

Reg. No. :

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Question Paper Code: U3904

M.E. DEGREE EXAMINATION, NOV 2025

Professional Elective

Structural Engineering

21PSE504 – DESIGN OF BRIDGES

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Determine the bending moments for a slab panel of a reinforced concrete Tee beam and slab deck is 2.5 wide between main girders and 4m between cross girders. Design the slab for IRC class A loading. Adopt M20 and Fe415 HYSD bars. CO2-App (20)
- Or
- (b) Determine the design live load for the reinforced concrete slab culvert using IRC class A loading. Show that the live moments are significantly lower when compared with those resulting from IRC class AA tracked vehicle loading on the slab culvert. CO2-App (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)
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° . Adopt M20 & Fe415 HYSD grades. Sketch the reinforcements in the box culvert. Assume relevant data. CO3-Ana (20)
3. (a) Design a post tensioned prestressed concrete slab bridge deck for a national highway crossing to suit the following data, CO4-Ana (20)
 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 .
- Or
- (b) Design a post tensioned prestressed concrete continuous beam and slab bridge deck for a national highway crossing to suit the following data, CO4-Ana (20)
 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 M60 grade concrete with compressive strength of concrete at transfer as 40N/mm^2 , For cast in situ deck slab adopt M20 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.
4. (a) Briefly mention the method of designing the reinforced concrete deck slab supported on stringer beams in a trussed bridge for IRC loads. CO1-U (20)

Or

(b) Explain the various advantages of steel bridges in comparison with the reinforced concrete and prestressed concrete bridges for national highway crossings. CO1-U (20)

5. (a) Design a reinforced concrete rocker bearing to transmit a support reaction of 600kN. Adopt M30 grade concrete and Fe415 grade HYSD bars. Permissible bearing stress in steel plate – 185 N/mm^2 . Sketch the details of reinforcements in the rocker bearing. CO5-Ana (20)

Or

(b) A concrete pier of a major bridge is rectangular in section with dimensions of 3 m wide by 10 m in length and a height of 10 m above ground with hemispherical cut and ease waters the top section is 2m by 10 m. The dead load from the super structure is 1800 kN from each span acting at a distance of 0.5 m from the centre line of the pier. The live load reaction from one span is 1000 KN. Wind pressure on pier is 2 kN/m^2 . The maximum permissible compressive stress on concrete per is 2000 kN/m^2 . Calculate the stresses developed at the base of the pier due to (i) dead load and self weight (ii) Effect of buoyancy (iii) Eccentricity of live load (iv) wind pressure. CO5-Ana (20)

