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## Fifth Semester B.E. Degree Examination, July/August 2021 Design of RC Structural Elements

Time: 3 hrs.

Max. Marks: 100

**Note: 1. Answer any FIVE full questions.  
2. Use of IS456 – 2000, SP – 16 Permitted.  
3. Assume any missing data suitably.**

- 1 a. What is a Stress block? Derive from fundamentals the expression for area of stress block  $0.36f_{uc} x_u$  and depth of centre of compressive force from the extreme fibre in compression  $0.42x_u$ . (10 Marks)  
 b. Briefly explain the modes of failure of beam sections with sketches. (10 Marks)
- 2 A rectangular simply supported beam of span 5m is 300mm × 650mm in cross section and is reinforced with 3 bars of 20mm on tension side as an effective cover of 50 mm. Determine short term deflections due to an imposed load of 20kN/m. Assume grade of concrete M<sub>20</sub> and Fe 415 grade steel. (20 Marks)
- 3 A singly reinforced beam 300mm × 450mm in section is reinforced with 3 – bars of 20mm diameter with an effective cover of 50mm. Effective span of the beam is 6m. Assuming M<sub>20</sub> concrete and Fe 415 steel, determine the Central Concentrated load P that can be carried by the beam in addition to its self weight. (20 Marks)
- 4 Calculate the area of reinforcement required for L – beam of flange width 1000mm , flange thickness 120mm , width of rib 250mm , total depth 750mm and effective cover 70mm to resist an ultimate bending moments (a) 400 kN-m (b) 75 kN – m. Assume concrete grade M<sub>20</sub> and steel of grade Fe 415. (20 Marks)
- 5 A T – beam slab floor has 125mm thick slab forming part of T – beams which are of 8m clear span. The end bearings are 300mm thick. Spacing of T – beams is 3.5m. The live load on floor is 3kN/m<sup>2</sup>. Design one of the intermediate beams. Using M<sub>20</sub> grade concrete and Fe 415 grade steel. Design the beam and sketch the details of reinforcement. (20 Marks)
- 6 Design a rectangular beam of section 230mm × 600mm of effective span 6m. Effective cover should be kept as 50mm imposed load on the beam is 40kN/m. Use M<sub>20</sub> concrete and Fe 415 steel. (20 Marks)
- 7 Design a Cantilever slab projecting 1.5m from a beam. Adopt live load of 2.5 kN/m<sup>2</sup>. Use M<sub>20</sub> concrete and Fe 415 steel. Design the slab and sketch the details of reinforcement. (20 Marks)
- 8 Design a dog legged stairs for an office building in a room measuring 2.8m × 5.8m clear. Vertical distance between the floor is 3.6m. Width of the flight is to be 1.25m. Allow a live load of 3kN/m<sup>2</sup>. Use M<sub>20</sub> concrete and Fe 415 grade steel. Assume the stairs are supports on 230mm walls at the end of outer edges of landing slabs. (20 Marks)
- 9 Design a square footing for a short axially loaded column of size 300mm × 300mm carrying 600kN load. Use M20 concrete and Fe 415 steel. SBC of soil is 180 kN/m<sup>2</sup>. Sketch the details of reinforcement. (20 Marks)
- 10 An R.C. column of unsupported length 2.75m has to be designed for an ultimate axial load 3250 kN. Find cross – sectional dimensions of the column and reinforcement required. Use M<sub>20</sub> grade of concrete and Fe 415 steel. Sketch the details of reinforcement. (20 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.