U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

July / August 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 19ME3DCSOM **Max Marks: 100**
Course: Strength of Materials

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

UNIT – I

1 a) Obtain an expression for elongation of a tapered circular bar. **06**

b) Three equally spaced rods in the same vertical plane support a rigid bar AB. Two outer rods are of brass, each 600 mm long and 25 mm in diameter. The central rod is of steel that is 800 mm long and 30 mm in diameter. Determine the forces in the rods due to an applied load of 120 Kn through the midpoint of the bar. The bar remains horizontal after the application of the load. Take $E_S/E_b=2$. **08**

c) A composite bar made up of copper, steel and brass is rigidly attached to the end supports as shown in Fig 1(c). Determine the stresses in the three portions of the bar when the temperature of the composite system is changed by 70^0C and if supports are rigid. **06**

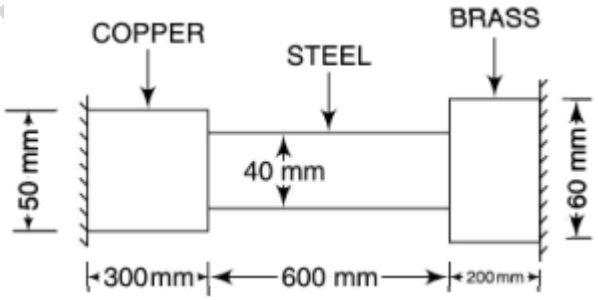

Fig 1(c)

OR

2 a) The stresses on two mutually perpendicular planes through a point in a body are 80 MPa and 50 MPa tensile. Determine the maximum value of the shear stress that can be applied so that the maximum value of the permissible principal stress is limited to 120 MPa. What will be the inclination of the principal stresses and the magnitude of the maximum shear stress? **10**

b) Obtain an expression for principal stresses on a plane subjected to two perpendicular direct stresses with simple shear. **10**

UNIT - II

3 a) Obtain the relation between load, shear force and bending moment. **08**

b) A cantilever of 14 m span carriess loads of 6,4,6 and 4 kN at 2m,4m,14 m respectively from the fixed end. Also UDL of 2 kN/m acts between 4 to 10m from fixed end. Draw the shear force and bending moment diagrams. **12**

UNIT - III

4 a) Derive the expression $\sigma/y=M/I=E/R$. **10**

b) A 280X120 mm I section beam is to be used as a cantilever of 3.6 m length. Find the uniformly distributed load which can be carried by the beam if the permissible stress is 125 MPa. $I=75X10^6$ mm^4. if the cantilever is strengthened by 10 mm thick steel plates welded at the top and bottom flanges to withstand a 40% increased load, find the width of plates and length over which plates should extend. **10**

OR

5 a) Obtain the relation $EI\frac{d^2y}{dx^2} = M$. **08**

b) A uniform circular bar of length l and diameter d is extended by an amount δ under a tensile load F. Show that if the bar is used as a simply supported at its ends and carries a central load W, the maximum deflection is $y=W\ \delta l/3Fd^2$. if $l=60d$ and maximum bending stress due to pull W is equal to 0.8 times the tensile stress due to pull F, determine the ratio y/δ. **12**

UNIT - IV

6 a) Obtain the relation $T/J=\tau/r=G\theta/l$. **10**

b) A hollow shaft transmits 200 kw of power at 150 rpm. The total angle of twist in a length of 5 m of the shaft is 3^0. Find the inner and outer diameters of the shaft if the permissible stress is 60 MPa. Take G =80 MPa. **10**

UNIT - V

7 a) A thick cylinder of 200 mm outer diameter and 140 mm inside diameter is subjected to internal pressure of 40 MPa and external pressure of 24 MPa. Determine the maximum shear stress of the cylinder at the inside diameter. **10**

b) Using Euler's formula, determine the critical stresses for a strut of slenderness ratio 80,120,160 and 200 under the condition of (a) both ends hinged and (b) both ends fixed. E=205 GPa. **10**

****