GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)
HIGHWAY ENGINEERING
SUBJECT CODE: 2150601
B.E. 5th SEMESTER

Type of course: Compulsory

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
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Scope of highway engineering, Highway planning and development in India, Classification of rural and urban roads, Road patterns, Planning and alignment surveys.	**4**	**10**
2	Highway geometric design: 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	**9**	**22**
3	Highway materials: subgrade soil, aggregates, binder materials, bituminous materials, bituminous paving mixes, cement and cement concrete – their engineering and physical properties, basic tests.	**7**	**16**
4	Pavement design factors, Design of flexible (GI 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	**7**	**16**
5	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	**6**	**16**
6	Traffic engineering: basic elements, road users - vehicles - traffic flow characteristics, speed – volume studies, surveys, parking studies, Accident studies: causes, collision and condition diagrams, preventive measures, Traffic control: markings, signs, signals, intersections, rotaries.	**9**	**20**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**20**	**20**	**20**	**15**	**10**

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.

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.

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

ACTIVE LEARNING ASSIGNMENTS: 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.