

# CBCS Scheme

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15CV/CT32

## Third Semester B.E. Degree Examination, June/July 2018 Strength of Materials

Time: 3 hrs.

Max. Marks: 80

**Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Missing data, if any, may be suitably assumed.**

### Module-1

- 1 a. For a bar of uniform section derive an expression for elongation due to self weight. (06 Marks)
- b. Evaluate the deformation of the bar, given,  $E_1 = E_2 = E_3 = 200\text{GPa}$ , refer Fig.Q1(b). (10 Marks)

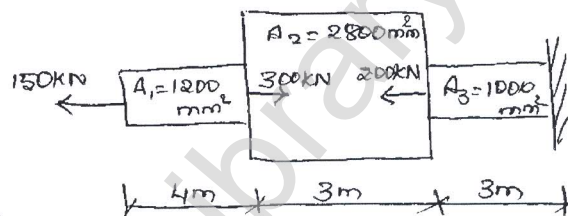


Fig.Q1(b)

OR

- 2 a. Derive an expression between Young's modulus, Modulus of rigidity and Poisson's ratio. (10 Marks)
- b. A circular rod of dia 200mm and 500mm long is subjected to a tensile force of 45kN modulus of elasticity =  $200\text{ kN/mm}^2$ , Find stress, strain and elongation of bar due to applied load. (06 Marks)

### Module-2

- 3 At a certain point in a stressed body, the principal stresses are  $\sigma_x = 80\text{ MPa}$  and  $\sigma_y = -40\text{MPa}$ . Determine  $\sigma$  and  $\tau$  on the planes whose normal's are at  $+30^\circ$  and  $+120^\circ$  with x - axis. (16 Marks)

OR

- 4 a. Derive an expression of tangential stress and longitudinal stress of thin walled pressure vessels. (08 Marks)
- b. A rectangular block of material is subjected to a tensile stress of  $100\text{N/mm}^2$  on one plane and a tensile stress of  $50\text{N/mm}^2$  on a plane at right angles together with shear stress of  $60\text{ N/mm}^2$  on same planes, find : i) direction of the principal plane ii) magnitude of the principal plane iii) magnitude of greatest shear stress. (08 Marks)

### Module-3

- 5 a. Define : i) bending moment ii) shear force iii) shear force diagram iv) bending moment diagram. (08 Marks)
- b. Draw SFD and BMD for the cantilever beam shown in Fig.Q5(b). (08 Marks)

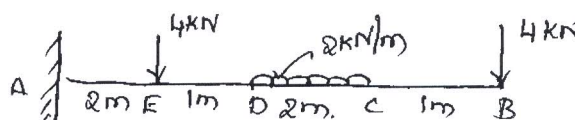


Fig.Q5(b)

OR

- 6 a. Derive the relation between load intensity, bending moment and shear force. (06 Marks)  
 b. A beam ABC, 8m long has supported at A and B, it is long between A and B. The beam carries an udl of 10kN/m between A and B. At free end point C, a point load of 15 kN acts. Draw BMD and locate point of contra-flexure, if any. (10 Marks)

Module-4

- 7 a. Explain pure bending with an suitable example and mention the assumptions of pure bending. (06 Marks)  
 b. A cast iron beam section shown in Fig.Q7(b) is freely supported on a span of 5m. IF the tensile stress is not to exceed 20 N/mm<sup>2</sup>. Find the safe UDL which the beam can carry. Find also the maximum compressive stress. (10 Marks)

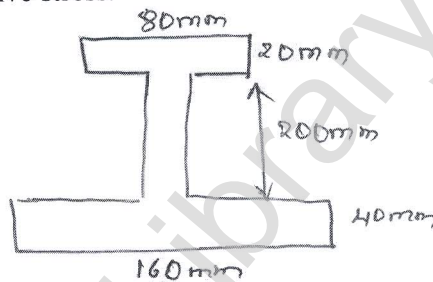


Fig.Q7(b)

OR

- 8 a. Derive an Euler's crippling load when both ends of the column are pinned. (08 Marks)  
 b. A hollow cylindrical cast iron column is 4m long both ends being fixed. Design the column to carry an axial load of 250 kN. Use Rankine's formula and factor of safety = 5. The internal diameter may be taken as 0.80 time the external diameter. Take  $E_C = 550 \text{ N/mm}^2$  and  $\alpha = \frac{1}{1600}$ . (08 Marks)

Module-5

- 9 a. Derive torsional equation for circular shaft. (08 Marks)  
 b. A steel shaft transmits 105kN at 160 rpm. If the shaft is 100mm in diameter. Find the torque on the shaft and the maximum shearing stress induced. (08 Marks)
- 10 a. Define pure torsion, polar modulus and torsional rigidity. (06 Marks)  
 b. A solid shaft is subjected to a torque of 15 kN-m. Find the necessary diameter of the shaft if the allowable shearing stress is 60N/mm<sup>2</sup> and the allowable twist is 1 degree in a length of 20 diameters of the shaft. Take  $C = 8 \times 10^4 \text{ N/mm}^2$ . (10 Marks)

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