

**GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT**

**COURSE CURRICULUM**  
**COURSE TITLE: HIGHWAY ENGINEERING**  
**(COURSE CODE: 3350606)**

<b>Diploma Programme in which this course is offered</b>	<b>Semester in which offered</b>
Civil Engineering	5 <sup>th</sup> Semester

**1. RATIONALE**

This syllabus which is cover all aspects related to Highway Engineering and treated from a practical point of view in addition to the Theoretical approach The Important of highway for prosperity of our country. Development in highway Engineering are taking place at a great speed, new materials, concepts of design and construction practices are emerging as road users demand high quality road. India is modernizing its road system and is planning to construct high speed highway facilities.

This course will enrich civil engineering technicians in performing their job related to highway with ease and confidence. They will be able to design and also able to read the drawing, execution of work and selection of good quality materials to be used in the highway construction.

**2. COMPETENCY (programme Outcomes according to NBA Terminology):**

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competencies.

1. Explain the importance of Highway and Transportation system and also it's geometrical aspects.
2. To develop the concept of construction and maintenance of highway.
3. To organize, supervise and co ordinate construction activities of highway.
4. To improve maintain and repairs of highway.
5. To perform the various tests on various materials used in highway construction work.
6. To select and test materials on site and laboratory as per IRC requirement.

**Pre-Requisite**

Student should be able to Read, Draw morphological nature of land and also knowledge of Basic Transportation Engineering.

**3. TEACHING AND EXAMINATION SCHEME**

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	0	2	5	70	30	20	30	<b>150</b>

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P - Practical; C - Credit; ESE - End Semester Examination; PA - Progressive Assessment

**Note:** It is the responsibility of the institute heads that marks for **PA of theory & ESE and PA of practical** for each student are entered online into the GTU Portal at the end of each semester within the dates specified by GTU.

#### 4. COURSE DETAILS

Unit	Major Learning Outcomes	Topics and Sub-topics
<b>Unit—I Introduction to Highway Engineering</b>	1a. Discuss Indian highway and its classification. 1b. Discuss various type of road development plan. 1c. Describe classification Urban road . 1d. Describe the various types of survey . 1e. Discuss Highway Project Report. 1f. Discuss the detailed survey. 1g. Discuss longitudinal Section & cross section. 1h. Describe availability of Construction materials, labourers , Equipments & Transportation.	1.1 Importance of roads in India & its' Characteristics. 1.2 Road classifications in India(Nagpur plan & Third road development (Lucknow) plan. 1.3 Fixing location Of Urban roads. 1.4 Requirements of an ideal road alignment & the factors affecting. 1.5 Details of highway project report.
<b>Unit—II Geometric design of Highway.</b>	2a. Describe various terms used in Highway and Its standards. 2b. Explain the L/S and C/S of Highway in cutting & Embankment. 2c. Demonstrate the basic Requirements of Curves.	2.1 Camber – definition, purpose, types, IRC – recommendation. 2.2 Kerbs, Road margin, road formation, right of way. 2.3 Design speed IRC – recommendations. 2.4 Gradient - definition, types IRC – Recommendation. 2.5 Sight distance - definition, types IRC - recommendation. 2.6 Curves - Necessity, types- Horizontal, vertical and transition curves, Widening of road. 2.7 Super elevation, definition, formula for calculating minimum and maximum Super elevation method of providing. 2.9 Simple problems on geometric Design of road.
<b>Unit—III Construction of road pavements, drainage and materials.</b>	3a. discuss Highway construction materials And Test. 3b. Explain pavement. 3c. Enumerate various Equipments used in High Way construction. 3d. Explain importance of Drainage and its maintenance	3.1 Type of road materials and Tests -Soil, Aggregates, bitumen, cement concrete, test on soil sub grade- C B R test, Test on Aggregate- Los Angeles abrasion, Impact, & shape test, test on Bitumen- penetration, Ductility and Softening point test. 3.2 Pavement – Types, Objectives, Functions, Components and structure of pavement, WBM. 3.3 Construction of bitumen road- Terms used – Bitumen, Emulsion, Cutback, Tar, grades of bitumen, prime coat, tack coat, seal coat, surface dressing construction & its Merits & demerits.

