Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–I • EXAMINATION – WINTER 2013

Subject Code: X11102 **Date: 24-12-2013**

Subject Name: Elements of Mechanical and Structural Engineering

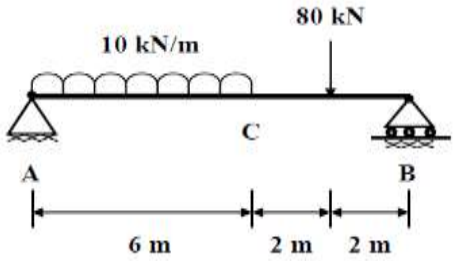
Time: 10.30 am - 01.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain different types of beam, support and loading with sketch.	**07**
	(b)	An engine operating on Diesel cycle has maximum pressure and temperature of 45 bar and 1500° C. Pressure and temperature at the beginning of compression are 1 bar and 27°C. Determine air standard efficiency of the cycle. Take $\gamma = 1.4$ for air.	**07**
Q.2	**(a)**	Explain Linear, shear, lateral, thermal and volumetric strain.	**07**
	(b)	Differentiate between ductile and brittle materials. What are significant behaviors of these materials under tensile loading?	**07**
		OR	
	(b)	Explain Carnot cycle on p-v and T-s diagram.	**07**
Q.3	**(a)**	Explain the working of Four stroke Petrol engine with neat sketch.	**07**
	(b)	Derive the equation of work required in single stage reciprocating air compressor without clearance.	**07**
		OR	
Q.3	**(a)**	Explain the working of Vapour Compression Refrigeration system.	**07**
	(b)	Explain advantages of multistage in reciprocating air compressor. Write applications of compressed air.	**07**
Q.4	**(a)**	Explain the difference between: (i) Positive Displacement pump and roto-dynamic pump. (ii) Single acting pump and Double acting pump	**07**
	(b)	Explain with a neat sketch split air conditioner and state their advantages.	**07**
		OR	
Q.4	**(a)**	Explain Linear, shear, lateral, thermal and volumetric strain.	**07**
	(b)	A steel bar 3.5 m long and 2000 mm^2 in area hangs vertically, which is securely fixed on its lower end. If a weight of 10 kN falls on the collar from a height of 8 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E as 200 GPa. Explain Linear, shear, lateral, thermal and volumetric strain.	**07**
Q.5	**(a)**	An Aluminum rod of 25 mm diameter and 1.7 m long is subjected to rise in temperature by 35° C. Calculate i) natural expansion ii) if natural expansion is prevented, the stress developed in the bar iii) axial force in the bar. Take E = 70 GPa, Coefficient of thermal expansion $\alpha = 18 \times 10^{-6}$ per °C.	**07**
	(b)	For torsion of a circular shaft, derive the equation $T/I_P = \tau/R = C\theta/L$ with usual notations.	**07**
		OR	
Q.5	**(a)**	Derive relation between shear force, bending moment and rate of loading.	**07**

(b) Find reactions about support A and B for the simply supported beam as shown in figure below. **07**



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