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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

THIRD SEMESTER M. TECH. DEGREE EXAMINATION

Civil Engineering

(Structural Engineering and Construction Management)

04CE 7403 Design of Bridges

Maximum Marks: 60 Duration: 3 Hours

IRC 6, IRC 21, IRC 18, IRC 83, IS 1343 permitted.

Part A

Answer all questions.

*Each question carries **3** marks*

1. Explain the IRC Specifications for live load for IRC class AA loading?
2. Explain Hendry-Jaegar method
3. Explain the design criteria of arch bridges.
4. Justify the selection of a prestressed concrete bridge for long span.
5. Explain the design criteria of composite prestressed bridges.
6. Explain the staging method of construction of bridge deck.
7. List out the forces acting on piers.
8. Explain the importance of expansion joints for bridge decks

(8 × 3 = 24 marks)

Part B

*Answer all questions. Each question carries **6** marks*

9. Explain the different IRC loading standards for Highway bridges.

Or

10. Explain the seismic effect on the bridge design .

11. An RCC Tee beam and slab girder deck is required for the crossings of a NH. The data available is as follows:
    Clear width of Roadway = 15m
    Footpaths 1m on either side, effective span = 20m
    Live loads – IRC class-AA or A whichever gives worst effect
    Thickness of wearing coat = 100mm
    Number of main girders = 8
    M20 grade concrete and HYSD Fe-415 tor steel bars
    Spacing of cross girders = 4m

Spacing of main girders = 2m
Design one interior panel of deck slab and one exterior girder and sketch the details of reinforcements

Or

12. An RCC Tee beam and slab girder deck suit the following data:
Clear width of Roadway = 7.5m
Footpaths 1m on either side, effective span = 16m
Live loads – IRC class-AA tracked
Thickness of wearing coat = 80mm
Number of main girders = 4
M20 grade concrete and HYSD Fe-415 tor steel bars
Spacing of cross girders = 4m
Spacing of main girders = 2.5m
Design one interior panel of deck slab and one exterior girder and sketch the details of reinforcements

13. Design a double cantilever bridge to suit the following data:
Total length of the bridge = 80m
Road width = 7.5m
Footpaths = 1.8m on either side
Spacing of Tee beams = 1.8m
Loading : IRC class AA tracked vehicle
Materials M-25 grade concrete and Fe-415 grade HYSD bars
Design one interior panel of deck slab and one main girder.

Or

14. Design a three span continuous RCC bridge with girders of variable cross-setion is required for the crossing of a NH. Design the deck slab and main girders to suit the following data:
Total length of bridge = 70m
Span lengths, end spans = 20m
Central span = 30m
Width of carriageway = 7.5m
Kerbs =600mm on either side
Spacing of main girders = 2.9m
Spacing of cross girders = 4m
M-20 grade concrete, Fe-415 tor steel
IRC class AA tracked vehicle

15. Design a post tensioned prestressed concrete slab bridge deck for a NH crossing to suit the following data:
Clear span = 10m
Width of bearing = 400mm
Clear width of roadway = 7.5m
Footpath = 1m on either side
Kerbs = 600mm wide
Thickness of wearing coat = 80mm
Live load = IRC class AA tracked vehicle
Type of structure = class 1 type

Materials: M-40 grade concrete and 7mm diameter High tensile wires with an ultimate tensile strength of 1500N/mm^2 housed in cables with 12wires and anchored by Freyssinst anchorages of 150mm diameter.
Compressive strength at transfer f_{ci} = 35N/mm^2
Loss ratio = 0.8

Or

16. Design the main girder of a post tensioned prestressed concrete Tee beam slab bridge deck for a NH crossing to suit the following data:
Clear span = 30m
Clear width of roadway = 7.5m
Footpath = 1.5m on either side
Kerbs = 600mm wide
Thickness of wearing coat = 80mm
Live load = IRC class AA tracked vehicle
Type of structure = class 1 type
Materials: M-50 grade concrete and strands of 15.2mm- 7 ply
Compressive strength at transfer f_{ci} = 40N/mm^2
Loss ratio = 0.8
For deck slab adopt M-20 grade concrete
Maximum Live load BM = 2000KNm (including Impact factor)
Maximum Live load SF = 400 KN
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17. Write a short note on the recent trends in the bridge construction

Or

18. Expain briefly about the push-out method of construction of bridge

19. A semi-circular end pier supports the deck forming a major highway. The various forces acting on the pier are listed below.
Dead loads from each span = 2000kN
Reaction due to live load on one span = 1000kN
Braking forces = 140kN
Wind pressure on pier = 2.4kN.m^2
Material of pier = 1:3:6 cement concrete
Top width = 2m, bottom width = 3m, total height of pier = 10m, HFL is 9m above the base of base, length of pier = 9m.

Or

20. Design an elastomeric pad bearing to support a Tee beam girder of a bridge using the following data:
Maximum dead load reaction per bearing = 300KN
Maximum Live load reaction per bearing = 1200 KN
Longitudinal force due to friction per bearing = 45KN
Effective span of girder =16m
Estimated rotation at bearing of the girder due to dead load and live loads = 0.002radians
Total estimated shear strain due to creep, shrinkage and temperature = 6 x 10^{-4}

(6 × 6 = 36 marks)