Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U2904

M.E. DEGREE EXAMINATION, NOV 2024

Professional Elective

Structural Engineering

21PSE504–DESIGN OF BRIDGES

(Use of IRC: 6-2010, IRC: 18-2000, IRC:21-2000, IRC: 22-2008, IRC: 24-2010, IRC: 83- 1999 (Part-I to III), IS 800:2007,IS 456:2000, SP 6-1:1964 and Pigeaud's curves is permitted)

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) A reinforced concrete slab culvert is to be designed for a NH crossing conforming to the IRC bridge code (IRC 112:2011). Using the following data at site design a suitable slab for the bridge deck. CO3-Ana (20)
   Foot paths – 1m wide
   Clear span – 6m
   Carriage way – Two Lane (7.5m wide)
   Wearing coat – 80mm
   Width of bearing – 400mm
   Materials – M30 & Fe415 Grades(HYSD Bars)
   Loading – IRC Class AA tracked vehicle

   Or

   (b) Design a RC Slab culvert for a National highway crossing to suit the following data CO3-Ana (20)
   Carriage way – Two Lane (7.5m wide)
   Foot paths – 1m on either side
   Clear span – 6m
   Wearing coat – 80mm
   Width of bearing – 400mm
   Materials – M25 & Fe415 Grades(HYSD Bars)
   Loading – IRC Class AA tracked vehicle
   Assume material properties

2. (a) Design a RCC Tee beam and slab deck to suit the following data, Effective span of girders – 16m, Width of roadway – 7.5m, Width of kerb – 600mm, Depth of kerb – 300mm, Number of main girders – 4, Width of girder – 300mm, Spacing of main girders – 2.5m, Thickness of wearing coat – 80mm, Spacing of cross girder – 4m, Materials – M20 & Fe415 Grades(HYSD Bars), Loading – IRC Class A wheel loads. Assume design data. CO3-Ana (20)

Or

(b) Design a reinforced concrete box culvert having a clear vent way of 3m by 3m. The superimposed dead load on the culvert is 12.8kN/m^2. The live load is estimated as 50kN/m^2. Density of soil at site is 18kN/m^3. Angle of repose is 30^o. Adopt M30 & Fe415 HYSD grades. Sketch the reinforcements in the box culvert. Assume material properties. CO3-Ana (20)

3. (a) Design a post tensioned prestressed concrete slab bridge deck for a national highway crossing to suit the following data,
Clear span – 10m, Width of bearing – 400m, Clear width of roadway – 7.5m, Foot paths – 1m on either side, Kerbs – 600mm wide by 300mm deep, Thickness of wearing coat – 80mm, Live load – IRC class AA tracked vehicle , Types of structure – Class 1 type, Materials – M40 grade concrete and 7mm diameter high tensile wires with an ultimate tensile strength of 1500N/mm^2 housed in cables with 12 wires and anchored by Freyssinet anchorages of 150mm diameter. Assume compressive strength of concrete at transfer as 35N/mm^2. CO4-Ana (20)

Or

(b) Design a post tensioned prestressed concrete continuous beam and slab bridge deck for a national highway crossing to suit the following data, Width of carriage way – 7.5m, Two continuous spans of 40m each, Kerbs – 600mm wide on each side, Thickness of wearing coat – 80mm, Live load – IRC class AA tracked vehicle For prestressed concrete girders, adopt M50 grade concrete with compressive strength of concrete at transfer as 40N/mm^2, For cast in situ deck slab adopt M30 grade concrete, Spacing of cross girders – 5m, Spacing of main girder – 2.5m, Loss ratio – 0.8, High tensile strands of 15.2m dia conforming to IS6006-1983. Assume relevant design data. CO4-Ana (20)

4.	(a)	Design a steel truss bridges to suit the following data, Effective span – 30m Roadway – 7.5m (two lane) Kerbs – 600mm IRC class AA traced vehicle Use M25 grade concrete and Fe415 grade HYSD bars for deck slab. Rolled steel sections with an yield stress of 236 N/mm^2. Assume relevant design data	CO2-App	(20)
		Or		
	(b)	Determine the loads and bending moments of steel truss bridges to suit the following data, effective span – 30m, roadway – 7.5m (two lane), kerbs – 600mm, IRC class AA traced vehicle, use M25 grade concrete and Fe415 grade HYSD bars for deck slab. Rolled steel sections with an yield stress of 236 N/mm2.	CO2-App	(20)
5.	(a)	Design the pier of a major bridge using the following data: Dimensions of pier; Height of pier-9 m, Width at top-2.0 m, Width at bottom-3.0 m, Length of pier-8.5 m, Maximum water level-8 m above base of pier. Girder bearings located at 500 mm from centre of pier on either side Dead load from each span 2300 kN, Reaction due to live load on one span = 1000 kN Maximum mean velocity of current - 3 m/sec, Material for pier, M-20 Grade concrete, Live load: IRC Class AA or Class A whichever produces the worst effect, Check the adequacy of the dimensions provided by computing the stresses in the pier	CO5-Ana	(20)
		Or		
	(b)	Design a steel rocker bearing for transmitting a vertical of 1000kN and a horizontal reaction of 100kN at the support of a bridge girder assuming the following permissible stresses according to IRC 83-1999. Permissible compressive stress in concrete bed block – 4 N/mm^2 Permissible bending stress in steel plate – 160 N/mm^2 Permissible bearing stress in steel plate – 185 N/mm^2 Permissible shear stress in steel – 105 N/mm^2 Sketch the typical details of the rocker bearing	CO5-Ana	(20)