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Total number of printed pages – 4

B. Tech
PCME 4307

Sixth Semester (Special / Back) Examination – 2013

ADVANCED MECHANICS OF SOLIDS

BRANCH : MECH

QUESTION CODE : E 317

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any **five** from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions :

2×10

- What are stress invariants ? Explain.
- Write the differential equations of equilibrium.
- Which is an octahedral plane ?
- What amount of elastic strain energy stored during bending ?
- What do you mean by asymmetrical bending ?
- Define the importance of shear centre.
- What is shrink fit ?
- Define stress concentration.



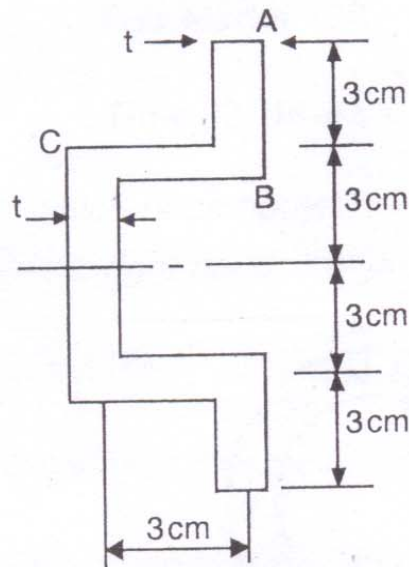
P.T.O.

- (i) Differentiate between lamina and laminates.
- (j) State the basic modes of fracture.
2. (a) The state of stress at a point is characterized by the components $\sigma_x = 12$, $\sigma_y = 4$, $\sigma_z = 10$, $\tau_{xy} = 3$, $\tau_{yz} = 0$, $\tau_{zx} = 0$ (in 1000 kPa units). Determine the principal stresses and their directions. 5
- (b) The state of stress at a point is characterized by the components $\sigma_x = 40$ MPa, $\sigma_y = -30$ MPa, $\sigma_z = 50$ MPa, $\tau_{xy} = \tau_{yz} = \tau_{zx} = 0$. Determine
- (i) the extremum values of the shear stress and its associated normal stress and
- (ii) the octahedral shear stress and associated normal stress. 5
3. (a) The displacement field for a body is given by
- $$u = (x^2 + y^2 + 2) i + (3x + 4y^2) j + (2x^3 + 4z) k .$$
- What is the displaced position of point which is originally at (1,2,3)? 5
- (b) Explain about different theories of failure. 5
4. (a) A cantilever beam of length L and constant flexural rigidity EI is loaded by a concentrated load W acting at the mid span. Determine by energy method the deflection and slope at the tip point of the beam considering only flexure. 5
- (b) A cantilever beam of length 2.5m and having a rectangular cross section 20 mm (width) \times 40 mm (depth) is subjected to an inclined load of 500 N at the free end. The inclination of the load is 30° to the vertical longitudinal plane

and the line of action of the load passing through centroid of the section of the beam. Find the position of neutral axis and the maximum stress in the beam. 5

5. (a) Write the assumptions made for bending of bars with large initial curvature. 2

(b) Determine the shear center of the "hat"-type thin-walled section indicated in Figure below. The thickness t is constant throughout the beam. 8



6. (a) Deduce the general equations for circumferential and radial stress developed in thick cylinder. 5

(b) A thick-walled circular cylinder of internal diameter 0.2 m is subjected to an internal pressure of 100 MPa. If the maximum permissible stress in the cylinder is limited to 150 MPa, determine the maximum possible external diameter D . 5

7. (a) What do you mean by the endurance limit of a material? Describe about different types of loading causes fatigue with neat sketch. 5

(b) Describe about basic modes of fracture and explain the nature with neat sketch. How it is different from each other? 5

8. Write short notes on any **two** of the following. 5×2

(a) FRP composites

(b) Fracture toughness evaluation

(c) Theorem of Virtual work.

