19.1.09

B.Arch. (Architecture) Part –III, 5th Sem. Final examination, 2009
Structural Engineering-III
(CE-501A)

Time: 3 hours

Full Marks: 70

Use separate answer script for each half. Answer any SIX questions, taking THREE from each half. All questions are of equal value. 2 marks are reserved for neatness in each half. All notations used have their usual meanings. Assume suitable data, if necessary

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First Half

1. a) Calculate the moment of resistance of a reinforced concrete beam of 450 mm depth and 250 mm width, if it is reinforced with i) 2 nos. 16Φ bars, ii) 3 nos. 16 Φ bars, ii) 4 nos.16 Φ bars.

   b) Why corner reinforcements are provided in a two-way slab?

2. a) Design a cross-section of a beam subjected to a moment of i) 50 kN-m, ii) 100 kN-m. Use grade of concrete and steel of your choice.

   b) A R.C. beam is designed with M20 grade concrete and Fe 415 steel. Do you think that the steel requirement will increase if i) M25 grade of concrete is used instead of M20? ii) Fe250 is used instead of Fe 415? Justify your answer. The size of the beam and bending moment are kept same.

3. A two-way slab has a clear span of 3m x 4.5 m, simply supported at four edges (support width 250 mm) with corners held down. Calculate the spacing of reinforcements at middle and end strips. Also calculate for the corner reinforcement. Given, intensity of live load is 4 kN/m^2. Take α_x=0.088 and α_y=0.056. Use M20 grade concrete and Fe 415 steel.

4. Draw the stress distribution diagram over a cross-section of a beam at the limit state of failure in flexure as per IS –456:2000. Indicate the line of actions and values of total tensile and compressive force on the section,

therein. Hence, considering a balanced section, derive an expression for i) neutral axis position and ii) moment of resistance, using equilibrium of the cross-section.

5.a) What are the advantages of Limit State method over Working Stress method of R.C. design?

b) What do you mean by two-way slab? Why shorter direction is more critical in flexure than longer direction in a two-way slab?

Second half

6. A simply supported beam AB of span L, carries a concentrated load W at point D (AD = a & DB = b).
   Find the deflection of point D from the cord line AB and the angle θ_A between this cord and the tangent at A. Also locate the point of maximum deflection and find the value of maximum deflection.

7. A continuous beam ABC, has built-in support at A and roller supports at B & C. Span AB = 9m, BC = 6m. Moment of Inertia of AB is 3I and that of BC is 2I.
   The beam carries a concentrated load of 60 KN at point 6m from A on span AB and uniformly distributed load of 12 KN/m on span BC.
   Assume Elasticity modulus $E = 2 \times 10^5$ N/sq.mm. and $I = 1 \times 10^5$ cm^4
   Determine the support reactions and also end bending moments of the beam, by Method of Consistent Deformation.

8 A Portal frame ABCD, has fixed support at A and hinged support at D. Height of AB and DC is 4m and span BC is 6m. Moment of Inertia of AB & DC is 2I and that of BC is 3I.
   Span BC carries uniformly distributed load of 24 KN/m.
   Analysis the beam by Slope Deflection Method and determine the end bending moment of each member and support reactions.

9 Determine the forces in all member of the pin-jointed steel truss for the loads, shown in Fig: Q9. Assume cross-sectional area of each member is 20 sq.cm.

10. Derive the Slope Deflection Equations.

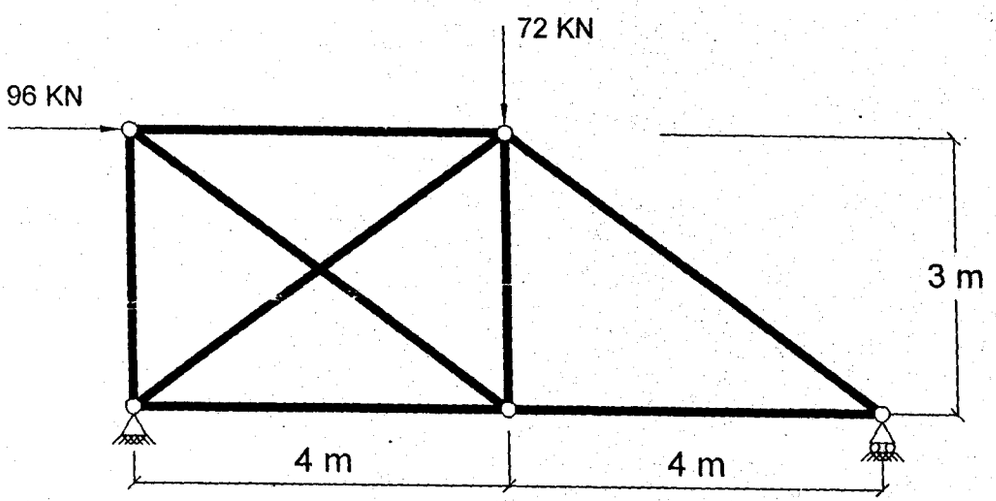

FIG : Q 9