Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2019

Subject Code: 2130003 **Date: 01/06/2019**

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.**

Q.1 **(a)** Explain with suitable figure. **03**

(a) Types of support,
(b) Types of load,
(c) Types of beam.

(b) Differentiate between following : **04**

1) Co-planar & Non coplanar force system
2) Concurrent & Non concurrent force system
3) Resolution & composition of force
4) Resultant & Equilibrant

(c) A hollow mild steel cylinder 4 meter long, 300 mm outer diameter and thickness of metal 50 mm is subjected to central load on the top when standing straight. The stress produced is 80000 kN/ m^2. Assume Young's modulus for mild steel as 2.0×10^5 N/mm^2 and Find (i) magnitude of the load , (ii) longitudinal strain produced and (iii) total decrease in length. **07**

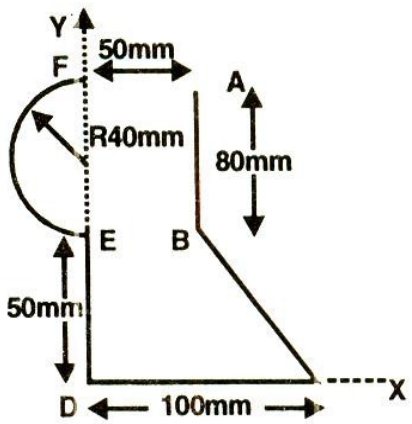
Q.2 **(a)** State and explain Varignon's theorem. **03**

(b) Derive relation between the rate of loading, shear force and bending moment. **04**

(c) A bar of 20 mm diameter is subjected to a pull of 50kN. The measured extension on gauge length of 250 mm is 0.12 mm and change in diameter is 0.00375 mm. Calculate: **07**
(i) Young's modulus (ii) Poisson's ratio and
(iii) Bulk modulus. And define bulk modulus & volumetric strain

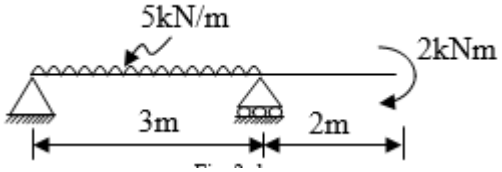
OR

(c) Locate centroid of following composite line segments as shown in fig: **07**

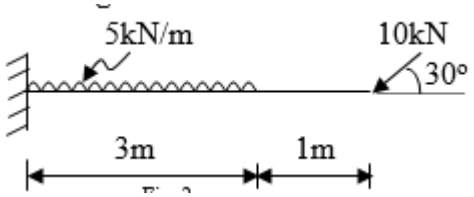


Q.3 **(a)** Explain following terms: **03**
(i) Shear force (ii) Bending moment (iii) Point of contra flexure

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



(c) Draw shear force and bending moment diagram (and axial thrust diagram, if it is) giving values at all important points for the following beam: **07**



OR

Q.3 **(a)** Discuss critically the assumption made in theory of Bending. **03**

(b) A hollow circular beam having outside dia. twice the inside dia. is subjected to a bending moment of 40 KN.m. If permissible bending stress in the beam is 106 N/mm^2, find the dia. of beam. **04**

(c) Draw only shape of shear stress distribution diagram for the following sections : **07**

(i) T section , (ii) symmetrical I section , (iii) Triangular section , (iv) H section, (v) Rectangular section (vi) circular section (vii) L section.

Q.4 **(a)** Define: **03**

(1) Centroid,
(2) Center of gravity,
(3) Center of mass.

(b) State and explain Pappus-Guldinus theorem I & II **04**

(c) From first principle find the moment of inertia of **07**

(1) Rectangle 'b' x 'd' @ top face
(2) Triangle 'b' (base) x 'h' (altitude) @ base

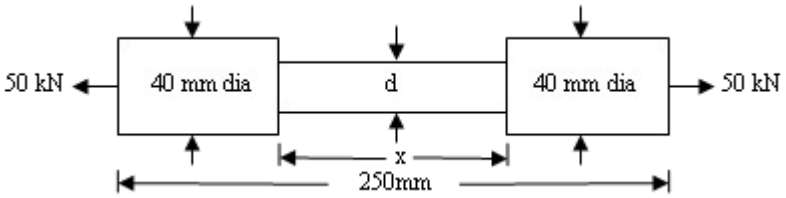
Apply parallel axes theorem, find M.I @ respective centroidal axis for all cases mentioned above.

OR

Q.4 **(a)** Explain the following terms: **03**

(i) Space (ii) Mass (iii) Particle

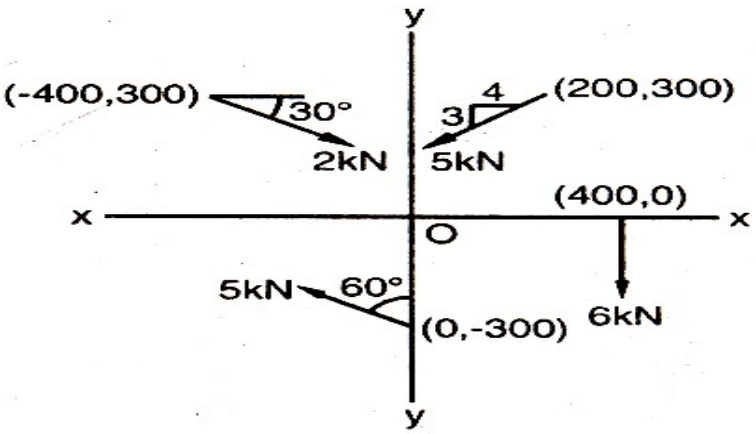
(b) The bar shown in fig.1 find the diameter of middle stress is limited to 130 MN/m^2. Find also the length of middle portion if the total elongation of bar is 0.15mm.Take E = 200 GN/m^2. **04**



(c) A ladder AB having length 4 meter and weighing 196 N is resting against a rough wall and a rough floor. Calculate the minimum horizontal force P required to be applied at 1 meter inclined length of ladder from bottom of ladder in order to push the ladder towards the wall. Assume μf = 0.3 and μw = 0.2. **07**

Q.5 **(a)** Derive the relation T/Ip = Cθ/L for circular shaft with usual notations. **03**

(b) Find resultant for the given force system as shown in fig. **04**



(c) A composite shaft ABC is composed of 500 mm length and 100 mm dia. of solid copper (AB) and 1000 mm length and 125 mm dia. of solid steel (BC). Torque transmitted by the shaft is 15kNm. Find (i) Max. Shear stress in each material (ii) Total angle of twist. Take Cc = 40 GN/m^2 and Gs=85GN/m^2. **07**

OR

Q.5 **(a)** Define coefficient of friction, Angle of friction, Angle of Repose. **03**

(b) Explain Principal plane, Principal stress, and Mohr's circle construction for 'like stresses'. **04**

(c) Two mutually perpendicular planes of an element of material are subjected to direct stresses of 10.5 MN/m^2(tensile) and 3.5 MN/m^2(comp.)and shear stress of 7 MN/m^2 . Find (i) magnitude and direction of principal stresses and (ii) Magnitude of the normal and shear stresses on a plane on which the shear stress is maximum. **07**

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