Printed Pages : 4

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320552(20)

BE (5th Semester)
Examination, Nov.-Dec., 2018

(New Scheme)

Structural Engineering Design - I

Time Allowed : 3 hours | *Maximum Marks* : 80
Minimum Pass Marks : 28

Note : (*i*) Part (*a*) of each question is compulsory. Attempt any **two** from (*b*), (*c*) and (*d*).
(*ii*) IS456-2000 is permitted.
(*iii*) Use suitable data wherever necessary.
(*iv*) The figures in the right-hand margin indicate marks.

UNIT - I

1. (*a*) Give factor of safety for concrete and steel W.S.M. [2]

(*b*) What are the limitations of working stress method of design of R.C.C. structures? [7]

(*c*) Write comparisons between W.S.M. and L.S.M. [7]

(*d*) Determine the moment of resistance of singly reinforced beam 180 mm wide and 300 mm deep to the centre of reinforcement, if the stresses in steel and concrete are not to exceed 140 N/mm^2 and 5 N/mm^2. The reinforcement consists of 4 nos. of 16 mm dia bar. Take m = 18. If the effective span of the beam is 5 m, find the maximum load the beam can carry, inclusive of its own weight. Use W.S.M. [7]

UNIT - II

2. (*a*) What is partial safety factor? [2]

(*b*) Write the design procedure to find the moment of resistance of doubly reinforced section. Use all the empirical formulas. [7]

(*c*) An R.C.C. beam 200 mm × 400 mm (effective) is reinforced with 3-16 mm ϕ bars. Find the ultimate uniformly distributed load which the beam can carry safely over an effective span of 5 m. Use M20, Fe415. [7]

(*d*) Determine the moment of resistance of the beam having dimension as 300 mm × 550 mm (effective). The beam is reinforced with 1963 mm^2 of steel in tension zone. Use M20 concrete and Fe415 steel. Also comment on the design of the beam. [7]

UNIT - III

3. (*a*) How is the effective width of the flange (b_f) decided in the design of T-beam? [2]

(*b*) A T-beam floor system has 120 mm thick slab supported on beam. The width of beam is 300 mm and effective depth is 500 mm. The beam is reinforced with 8 bars of 20 mm diameter. Use M20 grade of concrete and Fe415 steel. The beams are spaced 3 m centre-to-centre. The effective span of beam is 3.6 m. Find the moment of resistance of the T-beam. [7]

(*c*) Determine the limiting moment of resistance and limiting area of steel for a reinforced concrete T-beam having flange width of 1600 mm, effective depth of 350 mm and thickness of flange is 100 mm. The width of web is 250 mm. Use M20, Fe500. [7]

(*d*) Design a simply supported concrete slab for a room having inside dimension 3 m × 7 m. The thickness of supporting wall is 300 mm. The slab carries 75 mm thick flooring of unit weight 20 kN/m^2. The live load on the slab is 2 kN/m^2. Check for shear and development length. Use M20, Fe500. [7]

UNIT - IV

4. (*a*) Write about short column and long column. [2]

(*b*) What are the IS 456 : 2000 specifications regarding columns? [7]

(*c*) Design a short R.C.C. column to carry an axial load of 1600 kN. It is 4 m long, effectively held in position and restrained against rotation at both ends. Use M20 concrete and Fe415 steel. [7]

(*d*) A circular column 4.75 m high is effectively held in position on both ends and restrained against rotation at one end. Design the column to carry an axial load of 150 kN, if its diameter is limited to 500 mm. Use M20 concrete and Fe415 steel grade. [7]

UNIT - V

5. (*a*) What will be the minimum thickness at the edge of the footing? [2]

(*b*) Design a square footing of uniform thickness for an axially loaded column of 450 mm × 450 mm size. The safe bearing capacity of soil is 190 kN/m^2. Load on the column is 850 kN. Use M20, Fe415. Draw the neat sketch. [7]

(*c*) The main stair of an office building has to be located in an area of 3.5 m × 3.5 m. The vertical distance between the floors is 3.75 m. Design the stair if the live load is 3.0 kN/m^2. Use M20 concrete and Fe415 steel grade. [7]

(*d*) The size of a square footing is 2.25 m × 2.25 m. The load on the column is 850 kN. The size of column is 450 mm × 450 mm. The footing is having a uniform effective depth of 400 mm. Assume $P_t = 0.2\%$. Check for one-way shear and punching shear. Use M20, Fe415. [7]