**Module-II Traffic engineering:** Basic elements, road users - vehicles - traffic flow characteristics, speed - volume studies, travel-time studies, origin and destination	**10**	**24%**

	studies, 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 intersection.		
3	**Module-III Highway Materials:** Subgrade soil, aggregates, binder materials, bituminous materials, bituminous paving mixes, cement and cement concrete - their engineering and physical properties, basic tests.	**5**	**12%**
4	**Module-IV Pavement Analysis and Design:** 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	**10**	**24%**
5	**Module-V Pavement Maintenance:** 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	**5**	**12%**
6	**Module VI Intelligent Transportation System:** Introduction, Components of ITS. Architecture and integration with GIS Analysis and visualizations of traffic data in GIS. Integration of GPS and GIS.	**4**	**9%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25	**25**	**20**	**15**	**15**	**0**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above

Course Outcome:

After learning the course the students should be able to:

1. Know about highway planning and its classification
2. Carryout geometric design of highway
3. Carryout laboratory tests on aggregates and bituminous materials
4. Carryout preliminary design of flexible and rigid pavement
5. Know about pavement failures, its maintenance, importance of drainage, hill roads and their challenges
6. Carryout survey of classified traffic volume count and spot speed study on highway
7. Know about importance and working of different traffic control devices.

Text 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.

List of Experiments:

1. Introduction to Highway Engineering Laboratory Equipment.
2. California Bearing Ratio (CBR) Test.
3. Aggregate crushing Test
4. Aggregate Impact Test.
5. Flakiness Index and Elongation Index Test for Aggregate.
6. Los Angeles Abrasion Test / Deval Abrasion Test
7. Marshall Stability test on Bitumen mix.
8. Specific gravity and Water Absorption test for Aggregate.
9. Penetration test for Bitumen.
10. Softening point test for Bitumen.
11. Ductility test for Bitumen.
12. Flash and Fire Point test for Bitumen.
13. Specific gravity test for Bitumen
14. Viscosity Test for Bitumen.

Design based Problems (DP)/Open Ended Problem:

Below mentioned problems are for reference only. Similar problems may be developed by individual teachers.

1. Conduct classified traffic volume study and spot speed study on busy rural highway or urban street during peak hour to obtain the peak hour flow and design speed of a selected road section.

Major Equipment:

1. CBR testing machine
2. Los-Angeles abrasion testing machine
3. Aggregate Impact testing machine
4. Marshall stability testing machine
5. Bituminous material's ductility testing machine
6. Standard penetrometer for bituminous materials

List of Open Source Software/learning website: **www.nptel.iitm.ac.in/courses/**

Active learning Assignments (AL) : Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The Power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.