Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–III (NEW) EXAMINATION – WINTER 2020

Subject Code:3130608 Date:06/03/2021

Subject Name:Mechanics of Solids

Time:10:30 AM TO 12:30 PM Total Marks:56

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain following terms (i) Rigid body, (ii) Deformable body (iii) Elastic body.	**03**
	(b)	State Hook's low. Draw stress strain curve for Mild Steel Specimen and explain each point in detail.	**04**
	(c)	Three forces are acting on a weightless equilateral triangular plate as shown in **Fig. 1.** Determine magnitude, direction and position of resultant force.	**07**
Q.2	**(a)**	Explain : (i) Type of beams (ii) Type of loading on the beams.	**03**
	(b)	Determine support reaction for the given beam shown in **Fig. 2.**	**04**
	(c)	A simply supported beam 10 m long carries three point loads at 100 kN, 150 kN and 200 kN at 3m, 5m and 8m from left support. Draw S.F. and B.M. diagram for the beam.	**07**
Q.3	**(a)**	Discuss critically the assumption made in theory of Bending.	**03**
	(b)	A cantilever beam 2 m long has rectangular section 200 mm x 500 mm. Find out point load at free end of beam if permissible bending stress is $20N/mm^2$.	**04**
	(c)	A beam of I-section, having 5 m length is simply supported at each end and bears a u.d.l. of 20 kN/m as shown in **Fig. 3**. Determine maximum tensile and compressive bending stress.	**07**
Q.4	**(a)**	Derive with usual notations the theorem of perpendicular axis.	**03**
	(b)	Derive relation between bulk modulus (K), Poisson's ratio (1/m), and modulus of elasticity (E).	**04**
	(c)	A beam of I-section, having 5 m length is simply supported at each end and bears a u.d.l. of 20 kN/m as shown in **Fig. 3.** Determine maximum shear stress.	**07**
Q.5	**(a)**	Define: (1) Centroid (2) Center of gravity (3) Center of mass.	**03**
	(b)	State and prove Pappu's guldinus theorem for surface area of bodies.	**04**
	(c)	Determine the location of centroid of plane lamina shown in **Fig. 4** with respect to point O.	**07**
Q.6	**(a)**	Write assumption made in the theory of torsion.	**03**
	(b)	A solid steel shaft is to transmit 120 kW power at 600 r.p.m. Find the diameter of shaft if shear stress is to be limited to $100 N/mm^2$.	**04**
	(c)	Determine moment of inertia about base of a plane area as shown in **Fig. 4.**	**07**

Q.7 **(a)** Define : (i) Modulus of Elasticity (ii) Poisson's ratio(iii) Modulus of rigidity **03**

(b) In a tension test, a bar of 20 mm diameter undergoes elongation of 14 mm in a gauge length of 150 mm and a decrease in diameter of 0.85 mm at a tensile load of 6 kN. Determine the two physical constants Poisson's ratio and modulus of elasticity of the material. **04**

(c) A steel rod 30 mm in diameter is inserted inside a brass tube of 30 mm internal diameter and 40 mm external diameter, the ends are rigidly connected together. The assembly is heated by 20°C. Find value and nature of stress developed in both the materials. **07**

Take, α for steel = 12×10^{-6} per °C, α for brass = 18×10^{-6} per °C.

E for steel = 200 GPa, E for brass = 80 GPa,

Q.8 **(a)** Define principal planes and principal stresses. **03**

(b) A R.C.C. column 300 mm in dia. is reinforced with 6 nos. of 16 mm diameter steel bars. If permissible stress in steel and concrete are 230 N/mm^2 and 5 N/mm^2, respectively, find the load carrying capacity of the column. **04**

(c) The state of stress in two-dimensionally stress body at a point is shown in **Fig. 5.** Determine principal stresses and maximum shear stress and its location of planes. **07**

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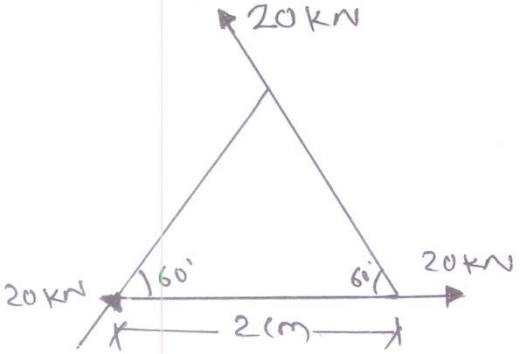

Fig-1.

