

**4<sup>TH</sup> SEM. / CIVIL. / 2023(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

1. Answer **All** questions 2 x 10
  - a. What is limit state of serviceability.
  - b. Write the factor of safety for steel and concrete in WSM.
  - c. What is development length ?
  - d. What is the maximum compressive stress rectangular beam ?
  - e. Why doubly reinforced section is used over singly reinforced section ?
  - f. Differentiate between one-way and two-way slab.
  - g. What do you mean by moment of resistance?
  - h. What do you mean by side face reinforcement?
  - i. Differentiate between column and pedestal.
  - j. What is the minimum and maximum amount of longitudinal reinforcement permissible in a Column?
  
2. Answer **Any Six** Questions 6 x 5
  - a. A R.C.C. beam 250mm×500mm has a clear span of 5.5m. The beam has 2-20mm diameter bars going into the support. Factored shear force is 140KN. Check for the development length if Fe 415 steel and M20 concrete is used.
  - b. Write the assumptions taken in WSM ?
  - c. Design a short R.C.C column to carry an axial load of 1600 KN. It is 4m long, effectively held in position and restrained against rotation at both ends. Use M-25 concrete and Fe-415 steel.
  - d. Find the moment of a beam having width as 300mm and effective depth as 550mm . The permissible stress in concrete in bending compression and steel in tension are respectively 5.6 N/mm<sup>2</sup> and 210 N/mm<sup>2</sup>.
  - e. A singly reinforced beam rectangular beam of width 250mm and 460mm effective depth is reinforced with 3nos of 16mm diameter bars . Find out the moment of resistance of the section.

- f. Explain the terms: balanced, under reinforced and over reinforced sections.
- g. State the different methods of design of concrete structure and explain it.

3. Design an R.C.C. beam of width 230mm and effective depth of 500mm subjected to a factored moment of 200KNm. Find the reinforcement required. Use M20 concrete and Fe415 steel. 10
4. Design a simply supported T beam of 6m span, the slab thickness is 100mm & characteristics load including self weight of the beam is 24 KN/m, given width of support and width of beam as 250 mm & 230 mm, use M20 and Fe415 steel. 10
5. Design a square footing of uniform thickness for an axially loaded column of 450mm×450mm size. The safe bearing capacity of soil is 190KN/m<sup>2</sup>. Load on column is 850KN. Use M20 concrete and Fe415 steel. 10
6. Design a two way slab for an office floor of size 3.5m by 4.5m with discontinuous and simply supported edges on all the sides with corners prevented from lifting and supporting a service load of 4kn/m<sup>2</sup> adopt M20 grade concrete and Fe415 bars. 10
7. Design a dog legged staircase for a live load of 5 KN/m<sup>2</sup> rise of the stair is 150mm and tread is 250mm. Ceiling height is 3.6m and width of flight is 150mm use M20 concrete and Fe415 steel. 10