

PARUL UNIVERSITY
FACULTY OF ENGINEERING & TECHNOLOGY
B.TECH EXAMINATION (MID SEMESTER)
4TH SEMESTER (2023-24)

SUBJECT NAME (CODE): Strength of Materials (303109257)

BRANCH: Mechanical /Automobile

DATE:01/02/2024

TIME:10.30 am TO 12:00 pm(1.5 Hrs)

TOTAL MARKS: 40

Mark

Sr. No. 05

Q.1 (A) Multiple Choice Questions.(Attempt all)

1. Mathematically, Strain energy = _____ (within the elastic limit).
 (a) Power (b) Work done (c) Young's Modulus (d) all of above
2. Out of below, On Principal plane (i) _____ stress is prominent and (ii) _____ is zero.
 (a) (i) torsional shear stress ,(ii)axial Stress. (b) (i) normal stress ,(ii)shear Stress
 (c) (i) shear stress ,(ii)normal Stress (d) (i) bending ,(ii) axial Stress
3. What is the shape of Torsional Shear Stress distribution diagram from Centre to outer diameter of a Solid shaft under torsion?
 (a) circle (b) Straight line (c) ellipse (d) parabola
4. Solid shaft subjected to pure torsion, the torsional shear stress at centre of circle is always _____.
 (a) Maximum (b) Zero (c) Mean of Maximum and Minimum (d) none of above.
5. Shear Modulus is the ratio of
 (a) volumetric stress and volumetric strain (b) Longitudinal stress and longitudinal strain
 (c) Shear Stress to Shear Strain (d) Longitudinal stress and lateral strain

(B) Fill in the Blanks (Attempt all)

1. For a body subjected to only shear stress $\tau=50$ Mpa as shown in Fig.01 below, find out the Value of Major Principal Stress= _____ MPa and Minor Principal Stress= _____ MPa.

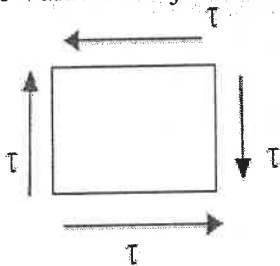


Fig.01

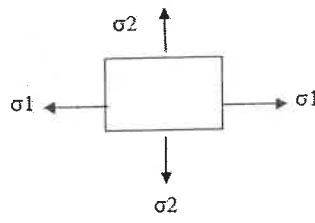


Fig.02

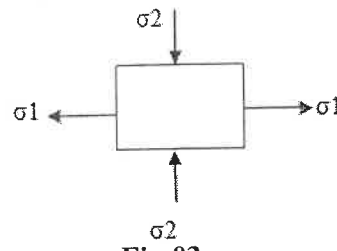


Fig.03

2. For a body subjected to tension $\sigma_1= 200$ Mpa and $\sigma_2=100$ Mpa as shown in Fig.02. Maximum Shear Stress _____ MPa.
3. In an element subjected to tension $\sigma_1= 300$ Mpa(Tensile) and $\sigma_2=100$ Mpa (Compressive) as shown in Fig.03. below, max shear Stress is _____ MPa
4. For a given certain fixed value of Torque T, shaft diameter d and Shear Modulus G, the angle of Twist $\theta =1^\circ$ for 1 meter length shaft. What is the angle of Twist θ for 2 meter length shaft (keeping the T,d and G constant)?
5. The ratio of Lateral strain to linear strain is called _____.

Q.2 Attempt any four (Each 3 Marks)

1. Write equations for (1) Torsion (2) Strain Energy using standard notations.
2. Draw Stress Strain diagram of a ductile material.
3. In an motorcycle kick in Fig. 04, force of $F=300\text{ N}$ is applied, length of kick is 200 mm , find out the torque produced in the shaft attached at kick. (Answer in N-m only).

