Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–II EXAMINATION – SUMMER 2015

Subject Code: 2722107 **Date: 28/05/2015**

Subject Name: Advanced Internal Combustion Engine

Time: 02:30 PM to 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.**

Q.1 **(a)** A hydrocarbon fuel has the following composition of dry products of combustion by volume: **07**

CO_2 = 12 % CO = 0.5% O_2 = 4% and the rest N_2

Determine the air/fuel ratio, the percent theoretical air and the percentage composition of fuel on a mass basis.

(b) A mixture of propane and oxygen, in the proper ratio, for the complete combustion and at 25 °C and 1 atm., reacts in a constant volume bomb calorimeter. Heat is transferred until the products of combustion are at 400 K. Determine the heat transfer per mole of propane. Enthalpy of formation at a given temperature and pressure for Propane, Carbon dioxide and water vapor are -103.85 MJ/kmol, -393.52 MJ/kmol and -241.82 MJ/kmol. Universal gas constant = 8.314 kJ/Kmol.K. Change in enthalpy between the reference state and the actual state for different substances (MJ/kmol) are given in following table: **07**

Temperature (K)	CO	CO_2	H_2O	N_2	O_2
298	0.0	0.0	0.0	0.0	0.0
400	2.975	4.008	3.452	2.971	3.029

Q.2 **(a)** A four stroke petrol engine at full load delivers 50 kW. It requires 8.5 kW to rotate it without load at the same speed. Find its mechanical efficiency at full load, half load and quarter load? **07**

Also find out the volume of the fuel consumed per second at full load if the brake thermal efficiency is 25%, given that calorific value of the fuel = 42 MJ/kg and specific gravity of petrol is 0.75. Estimate the indicated thermal efficiency.

(b) Derive an expression for the efficiency of Otto cycle and comment on the effect of compression ratio on the efficiency with respect of ratio of specific heats by means of a suitable graph. **07**

OR

(b) Show that the efficiency of the diesel cycle is lower than that of Otto cycle for the same compression ratio. Comment why the higher efficiency of the Otto cycle compared to diesel cycle for the same compression ratio is only of an academic interest and not practical importance. **07**

Q.3 **(a)** State the objects of supercharging of IC engines and explain turbocharging. **07**

(b) Describe briefly the MPFI system with a neat sketch. **07**

OR

Q.3 **(a)** How are the injection system classified? Describe them briefly. Why the air injection system is not used nowadays? **07**

	(b)	Briefly explain the stages of combustion in SI engines with the help of a P-ɗ diagram. Elaborating the flame front propagation.	**07**
Q.4	**(a)**	What are particulates? Describe in detail how particulate emissions are caused.	**07**
	(b)	Describe the wet sump lubrication system with the help of a diagram.	**07**
		OR	
Q.4	**(a)**	What are catalytic converters? How are they helpful in reducing HC, CO and NO_x emissions?	**07**
	(b)	Describe the effect of the following fuel characteristics on the performance of CI engine: Ignition quality, Volatility, Gravity, Corrosion and wear, Handling ease, safety and cleanliness.	**07**
Q.5	**(a)**	Describe the method of finding friction power using Morse test.	**07**
	(b)	What do you understand by stratified charge? With the help of a diagram describe operating principle of stratified charge engine.	**07**
		OR	
Q.5	**(a)**	Explain the factors effecting delay period in CI engine.	**07**
	(b)	Explain the phenomenon of dissociation.	**07**

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