 III–Sem/MECH/2014(W)(New)

STRENGTH OF MATERIAL

(Code – MET-301)

Full Marks : 70

Time : 3 hours

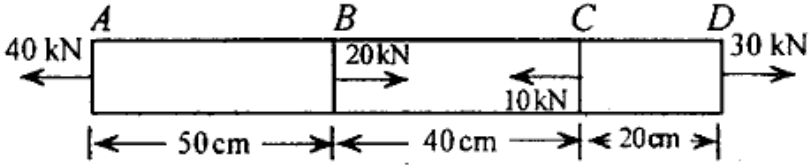
Answer any **five** questions

Figures in the right-hand margin indicate marks

1. (*a*) State Hooke's Law. 2

(*b*) Derive the relation between modulus of elasticity and modulus of rigidity. 5

(*c*) A steel bar 25 mm. diameter is loaded as shown in figure. Determine the stresses in each part and the total elongation. 7



2. (*a*) What do you mean by temperature stress ? 2

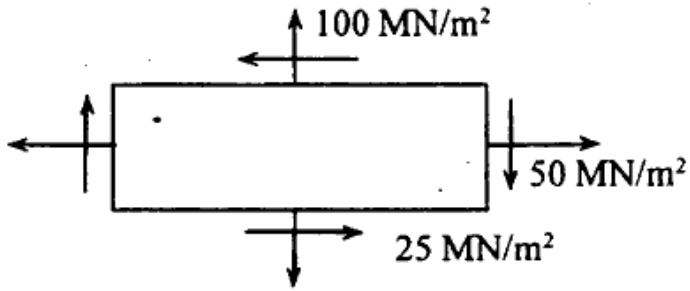
(*b*) Find out the stress due to impact loading. 5

(*c*) A cylindrical shell 2·5 m long and closed at the ends has an internal diameter of 1·25 m and wall thickness of 20 mm. Calculate the change in dimensions when subjected to an internal pressure of 1·5 MPa. Take $E = 200$ GPa and $\frac{1}{m} = 0{\cdot}3$. 7

3. (*a*) Define principal plane. 2

(*b*) Derive the principal stresses on a body subjected to two mutually perpendicular direct stresses. 5

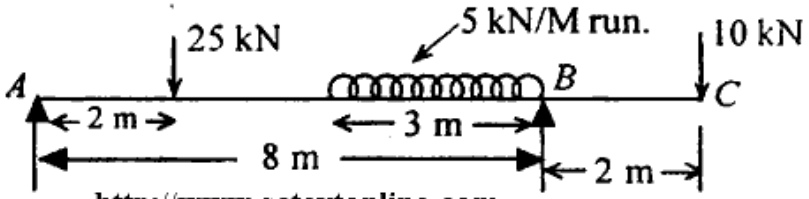
(*c*) A point in a material is subjected to a stress as shown below. Calculate (*i*) the principal stresses (*ii*) Maxm. shear stress and also the plane along which it acts. 7



4. (*a*) Define Bending Moment as applied to a loaded beam. 2

(*b*) What are different types of beam ? Explain in details. 5

(*c*) Find out the S.F and B.M at salient points of the following loaded beam and draw the S.F and B.M diagram. 7



5. (*a*) What do you mean by pure bending ? 2

(*b*) What are the assumptions taken while deriving bending equation under theory of simple bending ? 5

(*c*) A rectangular beam 8 cm × 6 cm is 2 m long and is simply supported at the ends. If carries a load of 3 kN at mid-span. Determine the maxm. bending stress induced in the beam. 7

6. Write short notes on any *two* : 7 + 7

(*i*) Mohr's circle

(*ii*) Resilience

(*iii*) Sectional modulus.

7. (*a*) Define torsional rigidity. 2

(*b*) Derive the formula $\frac{T}{J} = \frac{q_s}{R}$

where T = Torque

J = Polar Moment of inertia

q_s = Maxm. shear stress

R = Radius of circular shaft. 5

(*c*) What diameter of shaft will be required to transmit 80 kW at 80 rpm. if the maximum torque is 30 percent more than the mean and the limit of torsional stress is to be 56 MPa ? 7