Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-II Examination June 2010

Subject code: 110006

Subject Name: Elements of Mechanical Engineering

Date: 21 /06 / 2010 **Time: 02.30 pm – 05.00 pm**

Total 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 table is permissible.**

Q.1 **(a)** Define the following terms: **03**
(i) Prime mover
(ii) Specific heat
(iii) Internal energy

(b) What is isothermal process? Derive an expression for the work done during the isothermal process. **05**

(c) Determine the work done in compressing one kg of air from a volume of $0.15m^3$ at a pressure of 1.0 bar to a volume of $0.05 m,^3$ when the compression is (i) isothermal and (ii)adiabatic, Take γ=1.4 **06**
Also, comment on your answer.

Q.2 **(a)** Define the following terms: **02**
(i) Dryness fraction of steam
(ii) Degree of superheat

(b) Explain with a sketch the working of a four stroke Petrol engine. **05**

(c) The following results refer to a test on C.I. engine **07**
Indicated power ---------- 37 KW
Frictional power ---------- 06 KW
Brake specific fuel consumption-------- 0.28 Kg/Kwh
Calorific value of fuel ---------- 44300 KJ/Kg
Calculate:
(i) Mechanical efficiency
(ii) Brake thermal efficiency
(iii) Indicated thermal efficiency

OR

(c) Determine the enthalpy and internal energy of 1 Kg of steam at a pressure 10 bar(abs.), (i)when the dryness fraction of the steam is 0.85 (ii) when the steam is dry and saturated (iii) when the steam is superheated to300ºC. Neglect the volume of water and take the specific heat of superheated steam as 2.1 KJ/KgK. **07**

Q.3 **(a)** 'For the same compression ratio the air standard efficiency of Otto cycle is greater than that of Diesel cycle.' Justify the statement. **02**

(b) Draw P-V diagram for an ideal Diesel cycle and Derive an expression for its air standard efficiency in terms of temperatures only. **05**

(c) An engine operating on the ideal Diesel cycle has a maximum pressure of 44 bar and a maximum temperature of 1600ºC.The pressure and temperature of air at the beginning of the compression stroke are 1 bar and 27 ºC respectively. **07**
Find the air standard efficiency of the cycle. For air take γ=1.4

OR

Q.3	**(a)**	State the advantages of high pressure boilers.	**03**
	(b)	A boiler has equivalent evaporation of 10 Kg per Kg of coal at design condition. The coal is supplied at the rate of 400 Kg per hour to the boiler. The calorific value of the coal is 34 MJ/Kg. Calculate the thermal efficiency of the boiler.	**04**
	(c)	Explain with neat sketch the construction and working of Babcock and Wilcox boiler.	**07**
Q.4	**(a)**	Give comparison between a flywheel and a governor	**03**
	(b)	State the advantages of multistage compressor and explain with P-V diagram the working of two stage compressor.	**05**
	(c)	Classify the rotary pumps and describe with neat sketch working of a rotary gear pump.	**06**

OR

Q.4	**(a)**	Define air conditioning and classify the air conditioning systems	**03**
	(b)	Describe with neat sketch vapor compression refrigerating system.	**05**
	(c)	A single cylinder , single acting air compressor has a cylinder diameter of 150mm and stroke of 300mm. it draws air into its cylinder at a pressure of 1 bar and temperature 27 ºC.This air is then compressed adiabatically to a pressure of 8 bar if the compressor runs at a speed of 120rpm Find, (i) Mass of the air compressed per cycle (ii) Work required per cycle (iii) Power required to drive the compressor Neglect the clearance volume and take R= 0.287 KJ/KgK	**06**
Q.5	**(a)**	Differentiate between individual drive and group drive.	**03**
	(b)	Discuss the relative merits and demerits of belt, chain and gear drives.	**05**
	(c)	What is the function of a brake? Explain with neat sketch the working of an internal expanding shoe brake.	**06**

OR

Q.5	**(a)**	Give the statements of zeroth law, first law and second law of thermodynamics.	**03**
	(b)	What are Bio-fuels? Describe them in details.	**05**
	(c)	Describe in brief the various non-ferrous metals along with their applications.	**06**

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