4TH SEM./CIVIL./ 2024(S)

Th-1 STRUCTURAL DESIGN - I

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks
IS 456 code book is allowed in the exam

1. Answer **All** questions 2 x 10

   a. What is the value of modular ratio for M25 concrete and Fe415 steel?

   b. Define characteristic strength of concrete?

   c. Mention any two advantages of a doubly reinforced beam?

   d. What do you mean by M15 grade of concrete?

   e. Define development length.

   f. Write the IS code provision for effective width of flange for an isolated T-beam?

   g. Differentiate between one way and two way slab.

   h. What is the minimum number of longitudinal reinforcement to be provided for a circular column?

   i. Mention two important purposes of providing lateral ties in columns.

   j. At which section critical bending moment is calculated for footings supporting a concrete column.

2. Answer **Any Six** Questions 6 x 5

   a. Find out design constants of a rectangular section by taking M20 grade of concrete and Fe415 grade of steel.

   b. Write down the assumptions made for flexure in limit state of design.

   c. A singly reinforced concrete beam 250mm width is reinforced with four bars of 20 mm diameter at an effective depth of 400mm. Calculate the ultimate moment of resistance of the section in LSM if M25 grade of concrete and Fe 415 grade of steel is used.

d. A steel bar of 16mm diameter of Fe 415 is embedded in M20 grade concrete. Calculate its development length in tension and compression.

e. A simply supported rectangular beam 250mm X 450mm is reinforced with 4 nos. of 16mm diameter bars as tension reinforcement is subjected to an inclusive load of 25kN/m over a span of 3.5m. Design suitable shear reinforcement if M20 and Fe415 materials are used.

f. Design a cantilever slab to carry a live load of 3.5kN/m^2. The overhang of slab is 1.25m Use M20 and Fe 415.

g A short RCC column 450mm X 450mm is provided with 6 bars of 16 mm diameter. If the effective length of column is 2.5m, find ultimate load for the column. Use M20 and Fe 415. Use LSM.

3 Determine the ultimate moment capacity of a doubly reinforced beam, if width is 300mm, overall depth is 600mm, area of tensile reinforcement is 2060mm^2 and area of compressive reinforcement is 804mm^2. Take effective cover as 50mm for both tension and compression. Use M25 and Fe 415. Use LSM. 10

4 Design a rectangular beam of effective span 4.3m subjected to a live load of 12.5kN/m. Use M20 grade concrete and Fe 415 grade steel. Use LSM. 10

5 Find the moment of resistance of the T-beam having an effective flange width equal to 1000mm, depth of flange equal to 100mm and overall depth of the section equal to 500mm is reinforced with 4 nos. Of 25mm diameter HYSD bars. Assume effective cover equal to 50mm and use M25grade concrete and Fe 415 grade steel? 10

6 Design a dog legged staircase of flight 2.5m and landing on both sides as 2.5m and 1.5m with landing width 3m. Take live load as 5 kN/m^2, floor finish as 1 kN/m^2, rise = 150mm, tread = 250mm. Use M20 concrete and Fe 415 steel. Take floor height as 3m. Beams spanning on to the edge of a landing slab, which spans parallel with the risers. Assume any other data as per standard. 10

7 Design an isolated square footing for a column of 450mm X 450mm size reinforced with 6 nos. of 25mm diameter bars and carrying a service load of 2300kN. Assume soil with a safe bearing capacity of 300kN/m^2 at a depth of 1.5m below the ground. Assume M20 grade concrete and Fe415 grade steel. 10