Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, MAY 2025

B.E. CIVIL ENGINEERING

CE5402-Highway Engineering

(Regulation 2019)

Time: 3hrs Max.Marks: 100

CO1	Understand the concepts and standards adopted in Planning, Design and construction of Highways and its related infrastructures.
CO2	Apply the knowledge of science and engineering fundamentals in designing the geometrics for an efficient Highway network and design concepts.
CO3	Designing various types of pavements to meet specified needs of safety, efficiency and long time sustainability by adopting various design standards.
CO4	Select appropriate methods for construction, evaluation and maintenance of roadways.
CO5	Understand the bidding processes and types of highway projects and analyze the economic, financial aspects of the highway projects

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	State the functions of the Central Road Research Institute.	2	1	L1
2	List the different stages of engineering surveys for highway alignment.	2	1	L1
3	In a district with heavy rainfall, a two-lane state highway of 7m in width with bituminous concrete is to be constructed. What should be the height of the crown with respect to the edges in these two cases, assuming a straight-line camber?	2	2	L3
4	Define stopping sight distance.	2	2	L1
5	Write the expression for the radius of relative stiffness.	2	3	L1
6	What are warping stresses?	2	3	L2
7	Define the softening point of bitumen.	2	4	L1
8	Write the importance of California bearing ratio.	2	4	L2
9	What is meant by the spalling of joints	2	5	L2
10	Define 'Present Serviceability Index'.	2	5	L1

PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a) (i)	Explain the various factors that control Highway alignment in detail with figures wherever necessary.	9	1	L2
(ii)	Explain in brief the requirements of an ideal highway alignment.	4	1	L2
	OR			
11 (b) (i)	Describe the classification of roads based on location and function as per different road development plans.	9	1	L2
(ii)	Write short notes on Road development plan Vison 2021 and Rural road development plan Vision 2025.	4	1	L2

12 (a)	Derive the formula for calculating super elevation on horizontal curves.	**13**	2	L3
	OR			
12 (b)(i)	Calculate the stopping sight distance required to avoid a head-on collision of two cars approaching in opposite directions at a speed of 70 kmph and 80 kmph. Assume that the reaction time of drivers is 2.5 seconds and the coefficient between the road surface and tyres is 0.4.	**8**	2	L3
(ii)	The following are the required details about the road: Pavement width = 7 m, Radius of curve = 200 m, Maximum length of wheelbase = 6.5 m, Design speed = 70 kmph. Calculate the extra widening required.	**5**	2	L3
13 (a)	Design a flexible pavement based on the given data. The traffic studies and axle load distribution studies carried out during project preparation indicated that there are (i) 5600 commercial vehicles per day with rear axle loads in the range of 2500 to 3500 kg and growth rate of 6.5 % p.a with LDF = 1 and (ii) 2150 heavy commercial vehicles with rear axle loads in the range 11,000 to 13,000 kg and growth rate of 4.5% with LDF=1. The road pavement is expected to be constructed in a period of 3.0 years after this study and the flexible pavement structure is to be designed for a life of 15 years. The Design CBR value is 8%.	**13**	3	L4
	OR			
13 (b)	Explain the various factors influencing the design of Rigid pavements and the design procedure as per IRC 58.	**13**	3	L4
14 (a)(i)	Explain the construction procedure of water-bound macadam base.	**10**	4	L3
(ii)	What are the components of cement concrete pavements of highways with heavy traffic?	**3**	4	L3
	OR			
14 (b)	Summarise the desirable properties of aggregates and describe the aggregate impact test and Los Angeles abrasion test.	**13**	4	L3
15 (a)	Explain the field data collection during Benkelman beam deflection studies.	**13**	5	L3
	OR			
15 (b)	Explain the distress that occurs in old Cement concrete roads in India and its maintenance measures.	**13**	5	L3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16. (i)	While aligning a highway in a built-up area, it was necessary to provide a horizontal circular curve of a radius of 325 meters. The design speed is 65 kmph, the length of the wheelbase of the largest truck is 6.00 m and the width of the pavement is 10.5 m. Evaluate the superelevation, extra widening of pavement and length of transition curve.	**10**	2	L5
(ii)	Determine the spacing between contraction joints for 3.5-meter slab width having thickness of 20 cm and f=1.5 for plain cement concrete, allowable S_c=0.8 kg/cm^2 and for reinforcement cement concrete, 1.0 cm diameter bars at 0.30 spacing.	**5**	3	L5