Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: 2130003 **Date: 03/07/2026**

Subject Name: Mechanics of Solids

Time: 02:30 PM TO 05:00 PM **Total Marks: 70**

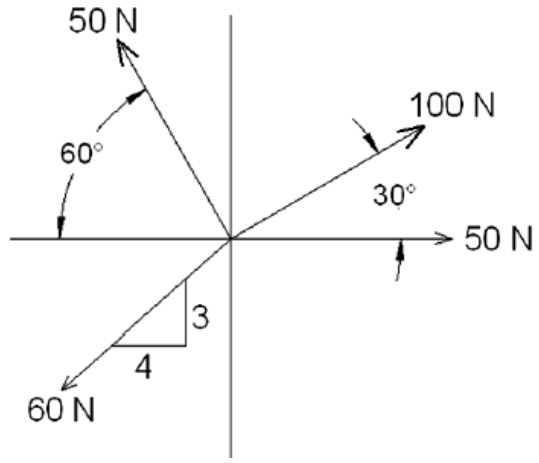
Instructions:

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 and explain Varignon's theorem. **03**

(b) Differentiate between following : **04**
1) Concurrent & Non concurrent force system
2) Resolution & composition of force

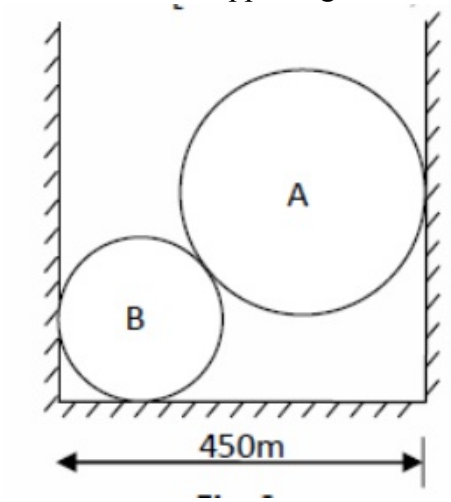
(c) Determine the magnitude and direction of resultant force for a system shown in Fig. by analytical method **07**



Q.2 **(a)** Define : Particle, Rigid body & Deformable body **03**

(b) State Pappus-Guldinus theorems-I and determine the surface area of the right circular cone of base radius 'r' and altitude 'h' **04**

(c) Two cylinders A and B rest in a box as shown in Fig. Cylinder A has a diameter 300 mm and weight 900 N and cylinder B has a diameter 200 mm and weight 360 N. The box is 450 mm wide at the bottom. Assume that all surfaces are smooth. Find the reactions at the supporting surface. **07**

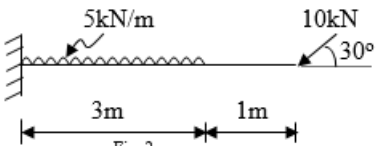


OR

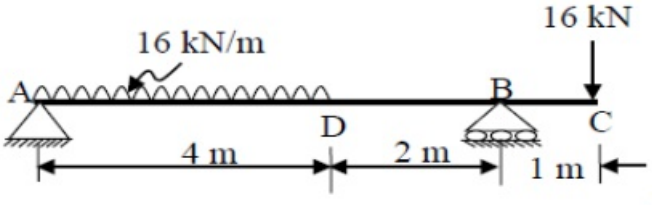
(c) Find the moment of inertia about centroidal axis of I section having web size 300 x 20 mm and flange size 180 x 20 mm. **07**

Q.3 **(a)** Explain: (i) Type of beams (ii) Type of loading on the beams. **03**

(b) Find out support reactions for the beam as shown in Fig. **04**



(c) Draw shear force and bending moment diagram giving values at all important points for the beam shown in Fig. **07**



OR

Q.3 **(a)** Write the assumption made in theory of pure torsion. **03**

(b) A steel tube of 2.2 m length is subjected to 40 $^{\circ}$C rise in temperature. Determine free natural expansion and stress developed in the tube, if expansion is prevented. Take E_S = 200 GPa and $\alpha_S = 12 \times 10^{-6}$ /$^{\circ}$C **04**

(c) A mild steel rod of 20 mm dia.,300 mm long is enclosed centrally inside a hollow copper tube of 30 mm external diameter and 25 mm internal diameter. Determine the stresses induced in each material and change in length if the assembly is subjected to an axial compression of 50 kN. $E_S = 2\ E_C$ & length of both members are same. **07**

Q.4 **(a)** Define coefficient of friction, Angle of friction, Angle of Repose. **03**

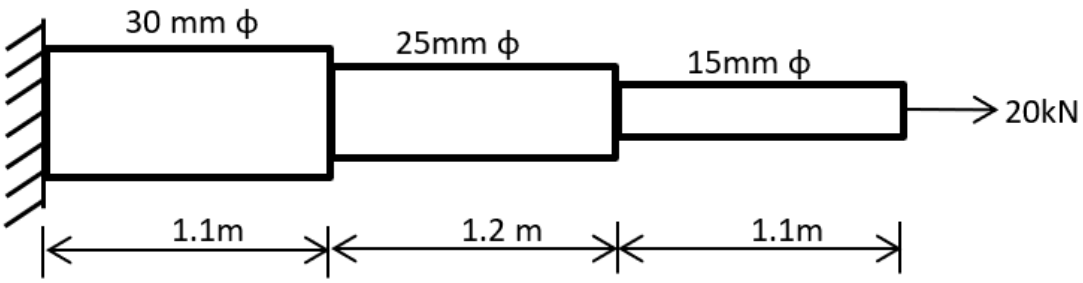
(b) A circular beam 200 mm dia. is subjected to shear force of 19 kN. Calculate the value of maximum shear stress and sketch the variation of shear stress along the depth of beam **04**

(c) A steel bar of length 500 mm and cross section 20 mm x 40 mm is pulled by an axial force 100 kN along its length. Find the change in dimensions and volume. Take E = 2 x 10^5 N/mm^2 and poisson's ratio = 0.3 **07**

OR

Q.4 **(a)** Explain cone of friction with neat sketch. **03**

(b) Determine change in length of the axially loaded bar as shown in Fig. Take E = 2 x 10^5 N/mm^2. **04**



(c) A solid shaft is required to transmit 120 kW power at 200 r.p.m. Find the suitable diameter of shaft if maximum torque transmitted in each revolution exceeds the mean by 20%. Take allowable shear stress as 70 N/ mm^2 for the material of the shaft. **07**

Q.5 **(a)** Define principal planes and principal stresses. **03**

(b) Determine the centroid of rectangular section using first principle. **04**

(c) A uniform ladder of weight 250 N, and length 5 m is placed against a vertical wall in position where its inclination with vertical is 30°. A man weighing 800N climbs the ladder. At what position will he induced slipping. Take μ = 0.2 at all contact surface. **07**

OR

Q.5 **(a)** State and explain the assumption made in Simple theory of pure bending. **03**

(b) Two mutually perpendicular planes of an element of material are subjected to direct stresses of 16.5 N/mm^2 (tensile) and 4.5 N/mm^2 (compressive) and shear stress of 7 N/mm^2 . Find magnitude and direction of principal stresses **04**

(c) A beam of T shaped cross section having flange 200 x 10 mm and flange 200 x 10 mm is subjected to bending moment of 20 kN.m. Find the bending stress at the top and bottom of beam. **07**

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