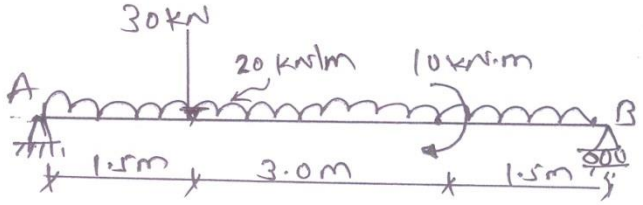

Fig-2.

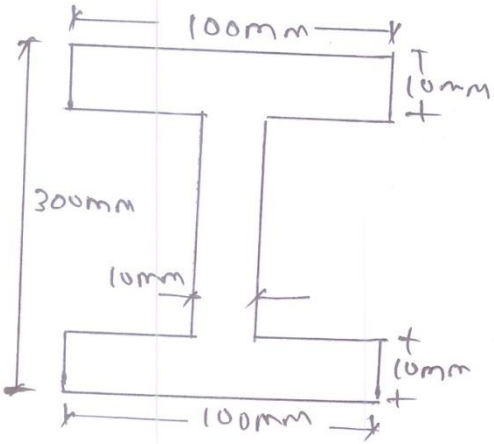

Fig-3

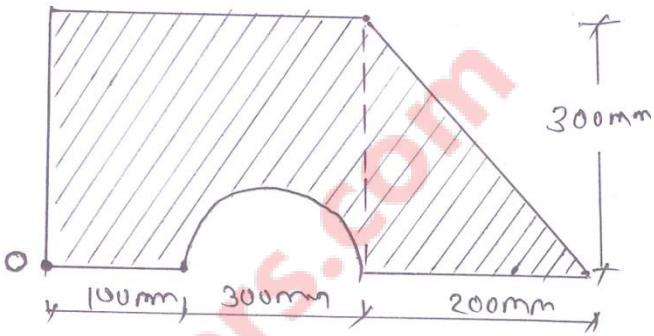

Fig-4

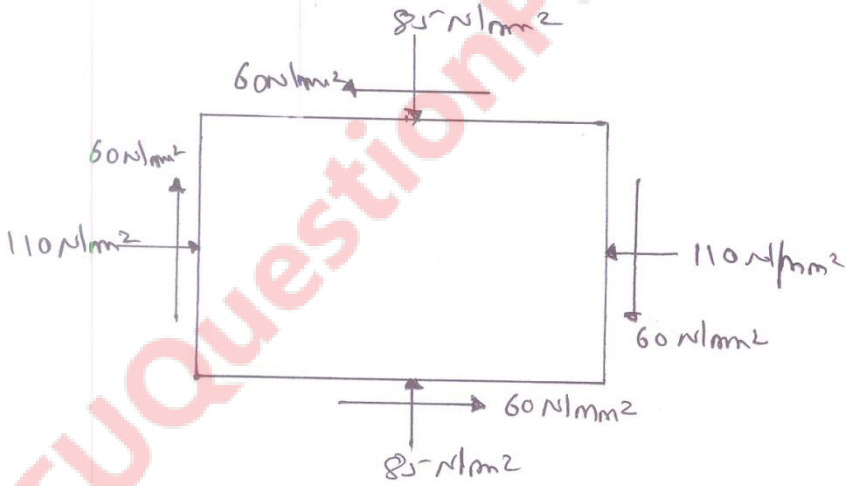

Fig.5

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