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# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Four Year B.Tech V Semester End Examinations (Regular) - November, 2019

Regulation: IARE – R16

## REINFORCED CONCRETE STRUCTURES DESIGN AND DRAWING

Time: 3 Hours

(CE)

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 is permitted

### UNIT – I

- (a) Explain under-reinforced, balanced and over-reinforced sections? [7M]

(b) Determine the minimum effective depth required and the corresponding area of tension reinforcement for a rectangular beam having a width of 200mm to resist an ultimate moment of 200kNm, using M20 grade concrete and Fe415 HYSD bars. [7M]
- (a) Draw the idealized stress-strain curves for concrete and steel. Draw the stress block parameters as per IS 456-2000. [7M]

(b) A reinforced concrete beam has width 300 mm and overall depth 700 mm, with a cover of 40 mm to the centre of the reinforcement. Design the beam if it is subjected to a factored bending moment of 225kNm. Use M20 grade concrete and Fe415 grade steel. Redesign the beam if necessary. [7M]

### UNIT – II

- (a) Draw the failure modes due to shear and also shear stress distribution for rectangular and T-beams. [7M]

(b) A simply supported rectangular beam 300 x 500 mm of effective span 7.0 m, is reinforced with 5 bars of 20 mm diameter on tension side no. 4 bars of 16 mm diameter on compression side. Check the deflection criteria. Use Fe415 steel. [7M]
- (a) What is bond, anchorage length and development length? [7M]

(b) A reinforced concrete beam of width 300 mm, effective depth 600 mm and overall depth 650 mm is subjected to factored shear force of 70 kN in one section. Assuming the percentage of tensile reinforcement as 0.5 in that section, determine the factored torsional moment that the section can resist if maximum steel for torsion is provided in that section and determine the reinforcement needed. Assume M30 concrete, Fe 500 for longitudinal and Fe 415 for transverse reinforcing steel bars. [7M]

### UNIT – III

5. (a) Write the procedure for design of two way simply supported slabs. [7M]  
(b) Design a one way slab with a clear span of 3.5m, simply supported on 200mm thick concrete masonry walls to support a live load of  $4\text{kN}/\text{m}^2$ . Adopt M20 grade concrete and Fe 415 HYSD bars. [7M]
6. (a) Give neat sketches for the reinforcement details for one way simply support and two way continuous slabs. [7M]  
(b) Design a simply supported one way slab over a clear span of 3.5 m. It carries a live load of  $4\text{ kN}/\text{m}^2$  and floor finish of  $1.5\text{ kN}/\text{m}^2$ . The width of supporting wall is 230 mm. Adopt M-20 concrete & Fe-415 steel. [7M]

### UNIT – IV

7. (a) Outline the procedure for design of axially loaded reinforced concrete column? [7M]  
(b) A rectangular reinforced concrete column of cross-sectional dimensions 300mm x 600mm is to be designed to support an ultimate axial load of 2000kN. Design suitable reinforcements in the column using M20 grade concrete and Fe415 HYSD bars. [7M]
8. (a) Explain the step-by-step procedure for design of centrally loaded short columns. [7M]  
(b) Design a short spiral column subjected to factored load( $P_u$ ) 2100 kN and factored bending moment ( $M_u$ ) 187.5 kNm using M 25 concrete and Fe 415 steel. The preliminary diameter of the column may be taken as 500 mm. Sketch the reinforcement details. [7M]

### UNIT – V

9. (a) List out the different types of footing and explain any two types in briefly. [7M]  
(b) Design a reinforced concrete circular footing for a circular column of 300mm diameter supporting a factored axial load of 750kN. Adopt the safe bearing capacity of the soil as  $200\text{kN}/\text{m}^2$  and use M20 grade concrete and Fe 415 HYSD bars. [7M]
10. (a) What are the Indian standard code recommendations for design of footings as per IS: 456-2000? [7M]  
(b) Design a combined footing for two columns C1, 400 mm x 400 mm with 8 bars of 16 mm diameter carrying a service load of 800 kN and C2, 300 mm x 500 mm with 8 bars of 20 mm diameter carrying a service load of 1200 kN. The column C1 is flushed with the property line. The columns are at 3.0 m c/c distance. The safe bearing capacity of soil is  $200\text{ kN}/\text{m}^2$  at a depth of 1.5 m below the ground level. Use M 20 and Fe 415 for columns and footing. Sketch the reinforcement details. [7M]