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320552(20)

B. E. (Fifth Semester) Examination, April-May/ Nov.-Dec. 2020

(New Course)

(Civil Engg. Branch)

STRUCTURAL ENGINEERING DESIGN-I

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *All questions are compulsory with internal choices among (b), (c) and (d) parts. IS 456 : 2000 is permitted.*

1. (a) Write down two differences between working stress method and limit state method of design. 2

(b) The cross-section of a simply supported reinforced beam is 200 mm wide and 300 mm deep to the center of the reinforcement which consists of 3 bars of 16 mm diameter. Determine the depth of NA and the the maximum stress in concrete when steel is stressed to 120 N/mm^2. Take m = 19. 7

(c) Derive the expressions for moment of resistance of a balanced rectangular section reinforced only in tension, having width b, effective dept d, area of steel A_{st}, and permissible stresses in steel and concrete as σ_{st} and σ_{cbc} respectively. 7

(d) A cantilever beam 3 m span is to carry a superimposed load of 8 kN/m. The beam has a constant cross-section of 300 mm × 500 mm throughout. Determine the tension reinforcement if mild steel bars are to be used. Take unit weight of concrete as 25 kN/m^3. 7

2. (a) Write the minimum grade of concrete for following :

(i) RCC

(ii) RCC exposed to sea water 2

(b) Design a balanced singly reinforced concrete beam section for an applied moment of 60 kn/m. The width of the beam is limited to 175 mm. Use M 20 concrete and Fe 415 steel bars. 7

(c) A reinforced concrete beam has width equal to 300 mm and total depth equal to 700 mm, with a cover of 40 mm to the center of the reinforcement. Design the beam if it is subjected to a total bending moment of 150 kN-m. Use M 20 concrete and HYSD bars of grade 415. 7

(d) Design the reinforcement for a reinforced concrete beam 300 mm wide and 400 mm deep of grade M 20 to resist an ultimate moment of 150 kN-m, using mild steel bars of grade Fe 250. 7

3. (a) Write any two limit state of collapse and two limit states of serviceability. 2

(b) Design a two way slab for a room 5.5 × 4.0 m clear in size if the superimposed load is 5 kN/m^2. Use M 25 concrete and Fe 415 steel. The edges of the slab are simply supported with corners held

down. Also draw a neat diagram of reinforcement detailing. 14

Or

(c) A T-beam has the following data : width of flange = 750 mm, breath of beam = 250 mm, effective depth = 500 mm, thickness of flange = 90 mm. Applied moment = 230 kN-m. Design the beam using M 20 concrete and Fe 415 steel. 14

4. (a) Write down the effective length of following braced and unbraced RC columns for designing :

(i) Fixed at both ends

(ii) Hinged at both ends

(iii) Hinged at one end and fixed at another end

(iv) Fixed at one end and free at another end 2

(b) Design an RCC column of size 450 mm × 600 mm. The axial load under the service load condition is 2000 kN and unsupported length is 3 m. Use M-20 concrete and Fe-415 steel. 7

(c) Design reinforcement for a spiral column of 500 mm diameter subjected to a factored load of 1500 kN. Column has unsupported length of 3·4 m and is braced against side sway. Use M-25 concrete and Fe-415 steeel. 7

(d) Design a tied square short column for factored axial load of 1750 kN, and effective length of 3·5 m. Use M-20 concrete and Fe-415 steel. 7

5. (a) As per IS-456 : 2000 what is the minimum thickness at the edge of footing and the minimum clear cover for footing. 2

(b) Design a dog-legged stair for a building in which the vertical distance between floors is 3·6 m. The stair hall measures 2·5 m × 5 m. The live load is 2·5 kN/m^2. Use M 20 concrete and Fe 415 steel bars. Also neatly draw the reinforcement detailing. 14

Or

(c) Design a rectangular isolated footing of uniform thickness for RC column bearing a vertical load of 600 kN and having a base size of 400 mm × 600

mm. The safe bearing capacity of soil may be taken as 120 kN/m^2. Use M-20 concrete and Fe-415 steel. Also check for one way shear and two way shear. 14