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

Z 6470

M.E. DEGREE EXAMINATION, MAY/JUNE 2008.

Elective

Structural Engineering

ST 1624 — DESIGN OF BRIDGES

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Use of relevant BIS. IRC Codes and Pigeaud's Curves are permitted.

Assume any required data suitably.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the types of the wing walls generally adopted to retain the earth behind the abutment wall?

2. What are the guidelines given by IRC 21-1987 for control of cracking to satisfy the serviceability requirements under the limit state of local damage?

3. Write short note on IRC Class AA Loading.

4. What is meant by net effective width of dispersion?

5. What is skew crossing? Where it is used?

6. What is the significance of box culvert?

7. List out the methods available for distribution of live loads among longitudinal girders.

8. Where the plate girder bridges are adopted and list the advantages?

9. What do you mean by shear connector?

10. List the types of bearings.

PART B — (5 × 16 = 80 marks)

11. (a) A reinforced concrete simply supported slab is required for the deck of a road bridge having the data given below :

Width of carriage way	: 7.5 m
Width of kerb	: 600 mm
Clear span	: 5.5 m
Width of bearing	: 400 mm
Type of loading	: IRC class AA
Materials used	: M30 grade concrete and Fe-415 grade HYSD bars

Design the deck slab and draw the following views :

(i) Half cross-section of deck slab showing details of reinforcements

(ii) Half longitudinal section of deck slab showing details of reinforcements.

Or

(b) Explain :

(i) Longitudinal forces in road bridges.

(ii) Centrifugal forces in road bridges.

(iii) Secondary stresses in members of bridge structures.

(iv) Temperature and shrinkage effects of concrete bridge structures.

12. (a) The reinforced concrete slab panel of an RCC Tee beam and slab deck is 2.2m wide between main Tee beams and 4.2m long between cross girders. Design the RC slab panel of IRC class A loading using M20 grade concrete and Fe 415 grade HYSD bars.

Or

(b) A reinforced concrete box culvert of rectangular water way 3.75m wide by 2.5m deep is required for a road crossing. The box culvert has to support a superimposed dead load of 10 kN/m^3 and a live load of 40 kN/m^2. Density of soil at site is 16 kN/m^3 and the angle of repose of soil is 30°. Use M25 grade concrete and Fe415 grade HYSD bars, design the box culvert and sketch the reinforcements.

13. (a) Design the deck slab of a double cantilever bridge to suit the following data :

Road width	: 7.5m between kerbs
Footpaths	: 1.8m on either side
Spacing of the Tee beams	: 1.8m
Loading	: IRC class AA tracked vehicle
Materials	: M25 grade concrete, Fe 415 grade HYSD bars.

Or

(b) Write down the step by step procedure of design of a Continuous bridges.

14. (a) Design a plate girder to carry a super imposed load of 140 kN per m on an effective span of 20m.

Or

(b) Design a post tensioned prestressed concrete slab bridge deck to suit the following data :

Clear span	: 7 m
Width of bearing	: 350 mm
Clear width of roadway	: 7.5 m
Foot path	: 1m on either side
Kerbs	: 600 mm wide
Thickness of wearing coat	: 80 mm
Loading	: IRC Class AA tracked vehicle
Compressive strength at transfer	: 35 N/mm^2

Materials : M40 grade concrete and 7mm diameter high tensile wires with an ultimate tensile strength of $1500N/mm^2$. For supplementary reinforcement adopt Fe415 grade steel bars.

15. (a) Design a reinforced concrete rocker bearing to transmit a support reaction of 500 kN. Adopt M30 grade concrete and Fe415 grade HYSD bars. Permissible bearing stress in concrete is 8 N/mm^2. Sketch the details of reinforcements in the rocker bearing.

Or

(b) Design an elastomeric pad bearing to support a Tee beam girder of a bridge using the following data :

Maximum dead load reaction per bearing	:	250 kN
Maximum live load reaction per bearing	:	650 kN
Longitudinal force due to friction per bearing	:	40 kN
Effective span of the girder	:	16 m
Estimated rotation at bearing of the girder due to dead and live loads	:	0.002 radians
Concrete grade	:	M25
Total estimated shear strain due to creep, shrinkage and temperature	:	6×10^{-4}