

Code: 20CE3502

III B.Tech - I Semester – Regular Examinations - DECEMBER 2022

**HIGHWAY ENGINEERING
(CIVIL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.

2. All parts of Question must be answered in one place.

BL – Blooms Level

CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	Describe the basic requirements of an ideal alignment.	L1	CO1	7 M
	b)	Determine the lengths of National and State highways required in a district with a total area of 7200km ² developed, semi-developed and undeveloped areas being 30, 45 and 25% of the district. The number of towns with population over 1.0, 0.5-1.0, 0.2-0.5 and 0.1-0.2 lakhs are 4,8,13 and 22 respectively in the district. Use the formulas: NH= [A/64 + B/80 +C/96 + 32K +8M] +D NH+SH=[A/20+B/24+C/32+48K+24M+11.2N+1.6P] + D	L2	CO1	7 M
OR					
2	a)	Explain road network pattern.	L2	CO1	7 M
	b)	Explain the reason for considering the ‘saturation system’ as a rational method to decide the final road network and phasing the road development programme.	L2	CO1	7 M

UNIT-II

3	a)	List out the methods of conducting O&D Studies.	L1	CO2	7 M
	b)	Discuss about traffic volume studies.	L2	CO2	7 M

OR

4	a)	In a district where rainfall is heavy, two types of road pavement are to be constructed: (i) two lane state highway with bituminous concrete surface and (ii) major district road of WBM pavement, 3.8m wide. What should be the height of the crown with respect to the edges in these two cases, assuming straight line camber?	L1	CO2	7 M
	b)	Spot speed studies were carried out at a certain stretch of a highway with mixed traffic flow and the consolidated data are given below. Determine (i) the upper and lower values or speed limits for installing speed regulations signs at this road stretch and (ii) the design speed for checking the geometric design elements of the highway.	L2	CO2	7 M

Speed range, kmph	No. of vehicles observed	Speed range, kmph	No. of vehicles observed
0 - 10	12	50 - 60	255
10 - 20	18	60 - 70	119
20 - 30	68	70 - 80	43
30 - 40	89	80 - 90	33
40 - 50	204	90 - 100	9

UNIT-III

5	a)	Enumerate the benefit of soil CBR test in highway engineering.	L2	CO3	7 M
	b)	The average normal flow of traffic on cross roads A and B during design speed are 400 and 250 PCU per hour, the saturation flow values on these roads are estimated as 1250 and 1000 PCU per hour respectively. The all-red time	L3	CO3	7 M

		required for pedestrian crossing is 12 sec. Develop two phase traffic signal with pedestrian crossing by Webster's method.			
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OR

6	a)	With neat sketches show few typical patterns of un-channelized and channelized intersections and write down the advantages and limitations of those intersections.	L1	CO3	7 M																	
	b)	The specific gravities and weight proportions for aggregate and bitumen are as under for the preparation of Marshall mix design. The volume and weight of one Marshall specimen was found to be 475 cc and 1100 gm. Assuming absorption of bitumen in aggregate is zero, find V_v , V_b , VMA and VFB; <table border="1" style="margin-left: 20px;"> <tr> <td>Item</td> <td>A_1</td> <td>A_2</td> <td>A_3</td> <td>A_4</td> <td>B</td> </tr> <tr> <td>Wt (gm)</td> <td>825</td> <td>1200</td> <td>325</td> <td>150</td> <td>100</td> </tr> <tr> <td>Sp. Gr</td> <td>2.63</td> <td>2.51</td> <td>2.46</td> <td>2.43</td> <td>1.05</td> </tr> </table>	Item	A_1	A_2	A_3	A_4	B	Wt (gm)	825	1200	325	150	100	Sp. Gr	2.63	2.51	2.46	2.43	1.05	L3	CO3
Item	A_1	A_2	A_3	A_4	B																	
Wt (gm)	825	1200	325	150	100																	
Sp. Gr	2.63	2.51	2.46	2.43	1.05																	

UNIT-IV

7	a)	Summarize the stresses in rigid pavements and its maintenance measures.	L1	CO4	7 M
	b)	Using the data given below, calculate the wheel load stresses at (i)interior, (ii) edge and (iii) corner regions of a cement concrete pavement using westergaard's stress equations. Also determine the probable location where the crack is likely to develop due to corner loading. <ul style="list-style-type: none"> • Wheel load, $P=5100\text{kg}$ • Modulus of elasticity of cement concrete, $E=3.0 \times 10^5 \text{ kg/cm}^2$ • Pavement thickness, $h=18\text{cm}$ • Poisson's ratio of concrete, $\mu=0.15$ • Modulus of subgrade reaction, $K=6.0 \text{ kg/cm}^3$ • Radius of contact area, $a=15\text{cms}$ 	L3	CO4	7 M

OR

8	a)	Outline the principle steps of rigid pavement design using stress equations.	L1	CO4	7 M
	b)	Design a new flexible pavement for a two-lane undivided carriageway using the following data: <ul style="list-style-type: none">• Design CBR value of subgrade 5%• Initial traffic on completion of construction 300cv per day• Average growth rate 6% per year• Design life 10years• VDF value 2.5	L3	CO4	7 M

UNIT-V

9	a)	Write the steps for the design of dowel bars.	L2	CO5	7 M
	b)	Explain the principle, application and method of construction of soil cement stabilization.	L2	CO5	7 M

OR

10	a)	Discuss the effects of construction of WBM roads.	L2	CO5	7 M
	b)	Explain the factor in design of mix for soil lime stabilization.	L2	CO5	7 M