USN | | | | | | | | | | |

09ARC3.5

Third Semester B.Arch. Degree Examination, Dec. 2015/Jan. 2016

Structure – III

Time: 3 hrs. Max. Marks: 100

Note: *1. Answer any FIVE full questions.*
2. Missing data, if any, may be assumed suitably.

1 a. Derive the torsion equation using usual notations. **(08 Marks)**

b. A hollow shaft of 6m length and inner and outer diameter of 75mm and 100mm is subjected to a torque of 10kNm. If G = 80 GPa, determine the maximum shear stress produced and the total angle of twist. **(12 Marks)**

2 a. What are the assumptions made in torsion theory? **(05 Marks)**

b. A shaft is required to transmit 245kW power at 240rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40N/mm^2 and the twist 1° per meter length. Determine the diameter required if i) the shaft is solid, ii) the shaft is hollow with external diameter twice the internal diameter.
Take modulus of rigidity 80 GPa. **(15 Marks)**

3 a. Write Euler's crippling load for different end conditions of a column. **(08 Marks)**

b. Find Euler's critical load for a hollow cylindrical cast – iron column 200mm external diameter and 25mm thick shell, if it is 6m long and hinged at both ends.
Take E = 80GPa. **(12 Marks)**

4 a. Derive Rankine's formula with usual notations. **(08 Marks)**

b. Design a hollow cylindrical cast iron column to carry axial load of 250kN with a length of 4m with both ends fixed. Assume a factor of safety of 5. Take diameter ratio as 0.8, α for cast iron is $\frac{1}{1600}$ and σ_c = 550MPa. **(12 Marks)**

5 a. Derive the $EI\frac{d^2y}{dx^2} = \frac{1}{R}$ differential equation using usual notation. **(08 Marks)**

b. Find the slope and deflection at the free end of a cantilever beam of span 'L' when loaded with point load at free end of magnitude 'W'kN. Use double Integration method. **(12 Marks)**

6 a. Find the displacement of free end of cantilever beam shown in Fig Q6 (a). Take E = 2×10^5 N/mm^2, I = 180×10^6mm^4. Use double integration method. **(10 Marks)**

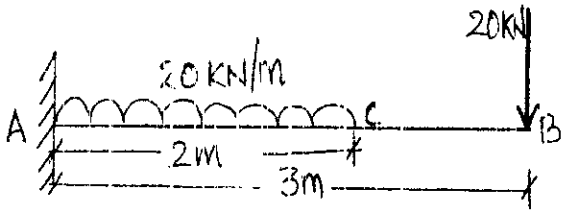

Fig. Q6 (a)

b. Find slope at supports and maximum deflection below point load for the beam shown in Fig. Q6 (b). EI = 10000 kNm^2. **(10 Marks)**

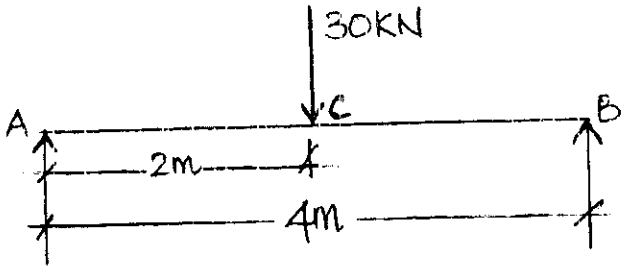

Fig. Q6(b)

7 Determine the maximum deflection and deflection under the loads for the beam shown in Fig Q7. Also determine the slopes at support.
Take EI = 360 × 10^{3}kNm^2 **(20 Marks)**

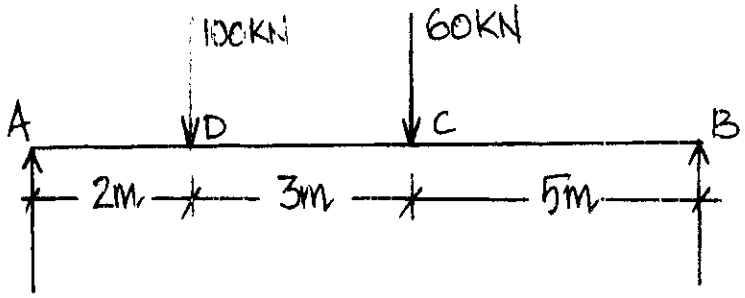

Fig. Q7

8 a. State moment area theorems. **(04 Marks)**

b. Using moment area method calculate maximum slope and deflection for following cases
   i) A simply supported beam of span 'L' carrying a concentrated load 'W' at mid span.
   ii) A cantilever beam of span 'L' carrying udl 'W' kN/m throughout. **(16 Marks)**

* * * * *