Seat No.: _____ Enrolment No._____

(E-1)

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. all Sem-I Examination December 08/January 09

Elements of Mechanical Engineering (110006)

DATE: 15-12-2008, Monday **TIME: 12.00 to 2.30 p.m.** **MAX. MARKS: 70**

Instructions:

1. ***Attempt all questions.***
2. ***Make suitable assumptions wherever necessary.***
3. ***Figures to the right indicate full marks.***
4. ***Use of Steam Tables and Mollier's Chart is permissible.***

Q: 1 **(a)** What are the various forms of energy? List the non conventional sources of energy. **03**

(b) Derive characteristics equation of a perfect gas. **04**

(c) A cylinder contains 0.6 m^3 of gas at a pressure of 1.0 bar and 90^0 C. The gas is compressed to a volume of 0.18 m^3 according to law pv^n = C. The final pressure is 5.0 bar. Assuming R=0.287 kJ/kg K and γ = 1.4 **07**

Calculate:

(i) The mass of gas

(ii) The value of index 'n' for compression

(iii) The change of internal energy of gas

Q: 2 **(a)** Differentiate between four stroke and two stroke i.c. engine. **03**

(b) A sample of wet steam at a pressure of 25 bar absolute has dryness fraction 0.80. Determine its enthalpy and internal energy. **04**

(c) Combined separating and throttling calorimeter is used to find out dryness fraction of steam. **07**

Following readings were taken:

Main pressure	= 12 bar ab.
Mass of water collected in separating calorimeter	= 2 kg
Mass of steam condensed in throttling calorimeter	= 20 kg
Temperature of steam after throttling	= 110 ^{0}C
Pressure of steam after throttling	= 1 bar ab.
Assume Cp of steam	= 2.1 kJ/kg K

Calculate dryness fraction of steam.

OR

(c) The following results refer to a test on i.c. engine. **07**

Indicated Power	= 42 kW
Frictional power	= 7 kW
Engine speed	= 1800 r.p.m.
Specific fuel consumption per b.p.	= 0.30 kg/kWh
Calorific Value of fuel used	= 43000 kJ/kg

Calculate:

(i) Mechanical Efficiency

(ii) Brake thermal efficiency

(iii) Indicated thermal efficiency

Q: 3	**(a)**	Derive an expression for efficiency of Carnot cycle.	**03**
	(b)	In an Otto cycle the compression ratio is 8.The temperatures at the beginning of compression and at the end of heat supply are 310 K and 1600 K respectively. Assume $\gamma = 1.4$ and $C_v = 0.717$ kJ/kg K . Find : (i) Heat Supplied (ii) Efficiency of the cycle.	**04**
	(c)	The compression ratio of an oil engine working on Diesel Cycle is 15. Cut off takes place at 12 % of the working stroke. The air is drawn in to cylinder at 100 kPa and 27^0C. Assume Cp=1.006 kJ/kg K and Cv =0.717 kJ/kg K. Calculate: (i) Temperature at the end of compression (ii) Pressure at the end of compression (iii) Air std. efficiency of the cycle.	**07**
		OR	
Q: 3	**(a)**	Differentiate between fire tube and water tube boiler.	**03**
	(b)	List various mountings and accessories and explain fusible plug.	**04**
	(c)	A stem generator evaporates 18000 kg of water per hour at 10 bar ab. pressure. The steam is 97 % dry. Feed water temperature is 40^0 C. Coal is fired at a rate of 2050 kg per hour, having calorific value 28000 kJ/kg. Calculate: (i) Thermal efficiency (ii) Equivalent evaporation per kg of coal.	**07**
Q: 4	**(a)**	Explain working of Watt governor with sketch.	**03**
	(b)	Explain working of single acting reciprocating pump with air vessels.	**04**
	(c)	Define volumetric efficiency with p-v diagram and usual notations. Prove that volumetric efficiency of reciprocating compressor is $1-C[(p_2/p_1)^{1/n}-1]$	**07**
		OR	
Q: 4	**(a)**	What is split air conditioner? State its advantages over window airconditioner	**03**
	(b)	What is refrigeration? What is refrigerating effect? What is one ton refrigeration?	**04**
	(c)	A single stage, single cylinder reciprocating air compressor with negligible clearance takes 1 m^3 of air per minute at 1.013 bar and 15^0C. The delivery pressure is 7 bar. Assuming law of compression $pv^{1.35} = C$, R=0.287 kJ/kg K. Calculate: (i) Mass of air delivered per minute (ii) Delivery temperature (iii) Indicated Power (iv) Isothermal efficiency	**07**
Q: 5	**(a)**	Differentiate between clutch and coupling. Describe Disc clutch.	**04**
	(b)	Compare belt drive, chain drive and gear drive.	**04**
	(c)	Explain the function of Flywheel with turning moment diagram.	**06**
		OR	
Q: 5	**(a)**	Define Ductility, Elasticity, Plasticity and Weldability	**04**
	(b)	State the first law of thermodynamics. State its limitations.	**04**
	(c)	List the various liquid fuels. State its advantages over solid fuels.	**06**