GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: ROADS AND BRIDGES
(Code: 3346002)

Diploma Programme in which this course is offered	Semester in which offered
Transportation Engineering	4th semester

1. RATIONALE

Knowledge and understanding of road alignments, geometric design, Pavement design, Bridge structures etc are very important for engineers working at site in order to make such structures safe and serviceable. At diploma level students are expected to study about these aspects of roads and bridges so as to supervise the laying of roads and construction of Bridges as per drawing and design. Thus it is a key course for transportation engineers.

2. COMPETENCY

The course content should be taught and curriculum should be implemented with the aim to develop required skills in the students so that they are able to acquire the following competencies.

- **Design and Supervise the construction of roads for a given situation**
- **Supervise the construction of bridges**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Explain Geometric Design of roads
ii. Comprehend various road sections in cutting and filling
iii. Describe various types of Pavement Structure , drainage aspects, soil stabilisation
iv. Discuss the importance of Economics in Highway
v. Enumerate type of bridges and bridge foundation
vi. Discuss the factors to be considered in design of bridges

4 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	150
4	0	2	6	70	30	20	30	

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

5 COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Introduction and Geometric Design of roads	1a. Explain Importance of Transportation. 1a.1 List Different Modes of Transportation 1a.2 Describe characteristics of road transport 1a.3 State the Scope of Highway Engineering 1a. Describe the roads and prepare road development plans. 1b. Select suitable Highway alignment and carry out Surveys. 1c. List & Explain Cross Sectional elements of roads 1d. Design Horizontal and Vertical Alignment features.	1.1 Importance of transportation 1.2 Different Modes of Transportation 1.3 Characteristics of Road Transport 1.4 Scope of Highway Engineering 1.5 Historical Development of Road Construction 1.6 Necessity of Highway Planning. 1.7 Road Patterns 1.8 Planning Surveys 1.9 Preparation of Plans 1.10 Highway Cross-sectional elements Camber, Kerb, Width of Pavement, Median, Road Margin , Formation Width, Right of Way, Control Lines 1.11 Sight Distances 1.1. Design of Horizontal Alignment Horizontal Curve, Design Speed, Super Elevation, Widening of Road, Horizontal Transition Curve, Setback Distance on Horizontal Curve 1.1. Design of Vertical Alignment Vertical Curves, Gradient, Summit Curve and Valley Curve
Unit – II Types of Pavements and their drainage aspects, Soil Stabilisation	2a. Describe various types of Pavement Structure. 2b. Explain the factors affecting design of Pavement 2b1. List the Functions of Pavement Components 2c1 Explain different types of Soil Stabilization of Road 2c2 Explain mechanics of soil stabilization 2d. Classify highway drainage 2d1 Comprehend different types of drainage in highway. 2a. Discuss highway drainage system.	2.1 Introduction 2.2 Types of Pavement Structure 2.3 Functions of Pavement Components 2.4 Factors to be considered in design of Pavement 2.5 Mechanics of Soil Stabilization 2.6 Methods of Stabilization 2.7 Problems in Soil Stabilization 2.8 Problems in thickness design in stabilized layer 2.9 Stabilization of black cotton soil. 2.10 Stabilization of Desert soil 2.11 Introduction and Importance of highway drainage 2.12 Classification of highway drainage 2.12.1 Surface drainage 2.12.2 Sub-surface drainage 2.12.3 Drainage of Hill roads 2.12.4 Drainage of Slope and Erosion 2.13 Road Construction in water logged areas
Unit – III Highway Economic and Finance	3a. Discuss the importance of Economics in Highway 3b. Explain highway user benefits and economic analysis	3.1 Introduction 3.2 Highway user benefits 3.3 Highway Cost 3.4 Economic Analysis 3.5 Highway finance

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit-IV Introduction to Bridges and Bridge Foundation	4a. Explain Importance of bridges 4b. Describe the Factors Affecting The Selection Of Site 4c. Explain terms Related To Bridges, 4d. Explain Functions and requirement of Bridge Foundation, 4e. Comprehend various types of Bridge Foundation	4.1. Importance of bridges and its Components 4.2. Factors Affecting The Selection Of Site 4.3. Terms Related To Bridge : - Length Of Bridge, Linear Waterway, Effective Linear Waterway, Afflux, Free Board, Vertical Clearance, High Flood Level ,Formation Level, Scour, Economic Span 4.4. Classification Of Bridges 4.5. Functions Of Bridge Foundation, 4.6. Requirements Of Bridge Foundation 4.7. Types Of Loading, 4.8. Classification Of Bridge Foundation- Shallow Foundation, Deep Foundation.
Unit-V Bridge Sub-Structure, Super – Structure & Construction Methods	5a. Discuss components and types of Piers, 5b. Describe functions of Abutment, Pier And Weep Holes. 5c. Explain Superstructures With Respect to Structural Behavior and Material Used 5d. Explain Importance of Bearings and methods of bridge erection	5.1 Components 5.2 Types of Piers, 5.3 Functions of Abutment, Pier and Weep Holes. 5.4 Classification of Superstructures With Respect To Structural Behavior and Material Used, 5.5 Importance of Bearings, 5.6 Types & advantages of Bearings 5.7 Methods of Erection of Various Types of Bridges
Unit-VI Maintenance of Bridges	6a.Explain deterioration and preventive measures of Bridge Structure 6b. Describe Various Types Of Bridge Defects and its remedial measures	6.1 Deterioration of Bridge Structure, factors Affecting Deterioration and Preventive Measures. 6.2 Defects In Bridge and Remedial Measures To Rectify Defects. 6.3 Inspection Report – Purpose, Necessity And Its Use, 6.4 Preparation Effective and Purposeful Inspection Report.

