

Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BE03022021

Date: 17-12-2025

Subject Name: Mechanics of Solids

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions

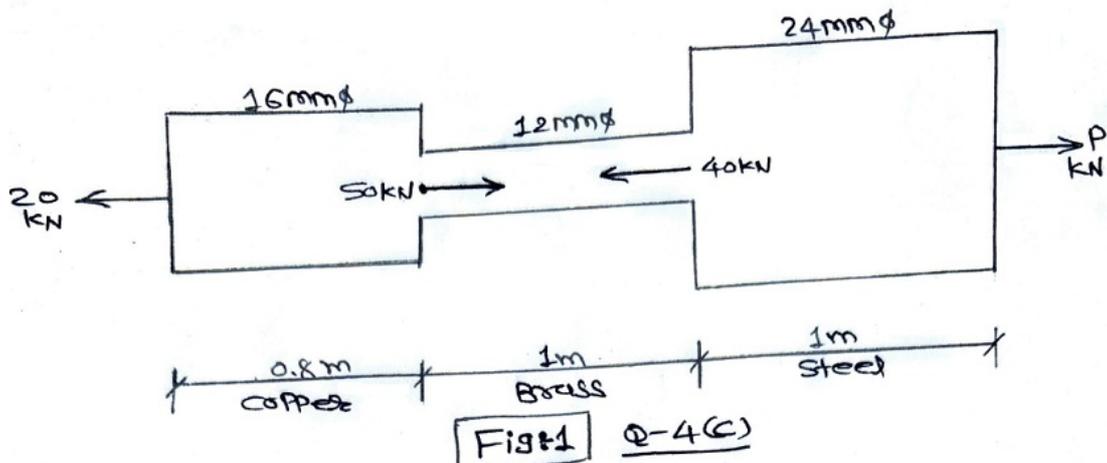
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

| | Marks |
|--|-------|
| Q.1 (a) State and explain parallelogram law of forces. | 03 |
| (b) Define: (i) space (ii)particle (iii) Equilibrant (iii) Force | 04 |
| (c) Fill in the blanks with most appropriate words | 07 |
| 1. Beam extends beyond the support then that beam is known as _____ beam | |
| 2. Moment of inertia of any plane area is maximum about an axis passing through _____ | |
| 3. At free end of cantilever bending moment is always _____ unless a concentrated moment is applied at the free end. | |
| 4. _____ of a force is the procedure of splitting a force into number of components. | |
| 5. _____ is equal and opposite to the resultant of several forces, acting on a body. | |
| 6. Point of contraflexure is where _____ | |
| 7. The shape of shear force diagram for cantilever beam subjected to couple at free end is _____. | |
| Q.2 (a) Define: (1) Rigid Body (2) Newton's second law (3) Law of Transmissibility. | 03 |
| (b) State Hook's law. Draw stress strain curve for MS specimen and explain each point in detail. | 04 |
| (c) The following forces are acting at a point, find the magnitude and direction of the resultant forces. 550N acting towards north.900N acting at 40°towards south of west1.25KN acting at 60° towards south of east400N acting from west to East. | 07 |
| OR | |
| (c) State and explain with figure Pappu's –Guildinus theorem of surface area of Revolution. | 07 |

- Q.3 (a)** Draw shear stress distribution diagram for rectangular, circular and I section. 03
- (b)** A cement concrete block having a shape of square cross section of 250 mm side and a uniform height of 350mm is tested in a compression testing machine by applying an axial compressive load of 'P'. It was observed that the height decreased by 0.28mm and the side increased by 0.0035mm. If the modulus of elasticity of concrete is $0.13 \times 10^5 \text{ N/mm}^2$, determine the value of 'P' and Poisson's Ratio 04
- (c)** A simply supported beam of span l is carrying uniformly distributed load 'w' over its entire span. Calculate SF and B.M. also draw SFD and BMD. 07

