Total No. of printed pages = 6

CE 131801

Roll No. of candidate ☐☐☐☐☐☐☐☐☐

2020

B.Tech. 8th Semester End-Term Examination

DESIGN OF STRUCTURES — IV

Full Marks – 50   Time – Two hours

The figures in the margin indicate full marks
for the questions.

Answer Question No. 1 and any *three* from the rest.

(Pigeaud's Curve and IS-1893 (Part-I) : 2002 allowed)

1.   Answer any *five* of the following :   (5 × 1 = 5)

    (i)   The total loading in case of IRC AA wheeled vehicle is _____.

    (ii)   A major bridge has span more than _____.

    (iii) The free board for a high level bridge should not be less than _____.

    (iv)   The intermediate supports of a multispan bridge structure are called _____.

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(v) The streams flowing between erodible banks and having erodible beds are known as _____ streams.

(vi) Minimum tensile strength of an elastomeric bearing as per IRC-83 (Part II) is _____.

(vii) The geographical point on the surface of earth vertically above the focus of a particular earthquake is known as _____.

(viii) The value of Zone factor (Z) to be considered for seismic design of a building located in Delhi is _____.

(ix) Pigeaud's method can be applied only if the slab is _____ loaded.

(x) The P waves and S waves are collectively known as _____ waves.

Answer any *three* questions from the following :

2. (a) Discuss the requirements of an ideal bridge. (5)

    (b) For a slab culvert the following information are available :   (10)

        (i)   Clear span = 6 m

        (ii) No. of lane = 2

        (iii) Live load = IRCAA tracked vehicle.

        Find the magnitude of design moment or the slab. Assume any missing data.

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3. (a) Draw a neat sketch explaining IRC Class A loading and IRC Class B loading. (7)

   (b) For a RCC T-beam bridge, dimension of an interior panel of the deck slab is 4.8 × 3.2 m width of longitudinal girder is 300 mm and that of cross girder is 250 mm. Find the maximum bending moment along short span and long span when IRC Class 70 R tracked vehicle is crossing over the bridge. Assume any missing data. (8)

4. (a) List out the loads and stresses to be considered for design of road bridges and culverts. (3)

   (b) For a National Highway RCC bridge the following information are given :

   (i) Clear width of roadway = 7.5 m

   (ii) Span = 16 m

   (iii) Three longitudinal girders at c/c distance of 2.5 m

   (iv) Width of longitudinal and cross girder = 300 mm

   (v) Live load-IRC Class AA tracked vehicle

   (vi) Thickness of wearing coat = 80 mm.

   Find the maximum B.M. & S.F. for the longitudinal girder assembly. Assume any missing data. (12)

5. (a) Discuss the usefulness of Courbon's method in the design of longitudinal girder assembly. (3)

   (b) Obtain Courbon's reaction factor and maximum bending moment for the longitudinal girder assembly for the following data : (12)

      (i) Span of bridge = 18 m

      (ii) Roadway = 2 lane

      (iii) Three longitudinal girders at c/c spacing of 2.5 m

      (iv) Kerb width = 0.6 m

      (v) Live load = IRC Class A.

6. (a) Explain rocker and roller bearing with a neat sketch showing its different components. (5)

   (b) Design a rocker and roller bearing for a 20 m spanned T beam bridge, where a reaction of 2500 kN is expected at the supports of the bridge. The other details are as follows : (10)

   Allowable pressure on rollers = 5N mm diameter mm length

   Bearing pressure on rocker pin = 30 N/mm²

   Allowable pressure on bearing plate = 2000 N/mm²

   Allowable pressure on concrete bed block = 3.8 N/mm²

7. (a) What do you understand by the terms — focus, epicenter and peak ground acceleration? (6)

(b) Explain briefly magnitude and intensity of an earthquake. (5)

(c) What do you understand by "OMRF and SMRF"? (4)

8. (a) What do you understand by strong column weak beam frame? Explain. (3)

(b) Calculate the seismic forces at different floor levels for the building as shown in Figure 1 having the following specifications : (12)

Size of the beam = 300 mm × 400 mm, Size of Column = 400 mm × 400 mm.

Thickness of slab = 140 mm, Thickness of infill wall = 250 mm, City — Dibrugarh

Soil type — Medium, Type of building — Important, Special Moment resisting frame, Imposed load = 3.2 kN/m².

Unit weight of concrete — 25 kN/M³, Unit weight of infilled wall — 20 kN/M³
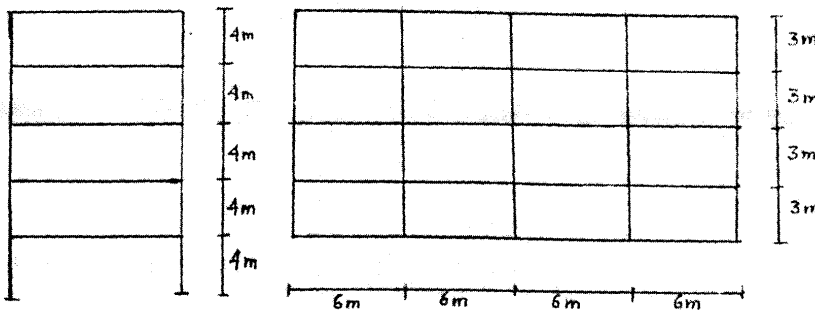

Figure 1

9. (a) What preliminary data should be collected before site selection of a proposed bridge? (5)

(b) What is scouring? What do you understand by normal scour depth and maximum scour depth? (5)

(c) A stream with hard banks has a width of 80 m. Its bed is alluvial (f = 1.1) and discharge through the section is 500 m³/sec. Calculate the maximum scour depth under the bridge having a single span of 50 m. (5)

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