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ET-508(A)

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

01126

June, 2015

ET-508(A) : STRUCTURAL DESIGN – I

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **four** questions. All questions carry equal marks. Use of code of practice IS-456 and scientific calculator is allowed. Any missing data may be assumed suitably.*

1. A rectangular beam 250 mm by 500 mm deep is reinforced with 2 – 14 mm bars in compression zone and 4 – 25 mm bars in tension zone, each at an effective cover of 40 mm. Determine the moment of resistance assuming M 20 mix and Fe 415 grade steel. The stress in compression zone is 353 N/mm^2 and maximum depth of neutral axis is 0·48 d. Use limit state method of design. $17\frac{1}{2}$

2. A rectangular beam is 200 mm wide and 400 mm deep upto the centre of reinforcement. Find the reinforcement required, if it has to resist a moment of 40 kNm. Assume M 20 mix and Fe 415 grade steel. Use working stress method of design. $17\frac{1}{2}$

3. A reinforced concrete column 8 m long (effective) and 400 mm in diameter is reinforced with 8 bars of 20 mm diameter. Find the safe load the column can carry. Take σ_{cc} = 4 N/mm^2 and σ_{sc} = 130 N/mm^2. The column is provided with lateral ties. Use working stress method of design. $17\frac{1}{2}$

4. A rectangular singly reinforced beam, 300 mm wide and having 500 mm effective depth is used as a simply supported beam over an effective span of 6 m. The reinforcement consists of 4 bars of 20 mm diameter. If the beam carries a uniformly distributed load of 12 kN/m, inclusive of the self weight, determine the stresses developed in concrete and steel. Take m = 19. Use working stress method of design. $17\frac{1}{2}$

5. A reinforced concrete beam 250 mm wide and of 400 mm effective depth is subjected to a shear force of 95 kN at the supports. The tensile reinforcement at the support is 0·5 percent. Find the spacing of 12 mm diameter 2-legged stirrups to resist the shearing stress at supports for M-15 concrete. Take the following values :

   $\sigma_{st} = \sigma_{sc}$ = 140 N/mm^2, f_y = 250 N/mm^2 and m = 19. Also design the minimum shear reinforcement at the mid-span of the beam. Use working stress method of design. $17\frac{1}{2}$

6. Design a footing for the foundation of a brick wall 400 mm thick and transmitting a load of 100 kN/m of its length. The bearing capacity of the soil is 60 kN/m^2. The unit weight of earth is 15 kN/m^3. Use f_{ck} = 15 N/mm^2, f_y = 250 N/mm^2 and load factor = 1·5. Use limit state method design. $17\frac{1}{2}$

7. Show that for the yield line analysis of two way slabs

$$w = 12\left[\frac{M_{nx} + M_{px}}{L_x^2} + \frac{M_{ny} + M_{py}}{L_y^2}\right],$$

where all the terms have their usual meanings. $17\frac{1}{2}$