U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Civil Engineering **Duration: 3 hrs.**

Course Code: 23CV5PCHEN / 22CV5PCHWE **Max Marks: 100**

Course: Highway Engineering

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Discuss the role of transportation in the economic and social activities of the country.	*CO1*	*PO1*	**06**
	b)		Discuss the salient features of Road Development Plan Vision: 2021	*CO1*	*PO1*	**06**
	c)		Determine the length of different categories of roads in a state in India by the year 2001, using the Third Road Development formula and the following data: Total area of the state = 96,000 sq.km, Total number of towns as per 1981 census=91. Overall density as per third road development plan.	*CO1*	*PO2*	**08**
			OR			
2	a)		Explain briefly fact-finding surveys and preparation of plans.	*CO1*	*PO1*	**06**
	b)		Outline the main features of various road patterns commonly in use.	*CO1*	*PO1*	**06**
	c)		List the requirements of an ideal alignment and discuss the factors controlling alignment.	*CO1*	*PO1*	**08**
			UNIT - II			
3	a)		Discuss about various elements included in the road margins	*CO2*	*PO1*	**06**
	b)		Calculate the safe passing sight distance for a design speed of 80 kmph. The average acceleration may be assumed as 3.28 kmph/sec.	*CO2*	*PO2*	**06**
	c)		A National Highway passing through a rolling terrain has a horizontal curve of radius equal to the ruling minimum radius. If the design speed is 80 kmph, calculate absolute minimum sight distance, superelevation, extra widening and length of transition curve. Assume necessary data suitably.	*CO2*	*PO2*	**08**
			OR			
4	a)		While aligning a highway in a built-up area, it is necessary to provide a horizontal circular curve of radius 215m. The design speed is 65	*CO2*	*PO2*	**12**

<table>
<tr><td></td><td></td><td></td><td>kmph, length of wheel base of largest truck = 6.0m and width of pavement is 10.5m. Design the following geometric features:
i) Superelevation
ii) Extra widening of pavement
iii) Length of transition curve.</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>b)</td><td>Discuss the various gradients that can be provided in vertical curves for a highway.</td><td>CO2</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td>a)</td><td>Enumerate the different laboratory tests conducted on aggregates and discuss any two.</td><td>CO3</td><td>PO1</td><td>08</td></tr>
<tr><td></td><td></td><td>b)</td><td>Design the flexible pavement for construction of new highway for the following data, as IRC: 37. No of commercial vehicles as per last count= 1000 CVPD, Period of construction = 3 years, Annual growth rate = 7.5%, Design CBR of soil = 10 %, Category of road =NH, two lane single carriage way, Design life =10 years, VDF= 3.5, LDF = 0.75. Calculate the overall thickness using pavement design catalogue given in table.
<table>
<tr><th rowspan="2">Cumulative traffic(msa)</th><th rowspan="2">Total pavement thickness(mm)</th><th>Pavement composition</th><th>Pavement composition</th><th rowspan="2">Granular base and sub base(mm)</th></tr>
<tr><th>BC(mm)</th><th>DBM(mm)</th></tr>
<tr><td>10</td><td>540</td><td>40</td><td>50</td><td rowspan="4">Base = 250

Sub base = 200</td></tr>
<tr><td>20</td><td>565</td><td>40</td><td>75</td></tr>
<tr><td>30</td><td>580</td><td>40</td><td>90</td></tr>
<tr><td>50</td><td>600</td><td>40</td><td>110</td></tr>
</table></td><td>CO3</td><td>PO3</td><td>08</td></tr>
<tr><td></td><td></td><td>c)</td><td>Describe the key differences in the design approach between flexible and rigid pavements.</td><td>CO3</td><td>PO1</td><td>04</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td></td><td>a)</td><td>Summarize the guidelines provided by the Indian Road Congress (IRC) for flexible pavement design.</td><td>CO3</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>A CC pavement slab of thickness 20 cm is constructed over a granular base having K as 15 kg/cm^3. The temperature difference was found to be 18˚C and 12°C during day and night respectively. C_x and C_y were found to be 1.02 and 0.87. Calculate the warping stress at edge and corner regions of the slab. Also find the frictional stress. E=3x10^{5}kg/cm^2; e=10x10^{-6} per ˚C; a=15cm; Slab length=4.5m, f=1.1. Assume any missing data suitably.</td><td>CO3</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td></td><td>a)</td><td>Discuss the construction procedure for cement concrete road.</td><td>CO4</td><td>PO1</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Mention the method of construction and quality control for granular sub-base layer.</td><td>CO4</td><td>PO1</td><td>10</td></tr>
</table>

			OR			
	8	a)	Discuss the construction procedure for Bituminous Concrete road.	*CO4*	*PO1*	**10**
		b)	Evaluate the suitability of Full Depth Reclamation (FDR) pavement for a particular road rehabilitation project.	*CO4*	*PO1*	**10**
			UNIT – V			
	9	a)	How do the causes of distresses vary and what implications does this have on maintenance strategies?	*CO4*	*PO1*	**06**
		b)	Elaborate different methods of economic analysis of highway project.	*CO4*	*PO1*	**06**
		c)	Discuss how environmental factors contribute to distress in both flexible and rigid pavements.	*CO4*	*PO1*	**08**
			OR			
	10	a)	List the different types of distress in rigid pavement. Discuss any one cause of distress and its remedial measures.	*CO4*	*PO1*	**06**
		b)	Discuss the various components of quantifiable and non-quantifiable benefits to the road users due to highway development project.	*CO4*	*PO1*	**06**
		c)	The maximum quantity of water expected in one of the open longitudinal drains on clayey soil is 1.0 m^3/sec. Design the cross section and longitudinal slope of trapezoidal drain assuming the bottom width of the trapezoidal section to be 1.0m and cross slope to be 1.0 vertical to 1.5 horizontal. The allowable velocity of flow in the drain is 1.3 m/sec and Manning's roughness coefficient is 0.02.	*CO4*	*PO2*	**08**

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