Gyanmanjari Innovative University

Course Syllabus
Gyanmanjari Diploma Engineering College
Semester-5 (Diploma)

Subject: Highway Engineering – DETCV15218
Type of course Professional Elective Courses
Prerequisite: Knowledge of Construction Materials

Rationale: The course covers key aspects such as highway planning, geometric design, pavement materials, traffic engineering, and maintenance strategies. It provides students with an understanding of modern construction techniques and quality control measures essential for building durable roads. Additionally, the study of traffic management systems and road safety ensures that engineers design highways that optimize mobility while minimizing accidents and congestion.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks					Total Marks
				Theory Marks		Practical Marks		CA	
CI	T	P	C	ESE	MSE	V	P	ALA	
3	0	2	4	60	30	10	20	30	150

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; ESE - End Semester Examination; MSE- Mid Semester Examination; V – Viva; CA - Continuous Assessment; ALA- Active Learning Activities.

Course Content:

Sr. No.	Course Content	Hrs.	% Weightage
1	**Introduction to Highway Engineering:** Importance of highways in infrastructure, Classification of roads (NH, SH, MDR, ODR, VR), Road development in India (NHDP, PMGSY), Highway planning and alignment.	05	15
2	**Highway Materials and Testing:** Soil, aggregates, and bitumen properties, Tests on highway materials (CBR test, Marshal Stability test), Traffic volume, speed, and capacity studies, Pavement types: Flexible vs. Rigid.	10	20
3	**Geometric Design of Highways:** Cross-section elements (carriageway, shoulders, medians), Sight distance: Stopping and overtaking, Horizontal and vertical alignment, Super-elevation and transition curves.	12	25
4	**Pavement Design and Construction:** Components of pavements, Design of flexible and rigid pavements Highway drainage system, Highway construction methods (WBM, Bituminous, Cement Concrete).	12	25
5	**Highway Maintenance and Traffic Engineering:** Common pavement failures and maintenance techniques, Highway safety and accident studies, Traffic signs, signals, and markings Intelligent Transportation Systems (ITS).	06	15

Continuous Assessment:

Sr. No.	Active Learning Activities	Marks
1	**Highway Alignment and Route Selection (Field & Map Study)** Students (in group) analyze real-world highway alignments using topographic maps and Google Earth. They propose optimized routes considering terrain, environment, and connectivity. Results of this activity are enhances problem-solving skills in highway planning. Prepare the report on solution of various data collection and upload in GMIU Web Portal.	10
2	**Pavement Material Testing (Lab Activity)** Faculty allocated various lab tests on Pavement material. Individual Student compares results with IRC standards and discusses material suitability. Prepare the report on various Material testing results and upload in GMIU Web Portal.	10
3	**Regulation of highway Maintenance**	10

	Students collect Maintenance data at a highway section. Students (in group) identify the questions and collect the answer by Highway authority. Results of this activity are increasing the communication skills in highway Maintenance. Prepare the report on deal of various highway Maintenance and upload in GMIU Web Portal.	
TOTAL		**30**

Suggested Specification table with Marks (Theory): 60

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	20%	25%	20%	10%	10%	15%

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.

Course Outcome:

After learning the course, the students should be able to:	
CO1	Understand the fundamentals of highway planning, road classifications, and alignment selection based on IRC guidelines.
CO2	Evaluate different pavement materials and conduct laboratory tests to determine their suitability for road construction.
CO3	Analyze and apply geometric design principles, including sight distances, curves, and super-elevation, for efficient road construction.
CO4	Design flexible and rigid pavements using standard methodologies.
CO5	Apply traffic engineering concepts, including traffic control devices, signals, and road safety measures, to improve transportation systems.

List of Practical

Sr. No.	Descriptions	Unit No	Hrs.
01	Study the classification of roads and propose a suitable route based on topography.	01	02
03	Conduct tests on aggregates to evaluate their suitability for highway construction.	02	02
04	Study the properties of bitumen and its suitability for road construction.	02	04
05	Learn highway planning and design principles using software	03	04

	tools.		
05	Calculate and design horizontal curves for a highway alignment.	03	04
06	Learn how to design cross-sections for various road types.	03	04
07	Design a flexible pavement using the CBR method.	04	02
08	Design a rigid pavement based on IRC: 58 guidelines.	04	02
09	Conduct a traffic volume survey at an intersection or highway stretch.	05	02
10	Assess the condition of a road surface using the Pavement Condition Index (PCI).	05	04
TOTAL			**30**

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
From the content 10% topics are suggested for flipped mode instruction.
Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.
The internal evaluation will be done on the basis of Active Learning Assignment.
Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in the laboratory.

Reference Books:

[1] Highway Engineering, Alok Kumar Goel, S.K. Kataria & Sons
[2] Principles and Practices of Highway Engineering, Khanna Editorial Team, Khanna Publishers
[3] Highway Engineering, S.C. Rangwala, Charotar Publishing House