Enrolment No.

## **GUJARAT TECHNOLOGICAL UNIVERSITY**

## **ME – SEMESTER II (NEW) – • EXAMINATION – SUMMER 2016**

Subject Code: 2722107 Date: 25/05/2016 **Subject Name: Advanced Internal Combustion Engine** Time:10:30 am to 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 why the higher efficiency of the Otto cycle compared to diesel cycle for 07 the same compression ratio is not a result of practical importance. (b) Compare the properties of alcohols and gasoline as engine fuels and also explain 07 the merits and demerits of alcohols as an alternate fuel. Q.2 (a) Draw and explain the p-v and T-s diagram for constant volume cycle and derive 07 an equation for efficiency of it. (b) What is enthalpy of combustion? What is internal energy of combustion? 07 OR (b) What do you understand by higher heating value and lower heating value of a 07 fuel? **Q.3** What is the basic difference in the combustion process of SI and CI engines? 07 **(a) (b)** Explain the scavenging process in two-stroke engine. What is meant by 07 blowdown? OR Q.3 Does the flame front exist in a CI engine? Explain. **(a)** 07 How supercharging of two-stroke engines is done? 07 (b) Explain the internationally accepted methods of measuring the following 07 **Q.4 (a)** invisible emission: 1. Oxides of nitrogen 2. Carbon monoxide 3. Unburned hydrocarbons (b) Explain briefly the engine heat transfer. Develop the necessary equation for the 07 rate of heat transfer. OR (a) What is smoke? Classify the measurement of smoke? Also explain comparison **Q.4** 07 method for smoke measurement. (b) What is the effect of the following on engine friction: 07 1. Stroke/bore ratio 2. Number of piston rings 3. Compression ratio 4. Oil viscosity 5. Cooling water temperature 6. Engine load 0.5 **(a)** The air flow to a four cylinder four stroke oil engine is measured by means of a 07 5 cm diameter orifice, having a  $C_d$  = 0.6. During a test on the engine the following data were recorded: Bore = 10.5 cm, stroke = 12.5 cm, engine speed = 1200 rpm, brake torque = 147 Nm, fuel consumption = 5.5 kg/hr, CV of fuel = 43100 kJ/hr, head across orifice = 5.7 cm of water, ambient temperature and pressure =  $20 \text{ }^{\circ}\text{C}$  and 1.013

- bar respectively. Calculate:
  - 1. The thermal efficiency on brake power basis.
  - 2. The brake mean effective pressure.
  - 3. The volumetric efficiency based on free air condition.

(b) Explain: HCCI engines

## OR

- A four stroke cycle petrol engine has six single acting cylinders of 7.5 cm bore 07 Q.5 **(a)** and 9 cm stroke. The engine is coupled to a brake having a torque arm radius of 38 cm. At 3300 rpm, with all cylinders operating the net brake load is 324 N. when each cylinder in turn is rendered inoperative, the average net brake load produced at the same speed by the remaining five cylinders is 245 N. Estimate the indicated m.e.p. of engine. With all cylinders operating the fuel consumption = 0.3 kg/min; fuel CV = 42000 kJ/kg; the jacket water flow rate and temperature rise = 65 kg/min and 12 °C. On test, the engine is enclosed in a thermally and acoustically insulated box, through which the output drive, water, fuel, air and exhaust connections pass. Ventilating air blown up through the box at the rate of 14 kg/min enters at 10 °C and leaves at 55 °C. Draw up a heat balance sheet of the engine, stating the items as a percentage of the fuel.
  - (b) Describe any one optical method for flame velocity measurement.

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