OR

- (a)** Define: 1) Point of Contra flexure, 2) Shear Force. 03
- (b)** State parallel axes and perpendicular axes theorems. 04
- (c)** Determine maximum bending stress and maximum shear stress in a cantilever beam of length 2m. The beam carries a UDL of KN/m over the entire length of 2m and a concentrated vertical downward load of 25KN at the free end of cantilever. The cross-section of the beam is a rectangle of size 350 mm deep and 250mm wide. 07
- Q.4 (a)** Mention the assumption made in the theory of pure bending. 03
- (b)** Define Moment & Couple giving two suitable examples. 04
- (c)** A stepped bar is loaded as shown in **Fig:1**. Calculate the stresses in each part and total change in the length of the bar. Take $E_{\text{Steel}} = 200 \text{ GPa}$ and $E_{\text{Brass}} = 80 \text{ GPa}$. 07



OR

- (a)** State and explain Hook's law. 03
- (b)** Define stress. Also explain types of stresses. 04
- (c)** A simply supported beam 8m long carries three point load at 100KN, 150KN, and 200 KN at 2m, 5m, 7m from left roller support. The self weight of the beam is 25 KN/M the right end support is hinged. Draw S.F and B.M diagram for the beam. 07
- Q.5 (a)** Write assumption made in the theory of torsion. 03
- (b)** Derive torsion equation with usual notations 04

(c) Find centroidal M.I of given C.S about X-X and Y-Y axis. Refer Fig:2

07

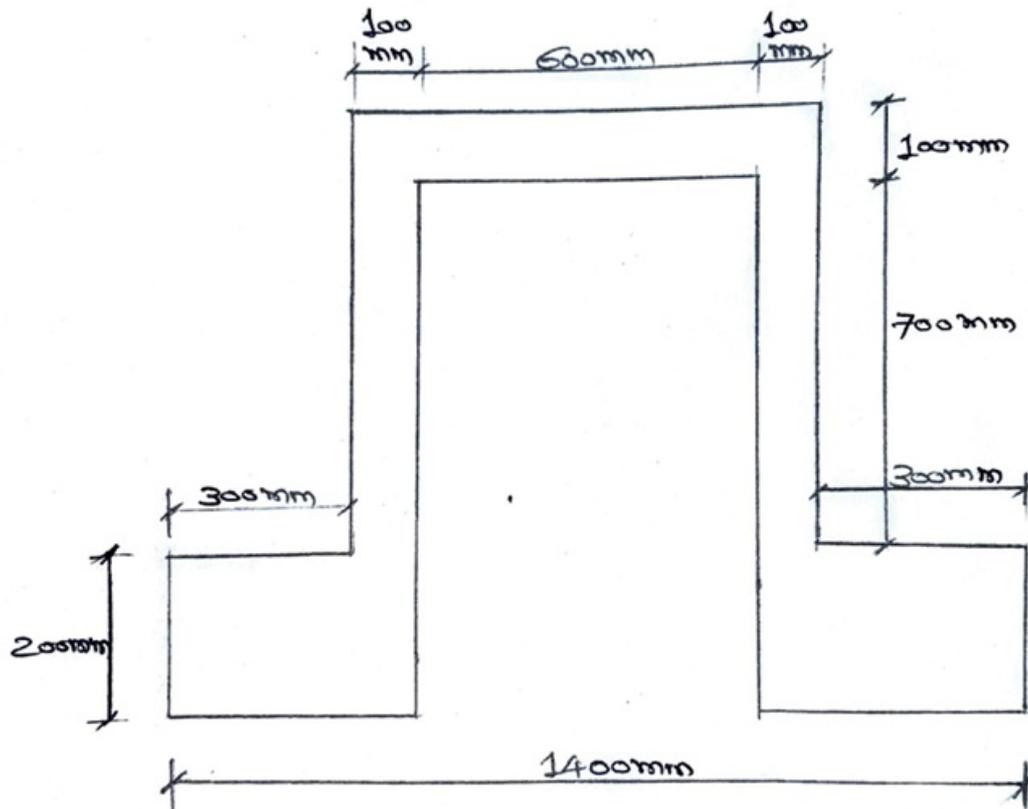


Fig:2 Q-5(c)

OR

(a) Explain : (1) Poisson's ratio (2) Hook's law (3) Bulk modulus.

03

(b) Derive the formula for the elongation of a rectangular bar under the action of axial load

04

(c) Determine the stress, strain, modulus of elasticity and Poisson's ratio from the following results for a bar tested on UTM. Diameter=20mm, Gauge length=150mm, increase in Gauge length=14mm, decrease in diameter=0.85mm, tensile load=6KN.

07
