Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2021

Subject Code:3130608 **Date:16/09/2021**

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.**

			MARKS
Q.1	**(a)**	State the characteristics of couple.	**03**
	(b)	State and explain parallelogram law of forces.	**04**
	(c)	Calculate magnitude and direction of the resultant force of the force system shown in **Figure-1**. Each square is of size 10 cm × 10 cm as shown in Figure-1.	**07**

Figure-1

Q.2	**(a)**	State and explain Lami's theorem.	**03**
	(b)	Calculate the point of application of resultant force of the force system shown in **Figure-1**. Each square is of size 10 cm × 10 cm as shown in Figure-1.	**04**
	(c)	Determine the support reactions for the beam shown in **Figure-2**. Also plot the shear force and bending moment diagrams.	**07**

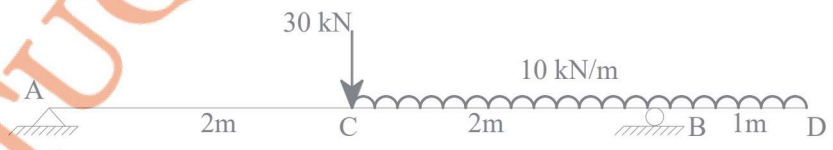

Figure-2

OR

	(c)	Determine the support reactions for the beam shown in **Figure-3**. Also plot the shear force and bending moment diagrams.	**07**

Figure-3

Q.3	**(a)**	Mention the assumption made in the theory of pure bending.	**03**

	(b)	Derive using first principle the equation for calculation of maximum shear stress at a section for a beam with rectangular cross section.	**04**
	(c)	Calculate the maximum bending stress and maximum shear stress at a section for the beam shown in **Figure-3**. Beam cross section is 300mm × 500mm deep.	**07**

OR

Q.3	**(a)**	Write the assumptions made in the analysis of perfect truss.	**03**
	(b)	State and explain Verignon's principle.	**04**
	(c)	Calculate the maximum bending stress and maximum shear stress at a section for the beam shown in **Figure-2**. Beam cross section is 300mm wide × 500mm deep.	**07**
Q.4	**(a)**	State parallel axes and perpendicular axes theorems.	**03**
	(b)	Derive torsion equation with usual notations.	**04**
	(c)	Locate the centroid from the given reference axes of the lamina shown in **Figure-4**.	**07**

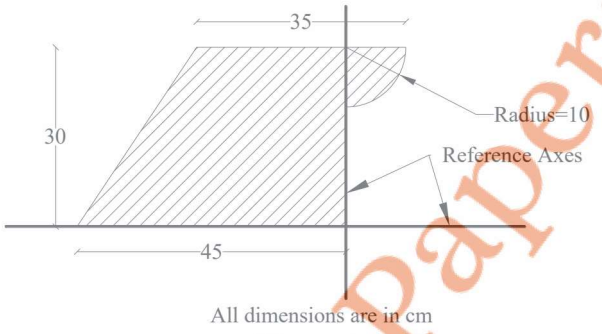

Figure-4

OR

Q.4	**(a)**	State assumptions made in theory of torsion.	**03**
	(b)	Derive the equation to locate centroid of the semicircular lamina.	**04**
	(c)	Calculate the moment of inertia of the section about the horizontal axis passing through the base. Refer **Figure-4**.	**07**
Q.5	**(a)**	State and explain Hook's law.	**03**
	(b)	A brass rod ABCD having a c/s area of 500mm^2 is subjected to axial forces as shown in **Figure-5**. If modulus of elasticity for brass is 80kN/mm^2, find the change in the length of the bar.	**04**

Figure-5

	(c)	The tensile stresses at a point across two mutually perpendicular planes are 120N/mm^2 and 60N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress.	**07**

OR

Q.5	**(a)**	Describe the Mohr's circle method to calculate principal stresses.	**03**
	(b)	A brass rod ABCD having a c/s area of 500mm^2 is subjected to axial forces as shown in **Figure-5**. If modulus of elasticity for brass is 80kN/mm^2, find stress in each part of the bar.	**04**
	(c)	A rectangular block of material is subjected to tensile stresses of 110MPa and 50MPa. Each of these stresses is accomplished by shear stress of 60MPa which tends to rotate block in anticlockwise direction. Determine direction and magnitude of Major and Minor principal stress on oblique plane.	**07**

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