

Z 6397

M.E. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Elective

Structural Engineering

ST 1624 — DESIGN OF BRIDGES

(Regulation 2005)

Time : Three hours

Maximum : 100 marks

Use of relevant BIS and IRC codes are permitted.

Assume any required data suitably.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Economical span.
2. What are the factors influencing the selection of type of Bridges?
3. Write note on IRC Class AA loading.
4. Define Impact effect. Give the Impact value for 70R loading with span less than 9 meters for tracked vehicle.
5. What is the effect of secondary stresses in the steel bridges?
6. Draw a typical sketch of an Abutment and a wing wall.
7. Write notes about – T – Beam bridges.
8. List out the basic difference between pre-tensioning and post tensioning.
9. Draw a typical cross section of Plate Girder Bridge with stiffeners.
10. Write down the importance and types of bearings.

PART B — (5 × 16 = 80 marks)

11. (a) Design the deck slab of R.C.C. slab culvert for a two lane carriage way with clear span of 6 m, with height of vent 3 m and depth of foundation as 1.35 m. Use Grade of concrete as M 25 and Grade of steel as HYSD bars. (16)

Or

- (b) Find out the design bending moment over a T-Beam bridge deck slab having the dimensions of width = 2700 mm and length = 3250 mm subjected to Class AA wheeled vehicle. (16)
12. (a) (i) What are the factors to be considered for selecting the bridge site? Discuss. (8)
- (ii) What are the preliminary data to be collected before constructing a bridge? How are they used? (8)

Or

- (b) (i) Discuss choice of foundations for piers and abutments. (8)
- (ii) What are the different types of foundation to be adopted for bridges? Explain any two in detail with neat sketches. (8)
13. (a) Write down the design principles of box girder bridges. (16)

Or

- (b) Explain the design principles of Continuous bridges. (16)
14. (a) Design the longitudinal girders of a post-tensioned prestressed concrete bridge to suit the following data :

Width of the road = 7.5 m

Effective span = 25 m

Kerbs = 600 mm each side

Live load = IRC Class AA Tracked vehicle

Grade of concrete for deck slab is M25 and for Beams M50

Cube strength at transfer = $f_{ci} = 35 \text{ N/mm}^2$

Permissible compressive stress at transfer = $f_{ct} = 17.5 \text{ N/mm}^2$

Permissible compressive stress at working load = $f_{cw} = 16.5 \text{ N/mm}^2$

Loss ratio = 0.80.

7 mm diameter high tensile wires having a characteristic tensile strength $f_p = 1500 \text{ N/mm}^2$ and for steel Fe-415 are available for use. (16)

Or

Design a post - tensioned prestressed concrete slab bridge deck for a national highway crossing to suit the following data :

Clear span = 12 m

Width of bearing = 500 mm

Clear width of road way = 7.5 m

Foot path = 1 m on either side

Kerbs = 600 mm wide

Thickness of wearing coat = 80 mm

Live load = IRC Class AA tracked vehicle

Materials : M 40 grade concrete and 8 mm diameter high tensile wires with an ultimate tensile strength of 1500 N/mm². For supplementary reinforcement, adopt Fe-415 grade HYSD bars. Compressive strength at transfer = $f_{ci} = 35$ N/mm². (16)

- (a) A plate girder is to be designed for a B.G. track to suit the following data :

Span of the bridge = 15 m

Dead load of track = 8.5 kN/m

E.U.L.L. for B.M. calculation/Track - 3010 Kn

E.U.L.L. for shear calculation/Track - 3222 Kn.

Design the plate girder alone. Stiffeners and bracing need not be designed. (16)

Or

- (b) Sketch the Steel roller-cum-rocker bearings with components. (16)