Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–I EXAMINATION – WINTER 2015

Subject Code: X11102 Date:30/12/2015

Subject Name: Elements of Mechanical and Structural Engineering

Time: 10:30am to 01:00pm Total Marks: 70

Instructions:

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

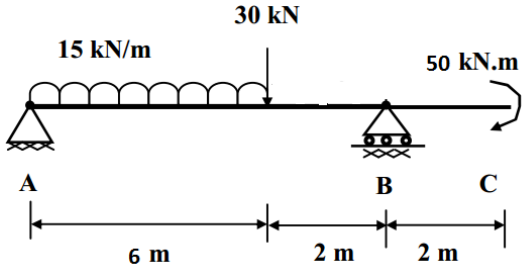
Q.1	**(a)**	Define prime mover. List out the different sources of energy.	**07**
	(b)	Differentiate between Otto and Diesel cycle.	**07**
Q.2	**(a)**	State and Describe classification of I. C. Engines.	**07**
	(b)	What are differences between governor and flywheel? Classify governors.	**07**
		OR	
	(b)	Explain construction and working of centrifugal pump with neat sketch.	**07**
Q.3	**(a)**	Explain with a neat sketch split air conditioner and state their advantages.	**07**
	(b)	A Rolls Royce engine has cylinder bore 13 cm with stroke length of 12 cm and clearance volume 270 cm^3. 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)**	In water turbine, water is supplied at a rate of 400 liter per second under a head of 18 meter, and it is discharged from the turbine at velocity of 1.8 meter per second. Determine power developed by the turbine.	**07**
	(b)	For torsion of a circular shaft, derive the equation $T/I_P = \tau/R = C_\theta/L$ with usual notations.	**07**
Q.4	**(a)**	An aluminum rod of 22 mm diameter and 1.7 m long is subjected to rise in temperature by 37°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 = 78 Gpa, Coefficient of thermal expansion $\alpha = 17 \times 10^{-6}$ per °C.	**07**
	(b)	Define Hooke's law and Young's modulus. Also calculate stress, strain and elongation of an M. S. bar of 30 mm diameter is acted upon by a tensile force of 65 kN. If the length of bar is 1.23 m and modulus of elasticity is 2.0×10^5 N/mm^2.	**07**
		OR	
Q.4	**(a)**	A steel shaft of 4.5 cm diameter and 50 cm length is twisted in a testing machine until one end rotates through an angle 0.50 with respect to other end. Torque of 15000 Nm is required to cause the twist. What is the maximum shear stress of the shaft and what is the value of modulus of rigidity?	**07**
	(b)	Derive the formula for the elongation of tapered circular bar under the action of axial load.	**07**
Q.5	**(a)**	Explain in detail behavior of ductile material under tension with salient points.	**07**
	(b)	A steel bar 2.5 m long and 1500 mm^2 in area hangs vertically, which is securely fixed on its lower end. If a weight of 12 kN falls on the collar	07

from a height of 8.5 mm, determine the stress developed in the bar. What will be the strain energy stored in the bar? Take E as 200 GPa.

OR

Q.5 **(a)** Explain Shear Force and Bending Moment. Also Derive the relation between shear force, bending moment and uniformly distributed load. **07**

(b) Draw the S.F and B.M diagram for the beam loaded as shown in the Figure below. **07**



****