M. Tech. Mechanical Engineering Design (CBCS Pattern) Semester-I

MED12 - Advanced Mechanics of Solids

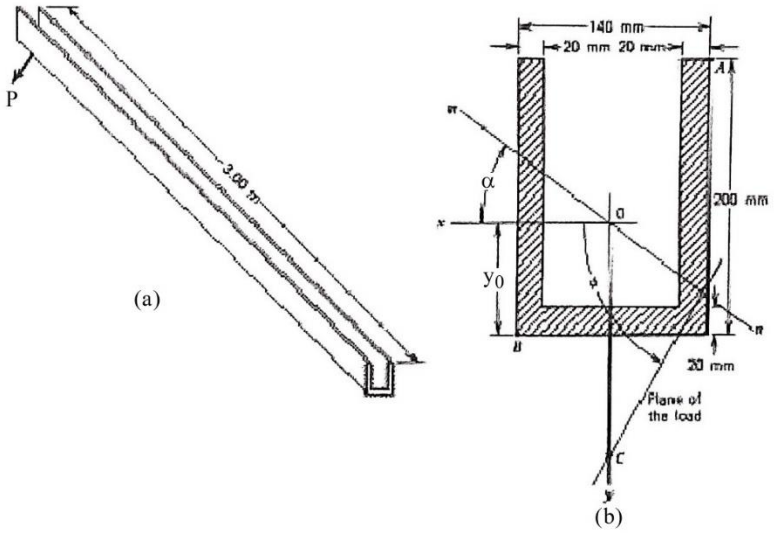
P. Pages : 2 **GUG/W/24/14187**

Time : Three Hours * 5 6 8 5 * Max. Marks : 70

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Solve **any five** questions.
6. Use of non programmable calculator is permitted.

1. a) What is Saint-Venant's principle? What is its significance? **4**

b) The cantilever beam as shown in figure (a) has a channel section as shown in figure (b). A concentrated load P = 12.0 kN lies in the plane making an angle $\phi = \pi / 3$ with the x-axis. Load P lies in the plane of the cross section of the free end of the beam and passes through shear center lies on the y-axis C, as shown. Locate points of maximum tensile and compressive stresses in the beam and determine the stress magnitudes. **10**



2. Derive the equation for deflections of straight beams subjected to nonsymmetrical bending. **14**

3. Derive the equation for linear elastic solution for equilateral triangle cross section and elliptical cross section. **14**

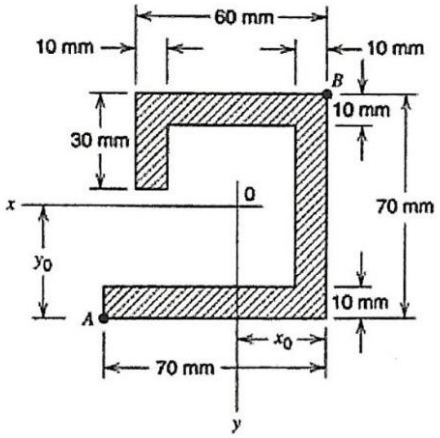
4. A steel railway car wheel may be considered a cylinder with a radius of 550 mm. The wheel rolls on a steel rail whose top surface may be considered another cylinder with a radius of 440 mm. For the steel wheel and steel rail, E = 200 GPa, $\upsilon = 0.29$ and Y = 990 MPa. If the wheel load is 110 kN, determine $\sigma_{max}, \tau_{max}, \tau_{oct(max)}, 2\tau_o$ and the factor of safety against initiation of yielding based on the maximum shear stress criterion. **14**

5. Discuss strain displacement relations for flat plates. **14**

6. Explain stress for two bodies in line contact for loads normal to contact area. **14**

7. Derive the equations for stress resultants in a flat plate. **14**

8. An extruded bar of aluminum alloy has the cross section shown in figure. A 2.10m length of this bar is used as a simple beam on a span of 2.00 m. A concentrated load P = 5.00 kN is applied at mid-length of the span and makes an angle of $\phi = 1.40$ rad wit x-axis. Determine the maximum tensile and compressive stresses in the beam. **14**



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