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2019

B.Tech. 8th Semester End-Term Examination

DESIGN OF STRUCTURES — IV

Full Marks – 100

Time – Three hours

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

IS 456, IS 800, IS 1893, IS 13920, IRC 21 and Pigeaud's
curves are permitted.

Assume any missing data if required

Answer Question No. 1 and any six from the rest.

1. Fill in the blanks of the followings : (10 × 1 = 10)
 - (i) In India the standard bridge loads are specified in IRC _____
 - (ii) Maximum impact factor for IRC Class AA tracked vehicle is _____
 - (iii) In bridge deck comprising integrally cast slab and girder, the moments develop due to wheel loads on the slabs are computed by _____ method.

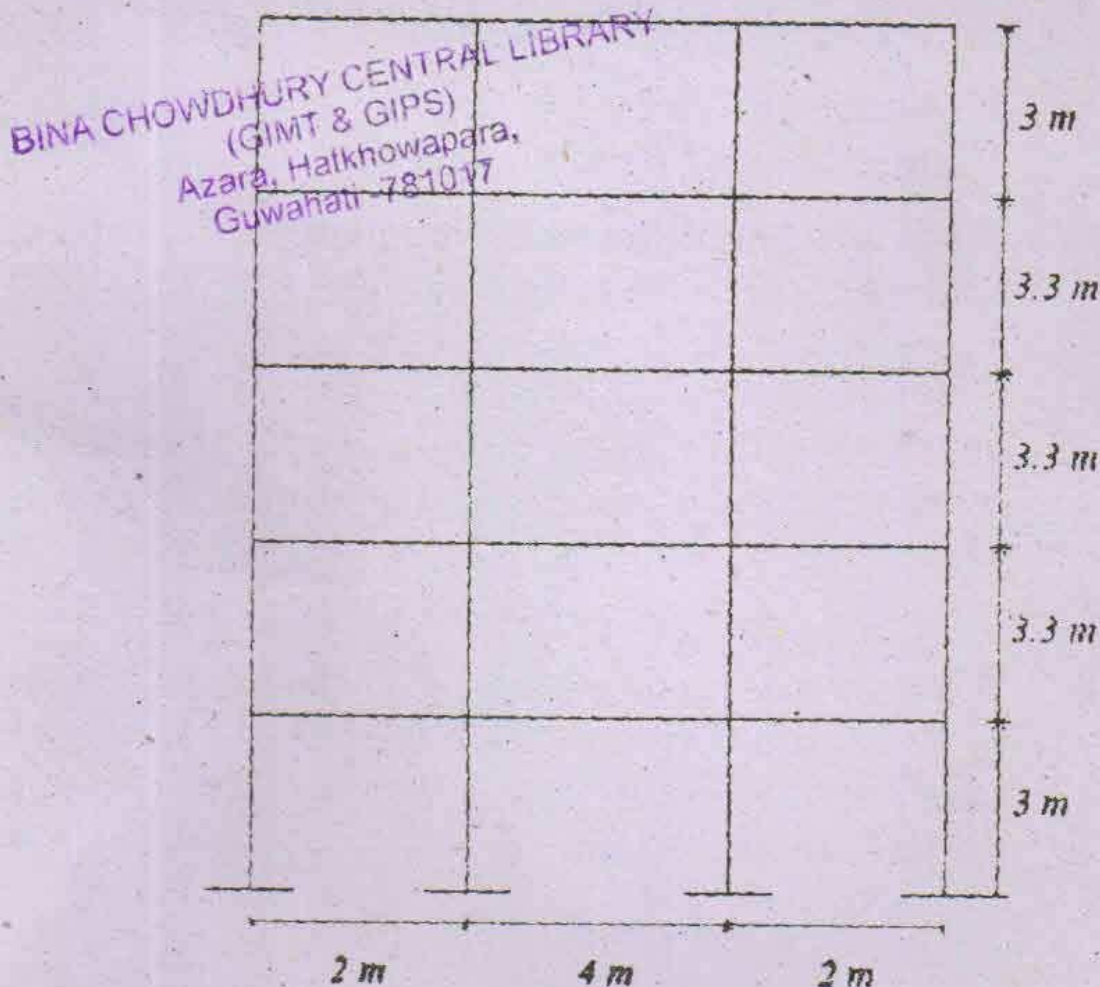
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- (iv) The seismic wave which travel through the inner layers of the earth is known as _____
- (v) For the design of solid deck slabs, the tension reinforcement shall not be less than _____ percent of the total cross sectional area when using Fe 415/500 grade bars.
- (vi) Courbon's method is applicable to the bridge design when there are at least _____ numbers symmetrically spaced cross girders.
- (vii) Sliding plate bearings are used for the girder bridges of span up to _____ m.
- (viii) The maximum wheel load of a single pair wheels of IRC class B loading vehicle is _____
- (ix) The response reduction factor for OMRF type building frame as per IS code is _____
- (x) For steel roller cum Rocker bearing, rollers of diameter _____ mm are generally preferred.