Unit	Major Learning Outcomes	Topics and Sub-topics
		3.4 Construction procedure of cement concrete Pavement, Construction joints, joints filler & sealers. 3.5 Equipments used in Highway Construction. 3.6 Importance, necessity and methods of drainage. 3.7 Surface drainage – side gutter, catch water drain, surface drainage. 3.8 Sub surface drainage –Longitudinal & cross drains.
<b>Unit—IV Traffic Engineering.</b>	4a. Discuss traffic, scope and it's characteristics. 4b. Discuss PUC, Accident Studies & Building code-IS 1904. 4c. Enumerate various traffic control devices.	4.1 Traffic characteristics and Traffic volume study. 4.2 Passenger car unit and factors affecting. 4.3 Accident studies and it's causes, Collision diagram. 4.4 Traffic control devices – road signs, marking, Signals, traffic island. 4.5 Advantages & disadvantages of signals. 4.6 Road intersections, Intersection at Grade, grade Separator intersection.
<b>Unit—V Hill Road.</b>	5a. Discuss Alignment of hill road and it's standard 5b. Explain drainage and protective works . 5c. Describe landslides.	5.1 Hill road its' parts, components , function types of curves. 5.2 Width of pavement formation, camber, sight distance, widening at curve. 5.3 Side drains, catch water drains, cross drains, retaining wall & breast wall. 5.4 Construction procedure of hill road. 5.5 Causes of landslides & it's classification. 5.6 Prevention of landslides.
<b>Unit—VI Maintenance and Repair of Road.</b>	6a. Discuss necessity of Maintenance of road. 6b. Explain pavement failures. 6c. Discuss Maintenance and repairs of Highway.	6.1 Flexible & Rigid pavement failures. 6.2 Causes of pavement failures. 6.3 Need for high way maintenance it's types. 6.4 Classification of maintenance. 6.5 Special repair of flexible & Rigid pavement.

### 5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
<b>I</b>	Introduction to Highway Engineering	4	1	1	3	5
<b>II</b>	Geometric design of Highway	8	2	3	10	15
<b>III</b>	Construction of road pavements, drainage and materials.	8	2	5	13	20
<b>IV</b>	Traffic Engineering.	8	2	3	5	10
<b>V</b>	Hill Road.	6	2	3	5	10
<b>VI</b>	Maintenance and Repair of Road.	8	1	2	7	10
<b>Total</b>		42	10	17	43	70

**Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)**

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

## 6. SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme outcomes). Following is the list of practical exercises for guidance.

**Note:** Here only course outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those programme outcomes/course outcomes related to affective domain.

S. No.	Unit No.	Practical/Exercise/Project	Approx. Hrs. Required for Practical	Approx. Hrs. Required for Project
1	I	The Students shall draw the dimensional sketches of cross section of road (with function of each part of road) , road junction, road curve and widening (IRC Recommendation ).	2	0
2	II	Demonstration only the following tests. - On Aggregate 1. Impact test. 2. Crushing test. 3. C B R test. - On Bitumen 1. Flash & Fire test. 2. Softening point 3. Penetration test	2	0
3	IV	Visit to a road under construction/constructed to study of 1.WBM road 2. Rigid & Flexible pavement for observing the type of Construction with brief report.	4	0
4	V	1. At least single visit of Road construction Equipments. 2.The Students shall draw the line sketches of various Equipments.	4	0
5	VI	Traffic volume study and its representation of an intersection of road	8	8
6	VII	Seminar	8	
		Total	28	08

## 7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: Course/topic based seminars, internet based assignments, teacher guided self learning activities, course/library/internet/lab based mini-projects etc. These could be individual or group-based.

S. No.	Unit No.	Student Activities
1	I	Comparison of different types of Roads

### 8. SPECIAL INSTRUCTIONAL STRETEGIES (If any)

Lecture cum demonstration of various types of equipments used in construction of Road .

Field demonstration about the maintenance of Roads .

### 9. SUGGESTED LEARNING RESOURCES

S. No.	Title of Books	Author	Publication
1	High way Engineering	Dr. L R Kadiyali & Dr. N B Lal	Khanna Publishers. Delhi
2	Traffic Engg. & Transport planning	Dr. L R Kadiyali	Khanna Publishers. Delhi
3	High way Engineering	S K Khanna & Justo	Khanna Publishers. Delhi
4	Highway Engineering	S P Bindra	DhanpatRai & Sons Delhi
5	Highway Engineering	Gur charan singh	Standard Publishers. Delhi
6	Highway Engineering	C A O'Flaherty	Edward Arnold ltd. London
7	Road, Railway, Bridge & Tunnel Engineering	Ahuja & Birdi	Standard book house Delhi
8	Transportation Engineering Vol. I & II	V N Vazirani & S P Chaondola	Khanna Publishers. Delhi
9	Road Engineering	P K Bhattacharjee	Orient Longmans Delhi Culcutta-Bombay-Madras

### 10. COURSE CURRICULUM DEVELOPMENT COMMITTEE

#### Faculty Members from Polytechnics

(1) Prof. N. J. Patel                      L.C.E. – Shri K J Polytechnic Bharuch

#### Coordinator and Faculty Members from NITTTR Bhopal

(1) Dr. SUBRAT ROY                      - Professor.