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ET-508(A)

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

Term-End Examination

December, 2017

00067

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.*

1. A rectangular beam 200 mm by 400 mm deep upto the centre of reinforcement is reinforced with 3 – 20 mm diameter bars in tension zone at an effective cover of 50 mm. Determine the depth of neutral axis, lever arm and moment of resistance assuming M 15 mix and Fe 250 grade steel. Use limit state method of design. $7+3\frac{1}{2}+7=17\frac{1}{2}$

2. Design a rectangular beam by limit state method of design for an effective span of 6·50 m. The superimposed load is 60 kN/m and the size of the beam is limited to 300 mm × 600 mm overall. The effective cover to reinforcement is 60 mm. The compressive stress in steel may be taken as 0·87 f_y. Use M 20 mix and Fe 415 grade steel. $17\frac{1}{2}$

3. The moment of resistance of a rectangular reinforced concrete beam of breadth b (mm) and effective depth d (mm) is 0·7 bd^2 Nmm. If the stresses in the outside fibre of concrete and in the steel do not exceed 4·2 N/mm^2 and 140 N/mm^2 respectively, and the modular ratio equals 18, determine the depth of neutral axis and area of tension steel in terms of b and d. Use working stress method of design. $17\frac{1}{2}$

4. A rectangular beam 300 mm by 600 mm deep is reinforced with 4 – 25 mm diameter bars at an effective cover of 50 mm. The shear force at the cross-section is 100 kN. Use M 15 concrete and Fe 415 steel. Design shear reinforcement providing vertical stirrups. Use working stress method of design. $17\frac{1}{2}$

5. Design a short circular column to carry an axial load of 1250 kN. Take permissible compressive stress in concrete in direct compression (σ_{cc}) and permissible compressive stress in column bars as 6 N/mm^2 and 130 N/mm^2 respectively. Use working stress method of design. $17\frac{1}{2}$

6. Show that in yield line analysis of two-way simply supported square slabs, the collapse load per unit length can be expressed as

$$W = \frac{24\ M_0}{L^2}$$

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