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320552(20)

B. E. (Fifth Semester) Examination, April–May 2021

(New Scheme)

(Civil Engg. Branch)

STRUCTURAL ENGINEERING DESIGN-I

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *In each question, (a) part carries 2 marks
and is compulsory; attempt any two parts
worth ~~woth~~ 7 marks each from the remaining parts.
Use of IS-456:2000 code is only permitted.
Assume suitable data, if required, and mention
it clearly. Draw neat sketches wherever
required. Use Limit State method unless
mentioned otherwise.*

Unit-I

1. (a) What is the value of modular ratio for M25 grade
of concrete? 2

(b) A RCC beam 200 mm wide has an effective depth of 350 mm. The permissible stresses in concrete and steel are 5 N/mm² respectively. Find the depth of neutral axis, area of steel and percentage of steel, using working stress method. 7

(c) A 250 mm wide rectangular beam has to resist a bending moment of 75 kN-m under working loads. The permissible stresses in concrete and steel are 5 N/mm² and 190 N/mm² respectively. Find the effective depth and tensile reinforcement required for a singly reinforced section, using working stress method. 7

(d) A beam 250 mm × 550 mm overall dimensions is provided with tension reinforcement of 1521 mm². The effective cover to reinforcement is 25 mm. The permissible stresses in concrete and steel are 7 N/mm² and 140 N/mm² respectively. Find out the moment of resistance of this section, using working stress method. 7

Unit-II

2. (a) What is the value of minimum tension reinforcement in RCC beam? 2

(b) Formulate the expression for moment of resistance of a rectangular singly reinforced section in limit state method of design. 7

(c) A R.C.C. beam of 300 mm width and 500 mm effective depth is subjected to factored moment of 175 kNm. If M20 grade of concrete and Fe500 steel are used, find the area of steel required. 7

(d) A R.C.C. beam, doubly reinforced, 200 mm wide and 330 mm deep is subjected to a factor of moment of 74 kN-m. Take the cover to centre of top and bottom reinforcements as 30 mm. Find the area of tension and compression reinforcement required, if M20 grade of concrete and Fe415 steel are used. 7

Unit-III

3. (a) What is a one way slab and a two way slab? 2

(b) Explain in brief about the various factors on which the effective depth of slab depends upon? 7

(c) The dimensions of an isolated RCC Tee beam are : Effective flange width 1500 mm, Flange thickness 100 mm, web thickness 300 mm and the effective depth of beam is 600 mm. The bottom reinforcement provided is 4500 mm². Determine the moment of resistance of the beam section, if M20 grade of concrete and Fe415 steel are used.   7

(d) Design a 125 mm thick one way RCC slab for the given data : Span 4 m, superimposed load 2 kN/m², floor finish 1 kN/m², Concrete grade M20, Steel Fe415, bar diameter 12 mm, clear cover 15 mm.   7

Unit-IV

4. (a) What are the limits for percentage of longitudinal reinforcement in a column?   2

   (b) Design a short axially loaded square column with 1% steel, for a factored load of 3000 kN. Unsupported length of the column is 3 m. Concrete grade M20, Steel Fe415.   7

(c) The diameter of a helically reinforced short column is 420 mm and it is reinforced with 7 numbers of 16 mm diameter bars. The cover upto outside of longitudinal reinforcement as 40 mm. Helical reinforcement consists of 8 mm diameter steel at a pitch of 55 mm. Concrete grade M20, Steel Fe415. Find the safe axial load on the column.   7

(d) Write down the design steps for a R.C.C. column subjected to axial load and bi-axial bending.   7

Unit-V

5. (a) What is the minimum depth of footing at the ends?   2

   (b) Write down the design steps for R.C.C. stairs.   7

   (c) An isolated footing of size 2·0 m × 2·0 m, and of uniform overall depth 400 mm is to be provided below a RCC column of size 500 mm × 500 mm, bearing a factored load of 1000 kN. Take the cover to centre of bottom reinforcement as 60 mm. Design and sketch the reinforcement details, assuming the footing to be safe in one way and two way shear?   7

(d) A isolated column footing of size 2·5 m × 2·5 m is provided below a column of size 500 mm × 500 mm. The factored axial load on the column is 1500 kN. The effective depth is 450 mm uniform. Check the footing for one way shear and two way shear.   7