

**April 2023***Time – Three hours  
(Maximum Marks: 100)*

- N.B.**
1. Answer all questions under Part-A. Each question carries 3 marks.
  2. Answer all the questions either (A) or (B) in Part-B. Each question carries 14 marks.

**PART – A**

1. Define ductility and malleability.
2. Define coefficient of friction.
3. Define Bulk Modulus.
4. Define linear strain and lateral strain.
5. Find  $I_{xx}$  and  $I_{yy}$  of a rectangular section of depth 400mm and breadth 200mm.
6. State Parallel axis theorem.
7. Define stiffness of shafts.
8. Define polar modulus.
9. What is point of contra flexure?
10. Define hogging and sagging.

**PART – B**

11. (a) List out and explain the various mechanical properties of the metal.

(Or)

- (b) Explain with neat sketch, the testing procedure of the fatigue test on the material.

12. (a) A bar of length 150mm is circular in section and is of uniform diameter of 50mm. It is subjected to an axial pull of 400kN and the extension in length and contraction in diameter were found to be 0.25mm and 0.02mm respectively. Determine the Poisson's ratio and values of elastic constants.

(Or)

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- (b) A steel rod of 30mm diameter is enclosed centrally in a hollow copper tube of external diameter of 50mm and 40mm internal diameter. The composite bar is then subjected to an axial load of 45kN. If the length of each bar is equal to 150mm, find (i) the stress in rod and tube (ii) load carried by each bar. Take  $E_s = 2 \times 10^5 \text{ N/mm}^2$  and  $E_{cu} = 1 \times 10^5 \text{ N/mm}^2$
13. (a) An angle section is of 75mm wide and 90mm deep overall, both the flanges of the angle are 20mm thick. Determine the position of centre of gravity and also calculate  $I_{xx}$  and  $I_{yy}$ .
- (Or)
- (b) Find the values of  $I_{xx}$ ,  $I_{yy}$ ,  $K_{xx}$  and  $K_{yy}$  of the T section 120mm wide and 120mm deep overall, both the web and flanges are 10mm thick.
14. (a) A shaft is to transmit 100kW at 160 rpm. the shear stress is not to exceed  $65 \text{ N/mm}^2$  and the angle of twist in a length of 3.5m is not to exceed  $1^\circ$ . Find a suitable diameter of the shaft. Take  $N = 8 \times 10^4 \text{ N/mm}^2$
- (Or)
- (b) A shaft running at 200 rpm has to transmit 125kW. The shaft should not be stressed beyond  $65 \text{ N/mm}^2$  and should not twist more than  $1.5^\circ$  in a length of 5m. Select suitable diameter for the shaft. Take  $C = 8 \times 10^5 \text{ N/mm}^2$
15. (a) A simply supported beam of span 4m carries a central point load of intensity 2kN at 2m from right support. In addition the beam carries an UDL of 1kN/m for 1m length from left support. Construct SFD and BMD. Calculate the position and magnitude of maximum bending moment.
- (Or)
- (b) A simply supported beam of span 7m is subjected to an UDL of 10kN/m for a length of 3m from left support and an UDL of 5kN/m for 2m length from right support. Draw bending moment and shear force diagrams.