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**August/September 2022**

**B.Tech. (Civil) IV SEMESTER**

**BASICS OF SOLID MECHANICS (PCC-CE-205R)**

Time : 3 Hours]

[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of Scientific calculator is permitted.*

## PART-A

**1.** (a) Define principal stresses and principal strains. (1.5)

(b) What is Mohr's Circle? Elaborate. (1.5)

(c) Define Poisson's ratio. (1.5)

(d) Define section modulus. (1.5)

(e) What is hoop stress? Elaborate. (1.5)

(f) Define Hooke's Law. (1.5)

(g) Define moment of Inertia. (1.5)

(h) Define Torsion. (1.5)

(i) What is modulus of rigidity? (1.5)

(j) Define bulk modulus. (1.5)

## PART-B

2. (a) A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15 cm, determine :

(i) stresses in the rod and tube.

(ii) load carried by each bar. (10)

(b) A rectangular bar of cross-sectional area 10000 $mm^2$ is subjected to an axial load of 20 kN. Determine the normal and shear stresses on a section which is inclined at an angle of 300 with normal cross-section of the bar. (5)

3. (a) Find the Young's modulus of a brass rod of diameter 25 mm and of length 250 mm which is subjected to a tensile load of 50 kN when the extension of the rod is equal to 0.3 mm. (5)

(b) A wooden beam 100 mm wide and 150 mm deep is simply supported over a span of 4 metres. If shear force at a section of the beam is 4500 N, find the shear stress at a distance of 25 mm above the Neutral axis. (10)



4. Derive the expression from Mohr's Circle for normal and tangential stress when a body is subjected to two mutually perpendicular tensile stresses of unequal intensities. Draw suitable diagrams. (15)

5. (a) Derive the expression of section modulus for a rectangle of width-b and depth-d. Draw suitable diagram. (5)

(b) What is theory of simple bending. Discuss the different assumptions of theory of simple bending. (10)

6. (a) A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take E – $2 \times 10^5$ $N/mm^2$. (10)

(b) A cylinder of internal diameter 2.5 m and thickness 5 cm contains a gas. If the tensile stress in the material is not to exceed 80 $N/mm^2$, determine the internal pressure of the gas. (5)

7. A cantilever of length 2.0 m carries a uniformly distributed load of 1 kN/m run over a length of 1.5 m from the free end. Draw the shear force and bending moment diagram for the cantilever. (15)