B. E. 4th Semester (M.E.) Examination
December-2006
STRENGTH OF MATERIALS—II
Paper—ME-206—E

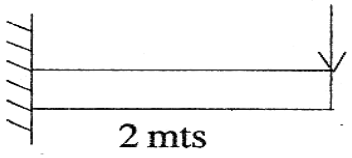
Note : Attempt any five out of eight questions.

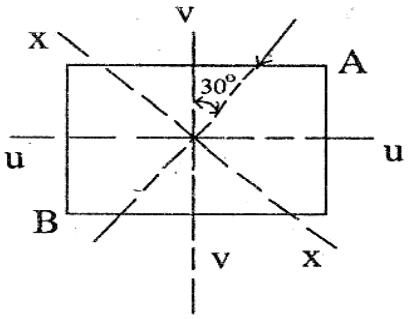
1. (a) A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-in and torque. T. if the yield point of steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to all the theories of failure. Take factor of safety = 1. 12

   (b) Discuss the significance of the theories of failure. 8

2. (a) A cantilever beam of 4x4 cm section, 2 m length is subjected to a load of 100 kg acting at the end as shown in figure below. Determine 12
   i. position of neutral axis,
   ii. maximum stress in beam, and
   iii. maximum deflection and its direction:

   $E = 2 \times 10^6$ kg/cm^2

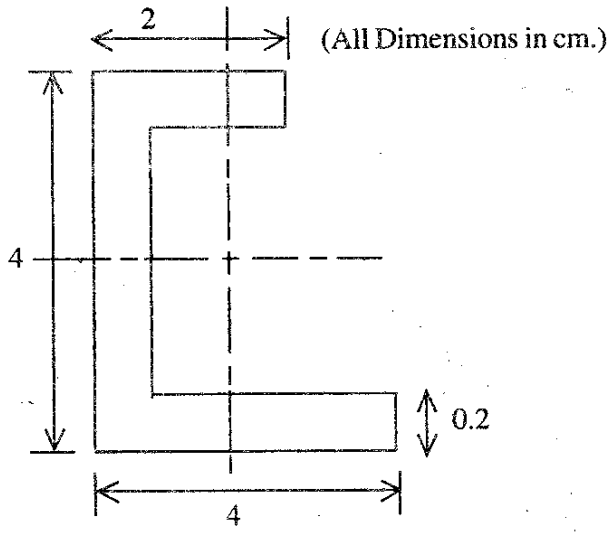




   (b) Derive the expressions for strain energy stored in a body, when load is applied gradually and with impact. 8

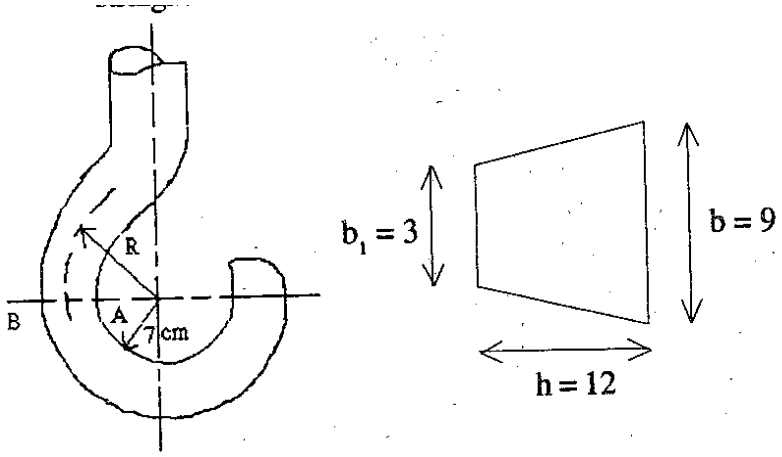
3. (a) Calculate the location of shear centre for the section. 13

   $x = 1.08$, $y = 1.6$,
   $I_x = 4.8$, $I_y = 2.57$,
   $I_{xy} = -1.46$



(b) Derive the equation for strain energy in shaft during twisting. 7

4. (a) The dimension of a 10-tonne crane hook are shown on next page. Find the circumferential stress on the inside and outside fibres at the cross- section AB and compare those values with the values found by using straight beam formula. 12



(b) Derive the stress equation in a curved beam, taking a circular section. 8

5.(a) Derive the equation of longitudinal stresses and strains in spherical thin walled vessels with the internal pressure p, applied in it. 10.

(b) Derive the equation for stress in any rotating uniform disc. 10

6. (a) A thick steel cylinder with internal diameter of 10 cm and external diameter 20 cm is fixed on the over circumference. Determine the stresses at inside and outside, if it is subjected to an internal fluid pressure of 100 kg/cm^2. Assume $\mu = 0.3$ 8

(b) Derive the Lame's equation for thick walled cylinder 12

7. (a) An open coiled helical spring of 12 effective coils of mean diameter 150 mm, made from 12 mm steel rod sustains an axial load 15 kg. Determine

i. the axial deflection,
ii. the axial twist, and
iii. the twist about a horizontal axis, if the helix makes an angle of 60° with the axis. 10

E =2.1 x 10^6 kg /cm^{2}andG. 8.4 x10^5kg/cm^2.

(b) Two shafts in line, which are prevented from moving axially, are connected by a. helical spring, the spring fitted loosely on the shafts and having its ends fixed to the shafts. If the coils of the spring are of circular cross-section and are inclined at 45° to the axis, derive the equation of couple per unit angle of twist. 10

8. (a) Derive the equation of hoop stress in thin walled cylindrical vessel with internal pressure p applied. 10

(b) Derive the equation of radial stresses and strains in thick spherical shell subjected to internal fluid pressure. 10