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## Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Design of RC Structural Elements

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer FIVE full questions, choosing ONE full question from each module.  
2. Use of IS456-2000, SP-16 permitted.  
3. Assume any missing data suitably.

### Module-1

- 1 a. Briefly explain the principles of limit state. (06 Marks)  
b. Briefly explain the modes of failure of beam sections with sketches. (06 Marks)  
c. What are the causes of cracking in RC members? (04 Marks)

### OR

- 2 A simply supported beam has a rectangular section and carries a uniformly distributed load of 20 kN/m over a clear span of 4.5 m. The cross section is 300mm × 550mm and is reinforced with 4 no's of 20 mm diameter bar.  
Assume cover = 25 mm and bearing = 300 mm. Assuming, M20 grade concrete and Fe415 steel, compute short and long term deflection of the beam. (16 Marks)

### Module-2

- 3 a. A Cantilever R.C. beam of span 2 m is rectangular in cross section 230 mm × 380 mm. It is reinforced with 3 – 16 mm diameter bars on tension side. Assume clear cover as 25 mm. M20 grade concrete and Fe415 steel is used. Determine the permissible concentrated load at the free end of Cantilever. (08 Marks)  
b. A Doubly reinforced beam section 250 mm wide 500 mm deep to the centre of the tensile reinforcement. It is reinforced with 3 – 16 mm diameter bars as compression reinforcement at an effective cover of 50 mm and 4 bars of 20 mm diameter as tension reinforcement. Determine the moment of resistance of the section. M20 concrete and Fe500 steel is used. (08 Marks)

### OR

- 4 a. Determine the minimum effective depth required and the corresponding area of tension reinforcement for a rectangle beam having a width of 200 mm to resist an ultimate moment of 200 kN-m. M20 grade concrete and Fe415 steel is used. (04 Marks)  
b. A reinforced concrete beam has a support section with a width of 250 mm and effective depth of 500 mm. The support section is reinforced with 3 bars of 20 mm diameter on the tension side. 2 legged 8 mm diameter stirrups are provided at a spacing of 200 mm centre to centre. Calculate the shear strength of the support section for M20 grade concrete and Fe415 steel. (06 Marks)  
c. A singly reinforced slab 120 mm thick is supported by T-beam spaced at 3 m C/C, the effective depth and width of web are 580 mm and 450 mm respectively. Eight HYSD bars of 20 mm diameter have been provided in tension in two layers, with 4 no's in each layer. The effective cover in lower tier is 50 mm. The effective span of simply supported beam is 3.6 m and grade of concrete is M20. Determine the depth of neutral axis and the moment of resistance of T-beams section. (06 Marks)



**Module-3**

- 5 a. Design the shear reinforcement for an RC beam  $300\text{mm} \times 600\text{mm}$  effective carrying a uniformly distributed load of  $30\text{ kN/m}$  run factored over a span of  $6\text{ m}$  supported over  $300\text{ mm}$  wide beams. Use M20 grade concrete and Fe415 grade steel. (08 Marks)
- b. Design the reinforcement for tension and compression reinforcement side and its percentage for a doubly reinforced rectangular beam simply supported at both ends. The size of the beam is  $300\text{ mm} \times 600\text{mm}$  effective. Effective cover to compression reinforcement is  $50\text{ mm}$ . The ultimate factored total load of  $90\text{ kN/m}$  including self weight of beam is acting between the supports of effective span  $6.0\text{ m}$ . Grade of concrete and steel are M20 and Fe415. (08 Marks)

**OR**

- 6 Design one of the intermediate T-beam for a hall measuring  $7\text{m} \times 12\text{m}$  with beams spaced at  $3\text{ m C/C}$ . Depth of slab is  $120\text{ mm}$ . Live load on slab is  $9.5\text{ kN/m}^2$  including finishes. Use M20 grade concrete and HYSD bars. (16 Marks)

**Module-4**

- 7 a. Distinguish between one way and two way slab. (02 Marks)
- b. Design an interior panel of a two-way slab of size  $5\text{m} \times 5\text{m}$ . Live load =  $3\text{ kN/m}^2$ , floor finish =  $1\text{ kN/m}^2$  and bearing =  $300\text{ mm}$ . Adopt M20 grade concrete and Fe415 grade steel. Sketch the reinforcement details in plan. (14 Marks)

**OR**

- 8 The clear dimension of a stair case hall is  $2.4\text{ m} \times 4.75\text{ m}$ . The floor to floor height is  $3.52\text{ m}$ . A two flight dog legged stair is to be provided between the two floors with a rise of  $160\text{ mm}$ . Design the stairs and also check for deflection. Sketch the reinforcement details of any one of the flight. (16 Marks)

**Module-5**

- 9 a. A RCC square column of side  $300\text{ mm}$  is reinforced with 4 bars of  $16\text{ mm}$  diameter. Determine the allowable service load on the column. M25 grade concrete and Fe500 steel is used. (04 Marks)
- b. A rectangular column of size  $300\text{mm} \times 500\text{mm}$  is subjected to an axial load of  $1200\text{ kN}$  and moment of  $30\text{ kN-m}$  acting about an axis bisecting the depth of column. Effective cover =  $50\text{ mm}$ . Calculate the necessary reinforcement adopting M20 grade concrete and Fe415 steel. Sketch the reinforcement details. (12 Marks)

**OR**

- 10 Design a rectangular footing of flat type for a column of size  $300\text{ mm} \times 500\text{ mm}$  carrying an axial load of  $1200\text{ kN}$ . SBC of soil is  $200\text{ kN/m}^2$ . Adopt M20 concrete and Fe500 steel. Sketch the reinforcement details. (16 Marks)

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