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320552(20)

BE (5th Semester)
Examination, April - May, 2017

[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** parts from (*b*), (*c*) and (*d*).

(*ii*) IS 456:2000 is permitted.

(*iii*) Use M_{20} & Fe_{415} unless and otherwise mentioned.

(*ii*) The figures in the right-hand margin indicate marks.

1. (*a*) Give the values of factor of safety used in working stress method for concrete and steel. [2]

(*b*) Derive the expressions for design constants in working stress method for balanced section. [7]

(*c*) An R.C.C. beam 300 mm × 640 mm overall is reinforced with 4 bars of 20 mm diameter. The beam has to carry a superimposed load of 50 kN/m, including the self-weight of the beam over an effective span of 4 m. Find the actual stresses developed in steel and concrete. The effective cover is 40 mm. Take $m = 13.33$. [7]

(*d*) A concrete beam 400 mm × 600 mm effective is reinforced with 4-25mm ϕ bars on tension side and 4-20 mm ϕ on compression side. Find the moment of resistance of the beam. Use M_{20} grade concrete and Fe_{415} steel. Take $d' = 40$ mm and $m = 13.33$. [7]

2. (*a*) Write the expression for lever arm used in beams in limit state method. [2]

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

(*c*) An R.C.C. beam 250 mm × 500 mm has a clear span of 5.5m. The beam has 2-20 mm ϕ going into support. The factored shear force is 140kN. Check for development length if Fe_{415} and M_{20} grade concrete is used. [7]

(*d*) Design a lintel over a 2.0m wide opening located centrally in a 300mm thick wall. The height of masonry wall above the lintel is 3m. Take unit weight of masonry as 19 kN/m^3 [7]

3. (*a*) Write the expression for calculating effective flange width (b_f) for an isolated T-beam and label it. [2]

(*b*) Find the moment of resistance of a T-beam having a rib width of 240 mm, effective depth of 400 mm flange width of 740 mm flange thickness of 100 mm. The beam is reinforced with 5-16 mm diameter. [7]

(*c*) A simply supported slab of a corridor of a hospital building has a clear span of 2.5 m and is supported on beams 230 mm wide. Design the slab for a public building. The slab is having a 80 mm thick tiled flooring. Unit weight of tiled flooring is 18 kN/m^3. [7]

(*d*) Design a simply supported reinforced concrete slab for a room of clear dimensions 4 m×5 m. The slab is supported on the walls of width 300 mm. The corners of the slab are not held down. [7]

4. (*a*) Give use of transverse reinforcement or ties in column. [2]

(*b*) A short column is required to carry a factored load of 1900 kN. Design the column assuming $e_{min} \leq 0.05D$. [7]

(*c*) Design a circular column of diameter 400 mm subjected to a load of 1200 kN. The column is having helical reinforcement. Design the helix. The column is 3 m long

and effectively held in position at both ends but not restrained against rotation. [7]

(*d*) Explain use of moment interaction diagram and label it. [7]

5. (*a*) Draw the positions of critical section for bending moment, one-way shear and punching shear in 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 column is 850 kN. [7]

(*c*) Design the waist slab only for a dog-legged staircase for an office building in a room measuring 3.0m×6.0m (clear dimensions). Floor to floor height is 3.5m. The building is a public building liable to overcrowding. Stairs are supported on brickwork walls of 230mm thick at the ends of landing. [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 pt = 0.2%. Check for one way shear and punching shear only. Use M_{20} grade of concrete and Fe_{415} steel. [7]
