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No. of Printed Pages—4 **ME-602**

B. TECH.

SIXTH SEMESTER EXAMINATION, 2003–2004

I. C. ENGINES

Time : 3 Hours *Total Marks : 100*

Note : (1) Attempt all the **FIVE** questions.

(2) All questions carry equal marks.

1. Answer any FOUR of the following :— **(5×4=20)**

(*a*) What do you understand by Stirling cycle ? Show the cycle on P–V and T–S diagrams.

(*b*) Explain the effect of chemical equilibrium loss upon the Otto cycle.

(*c*) Discuss the valve timing diagram for SI engine.

(*d*) Describe the knock rating of SI and CI engine fuels.

(*e*) Discuss the working of battery ignition system with a neat sketch.

(*f*) Explain the effect of ignition timing on exhaust emissions.

2. Answer any TWO of the following :— **(10×2=20)**

(*a*) Determine the diameter of throat and main fuel jet in the carburettor of a 4-stroke SI engine of 1000 cc capacity. Engine develops maximum power at 5600 rpm and the velocity of air at throat is 100 m/s for this condition. Volumetric efficiency may be taken as 75% and air-fuel ratio is 15 : 1. Coefficient

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of discharge for venturi is 0·8 and for main jet, it is 0·7. Diameter of emulsion tube is $\frac{1}{3}$ rd of throat diameter. Gasoline surface is 6 mm below throat. Assume specific gravity of gasoline as 0·75, and ambient conditions may be 1·013 bar and 20 °C. Specific heat of air may be taken as 1·005 kJ/kg.K.

(*b*) Explain the effect of engine variables on flame-speed in SI engines.

(*c*) With the help of suitable sketches, explain the working of carburettor having choke and power enrichment system.

3. Answer any TWO of the following :— **(10×2=20)**

(*a*) Discuss the various stages of combustion in CI engine, in detail.

(*b*) Determine the diameter of fuel orifice in fuel injector of a 4-stroke CI engine. Engine develops 25 kW per cylinder at 3000 rpm. Specific fuel consumption of 30 API fuel is 0·3 kg/kWh and fuel is injected at a pressure of 180 bar over the crank travel of 26°. Pressure in combustion chamber is 40 bar and the coefficient of discharge of orifice is 0·88 and specific gravity of fuel is given by :

$$SG = \frac{142}{132 + API}$$

(*c*) Write short notes on any TWO of the following :—

(*i*) Crankcase ventilation

(*ii*) Methods of supercharging

(*iii*) Types of cooling system

4. Answer any FOUR of the following :— **(5×4=20)**

(*a*) A single-stage single-acting reciprocating air compressor has air entering at 1 bar, 20 °C and leaving at 12 bar. Compression follows polytropic index of 1·2. Compressor runs at speed of 240 rpm and has L/D ratio of 1·8. Mechanical efficiency of compressor is 0·88. Determine the isothermal efficiency. Compressor admits 1 m^3 of air per minute.

(*b*) Discuss the effects of clearance upon performance of reciprocating compressor.

(*c*) Describe the working of centrifugal compressor.

(*d*) A roots blower admits air at 0·5 m^3/s at 1 bar and 27 °C to deliver it at 2 bar. Determine the indicated power required to drive compressor and isentropic efficiency.

(*e*) Write short notes on the following :—

(*i*) Multistage compression

(*ii*) Axial flow compressor

5. Answer any TWO of the following :— **(10×2=20)**

(*a*) Show that the optimum specific work output shall be obtained at same overall pressure ratio for each of the following arrangements operating between the maximum and minimum temperatures of T_3 and T_1 respectively in the gas turbine installation having arrangements given below :

(*i*) there is single-stage compression followed by two stages of expansion in turbine. Expansion ratio in two stages is equal and reheat at inlet to the second stage of expansion is up to maximum temperature.

(*ii*) there occurs compression in two stages of equal compression ratio with intercooling up to the minimum cycle temperature at inlet to second stage of compression followed by single-stage expansion in turbine.

(*b*) Discuss the effect of reheating, regeneration and intercooling on the performance of gas turbine cycle. Also show the processes on T–S diagram.

(*c*) Write short notes on any *TWO* of the following :—

(*i*) Turbojet engine

(*ii*) Merits and demerits of jet propulsion

(*iii*) Propulsive power and Propulsive efficiency

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