

GUJARAT TECHNOLOGICAL UNIVERSITY

BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: 3141907

Date: 25/05/2026

Subject Name: Fundamentals of Machine Design

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.

- Q.1**
- (a) Define the following terms: **03**
(i) Standardization (ii) Polar Moment of inertia (iii) Center of gravity
- (b) Define: (i) Poisson's ratio (ii) Bulk modulus (iii) Hooke's law (iv) Volumetric strain. **04**
- (c) Explain the different types of loads, beams and supports related to beams with neat sketches. Also state the applications of each. **07**

- Q.2**
- (a) Explain limits, fits and tolerance. **03**
- (b) Justify, why cotter is taper? State the applications of a cotter joint. **04**
- (c) Design a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. **07**
The allowable stresses are 60 MPa in tension, 45 MPa in shear and 85 MPa in crushing.

OR

- Q.2**
- (c) Discuss the design procedure of a cotter joint. **07**
- Q.3**
- (a) Explain ergonomics consideration in machine design. **03**
- (b) Derive the bending equation. Also state the assumptions made in this derivation. **04**
- (c) Find moment of inertia of the shaded area shown in the Fig. 1 about the axis AB. **07**

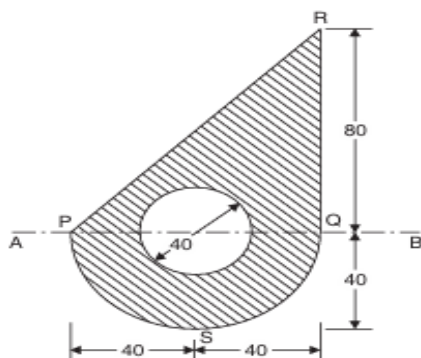


Fig. 1

OR

- Q.3**
- (a) Explain Aesthetic consideration in machine design. **03**
- (b) Give a difference between shaft, spindle and axle. **04**
- (c) Derive a relation between modulus of elasticity, modulus of rigidity, Poisson's ratio. **07**
- Q.4**
- (a) Discuss the different types of keys. **03**

(b) Define torsion and polar modulus. Why hollow circular shafts are preferred when compared to solid circular shafts? **04**

(c) A circular steel pipe of external diameter 60 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2 m. If permissible stress in steel is 150 N/mm^2 , determine the maximum concentrated load that can be carried by it at mid span. **07**

OR

Q.4 (a) Explain the Soderberg criteria with diagram. **03**

(b) Draw and explain S-N curve. **04**

(c) Discuss the design procedure of a right-angle bell crank lever. **07**

Q.5 (a) Define ‘slenderness ratio’. State the assumptions used in Euler’s column theory. **03**

(b) Define a stress concentration factor? State the different methods to reduce stress concentration with neat sketch. **04**

(c) Assume the data of the intermediate shaft illustrated in the previous example. The permissible angle of twist for the shaft is 0.25° per meter length and the modulus of rigidity is 79300 N/mm^2 . Determine the shaft diameter on the basis of torsional rigidity. **07**

OR

Q.5 (a) Explain the condition of overhauling and self-locking of screws? **03**

(b) Discuss the various types of power threads. Give two practical applications for each type. **04**

(c) Explain in detail Rankine’s formula for the column. **07**
