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Total No. of Questions : 09]

[Total No. of Pages : 03

**B.Tech. (Sem. - 3<sup>rd</sup>)**  
**SOLID MECHANICS**  
**SUBJECT CODE : CE - 207**  
**Paper ID : [A0604]**

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

**Instruction to Candidates:**

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

**Section - A**

**Q1)** **(10 × 2 = 20)**

- a) Define modulus of rigidity.
- b) What do principal plane mean?
- c) Write the expression for the co-ordinates of the centre of Mohr's circle in a two-dimensional stress system.
- d) What is the nature of variation of bending moment due to a concentrated load?
- e) What do pure bending of a beam?
- f) Write the expression for maximum deflection of a simply supported beam of span/carrying a UDL of intensity 'W' per unit length.
- g) Define torsional rigidity of a shaft.
- h) Two shafts having same length and material are joined in series. If the ratio of their diameters is 2, then what is the ratio of their angles of twist?
- i) What do modulus of resilience in simple bending mean?
- j) Define slenderness ratio of a column.

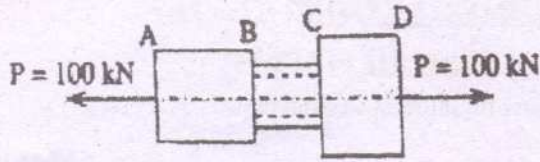
**Section - B**

**(4 × 5 = 20)**

**Q2)** Discuss briefly the theories of failure for brittle material.

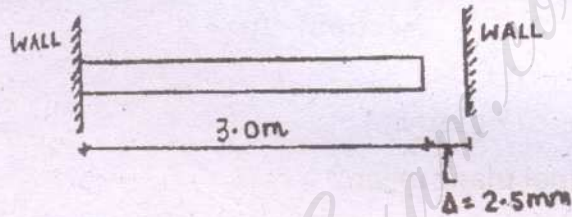
**Q3)** A solid round bar 3 m long and 5cm in diameter is used as a column with both ends hinged. Determine the percentage change in the Euler's crippling load of the column if the end conditions are changed to both end fixed. Take  $E = 200 \text{ GPa}$ .

**Q4)** A stepped circular section bar ABCD, figure shown below, of steel ( $E = 210 \text{ GPa}$ ) has the part AB (solid, dia = 50mm, length = 60mm), part BC (hollow, od = 30mm, length = 50mm) and part CD (solid, dia = 70mm, length = 50mm). What should be the inner diameter of part BC if the tensile stress in it is 200 MPa? What is the total elongation of the bar ABCD?



**Q5)** A bronze bar 3m long with a cross-sectional area of  $320 \text{ mm}^2$  is placed between two rigid walls. At a temperature of  $-20^\circ\text{C}$ , there is a gap of 2.5mm, as shown in figure below. Find the temperature at which the compressive stress in the bar will be 35 MPa.

Use  $\alpha = 18.0 \times 10^{-6}/^\circ\text{C}$  and  $E = 80 \text{ GPa}$ .

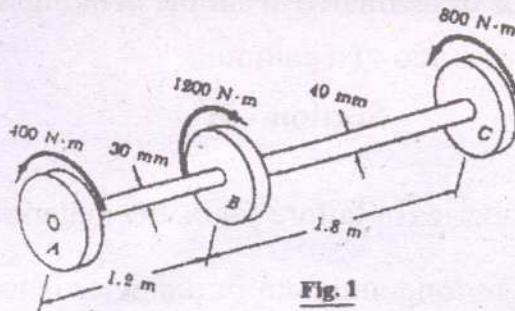


**Q6)** At a point in a strained material, the principal stresses are 130MPa tensile and 50MPa compressive. Find the resultant stress and its direction on a plane inclined at  $45^\circ$  to the axis of 130MPa stress by Mohr's circle diagram. Also determine the maximum intensity of shear stress in the material.

**Section - C**

(2 × 10 = 20)

**Q7)** The torques shown in figure 1 given below are exerted on pulleys A, B, C. Knowing that both shafts are solid and made of brass ( $G = 39 \text{ GPa}$ ), determine the maximum shearing stress in both the shafts and the angle of twist between pulleys A and C.



Q8) Draw the shear force and bending moment diagrams for the beam shown in figure 2. Clearly show the values of shear force and bending moment at important locations. Point out the point(s) of contraflexure if present.  $AB = FC = CD = 1\text{m}$ ,  $BF = 3\text{m}$ .

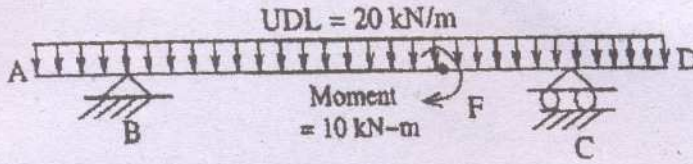
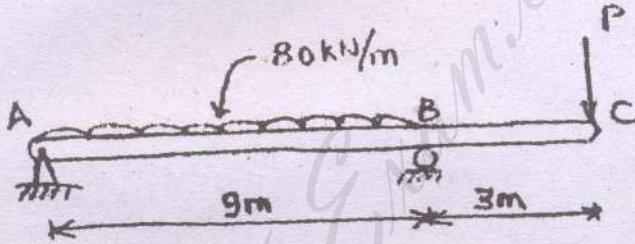


Fig. 2

Q9) The simply supported beam ABC (figure given below) carries the uniformly distributed load between its supports and the concentrated load P at end C. Find the value of P for which

- (a) There is no deflection at C.
- (b) The deflection curve at B is horizontal.



EI is constant

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