

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC Sem I Examination January 2010****Subject code: X 11102****Subject Name: Elements of Mechanical & Structural Engineering****Date: 08 / 01 / 2010****Time: 11.00 am – 1.30 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) Derive an expression for finding efficiency of a Carnot Cycle. Draw P-V and T-S diagram of the same. **07**
- (b) Define: 1. Yield stress 2. Ultimate stress 3. Normal stress. Explain the relations between stress & strain. **07**
- Q.2** (a) Explain vapour compression cycle of refrigeration with neat sketch showing the functions of all the components. **07**
- (b) What are the various physical properties of materials? **07**
- OR**
- (b) Differentiate between 1. Impact strength and toughness **07**
2. Elasticity and plasticity
- Q.3** (a) Differentiate between two stroke and four stroke engines. **07**
- (b) A Rolls Royce engine has cylinder bore 13.7cm, stroke length 13.0 cm and clearance volume 280 cm³. Express the clearance volume as percentage of swept volume and find air-standard efficiency of the engine operating on four- stroke cycle. **07**
- OR**
- Q.3** (a) Derive an expression for finding volumetric efficiency of reciprocating compressor. **07**
- (b) Explain the classification of various types of pumps. **07**
- Q.4** (a) A circular rod of 10 mm diameter and 400 mm long is subjected to a tensile force 50 kN. The modulus of elasticity for steel may be taken as 200 kN/mm². Find stress, strain and elongation of the bar due to applied load. **07**
- (b) 1. How lateral and linear strains are related? **07**
2. Define and explain bulk modulus.
- OR**
- Q.4** (a) Explain the term 'factor of safety' and use in practice. **07**
- (b) Three steel pillars of equal length 150 mm and cross section area of 1200 mm², support a rigid platform of 240 kN. Take $E_s = 2 \times 10^5 \text{ N/mm}^2$ & find stress developed in each pillar. **07**
- Q.5** (a) How the support reactions vary in various types of supports in beams? **07**
- (b) Explain shear force and bending moment in a beam. **07**
- OR**
- Q.5** (a) What is the difference between ductile and brittle materials? Explain their behavior under tensile loading. **07**
- (b) Derive an expression of stiffness of a shaft under torsion. **07**
