

Code No: A5202

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M.TECH I SEMESTER EXAMINATIONS, APRIL/MAY 2012

ADVANCED MECHANICS OF SOLIDS

(DESIGN FOR MANUFACTURING)

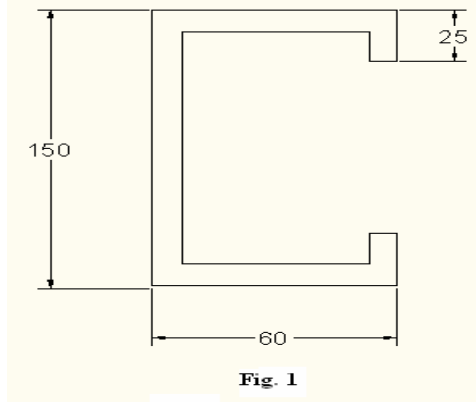
Time: 3hours

Max.Marks:60

Answer any five questions  
All questions carry equal marks

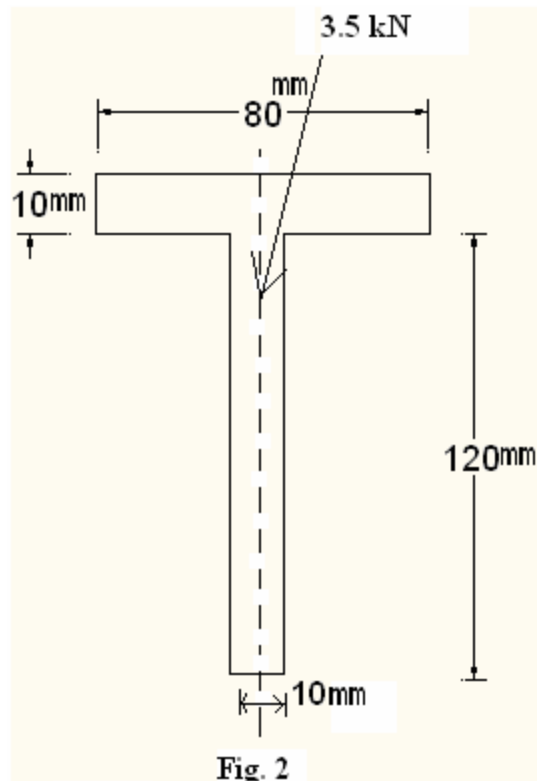
- - -

- Explain membrane analogy for torsion of non-circular shafts.
  - A T-section with flange 150 mm x 25 mm and web 250 mm x 12 mm is subjected to a torque of 500 N-m. Find the maximum shear stress and angle of twist per meter length.  $G = 82 \text{ kN/mm}^2$ .
- Determine the shear centre of the section shown in fig.1. The thickness of the section is 10 mm throughout the cross-section. All dimensions are in mm



- A simply supported beam of length 1.8m carries a central load of 3.5 kN inclined at  $30^\circ$  to the vertical and passing through the centroid of the section as shown in fig.2. The thickness is 10 mm throughout the section. Determine a) maximum tensile stress b) maximum compressive stress and c) deflection due to the load. All dimensions are in mm

Contd...2



4. a) State the assumptions and limitations in Winkler Bach theory for curved beams.  
 b) Find the load carrying capacity of a hook of rectangular cross section 100x75 mm. The thickness of hook is 75mm, the radius of inner fiber is 150 mm while that of outer fiber is 250mm. The line of action of force passes at a distance of 75 mm from the inner fibers. The allowable stress is 70 N/mm<sup>2</sup>.
  
5. A plate made of mild steel has a thickness  $h=10$  mm and covers a circular opening having a diameter of 200mm. The plate is fixed at the edges and is subjected to a uniform pressure 'p'.
  - i) Determine the magnitude of the yield pressure and deflection at the center of the plate
  - ii) Determine the working pressure based on a factor of safety 2.  
 For mild steel take  $E = 200$  GPa,  $\mu = 0.29$ , Yield stress = 315 GPa.
  
6. a) List out the assumptions on which a solution for contact stresses is based.  
 b) Explain the method of computing contact stresses.
  
7. A long cylinder of diameter 60cm is rotating at 3000 rpm. Calculate the maximum stress in the cylinder. Draw the radial and hoop stresses along the radius.
  
8. A steel I-beam ( $E=200$  GPa) has a depth of 102 mm, width of 68 mm, moment of inertia of  $I_x=2.53 \times 10^6$  mm<sup>4</sup>, and length of 4m. It is attached to a rubber foundation for which  $k_0=0.350$  N/mm<sup>3</sup>. A concentrated load  $P=30.0$  kN is applied at one end of the beam. Determine the maximum deflection, maximum flexural stress in the beam, and the location of each.