Roll No. **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(AE) (2011 Onwards) (Sem.–3)

MECHANICS OF MATERIALS

Subject Code : BTAE-301

M.Code : 54109

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer briefly :

a. What is proportionality limit?

b. Draw the stress strain diagram for ductile material.

c. State Hook's law.

d. Draw the BMD and SFD of a cantilever beam of length '1' having point load 'w' at its free end.

e. Define temperature stress and strain.

f. Write the assumptions made in theory of simple bending.

g. What is torsional rigidity?

h. What is strut?

i. A simply supported beam of uniform circular cross-section is subjected to a maximum bending moment of 30KN-m. If the diameter of beam is 40mm. Find the values of maximum and minimum bending stress.

j. Define hoop stress.

SECTION-B

Q2. Find the elongation in a uniformly tapering rectangular bar subjected to axial pull **P**. The thickness of bar is **t** and width of bar is **a** at bigger end and **b** at smaller end.

Q3. The stresses on two perpendicular planes through a point in a body are 30 MPa and 15 MPa both tensile along with shear stress of 25 MPa. Find the magnitude and direction of principal stresses.

Q4. Derive the torsion equation and state the assumptions of torsion theory.

Q5. A 400 mm × 150 mm I-girder has 20 mm thick flanges and 13 mm thick web. Calculate the maximum intensity of shear stress and sketch the distribution of shear stress across the section, the S.F at the cross section being 160 kN.

Q6. A short column of hollow cylindrical section 25 cm outside diameter and 15 cm inside diameter carries a vertical load of 400 kN along one of the diameter planes 10 cm away from the axis of the column. Find the extreme intensities of stresses and state their nature.

SECTION-C

Q7. A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20°C. At this stage, they are rigidly connected at both ends. When the temperature is raised to 320°C, the length of the bars increased by 1.5 mm. Determine the original length and final stresses in the bars.

Take $E_s = 220 GN/m^2$, $E_s = 110 GN/m^2$, $\alpha_s = 0.000012/°C$ and $\alpha_c = 0.0000175/°C$

Q8. A beam ABCDE is 4.6m in length and loaded as shown in Fig.1 below. Draw the S.F.D and B.M.D diagrams for the beam, indicating all major values and find the points of contra-flexure, if any.

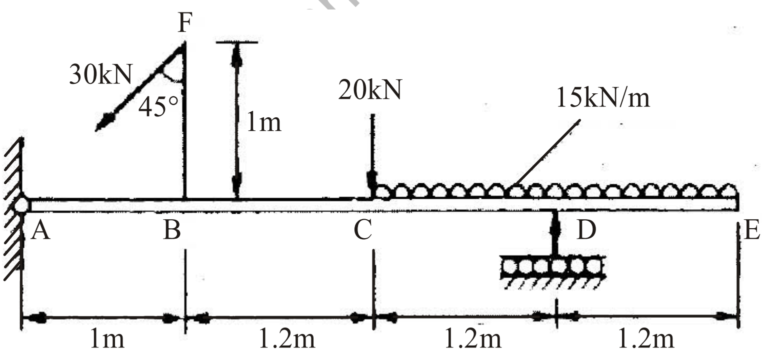

Fig.1

Q9. A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MN/m^2. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of 200 N-m, find the magnitude and nature of the principal stresses set up in the cylinder. E = 200 GN/m^2 and $v = 0.3$.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.