## 23525

# M. Tech. 3rd Semester Civil Engg.
# (Specialisation in Structural Design)
# (Elective-III) Examination – December, 2014

### DESIGN OF BRIDGES
### Paper : MTSD-308

*Time : Three Hours ]*                    *[ Maximum Marks : 100*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

*Note :* Attempt any five questions. All questions carry equal marks. Assume suitable data. Use of IRC-18-2000, IRC : 21-2000 and IS : 456 code is allowed.

1. What are the Indian Roads Congress Bridge loading standards for different type of loadings ? Explain with neat sketch.                    20

2. Design a R.C.C. Tee beam girder for a National highway bridge to suit the following data :         20

   Clear width of roadway = 7.5 m,

Width of kerbs = 600mm, Effective span = 20m

Live load = I.R.C. Class AA tracked vehicle

Concrete = M20 grade, Steel = Fe-415 grade for steel

Spacing of cross girders = 4m,

Spacing of main girders = 2.5m

Design the deck slab, main girders and one of the cross girders, Using Courbon's

method. Sketch the typical details of reinforcements.

3. A two span continuous reinforced concrete bridge with girders of variable cross section is required for a bridge, crossing, Design the deck slab and main girder to suit the following data :                                    20

Total length of bridge = 50m

Span length : two equal spans of 25m each

Width of carriage way = 7.5m

Kerbs = 600mm on either side, Footpaths = 1m on either side

Spacing of main girders = 3m, Spacing of cross girders = 5m

Concrete : M 20 grade; Steel : Fe 415 tor steel

Loading : IRC Class A or class AA whichever gives the worst effect

Design the bridge deck and draw typical sections showing reinforcements details in the deck slab and girder.

4. Design a double cantilever bridge to suit the following data : 20

   Total Length of the bridge = 52m

   Road width = 7.5m (two lane)

   Footpaths = 1.5m on either side

   Spacing of tee beams = 2m

   Loading : IRC class AA tracked vehicle

   Materials : M20 grade concrete, Fe 415 grade steel

   Design the deck slab and one of the main girders and sketch the details of reinforcement.

5. Design a post tensioned prestressed concrete Tee beam and slab bridge deck to suit the following data :

   20

   Effective span = 24m

   Width of carriage way = 7.5m

   Kerbs 600mm wide on either side of the road

   Spacing of main girder = 2m

   Spacing of cross girders = 4m

   Loading is IRC Class AA tracked vehicle

Adopt M 45 grade and high tensile steel strands confirming to IS : 6006 and supplementary reinforcement comprising Fe 415 steel HYSD Bars. Permissible stresses are as specified in IRC-18-2000 loss ratio = 0.85.

**6.** Explain the following terms in detail.         $4 \times 5 = 20$

   (a)  Diaphragms

   (b)  End block

   (c)  Short term deflections

   (d)  Check for diagonal tension

**7.** Design a reinforced concrete rocker bearing to transmit a support reaction of 800 kN. Adopt M 30 grade concrete and Fe 415 grade HYSD bars. Permissible bearing stress in concrete = $8N/mm^2$. Sketch the details of reinforcement in the concrete rocker bearing.                          20

**8.** What are the different types of forces acting on the Piers ? What the general features of the piers ? How to do the stability analysis of piers. Explain with neat sketches.                          20