Hall Ticket No | | | | | | | | | | | Question Paper Code: BST002

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Supplementary) - July, 2018

Regulation: IARE–R16

ADVANCED REINFORCED CONCRETE DESIGN

(Structural Engineering)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) What do you understand by the term limit state of serviceability? Why is it difficult to make an accurate prediction of the total deflection and the maximum crack-width in a reinforced concrete flexural member? **[7M]**

   (b) Determine the reinforcement required for a beam of size 300 mm x 600 mm subjected to a factored bending moment of 150 kNm, factored shear force of 100 kN and factored torsional moment of 50 kNm. Use M20 grade concrete and Fe 415 steel. **[7M]**

2. (a) Explain the stress-strain relationship for concrete and steel (with sketches) used in the limit state method of design. **[7M]**

   (b) A rectangular beam section 200 mm wide and 450 mm overall depth is reinforced with 3 bars of 16 mm diameter at an effective depth of 420 mm. Two hanger bars of 12 mm diameter are provided at the compression face. The effective span of the beam is 5 m. The beam supports a service load of 10 kN/m. If fck = 20 N/mm^2 and fy= 415 N/mm^2. Compute the short term deflection, long term deflection and check the limit state of deflection. **[7M]**

UNIT – II

3. (a) What do you understand by the term Redistribution of moments ? Explain with an example. **[7M]**

   (b) Determine the permissible service load for a rectangular slab of size 4 m x 6 m and depth as 150 mm which is simply supported on all sides and is reinforced with 10 mm bars 150 mm c/c in shorter direction and 10 mm bars 200 mm c/c in longer direction. Take effective cover as 25 mm and use M20 grade concrete and Fe 415 steel. **[7M]**

4. (a) Draw the bending moment diagram envelope after 30% redistribution, for a fixed ended beam of span 5 m carrying 20 kN/m load at collapse. **[7M]**

   (b) Derive the expression for the ultimate load carrying capacity of an isotropically reinforced square slab simply supported on all edges subjected to uniformly distributed load over entire area by virtual work method and equilibrium method **[7M]**

UNIT – III

5. (a) Explain the limitations of Direct Design method of analysing flat slabs. What are the assumptions of equivalent frame method. **[7M]**

   (b) Determine the design moment in both directions for the interior panel for the slab column system without drop and without coulmn head with the following data: Slab = 20 m x 30 m, Panel size = 4 m x 6 m, Live load = 4 kN/m^2, Finishes = 1 kN/m^2, Size of the columns = 500 mm x 500 mm, Floor to floor height = 4 m. Use M20 grade concrete and Fe 415 steel. **[7M]**

6. (a) What do you understand by the term middle strip and column strip in a flat slab? What are the functions of drop panel and column heads in a flat slab? Explain in detail with a sketch **[7M]**

   (b) Design an interior panel of a flat slab with the following data: Size of floor = 20 m x 20 m, Size of panels = 5 m x 5 m, Live load = 4 kN/m^2, Size of columns = 500 mm diameter. Use M20 grade concrete and Fe 415 HYSD bars. Drop width = 2.5 m are to be provided. **[7M]**

UNIT – IV

7. (a) How do you classify a beam as a deep beam? In what way the design of a deep beam is different from that of a simple beam? **[7M]**

   (b) Design a corbel to support a factored load of 400 kN at a distance of 200 mm from the face of a column of cross-section 300 mm x 400 mm. Adopt M25 grade concrete and Fe 415 grade HYSD bars. Sketch the details of reinforcements in the corbel. **[7M]**

8. (a) List the significant parameters influencing the determination of dimensions of a corbel. **[7M]**

   (b) Design a deep beam 300 mm wide and 4 m deep, simply supported over a clear span of 6 m. The beam carries a live load of 160 kN/m at the service state and is supported on walls of 600 mm thick on each end. Use M20 grade concrete and Fe 415 steel having permissible tensile stress of 230 N/mm^2. **[7M]**

UNIT – V

9. (a) Design a short column of size 500 mm x 600 mm subjected to an axial load, P_u = 2000 kN and biaxial bending moments as follows: $M_u x$ = 150 kNm, $M_u y$ = 120 kNm. Use M20 grade concrete and Fe 415 steel. **[7M]**

   (b) Where do we use combined footing? Explain various types of combined footings. **[7M]**

10. (a) Explain the difference between long column and short column. What are additional secondary moments in slender columns? **[7M]**

    (b) Design a combined footing for two columns, C1 and C2, 400 mm x 400 mm and 500 mm x 500 mm in size carrying 500 kN and 800 kN of load respectively. The smaller column is 0.4 m away from the property line. The columns are 4 m apart the bearing capacity of the soil is 140 kN/m^2. Use M20 grade concrete and Fe 415 steel. **[7M]**