

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 1 – EXAMINATION – SUMMER 2026

Subject Code: BE01000091/BE01R00091

Date: 23/06/2026

Subject Name: Mechanics of Solids

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

Q.1 (a) State 1) Principle of superposition, 2) Newton's first law of motion, 3) Principle of transmissibility. **03**

(b) State Lami's theorem. Determine tension in rope OQ and OR shown in figure -1 **04**

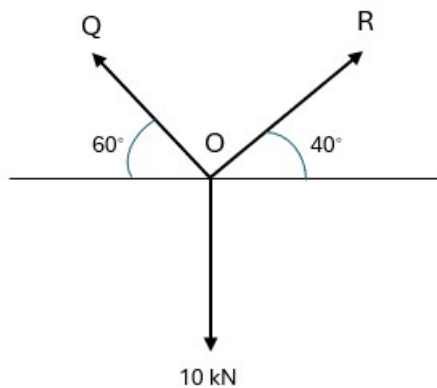


Figure :1

(c) Determine magnitude and direction of resultant of force system shown in Figure -2 **07**

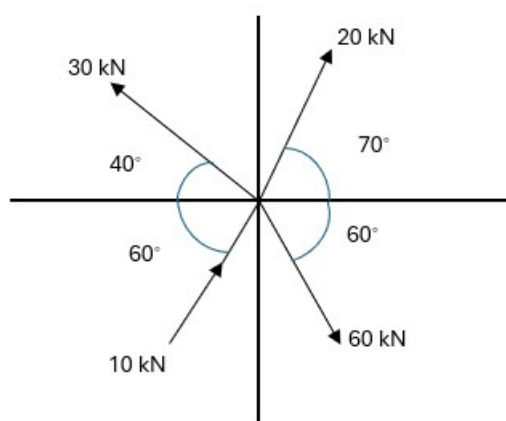


Figure :2

Q.2 (a) Calculate reactions of simply supported beam having 10 m total length, 50 kN point load at distance 3 m from left support and UDL of 10 kN/m on its entire length. **03**

(b) Derive the relation between shear force and bending moment. **04**

- (c) Draw shear force and bending moment diagram with calculations of a cantilever beam as shown in Figure -3

07

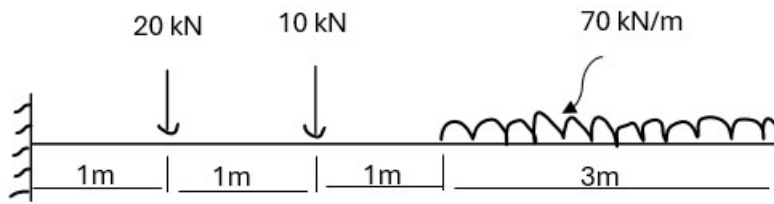


Figure :3

OR

- Q.2 (c) Draw shear force and bending moment diagram with calculations of a simply supported beam as shown in Figure -4

07

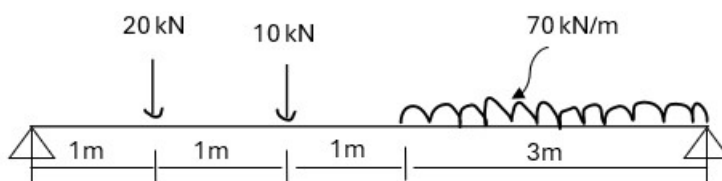


Figure :4

- Q.3 (a) State any three assumptions made in the theory of torsion.
 (b) State and explain Pappus-Guldinus theorem 1.
 (c) Find centre of gravity of L beam as shown in figure 5.

03

04

07

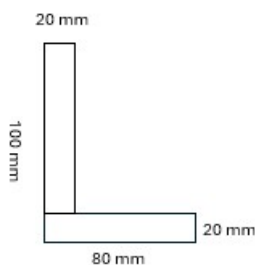


Figure :5

OR

- Q.3 (a) A hollow shaft of 20 mm outside diameter and 16 mm inside diameter is subjected to a torque of 40 Nm. Find the shear stress at the outside and inside of the shaft.
 (b) State and explain parallel axis theorem.
 (c) Calculate centroidal moment of inertia I_{xx} and I_{yy} for I beam as shown in figure 6.

