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BIME-010

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

Term-End Examination

00585 **December, 2014**

BIME-010 : THERMAL ENGINEERING

Time : 3 hours *Maximum Marks : 70*

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

1. Describe with a neat sketch the construction and working of a single-stage single-acting reciprocating air compressor. *10*

2. A single-stage single-acting air compressor running at 1,000 rpm delivers air at 25 bar. For this purpose the induction and free air conditions can be taken as 1·013 bar and 15°C, and the free air delivery as 0·25 m^3/min. The clearance volume is 3% of the swept volume, and the stroke/bore ratio is 1·2 : 1. Calculate the bore and stroke and the volumetric efficiency of this machine. Take the index of compression and expansion as 1·3. Also, calculate the indicated power and the isothermal efficiency. *10*

3. What are the advantages and disadvantages of a 2-stroke engine over a 4-stroke engine ? *10*

4. An eight cylinder automobile engine of 85·7 mm bore, and 82·5 mm stroke with a compression ratio of 7 is tested at 4,000 rpm on a dynamometer which has a 53·35 cm arm. During a 10 minute test at a dynamometer scale beam reading of 40·8 kg, 0·455 kg of gasoline for which the calorific value is 11000 kcal/kg are burned and air at 21°C and 1·027 kg/cm^2 is supplied to the carburettor at the rate of 5·44 kg per minute. Find the *10*

   (a) BHP delivered

   (b) BMEP

   (c) BSFC

   (d) Brake specific air consumption

   (e) Brake thermal efficiency

   (f) Volumetric efficiency

5. How are the fuels for spark ignition engines rated ? Explain the effect of Octane Number on the performance of spark ignition engine. *10*

6. Explain the phenomenon of knocking in SI engine. What are the different factors which influence the knocking ? Describe the methods used to suppress it. *10*

7. What is the effect of acceleration on the performance of a simple carburettor ? How is it taken care of in a modern carburettor ? *10*

8. Discuss in detail the requirements of a good sparking plug. Explain with the help of a neat sketch the construction of a spark plug, describing in particular the materials used for its different parts. *10*

9. A 4-cylinder, 4-stroke engine has a compression ratio of 7·5 : 1. A test on this engine gave the following results :

   Net brake load and effective brake arm = 21·5 kg, and 50 cm; respectively,

   IMEP = 7·5 bar, N = 3,000 rpm, fuel consumption = 10·8 kg/m, CV of fuel = 44 MJ/kg, D = 8·6 cm; and L = 10 cm.

   Find the : *10*

   (a) Mechanical efficiency

   (b) Brake thermal efficiency

   (c) Relative efficiency

   (d) BMEP

10. A single cylinder four-stroke CI engine running at 1,800 rpm has a bore of 85 mm and a stroke of 110 mm. It takes 0·56 kg of air per minute and develops a brake power output of 6 kW while the air-fuel ratio is 20 : 1. The calorific value of the fuel is 42,550 kJ/kg, and the ambient air density is 1·18 kg/m^3. Calculate : *10*

(a) The volumetric efficiency

(b) Brake specific fuel consumption