Total Pages : 5

III/SEM/MECH/2018 (W)/NEW

STRENGTH OF MATERIAL

(MET - 301)

Full Marks : 80

Time : 3 hours

Answer any **five** questions including Q.Nos. **1** & **2**.

The figures in the right-hand margin indicate marks.

1. Answer the following : 2 × 10

(*a*) Compare Engineering stress with true stress.

(*b*) State Hooke's law.

(*c*) Define Poisson's ratio.

(*d*) Explain Temperature stress.

(*e*) State the relationship between stress due to gradually applied load and suddenly applied load.

(*f*) What do you mean by thin cylinder ?

(*g*) Define shear force and bending moment.

(*h*) What is section modulus ?

(*Turn Over*)

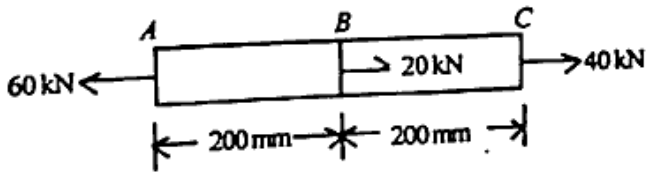
(*i*) Define beam and column.

(*j*) Write down pure torsion equation with proper notation.

2. Answer any *six* questions : 5 × 6

(*a*) A hollow cast iron column has internal diameter of 200 mm. What should be the external diameter of the column ? So that it can carry a load of 1.6 MN without the stress exceeding 90 MPa.

(*b*) A steel bar *ABC* of 400 mm length and 20 mm diameter is subjected to a point load as shown in Figure 1. Determine the total change in length of bar. Take $E = 200$ GPa.



(*c*) A concrete column of 350 mm diameter is reinforced with four bars of 25 mm diameter. Find the stress in steel when the concrete is subjected to a stress of 4.5 MPa. Also find the safe load the column can carry.
Take $E_s/E_c = 18$.

(*Continued*)

(*d*) Derive the expression of circumferential stress in thin cylinder.

(*e*) Draw S.F.D and B.M.D of the beam shown in Figure 2.

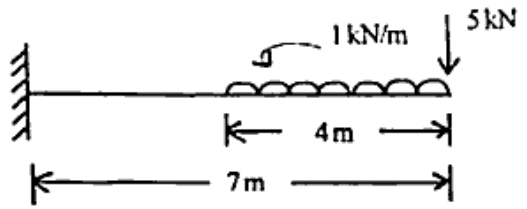


Figure 2

(*f*) Write down Euler's formula for buckling load with various end conditions.

(*g*) A solid steel shaft has to transmit 120 kW at 160 rpm. Taking allowable shear stress 80 MPa, find the suitable diameter of shaft. The maximum torque transmitted in each revolution exceeds the mean by 25%.

(*h*) Derive the relationship between Young's modulus of elasticity and Bulk modulus.

3. A cylindrical vessel 1.8 m long, 800 mm in diameter is made up of 8 mm thick plates. Find the hoop and longitudinal stresses in vessel, when it

contains fluid pressure of 2.5 MPa. Also find out the change in length, diameter and volume of the vessel. Take $E = 200$ GPa and $\frac{1}{m} = 0.3$. 10

4. A machine component is subjected to stresses as shown in Figure 3.

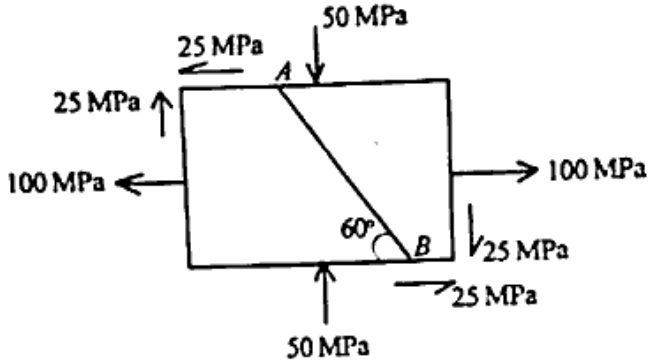


Figure 3

Find the normal and shearing stresses on the section AB inclined at 60° with X-X axis. Also find the resultant stress on the section. 10

5. Draw SFD and BMD of the overhanging beam as shown in Figure 4 and locate point of contraflexure if any. 10

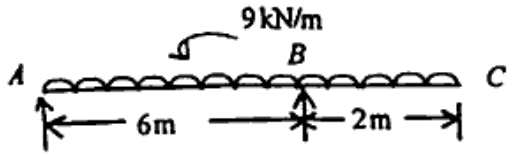


Figure 4

6. Derive the following relationship for pure bending : 10

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

M = Moment of Resistance

I = Moment of Inertia

σ = Bending stress

y = Distance from neutral axis to fibre of consideration

E = Young's modulus of elasticity

R = Radius of gyration.