SRINIX COLLEGE OF ENGINEERING, BALASORE

2ND INTERNAL EXAM-2020-21

SUB: MECHANICS OF SOLID **Time: 2 hrs**

SEMESTER: 3RD (CIVIL ENGG.) **Full Mark: 60**

Part A: Answer all **(10×2)**

1. Write down the relationship between shear force, bending moment and load.
2. What do you mean by the point of contra-flexure and point of maximum bending moment?
3. What is composite beam and what is its utility?
4. Define slenderness ratio. Write down the formula to find out the crippling load of column with different end conditions.
5. What do you mean by proof stress?
6. Define section modulus. Write down the expressions to find out section modulus of solid rectangle, hollow rectangle, solid circle and hollow circular section with neat sketches.
7. A 100 mm dia steel bar free to expand is heated from 15°c to 40°c. Calculate the stress developed.
8. A steel bar of 40 mm dia is subjected to an axial compressive load of 250 kN. If the length of the bar is 2m and E=200Gpa.calculate the elongation of the bar.
9. What is Mohr's stress circle? Explain its significance.
10. Define the following terms. Principal stress, principal plane and complementary shear stress.

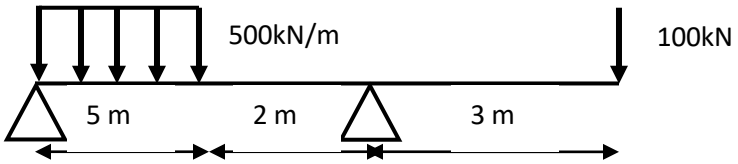
Part B:

Answer any four **(5×4)**

1. Draw the stress-strain curve for mild steel rod subjected to tension and explain about its salient points.
2. Derive the relation $\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$ Symbols has their usual meanings.
3. A steel tube of 40 mm outer dia and 30 mm inner dia encloses a gun metal rod of 20 mm dia and it is rigidly joined at each end. If at a temperature of 25°c there is no

longitudinal stress. Determine the stresses developed in the rod and the tube when the temperature of assembly is raised to 200 °c. Take the $\alpha_s=11\times10^{-6}$/°c, $\alpha_{gun\ metal}=11\times10^{-6}$/°c, E_s=200GPa and $E_{gun\ metal}$ =90 GPa. Also find the increase i9n length. If the original length of assembly is 1 m.

4. Draw the SFD and BMD of the beam as shown below. Find the position and magnitude of maximum bending moment and locate the point of contraflexure if any.



5. A cylindrical shell 2.5 m long. Which is closed at its ends has an internal dia of 1 m and a wall thickness of 12 mm. calculate the hoop stress and axial stress induced and also the change in dimension of the shell if it is subjected to an internal pressure of 1.8 MN/m^2. Take E= 200GN/m^2 an poisons ratio μ=0.25.

Part C

Answer any two **(10×2)**

6. A body is subjected to two normal tensile stresses along with one shear stress. Two normal stresses along X and Y direction are 20 MPa and 10 MPa respectively. The shear stress is 25 MPa. Find out the direction and magnitude of principal stresses in the material. Also locate the planes of maximum shear stress and calculate the normal and shearing stress on these planes.
7. Draw the mohrs circle of a member which is subjected to tensile stresses of 200 MPa and 150 MPa at right angles to each other. Determine the normal, tangential stresses on a plane inclined at 60° to the 200 MPa stress. Also find the plane on which the resultant stress has maximum obliquity.
8. A metal bar 5 cm × 5 cm section is subjected to an axial compressive load of 500 kN. The concentrated on a 20 cm gauge length is found to be 0.5 mm and the increase in thickness og 0.045 cm. Find the value of Young's modulus and poisson's ratio.