2. Design a reinforced concrete slab culvert for a National Highway crossing to suit the following data: (15)

- (a) Clear span = 6 m
- (b) Carriage way = Two lane (7.5m wide)
- (c) Foot Path = 1 m on either side
- (d) Average thickness of wearing coat = 80 mm
- (e) Width of bearing = 400 mm
- (f) Grade of concrete = M-25 and Grade of Steel Fe 415
- (g) Loading: IRC Class A vehicle.

3. (a) Briefly explain the different methods of seismic analysis of buildings as per Indian standard. (5)
- (b) Evaluate the seismic forces at each floor level of the building as shown in Fig. 1 (10)



The building frame is to be designed as SMRF. The building will be used as institutional building located in Guwahati Equivalent UDL from DL+LL of floors =15 kN/m at all levels excluding wall load.

Thickness of the wall = 120 mm

Size of all beams – 250 mm × 400 mm

Size of all columns = 350 mm × 350 mm

Slab thickness = 100 mm

4. (a) A bridge is proposed to be constructed across an alluvial stream carrying a discharge of 500 m³/sec. Assuming the value of silt factor as 1.1, Calculate depth of maximum scour when the bridge consists of: (5)
- (i) Three spans of 15 m each
 - (ii) Two spans of 30 m each.
- (b) What are the characteristics of an ideal site for a major bridge? Briefly explain. (5)
- (c) What are the different components of a typical bridge? Show with a neat sketch. (5)
5. (a) Schematically explain the ductile detailing provision of longitudinal and transverse reinforcement in beams and columns, as per IS code. (7)
- (b) What do you understand by ductile detailing of a building? Explain with sketches, how you take care of special moment resisting frames (SMRF) in buildings. (8)

6. (a) What do you understand by soft-storey and weak-storey? Explain the difference. (4)
- (b) What do you understand by vertical and horizontal irregularities of buildings? Explain. (5)
- (c) What is Response Spectra? (3)
- (d) What do mean by magnitude and intensity of earthquake? (3)
7. (a) Design a steel rocker bearing transmitting a vertical reaction of 800 kN and a horizontal reaction of 120 kN at the support of a girder bridge. Assume the following permissible stresses according to IRC : 83-1982. (12)

Permissible stress on concrete bed block
 $= 4 \text{ N/mm}^2$

Permissible flexural stress $= 160 \text{ N/mm}^2$

Permissible bearing stress $= 185 \text{ N/mm}^2$

Permissible shear stress $= 105 \text{ N/mm}^2$

- (b) Sketch the typical details of the rocker bearing of the above question. (3)
8. For a RCC bridge in a National Highway, the following information are available :
- (a) Effective span of the bridge : 16 m
- (b) Clear with of the roadway : 7.5 m

- (c) Thickness of the wearing coat : 80 mm
- (d) Wheel load : IRC AA tracked vehicle
- (e) Material : M25 grade of concrete and Fe 415 HYSD bars.

Design the longitudinal Girder. (15)

9. A slab panel of a reinforced concrete T-beam slab deck is $2\text{ m} \times 4\text{ m}$ supported on all four sides and continuous over the main and cross girders. Determine the bending moments for IRC Class A train. Assume the thickness of the slab is 200 mm and wearing coat is 80 mm. Also adopt M 20 grade of concrete and Fe 415 grade of steel. (15)

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