(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2134   Roll No. [ ][ ][ ][ ][ ][ ][ ][ ][ ]

B.Tech.

(SEMESTER-V) THEORY EXAMINATION, 2012-13

DESIGN OF CONCRETE STRUCTURES - I

Time : 3 Hours]   *[Total Marks : 100*

Section – A

1.   Attempt **all** questions parts. Each part carries equal marks.   **10 × 2 = 20**

(a)   Draw the stress' – distribution diagram for axially loaded column and eccentrically loaded column.

(b)   What are the advantages of limit state method over working stress and ultimate load methods ?

(c)   What is modular ratio ? Determine the modular ratio at M20 grade concrete.

(d)   State the assumptions made in working stress method.

(e)   How do you classify a column as short or long ?

(f)   Discuss the merits of working stress method.

(g)   Distinguish between one way and two way slabs.

(h)   Explain the terms 'balanced', 'over reinforced' and 'under reinforced' sections in bending.

(i)   When shear reinforcement is necessary in a beam ?

(j)   Mention the difference in design principles for L Beam and T Beam.

Section- B

2. Attempt any **three** question parts. Each part carries equal marks.   10 × 3 = 30

(a) Design a rectangular reinforced concrete beam simply supported on masonry walls 300 mm thick with an effective span of 5 m to support a service load of 8 kN/m and a dead load of 4 kN/m in addition to its own weight. Adopt M-20 grade concrete and Fe-415 HYSD bars. Width of support of beams = 300 mm. Using working stress method.

(b) A tee beam has an effective flange width of 2500 mm and depth of flange is 150 mm, width of rib = 300 mm, effective depth = 800 mm. Using M-20 grade concrete and Fe-415 HYSD bars, estimate the area of tension reinforcement required if the section has to resist a design ultimate moment of 1200 kN/m.

(c) Design a circular column with helical reinforcement of 400 mm diameter and 4 m in length to carry factored load of 1000 kN. The column is hinged at both ends. Use concrete M-25 and steel Fe-415.

(d) Design a one way slab for an office floor which is continues over the tee beams spaced at 3.5 m intervals. Assume a live load of 4 kN/m^2 and adopt M-20 grade concrete and Fe-415 HYSD bars.

(e) A reinforced concrete beam has a support section with a width of 250 mm and effective depth of 500 mm. The support section is reinforced with 3 bars of 20 mm diameter on the tension side. 8 mm diameter 2 legged stirrups are provided at a spacing of 200 mm centers. Using M-20 grade concrete and Fe-415 HYSD bars, calculate the shear strength of the support section.

Section – C

Attempt **all** questions. Each question carries equal marks.   10 × 5 = 50

3. Attempt any **two** parts of the following :   5 × 2 = 10

(a) A rectangular beam of width 300 mm and effective depth 500 mm reinforced with 4 bars of 12 mm diameter. Find the moment of resistance and stresses in the top compression fiber of concrete and tension steel. Use concrete M-20 and steel Fe-415. Adopt working stress method.

(b) Design a doubly reinforced concrete beam for a residential floor of a building to suit the following data : Effective span = 5 m, Dead load = 8 kN/m, Live load = 12 kN/m, Width of beam = 500 mm, Material M-20 grade concrete Fe-415 HYSD bars, Effective depth = 450 mm, Cover to compression steel = 50 mm.

(c) A singly reinforced concrete beam is of width 400 mm and effective depth 615 mm. It is reinforced with 8 Nos. 20 mm mild steel bars. Assuming M-25 concrete, determine its moment of resistance according to the working stress method. Determine also the stress in steel when the beam is subjected to the above moment.

4. Attempt any **one** part of the following : $\qquad$ 10 × 1 = 10

(a) Design a rectangular beam section subjected to an ultimate moment of 120 kN/m. Use concrete M-20 and steel Fe-415. Adopt limit state method.

(b) A reinforced concrete beam of rectangular section 200 mm wide by 550 mm deep is reinforced with 4 bars or 25 mm diameter at an effective depth of 500 mm. Using M-20 grade concrete and Fe-415 HYSD bars, calculate the safe moment of resistance of the section.

5. Attempt any **one** part of the following : $\qquad$ 10 × 1 = 10

(a) Design the reinforcements in a circular column of diameter 400 mm to support a factored load of 800 kN together with a factored moment of 80 kN/m. Adopt M-20 grade concrete and Fe-415 HYSD bars.

(b) A rectangular column of effective height of 4 m is subjected to a characteristics axial load of 800 kN and bending moment of 100 kN/m about the major axis of the n. Design a suitable section for the column so that the width should not exceed 400 mm. Use the minimum percentage of longitudinal steel.

Assume $f_y = 415$ N/mm^2 and $f_{ck} = 20$ N/mm^2.

6. Attempt any **one** part of the following : $\qquad$ 10 × 1 = 10

(a) A rectangular beam width b = 350 mm and d = 550 mm has a factored shear of 400 kN at the critical section near the support. The steel at the tension side of the section consists of four 32 mm bars which are continued to support. Assuming $f_{ck} = 25$ and $f_y = 415$ (N/mm^2) design vertical stirrups for the section.

(b) Design a simply supported R.C.C. Slab for a roof of a hall 4 m × 10 m (inside dimensions) with 230 mm walls all around. Assume a live load of 4 kN/m^2 and finish 1 kN/m^2. Use grade 25 concrete and Fe 415 steel.

7. Attempt any **two** parts of the following :   5 × 2 = 10

(a) Explain the principles of limit state method.

(b) Explain general principles of working stress design.

(c) Design the interior span of a continuous one way slab for an office floor continuous over tee beams spaced at 3 metres. Live load = 4 kN/m, floor finish = 1 kN/m². Use concrete M-20 and steel Fe-415. Adopt limit state method. Sketch the steel reinforcement.

———————