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Total number of printed pages – 3

B. Tech
PCME 4307

Sixth Semester Back Examination – 2015

ADVANCED MECHANICS OF SOLIDS

BRANCH : MECH

QUESTION CODE : M 240

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

- Define principal plane.
- Explain state of pure shear.
- Name various yield criteria used.
- Define elastic strain energy.
- Define Asymmetrical bending with an example.
- Define Shear Centre with an example.
- Explain shrink fit in Compound cylinders.
- Explain about Notch sensitivity.
- Name various uses of composite materials.
- Explain about fracture toughness.

2. (a) The state of stress at a point is characterized by the components

5

$$\tau_{ij} = \begin{vmatrix} 12.31 & 4.2 & 0.84 \\ 4.2 & 8.96 & 5.27 \\ 0.84 & 5.27 & 4.34 \end{vmatrix} \text{ MPa}$$

Find the values of the principal stresses and their directions.

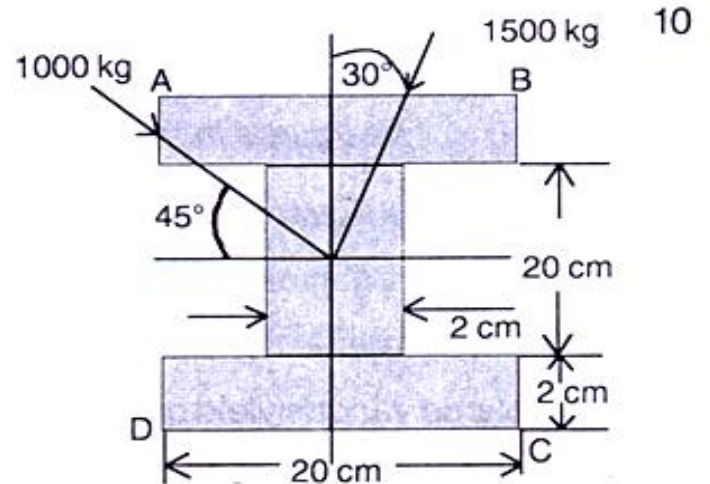
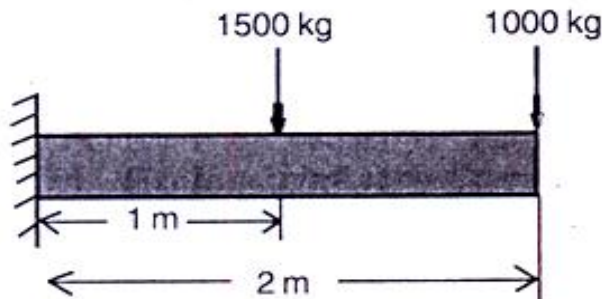
P.T.O.

(b) The state of stress characterized by ζ_{ij} is given as

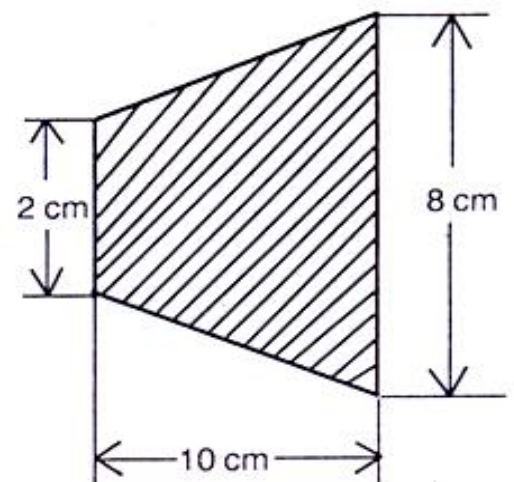
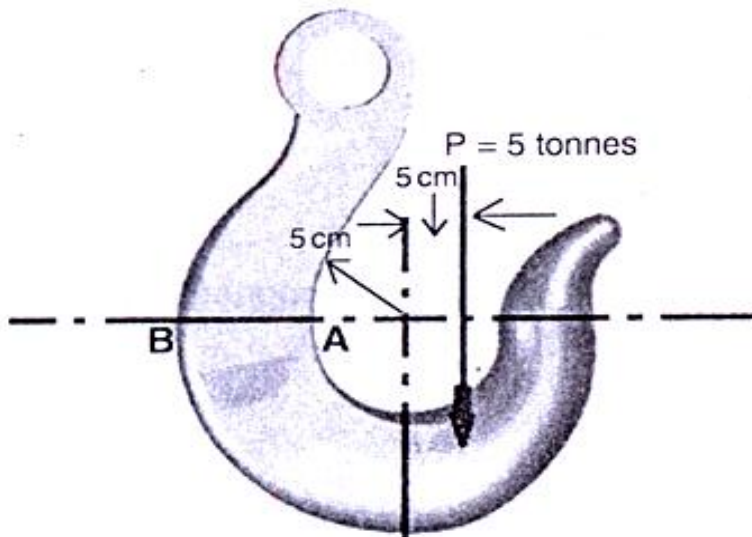
$$\tau_{ij} = \begin{vmatrix} 10 & 4 & 6 \\ 4 & 2 & 8 \\ 6 & 8 & 6 \end{vmatrix} \text{ MPa}$$

Resolve the given state into a hydrostatic state and a pure shear state. Determine the normal and shearing stresses on an octahedral plane. 5

3. (a) Derive the differential equations of equilibrium in 3-D with neat sketches. 5
 (b) What do you understand by plane state of stress? Derive the expressions for principal stresses in plane state of stress. 5
4. A cantilever beam of I-section is used to support the loads inclined to the vertical axis, as shown in figure below. Compute the stresses at the corners A, B, C and D of the wall section. What is the inclination of the neutral axis at the wall section? 10



5. A 5 tonne crane hook has a trapezoidal section as shown in the figure below. Find the stress on inside fibres and on the outside fibres at the section AB. 10



6. (a) Derive equations for circumferential and radial stress developed in thick walled cylinder under plane stress condition subjected to external and internal pressure. Assume proper symbols of the variables used. 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. 5
7. (a) Briefly describe about the Fatigue tests. 5
- (b) Describe about the basic modes of fracture. 5
8. Write short notes on any **two** : 5×2
- (a) Theories of Failure
- (b) Theorem of virtual work
- (c) Micromechanics of FRP Composites
- (d) Gerber and Soderberg criteria.