03

04

07

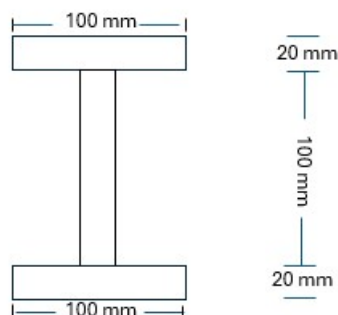
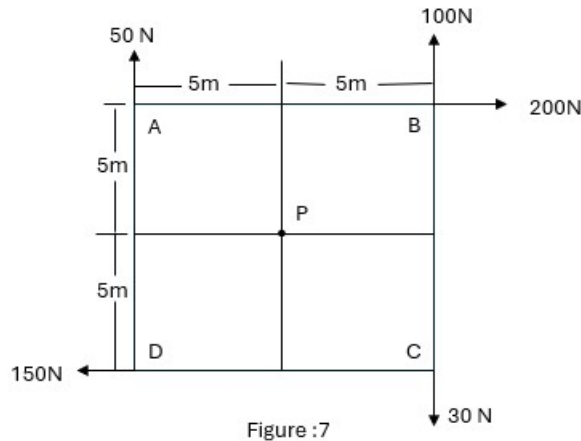


Figure :6

- Q.4** (a) Explain 1) Coplanar forces, 2) Concurrent forces, 3) Collinear forces **03**
- (b) Draw shear stress distribution diagrams for 1) I section, 2) T section, 3) Hollow circular section, 4) L section **04**
- (c) A 5 m simply supported beam having cross section as shown in figure 6 carries a point load of W at 3m from left support. Find value of W so that maximum bending stress in tension and compression are limited to 100 MPa and 80 MPa respectively. (Top flange is in compression). **07**

OR

- Q.4** (a) Determine the algebraic sum of the moments of the force about P as shown in figure - 7 **03**



- (b) State any four assumptions made in the theory of simple bending. **04**
- (c) A 6 m simply supported beam having cross section as shown in figure 5 carries a point load of 80 at centre of beam. Draw shear stress distribution diagram across the section at point of maximum shear force, indicate values at all important point. **07**
- Q.5** (a) Define 1) Stress , 2) Strain and 3) Elasticity. **03**
- (b) A steel rod of 25 mm in diameter and 2 m long is subjected to an axial pull of 45 kN. find 1) The intensity of stress 2) The strain 3) Elongation. Take $E = 2 \times 10^5 \text{ N/mm}^2$. **04**
- (c) A brass bar having a uniform cross-sectional area of 1000 mm^2 is subjected to axial forces as shown in figure 8. Find the total change in length of bar. Take $E = 1.05 \times 10^5 \text{ N/mm}^2$. **07**

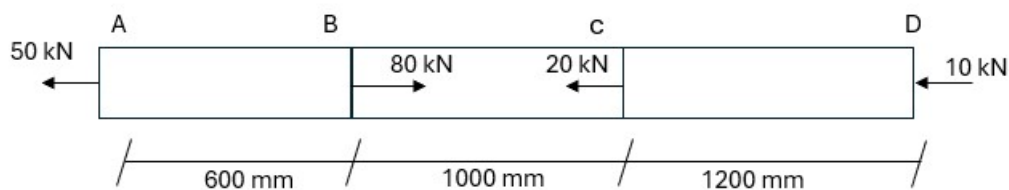


Figure :8

OR

- Q.5** (a) Define 1) Poisson's ratio, 2) Bulk modulus and 3) Lateral strain. **03**
- (b) Find the elongation of bar for following condition 1) under its own weight having uniform cross section area A, Length l, and weight w per unit length when it is suspended from ceiling. and 2) subjected to only axial load P, at free end of the vertical bar. **04**

(c) A rectangular block 250mm*100mm*80mm is subjected to axial load as follow.

07

1. 480 kN tensile in the direction of its length
2. 900 kN tensile 250 mm* 80 mm faces
3. 1000 kN compressive on the 250 mm *100 mm faces

Assume Poisson's ratio as 0.25, find in terms of E of the material the strain in the direction of each force. If $E = 2 \times 10^5$, Find the values of modulus of rigidity and bulk modulus for the material of block. Also calculate the change in the volume of the block.