6 SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction Geometric Design	14	3	6	7	16
II	Highway Pavements Stabilization and highway drainage	12	6	6	6	18
III	Highway Economic and Finance	4	-	3	3	6
IV	Introduction-(Bridges Bridge Foundation	12	3	6	6	15
V	Bridge Sub- Structure And Super –Structure & Construction Methods	8	3	3	3	9
VI	Maintenance of Bridges	6	-	3	3	6
Total		**56**	**15**	**27**	**28**	**70**

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

7 SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills **(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 outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of* ***Course Outcomes*** *related to affective domain. Thus over all development of* ***Programme Outcomes (****as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1	I, IV and V	The Student Shall Draw The Dimensional Sketches(Along with Brief Note)of Different alignment of Road, Cross-Section of Road , Road Junctions, Road Signs, Road Markings , Road Curves and Widening, Surface and Subsurface Drainage, Types of Bridge, Bridge Bearings etc.	6

S. No.	Unit No.	Practical/Exercise (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
2	ALL	Visit to a Road Under Construction or an Existing Road having the Same Features and student shall be required to submit a brief report of the Visit as a part of their Term Work	4
3	ALL	Seminar on the Select Topic from above Topics or Sub-Topics Student are required to submit and Present/Defend the Seminar in the Presence of Students and Teacher	4
4	I	Tutorial on Geometric Design of Highway	4
5	I, II, V,VI	Assignment on Highway Alignment, Geometric Design of Highway, Highway Pavements, Soil Stabilization and Drainage of Highway, Bridge Structures, Bridge Maintenance etc.	6
6.	IV,V,VI	Visit to a Bridge Under Construction or an Existing Bridge having the Same Features and student shall be required to submit a brief report of the Visit as a part of their Term Work	4
Total Hrs			**28**

8 SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Student will visit nearby Road Construction and Submit report for the same.
ii. Student will observe the geometric features of the road.
iii. Student will solve Numerical examples.
iv. Student will visit nearby Bridge Construction and Submit report for the same.

9. SPECIAL INSTRUCTIONAL STRATEGIES (If Any):

Unit No.	Topic / Sub Topic	Instructional strategies
I	Alignment of Road	PPT/Transperancy
I	Highway Cross-Section	Model or PPT
I	Geometric Design	Site Visit to Road under construction or Existing Road
V	Bridge Sub/Super Structure	Site Visit to Bridge under construction or Existing Bridge
ALL	Tutorials and Assignments	Handouts

10. SUGGESTED LEARNING RESOURCES

A. List of Books

S. No.	Title of Books	Author	Publication
1.	Highway Engineering	S.K.Khanna and C.E.G.Justo	Nem chand Bros. Roorkee
2.	Highway Engineering	S.P.Bindra	by Dhanpat Rai & Sons, Delhi
3.	Principles and Practice of Highway Engineering	S.C.Sharma & C.C.Sharma	Asia Publishing House , Delhi
4.	Highway Engineering	L.R.Kadiyali	
5.	Highway Engineering	S.C. Rangwala	
6.	Transportation Engineering	Vazirani & Chandola	
7.	Principles and Practice of Bridge Engineering,	S.P. Bindra	Dhanpat Rai & Sons, New Delhi
8.	Essential of Bridge Engineering	D.J. Victor	Oxford & IBH Pub. Co. Ltd. Mumbai

B. List of Major Equipment/Materials

---No equipments or Materials required------

C. List of Software/Learning Websites

i. www.waterbouw.tudelft.nl/
ii. www.learnrstv.com
iii. www.shiksha.com , IIT, Roorkee
iv. www.blackwellpublishing.com
v. www.hrpwa.org
vi. www.creativeworld9.com
vii. nptel.iitm.ac.in

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. Prakash. A. Pandya**, Lecturer in Civil Engg. Deptt. – Govt. Polytechnic, Himatnagar
- **Prof. (Smt.) Shruti .B. Khara**, Lecturer in Civil Engg. Deptt. – Govt. Polytechnic for Girls, Ahmedabad.

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. Subrat Roy**, Professor, Department of Civil and Environmental Engineering
- **Prof M.C. Paliwal, Associate Professor,** Department of Civil and Environmental Engineering