

GUJARAT TECHNOLOGICAL UNIVERSITY**B E Sem-VI Examination May 2011****Subject code: 161902****Subject Name: Internal Combustion Engines****Date: 17/05/2011****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 with neat sketch Combustion stages in S. I. Engine. Also define Auto ignition Temperature. **07**

(b) Explain with neat sketch Detonation in C. I. Engine. Also mention the Factor affecting the detonation. **07**

Q.2 (a) Prove that the Air fuel Ratio for Simple Carburettor if air is assumed to be incompressible is equal to **07**

$$\text{A.F. Ratio} = \frac{C_{da} A_a \sqrt{2\rho_a (\Delta p)}}{C_{df} A_f \sqrt{2\rho_f [(\Delta p) - h g \rho_f]}}$$

(b) A simple carburettor has the venturi of throat diameter of 8 cm and the coefficient of discharge is 0.94. The fuel orifice has the diameter of 0.5 cm and its coefficient of discharge of 0.7. find the air-fuel ratio if pressure drop amounts to 0.14 bar when (a) nozzle lip is neglected (b) nozzle lip is taken in to account and it is equal to 0.5 cm. Assume density of fuel as 780 kg/m³, approach factor as 1 and density of air as 1.293 kg/m³. **07**

OR

(b) A:F ratio of mixture supplied to an engine by carburettor is 15:1. The fuel consumption of engine is 7.5 kg/hour. The diameter of venturi is 2.2 cm find the diameter of fuel nozzle if tip of nozzle is 4 mm. Take the following specification for calculation. **07**

Q.3 (a) A Petrol engine using a compression ratio 7 and A/F ratio of 15:1 has the pressure and temperature at the end of suction stroke 1 bar and 57°C respectively. The fuel used has a calorific value of 44000 kJ/kg. compression follows the law $PV^{1.33} = C$ and specific heat at constant volume is given by the relation $C_v = 0.718 + 2.1 \times 10^{-4} T$, where T is in degree Kelvin. Determine the maximum Pressure and Temperature in the cylinder. Also compare this value with that of constant specific heat, $C_v = 0.718$. **07**

(b) Explain with neat sketch working Simple Carburettor. Also explain Drawback and application of simple Carburettor. **07**

OR

Q.3 (a) Explain with neat sketch Stages in Combustion of C. I. Engine. Also give classification of Combustion chambers for C. I. Engine. **07**

- (b) Explain with neat sketch Valve timing diagram for Diesel engine. Also explain deviation of an actual cycle from an ideal cycle. 07

- Q.4 (a)** The following observations were made during the test on an oil engine. 07
B.P. of the engine = 31.5 kW. Fuel used = 10.5 kg/hr, CV of Fuel = 43000 kJ/kg, Jacket circulating water = 540 kg/hr. Rise in temperature of cooling water = 56°C. Exhaust gases are passed through the exhaust gas calorimeter for finding the heat carried away by the exhaust gases. Water circulated through the exhaust gas calorimeter = 545 kg/hr. Rise in temperature of water passing through calorimeter = 36°C. Temperature of exhaust gas leaving exhaust gas calorimeter = 82°C. A/F ratio is 19:1. Ambient temperature = 17 °C. Cp for exhaust gases = 1kJ/kg K. Cp of water = 4.186 kJ/kg K. Draw up the heat balanced sheet on minute and Percentage basis.

- (b) Explain the Methods of obtaining Friction Power and explain any one of them in details. 07

OR

- Q.4 (a)** Explain Ignition Requirement. Also Give Types of Ignition Systems and explain in detail any one of them. 07

- (b) What is Variable Compression Ratio(VCR) Engine and explain methods of obtaining VCR and performance of VCR Engine. 07

- Q.5 (a)** Define Supercharging and give its advantages. Also explain the methods of Supercharging and explain any of them. 07

- (b) In SI engine works on Otto cycle with compression ratio 6. The initial Pressure and Temperature of the cycle are 1 bar and 37° C. The maximum pressure in the cycle is 30 bar. For unit mass flow calculate (1) Pressure volume and Temperature at various sailent Point in the cycle and (2) Ratio of heat supplied to heat rejected and efficiency. Assume $\gamma = 1.4$ and $R = 8.314 \text{ kJ/kmol K}$. 07

OR

- Q.5 (a)** Define EURO and INDIAN(Bharat) Norms. The petrol used in an SI engine is assumed to have a chemical formula C_7H_{16} . Determine : (a) the stoichiometric A:F ratio and (b) If 50% excess air si supplied then find the volumetric composition of dry exhaust products. Air contains 23% of O_2 and 77% of N_2 by Mass. 07

- (b) Explain alternative fuels for I. C. Engine and explain any one of Fuel in details. Also Define Octane and Cetane No. 07
