

320512(20)

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

(Old Scheme)

(Civil Engg. Branch)

STRUCTURAL ENGINEERING DESIGN-I

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : Attempt all questions. Part (a) from each question is compulsory. Attempt any one from (b) and (c). Assume and mention data missing, if any IS Code 456 : 2000 is allowed.

Unit-I

1. (a) Minimum cement content for M20 concrete mix in RCC is :
 - (i) 300 kg/m³

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- (ii) 350 kg/m^3
(iii) 375 kg/m^3
(iv) 280 kg/m^3 2
- (b) A singly reinforced rectangular beam of width 350 mm is subjected to a uniformly distributed load of 15 kN/m over an effective span of 8 m. Determine the depth required for the beam and also calculate the area of tensile reinforcement required. Use M20 concrete and Fe 415 steel. Design for shear and bond also by working stress method. Draw detailed drawing for this design. 14
- (c) Design the section of a doubly reinforced beam by working stress method to resist a bending moment of 185000 Nm. The section of the beam is restricted to 350×700 mm. Assume 50 mm effective cover. M 20 grade of concrete and mild steel reinforcement is used. Draw detailed drawing of this design. 14

Unit-II

2. (a) The value of partial factor of safety in Limit State Design is :

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- (i) 1.5
(ii) 1.2
(iii) 1.15
(iv) 1.25 2
- (b) Design a cantilever beam by Limit State Method having an effective span of 3 m. The beam is carrying a load of 14 kN/m including its own weight. Use M 20 concrete and Fe 415 steel. Draw detailed drawing of this design. 14
- (c) Find out the ultimate moment of resistance of a rectangular beam $300 \text{ mm} \times 550 \text{ mm}$. The areas of tension and compression reinforcement are 2500 mm^2 and 400 mm^2 respectively. Take effective cover as 50 mm. Assume M 25 grade of concrete and Fe 500 steel. 14

Unit-III

3. (a) In a slab alternate bars are bent up at a distance :
(i) $L/7$ from the center of the support
(ii) $L/5$ from the center of the support

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- (iii) $L/6$ from the center of the support
- (iv) None of the above 2
- (b) A simply supported slab of a corridor of a hospital building has a clear span 2.5 m and is supported on beams 230 mm width. Design the slab, if the slab is carrying a live load of 5 kN/m^2 . Use M 20 concrete and HYSD Fe 415 bars. Draw detailed drawing of this design. 14
- (c) Design a slab with corners held down for an office building of size $4.5 \times 6.5 \text{ m}$ with two adjacent edges discontinuous. Draw detailed drawing of this design. 14

Unit-IV

4. (a) The safe load carried by helical reinforced column is :
- (i) 2 times the load carried by the similar column with ties
- (ii) 2.5 times the load carried by the similar column with ties
- (iii) 1.05 times the load carried by the similar column with ties

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- (iv) 1.25 times the load carried by the similar column with ties 2
- (b) Design a column of size $450 \times 600 \text{ mm}$ and having 3 m unsupported length. The column is subjected to a load of 2000 kN and is effectively held in position but not restrained against rotation. Use M20 concrete and Fe 415 steel. Draw detailed drawing of this design. 14
- (c) Design a circular column with helical reinforcement to carry an axial load of 1500 kN. The column has an effective length of 2.50 m. Draw detailed drawing of this design. 14

Unit-V

5. (a) As per IS456 : 2000 minimum thickness at the edge of the isolated footings should be :
- (i) 10 cm
- (ii) 15 cm
- (iii) 20 cm
- (iv) 5 cm 2

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- (b) Find the depth of a square footing of uniform thickness for an axially loaded column of 450×450 mm size. The safe bearing capacity of soil is 190 kN/m^2 . Load on the column is 900 kN . Use M20 concrete and Fe 500 steel. 14
- (c) Describe the various components of staircase and the values usually adopted in the design of staircase. 14