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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Supplementary) - July, 2017

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

IS 456 - 2000 and SP - 16 Charts are Permitted

UNIT – I

1. (a) Write the assumptions in limit state of collapse in flexure. [6M]
 (b) Find the M.R. of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 3 bars of 16 mm dia. of Fe 415 steel. Take M 20 concrete. Determine the actual stresses when the section is subjected to the limiting moment of resistance. [8M]

2. (a) Write short notes about the development length. [4M]
 (b) A simply supported beam, 300 mm wide and 600 mm effective depth carries a uniformly distributed load of 74 kN/m including its own weight over an effective span of 6 m. The reinforcement consists of 5 bars of 25 mm diameter. Out of these, two bars can be safely bent up at 1 m distance from the support. Design the shear reinforcement for the beam. [10M]
 Given data: Grade of concrete: M 20
 Grade of steel: Fe 415
 Assume width of support = 400 mm

UNIT – II

3. (a) Write short notes about the upper bound and lower bound theorems. [6M]
 (b) Design a continuous reinforced concrete beam of rectangular section to support a dead load 10 kN/m and live load of 12 kN/m over 3 spans of 6 m each. The ends are simply supported. Adopt M -20 grade and concrete Fe-415 HYSD bars. Sketch the details of reinforcements in the beam. [8M]

4. (a) Write the assumptions and characteristic features of yield lines for analysis of slabs. [6M]
 (b) Design a circular slab of diameter 5 m which is simply supported at the edges. Live load = 4 kN/m². Assume M-20 grade concrete and Fe-415 HYSD bars. Assume load factors according to IS:456-2000. [8M]

UNIT – III

5. (a) Write different types of flat slabs with diagrammatically representation. [6M]
(b) Design the interior panel of a flat slab for a ware house to suit the following data: [8M]
Given Data: size of ware house 24 m by 24 m divided into panels of 6 m by 6 m
Live load -5 kN/m^2
Materials: M-20 Grade concrete
Fe-415 grade HYSD bars.
6. (a) Write the guidelines for proportioning [6M]
i. Drops
ii. Column heads
iii. Thickness of flat slab
(b) Design an interior panel of a flat slab of size $5 \text{ m} \times 5 \text{ m}$ without providing drop and column head. Size of columns is $500 \times 500 \text{ mm}$ and live load on the panel is 4 kN/m^2 take floor finishing load as 1 kN/m^2 . Use M20 concrete and Fe 415 steel. [8M]

UNIT – IV

7. (a) Discuss the steps for designing of deep beams. [6M]
(b) A reinforced concrete deep girder is continuous over spans of 9 m apart from center to center it is 4.5 m deep, 300 mm thick, and the supports columns 900 mm in width. If girder supports a uniformly distributed load of 200 kN/m including its own weight, design the necessary steel assuming M 20 concrete and Fe 415 steel. [8M]
8. (a) Discuss stepwise procedure as recommended for the design of corbels. [6M]
(b) Design a corbel to support a factored load of 400 kN at a distance of 200 mm from the face of a column 300 mm by 400 mm. Adopt M-25 grade concrete and Fe-415 grade HYSD bars. Sketch the details of reinforced in the corbel. [8M]

UNIT – V

9. (a) Give the details of Indian standard code requirements of slenderness components like short and axially loaded tied column. [6M]
(b) Design the reinforcements in a column size 400 mm by 600 mm subjected to an axial working load of 2000 kN. The column has an unsupported length of 3 m and is braced against side sway in both directions. Adopt M-20 grade concrete and Fe-415 HYSD. bars. [8M]
10. (a) Write short notes, on the following and also represent them using diagrams: [6M]
i. Isolated column footing
ii. Combined footing
(b) A reinforced concrete column 400 mm by 400 mm supports an axial service load of 100 kN the safe bearing capacity of the soil at site is 200 kN/m^2 . Adopting M-20 grade concrete and Fe-415 HYSD bars design a suitable footing for the column and sketch the details of reinforcement. [8M]

