

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER – I • EXAMINATION – WINTER 2012

Subject code: X 11102

Date: 21/01/2013

Subject Name: Elements of Mechanical and Structural Engineering

Time: 10.30 am - 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.

- Q.1** (a) What is prime mover? Explain different types of prime mover. **08**
- (b) Explain following terms. **06**
- (i) Enthalpy (ii) Entropy (iii) Internal Energy

- Q.2** (a) Define specific heat. A vehicle of 2000 kg mass is running at a speed of 60 km/h. The brakes are applied and the vehicle is brought to rest. Determine the rise in the temperature of the breaks if their mass is 10 kg. the specific heat of the material of the brakes = 0.50 kJ/ kg k **07**
- (b) Derive an expression for the efficiency of Carnot cycle. Enlist limitation of Carnot cycle. **07**

OR

- (b) Explain process of Otto cycle. Represent the same on p-v Diagram. **07**
- Q.3** (a) Explain the difference between: **07**
- (i) Positive Displacement pump and roto-dynamic pump.
- (ii) Single acting pump and Double acting pump
- (b) Explain with a neat sketch split air conditioner and state their advantages. **07**

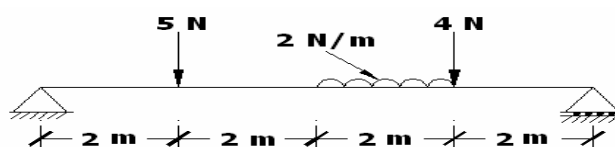
OR

- Q.3** (a) Define: Stress, Strain, Strain Energy, Point of Contra-flexure, Toughness, Modulus of Resilience, Poisson's Ratio **07**
- (b) A 20 mm diameter steel bar of length 4 m is subjected to an axial pull of 50 kN. Find out change in diameter, length and volume. Take $E = 200 \text{ GPa}$, Poisson's Ratio = 0.25 **07**

- Q.4** (a) Draw stress-strain curve for mild steel and mark various important points. Give brief description of these points. **07**
- (b) State different types of beam and draw them. Explain different type of loads on beam. **07**

OR

- Q.4** (a) For a simply supported beam as shown below, calculate support reactions and draw shear force and bending moment diagram. **07**



- Q.4** (b) Derive relation between shear force, bending moment and rate of loading. **07**

- Q.5** (a) A steel bar having 50 mm diameter and 4 m length hangs vertically, which is **07**

securely fixed at its lower end. If a weight of 35 kN falls on the collar from a height of 20 mm, determine stresses developed in the bar. Also calculate strain energy stored in the bar. Take $E = 200 \text{ GPa}$

- (b) Derive generalized formula for torsion of circular shaft (with usual notations). **07**

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$

OR

- Q.5** (a) Explain different types of stresses with neat sketch. Explain Hooke's Law. **07**
(b) Derive relation between Modulus of Elasticity (E), Modulus of Rigidity (G) and Poisson's Ratio (μ). **07**
