Lok Jagruti Kendra University
University with a Difference

Diploma in Civil Engineering

LJ Polytechnic

Course Code:025050403

Highway Engineering

Programme / Branch Name	Diploma in Civil Engineering					
Course Name	Highway Engineering				**Course Code**	025050403
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ No prerequisites

3. Rationale

Highway engineering subject deals with the process of design, construction and maintenance of different types of roads. Growth of traffic increases day by day because of population and economy, therefore it is necessary to construct new roads and improve existing road design which is efficient, easy, safe and comfortable to use and economical to build. Due to the population increase, standards of highway engineering are continuously being improved. Highway engineers must know the future traffic flows. According to the volume and the intensity of traffic they have to design highway intersections or interchanges, geometric alignment, design pavements and materials, structural design of pavement thickness and pavement maintenance. Diploma students are expected to study these aspects of highway engineering because they are supposed to design and construct different types of roads.

4. Objectives

- ✓ To know about highway planning, designing and the concept of different types of pavements used in highways.
- ✓ To understand an ideal road alignment and the geometric design of the highway.
- ✓ To gain knowledge of highway construction materials and their relevant tests.
- ✓ To find out the reasons for pavement failures and their remedies.
- ✓ To study different types of highway drainage for efficient highway field execution and its maintenance.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1.	**Introduction**	1.1. General 1.2. Modes of Transportation 1.3. Advantages of Road 1.4. Importance of Roads in India 1.5. Requirements of an Ideal Road 1.6. Indian Institutions for Highway at National Levels	• Explain the Importance of Transportation. • Describe Modes of Transportation. • Knowledge about Indian Institutions for Highway at National Levels.	10	4
2.	**Highway Planning and Alignment**	2.1. General 2.2. Objectives of Highway Planning 2.3. Classificaton of Highways 2.4. Highway Alignmnent 2.5. Factors Affecting Highway Alignment 2.6. Planning Surveys 2.7. Engineering Surveys 2.8. Project Report and Drawings	• Identify the Requirements and Factors Controlling Alignment. • Classify Highways Based on Traffic Volume, Load Transport or Tonnage and Location and Functions. • Knowledge about Engineering Surveys for Highway Alignment. • Identify the Drawings and Reports and Preparation of Detail Project Report.	15	6
3.	**Geometrical Design of Highway**	3.1. General 3.2. Road Structure 3.3. Typical Cross Sections of Road 3.4. Right of Way 3.5. Camber 3.6. Design Speed 3.7. Stopping Sight Distance 3.8. Overtaking Sight Distance 3.9. Sight Distance at Intersections 3.10. Road Gradient 3.11. Super elevation 3.12. Horizontal Curves 3.13. Vertical Curves	• Understand the Importance of Geometric Design and its Criteria. • Learn about Highway Cross Section Elements. • Explain Sight Distance, Super Elevation and Curves.	25	10

4.	**Highway Pavement, Construction and Materials**	4.1. Designs of Highway Pavements- Generals 4.2. Types of Pavements 4.3. Factors Affecting the Designs of Pavements 4.4. Low Cost Road- General 4.5. Classification of Low Cost Roads 4.6. Soil Stabilized Road 4.7. Bituminous Road- General 4.8. Advantages and Disadvantages of Bituminous Road 4.9. Bituminous Materials 4.10. Construction of Bituminous Road 4.11. Cement Concrete Road- General 4.12. Advantages and Disadvantages of Cement Concrete Road 4.13. Methods of Construction of Cement Concrete Road 4.14. Construction Procedure of Cement Concrete Road 4.15. Joints in Cement Concrete Road 4.16. Test for Highway Materials- General 4.17. Test for Road Aggregates 4.18. Tests for Bituminous Mterials	• Knowledge about Types of Pavements. • Understand the Components, Functions and Factors to be Considered in Design of Flexible Pavement and Rigid Pavement. • Explain the Construction Procedure of Different Types of Pavements. • Learn about Joints in CC Pavements. • Identify Materials Used in Pavement Constructions. • Perform Laboratory Tests on Material Used in Highway Construction.	30	14
5.	**Highway Drainage and Maintenance**	5.1. Highway Drainage- General 5.2. Sources of Water Entering the Road Structure 5.3. Defects Due to Improper Highway Drainage 5.4. Requirements of Good Highway Drainage System 5.5. Surface Drainage 5.6. Sub Surface Drainage	• Knowledge about Requirements and Importance of Highway Drainage. • Identify the Surface and Sub Surface Drainage. • Classify Various Maintenance Works Used in Highway. • Explain the Distress in Bituminous	20	8

		5.7. Highway Maintenance- General 5.8. Causes of Failure of Pavements 5.9. Typical Flexible Pavement Failure 5.10. Typical Rigid Pavement Failure 5.11. Maintenance of Earth Roads, Bituminous Roads and Cement Concrete Roads	Pavement and CC Pavement and Describe their Maintenance Method.		
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/programme outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	**Tests for Bitumen:** (a) To determine the penetration test of bitumen (b) To determine the ductility test of bitumen. (c) To determine the softening point test of bitumen (d) To determine the flash and fire point test on bitumen. (e) To determine the viscosity test on bitumen.	Laboratory Test of Bitumen	10
2.	**Tests for Aggregates:** (a) To determine the abrasion value test of aggregates. (b) To determine the impact value test of aggregates. (c) To determine the crushing value test of aggregates.	Laboratory Test of Aggregates	6
3.	Draw the sketches of a cross-section of road, types of camber, superelevation, road curve and widening.	Knowledge of Geometric Design	2
4.	Seminar- The topic of the seminar shall be given to a group of students.	Microsoft PowerPoint Skill	2
5.	To conduct a visit of road construction of flexible pavement and prepare a report on it.	Construction of Flexible Pavement	2
6.	To conduct a visit of road construction of rigid pavement and prepare a report on it.	Construction of Rigid Pavement	2
7.	To conduct a visit of road maintenance site and prepare a report on it.	Maintenance of Road	2
8.	Prepare a detailed report on any highway located in India.	Microsoft Word Skill	2
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1.	Introduction	25	50	0	0	0	25
2.	Highway Alignment and Project Preparation	30	40	20	0	0	10
3.	Geometric Design of Highway	20	40	25	0	15	0
4.	Highway Pavement, Construction and Materials	25	40	25	0	0	10
5.	Highway Drainage and Materials	20	45	20	0	0	15

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Highway Engineering by S.C.Rangwala, Charotar Publications.

9. Reference Books

1) Highway Engineering by S.K. Khanna, C.E.G. Justo, A.Veeraragavan, Neem Chand & Bros, Roorkee, India.
2) Highway Engineering by Dr. L R Kadiyali & Dr. N B Lal, Khanna Publishers, Delhi.
3) Highway Engineering by S P Bindra, Dhanpat Rai & Sons Delhi.

10. List of Publications

1) National Building Code of India 2016- Volume I & II by Bureau of Indian Standards.
2) IRC and MORTH for highway planning, design and construction.
3) IS Codes for Testing Construction Materials.

11. Open Sources (Website, Video, Movie)

1) www.nptel.ac.in
2) LJP-Civil-Highway Engineering (YouTube)