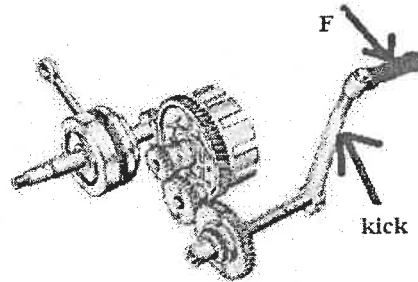


Fig.04

4. Find out Moment of inertia of the Given T- Section about Centroidal axis xx (i.e I_{xx}). (Refer Fig.05)

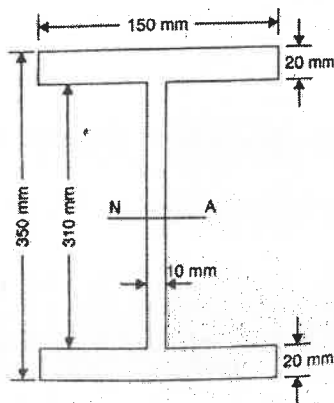


Fig.05 for Que 2(3)

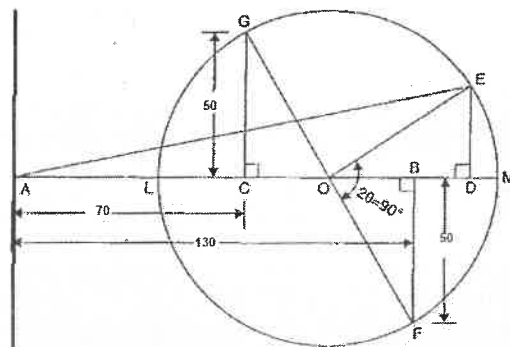


Fig. 06 [For Que 3(3)]

5. A solid In a machine a solid shaft is required to transmit 75 kW at 200 rpm . The Yield strength in shear is 210 N/mm^2 . Determine the diameter of shaft. The maximum Torque transmitted at each revolution 30% higher than mean torque. Assume Factor of safety as 3 .

Q.3 Attempt any two.(Each 4 marks)

1. An axial pull of 50 kN is suddenly applied to a steel bar to a steel bar 2 m long and 1000 mm^2 in cross section. If modulus of elasticity of steel is 200 kN/mm^2 , find (i) maximum instantaneous stress (ii) maximum instantaneous extension (iii) Strain energy.
2. A rod of area 90 mm^2 has a length of 3 m . Determine the strain energy if the stress of 300 MPa is applied when stretched. Young's modulus is given as 200 GPa
3. Read the given Mohr circle, find out/ calculate major, minor principal stress and max. shear stress. (Refer Fig. 06)

Q.4 (A) A point in a strained material is subjected to stresses shown in Fig.07 .Determine the normal and tangential stresses across the oblique plane shown below (Use Analytical or Graphical method) 05

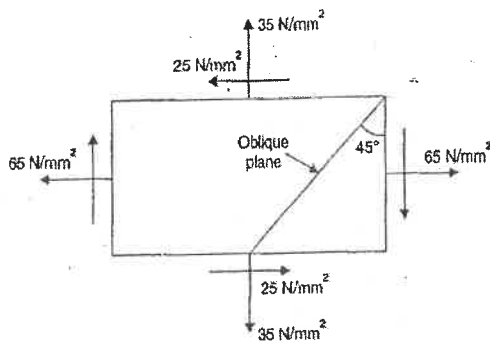


Fig. 07 [For Que 4(A)]

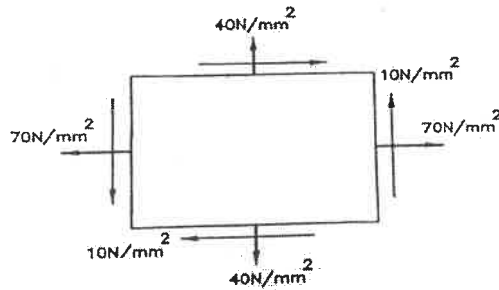


Fig. 08 [For Que 4(B) or (B)]

(B) For an element shown in Fig.08. Find Principal stresses and location of corresponding principal planes (use analytical method only). 05

OR

(B) An element shown in Fig. 08. Find maximum shear stress and location of the plane containing it. (use analytical method only). 05
