

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)

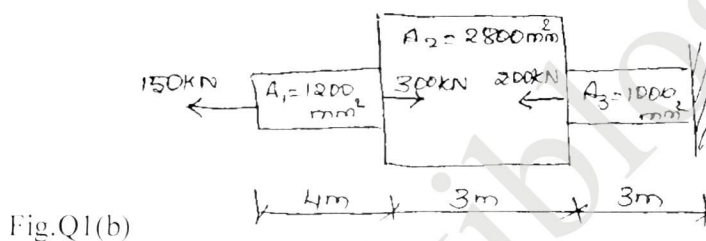


Fig.Q1(b)

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 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 σ and τ 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 N/mm^2 on one plane and a tensile stress of 50 N/mm^2 on a plane at right angles together with shear stress of 60 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)

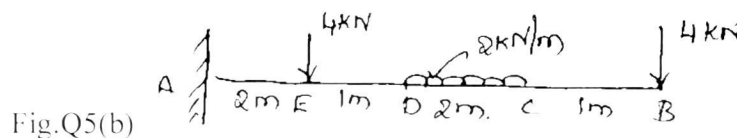


Fig.Q5(b)

OR

- 6 a. Derive the relation between load intensity, bending moment and shear force. (06 Marks)
 b. A beam ABC, 8m long has supports at A and B, it is 6m 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/mm². Find the safe UDL which the beam can carry. Find also the maximum compressive stress. (10 Marks)

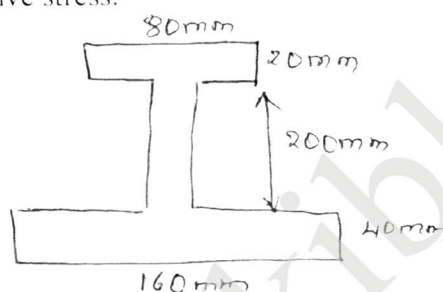


Fig.Q7(b)

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 a 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)

OR

- 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/mm² 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)