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BIME-010

B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination

00392

December, 2016

BIME-010 : THERMAL ENGINEERING

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) What are the factors that limit the compression ratio in petrol engines ?

(b) A four-stroke petrol engine has six cylinders of 7·5 cm bore and 9 cm stroke. The engine is coupled to a brake which has a torque arm radius of 38 cm. At 3300 rev/min, with all cylinders operating, the net brake load is 323 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 mean effective pressure. 7+7

2. (a) "Compressed Natural Gas (CNG) is preferable in S.I. engines than C.I. engines." Justify the statement.

(b) The air flowing to a four-cylinder, four-stroke oil engine is measured by means of a 5 cm diameter orifice having coefficient of discharge of 0·6. During a test on the engine the following data were recorded :

Bore = 10 cm; stroke = 12 cm; speed = 1200 rpm, brake torque = 120 Nm; fuel consumption = 5 kg/hr; Calorific value of fuel = 42 MJ/kg; pressure drop across the orifice is 4·6 cm of water; ambient temperature and pressure are 17°C and 1 bar respectively.

Calculate :

(i) The thermal efficiency on brake power basis

(ii) The brake mean effective pressure 7+7

3. (a) Discuss the three basic requirements of a good S.I. engine combustion chamber.

(b) A 4-stroke gas engine develops 3·5 kW B.P. at 160 rpm and at full load. Assuming the following data, find the relative efficiency on I.P. basis and Air-Fuel ratio used :

Volumetric efficiency : 87%

Mechanical efficiency : 73·5%

Clearance volume : 2100 cm^3

Swept volume : 9000 cm^3

Fuel consumption : 5 m^3/hr

Calorific value of fuel : 18000 kJ/m^3

All working cycles are effective. 7+7

4. (a) Explain the phenomenon of knock in C.I. engines and compare it with S.I. engine knock.

(b) What are the main applications of compressors ? Define the adiabatic efficiency and the isothermal efficiency of compression. 7+7

5. (a) Explain the advantages of multistage compression over single stage compression.

(b) Compare the relative advantages and disadvantages of four-stroke and two-stroke cycle engines. 7+7

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

(b) A four-stroke eight-cylinder engine of 9 cm bore and 8 cm stroke with a compression ratio 7 is tested at 4500 rpm on a dynamometer which has 54 cm arm. During a 10-minute test the dynamometer scale beam reading was 412·02 N and the engine consumed 4·4 kg of gasoline having a calorific value of 44000 kJ/kg. Air at 27°C and 1 bar was supplied to the carburettor at the rate of 6 kg/min. Calculate

(i) Brake thermal efficiency, and

(ii) Air-fuel ratio. 7+7

7. (a) "Supercharging is preferred in diesel engines than petrol engines." Justify this statement.

(b) For an engine working on the Otto cycle between given lower and upper limits of absolute temperature, T_1 and T_2 respectively, show that for maximum work to be done per kg, the ratio of compression is given by

$$\gamma = \left(\frac{T_2}{T_1}\right)^{1\cdot25}$$

where γ = ratio of specific heats = 1·4. 7+7