**Code: 9D15103**

M.Tech I Semester Supplementary Examinations February/March 2018

**ADVANCED MECHANICS OF SOLIDS**

(Machine Design)

(For students admitted in 2012, 2013, 2014, 2015 & 2016 only)

Time: 3 hours Max. Marks: 60

Answer any FIVE questions

All questions carry equal marks

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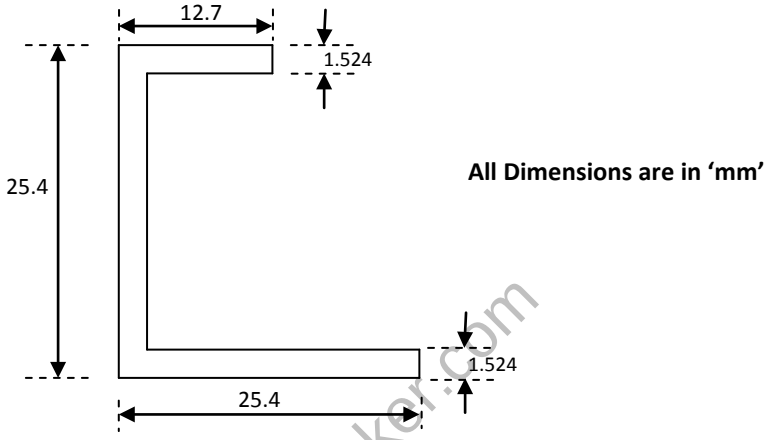
1 (a) A ductile steel shaft is subjected to a bending moment of 10 kN-m and a torsional moment of 8 kN-m. Using the maximum shear stress theory determine the diameter of the shaft assuming factor of safety 2. The yield stress of the material is 250 N/mm$^2$.

(b) Explain: (i) Maximum elastic strain theory. (ii) Octahedral stress theory.

2 Determine the shear centre of thin walled section shown in figure below.




Thin Walled Section

3 A ring has 200 mm mean diameter has a rectangular cross-section with 50 mm in the radial direction and 30 mm perpendicular to the radial direction. If the maximum stress is limited to 120 N/mm$^2$, determine the tensile load that can be applied on the ring.

4 (a) Show that $\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}=0$ in the case of torsion of solid prismatic bars.

(b) A thin walled box section having dimensions $2a \times a \times t$ is to be compared with a solid circular section of diameter 'a'. Determine the thickness 't' so that the two sections have same maximum shear stress for the same torque and the same stiffness.

5 (a) Briefly explain the methods to compute contact stresses.

(b) Derive the expression for contact pressure on a single row ball bearing. If the ball diameter is 60 mm, the radius of the groove is 30 mm. The diameter of the outer face is 30 mm and the greatest compressive force on one ball is 6 kN. Calculate the contact pressure.

6 Verify about the possibility of the given stress function. If so, investigate what problems of plane stress can be solved by the stress function:

$$\phi=\frac{A}{6}(x^3+y^3)+A_1xy$$

Here A and $A_1$ are arbitrary constants. Also sketch the distribution of stress.

7 Derive the expressions for a radial and circumferential stresses for a rotating hallow disc and deduce the equations for stresses at the centre of a solid disc.

8 Derive the expression for the maximum deflection of a flat solid circular plate with simply supported edges of radius 'a' when subjected to uniform lateral pressure '$P_0$'. The thickness of the plate is 'h'.



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