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BME–053

DIPLOMA IN MECHANICAL ENGINEERING (DME)

00782

Term-End Examination

December, 2010

BME–053 : APPLIED THERMAL ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any seven** questions.*

1. (a) Derive an Expression for the thermal efficiency of an Otto cycle with suitable sketch. 5

   (b) Air enters an Otto cycle at 1.0 bar and 27°C. The compression ratio is 7.5. The temperature of air after adiabatic compression is 277°C. Find the thermal efficiency, the maximum pressure; the maximum temperature and the mean effective pressure of the cycle. 5

2. (a) Discuss the merits and demerits of two stroke Internal Combustion Engine. 4

   (b) What do you mean by 'Carburation'? Explain the working of simple Carburator with neat sketch. 2+4=6

3. (a) Enumerate the desirable properties of a good fuel for a petrol Engine. 4

(b) Explain the working of a fuel injector with neat sketch. 6

4. (a) What are the effects of detonation on a diesel engine and when does it occur ? 4

(b) What is necessity for cooling IC Engines ? Describe the working of a forced circulation water cooling system of an I.C. engine. 2+4=6

5. (a) What are the desirable properties of a good lubricant ? 4

(b) What is 'scavenging' in an I.C. engine ? Compare the scavenging in a two stroke with four stroke I.C. Engine. 2+4=6

6. (a) What are the different methods of determining the power absorbed in overcoming friction in an I.C. Engine ? 4

(b) A four cylinder four stroke Petrol Engine Working on the Otto cycle consumes 7 kg of petrol per hour. The compression ratio of the engine is 5. The thermal efficiency of the engine is 62% of the air standard efficiency. Calculate the thermal and air standard efficiencies. The calorific value of the fuel is 45000 kJ/kg. Determine the Power developed per cylinder. 6

7. (a) Define Volumetric Efficiency. 3

(b) A single stage single acting air compressor takes in air at 1 bar at a rate of $3m^3/min$ and delivers it with a pressure ratio of 10. If the Compression and Expansion follow the law $PV^{1.3}=C$. Determine the power required if the clearance volume is 6% of the swept volume is 14.5 litres. Determine the speed of compressor and the volumetric efficiency. 7

8. (a) Explain why staging is done in reciprocating air compressor. 4

(b) Derive an Expression for the Optimum Pressure ratio giving maximum specific output in simple cycle gas turbine. 6

9. (a) State merits and demerits of closed cycle gas turbine over open cycle gas turbine. 3

(b) A gas turbine is designed to operate under the following conditions : 7

Maximum temperature = 650°C $r_p=5$.

Inlet pressure and temperature = 1.05 bar and 15°C.

Turbine isentropic efficiency = 86%.

Compressor isentropic efficiency = 82%.

Mechanical efficiencies of the compressor and turbine = 99%.

Efficiency of combustion = 98%.

Determine the improvement in Plant thermal efficiency that would result from the addition of heat exchanger of 65% effectiveness. Allow the pressure loss of 0.905 bar in the heat exchanger for air Cp = 1.005 and Cp = 1.13kJ/kg/k for gas. Assume that in the heat exchanger mean specific heat of the Exhaust products and air is same.

10. Write short notes of the following : 10

(a) Knocking.

(b) Turbo - Charging.

(c) Clearance ratio.

(d) Morse Test.