

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

**Term-End Examination**

00383

June, 2018

**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 300 mm × 600 mm deep is reinforced with 2 – 12 mm diameter bars in compression zone and 4 – 20 mm diameter bars in tension zone at an effective cover of 50 mm. Determine the moment of resistance by limit state method of design assuming M 15 mix and Fe 415 grade steel. The compressive stress in steel may be taken equal to 0.87 y.

$17\frac{1}{2}$

2. Determine the reinforcement required for a rectangular beam to resist a bending moment of 40 kNm using M 15 mix and mild steel. Assume  $b = \frac{d}{2}$  and use limit state method of design.  $17\frac{1}{2}$
3. An RCC beam 300 mm wide and 600 mm deep has 4 bars of 20 mm diameter as tension reinforcement, the centre of bars being 50 mm from the bottom of the beam. Determine the uniformly distributed load the beam can carry (inclusive of its own weight) over an effective simply supported span of 6 m. The permissible stresses in concrete and steel may be taken as  $5.2 \text{ N/mm}^2$  and  $126 \text{ N/mm}^2$  respectively. Take modular ratio,  $m = 18$ . Use working stress method of design.  $17\frac{1}{2}$
4. A simply supported beam, 300 mm wide and 550 mm effective depth carries a uniformly distributed load of 40 kN/m, including its own weight, over an effective span of 5.0 metres. Design the shear stirrups in the form of vertical stirrups. Use M 15 concrete. Take permissible tensile stress in reinforcement as well as shear reinforcement  $140 \text{ N/mm}^2$  and  $f_y = 250 \text{ N/mm}^2$ . Assume that the beam contains 0.75% reinforcement throughout the length. Use working stress method of design.  $17\frac{1}{2}$

5. A reinforced concrete column of 5.0 m effective length and 500 mm diameter is reinforced with nine (09) bars of 20 mm diameter. Find the safe load the column can carry. Take permissible compressive stress in direct compression ( $\sigma_{cc}$ ) as  $4 \text{ N/mm}^2$  and  $130 \text{ N/mm}^2$  respectively. The column carries lateral ties. Use working stress method of design.

$17 \frac{1}{2}$

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

$$w = \frac{8 M_0}{L^2},$$

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