

Con. 6162-09.

SP-7976

(3 Hours)

[Total Marks : 100

**N.B. : (1) Question No. 1 is compulsory.**

- (2) Answer **any four** of remaining six questions.
- (3) **Assumptions** made should be clearly stated.
- (4) Assume **suitable data** wherever required.
- (5) Figures to the **right** indicate marks.
- (6) Illustrate answers with **sketches** wherever required.

1. (A) Answer any **Five** of the following :

(20)

- (a) Discuss the difference between theoretical and actual valve timing diagrams of a diesel engine?
- (b) "Auto-ignition is the cause of detonation". Justify the statement.
- (c) What is the difference between physical delay and chemical delay? State the factors on which delay period depends.
- (d) How do you define volumetric efficiency of an I. C. engine? How is it related to the power output of the engine?
- (e) Explain briefly crankcase scavenging.
- (f) What are the desirable properties of good I. C. engine fuels?
- (g) What is the difference between ignition timing and firing order?

2. (a) The following data refer to an eight-cylinder four-stroke petrol engine: (10)

Bore = 110 mm, Stroke = 110 mm, Composition of the fuel used is C = 84% & Hydrogen = 16%, throat diameter of the choke tube = 42 mm, volumetric efficiency at 300 rpm speed is 70% (referred to 0°C and 1.013 bar), the pressure depression = 0.12 bar, the temperature at the throat 15°C.

Characteristic gas constant: for air = 287 J / kg. K and for fuel vapour = 97 J / kg. K

If chemically correct air-fuel ratio is supplied for combustion, determine:

- (i) Fuel Consumption in kg per hour
- (ii) The air velocity through the tube

(b) What are the requirements of an ignition system for an I. C. engine? (06)

(c) Discuss briefly Mist lubrication system. (04)

3 (a) An eight-cylinder four-stroke diesel engine has a power output of 400 kW at 800 rpm. The fuel consumption of the engine is 0.25 kg/kWh. The pressure in the cylinder at the beginning of injection is 32 bar and the maximum cylinder pressure is 55 bar. The injector is expected to be set at 210 bar and the maximum pressure at the injector is set to be about 600 bar.

Calculate the orifice area required per injector if the injection takes place over 12° crank angle.

Assume the following:

Specific gravity of fuel = 0.85; Coefficient of discharge for the injector = 0.6;

Atmospheric pressure = 1.013. The effective pressure difference is the average pressure difference over the injection period. (10)

(b) Describe the method commonly used in laboratory for measuring the air supplied to an I. C. engine. Derive the formula used for finding the mass of air supplied to an engine. (10)

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4. (a) Explain how supercharging helps to improve the power output. What are its limitations? (06)
- (b) What is the significance of ASTM distillation curve? (04)
- (C) A diesel engine operating on four-stroke cycle is to be designed to operate with following characteristic at sea level, where the mean conditions are 1.013 bar and  $10^{\circ}\text{C}$ . B.P. = 260 kW, volumetric efficiency = 78% (at sea level free air conditions), specific fuel consumption of the engine = 0.25 kg/BPh; A/F ratio = 17; Speed = 1500 rpm. Calculate the required engine capacity and the anticipated brake mean effective pressure. The engine is fitted with a supercharger so that it may be operated at an altitude of 2700 m where the atmospheric pressure is 0.72 bar. The power taken by a supercharger is 10% of the total power produced by the engine and the temperature of the air leaving the supercharger is  $32^{\circ}\text{C}$ . The A/F ratio and thermal efficiency remain the same for the supercharged engine as when running unsupercharged at engine at sea level, as does the volumetric efficiency. Calculate the increase of air pressure required at the supercharger to maintain the same net output of 260 kW. Take  $R = 0.287 \text{ kJ/kgK}$ . (10)
5. (a) A four cylinder petrol engine has a bore of 60 mm and a stroke of 90 mm. Its rated speed is 2800 rpm and it is tested at this speed against brake which has a torque arm of 0.37 m. The net brake load is 160 N and the fuel consumption is 9 liters per hour. The specific gravity of fuel is 0.74 and it has calorific value of 44000 kJ per kg. A Morse test is carried out and the cylinders are cut out in the order 1, 2, 3, 4 with corresponding brake loads of 110, 107, 104 and 110 N respectively. Calculate for this speed:  
 (i) engine torque (ii) brake mean effective pressure  
 (iii) brake thermal efficiency (iv) specific fuel consumption  
 (v) mechanical efficiency (vi) Indicated mean effective pressure (14)
- (b) Why Morse test is not suitable for single cylinder engine? Describe the method of finding friction power using Morse test. (06)
6. (a) Describe with suitable sketches the combustion phenomenon in SI engine. Explain the three phases of combustion. Discuss the effect of engine variables on ignition lag. (10)
- (b) How the lubrication of two-wheeler is done? What is role of lubricating oil filter of automobile engines? (06)
- (C) State the advantages and limitations of petrol injection. (04)
7. Write short notes on (any five): (20)
- (a) Solex Carburetor (b) Alternative fuels for I C engines  
 (C) Phenomenon of dissociation (d) Combustion chambers of C I engine  
 (e) Factors that limits the compression ratio in SI and CI engines.  
 (f) Water Cooling and Air Cooling.
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