| BIMEE-023 |

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

Term-End Examination
December, 2014

00355

BIMEE-023 : COMBUSTION ENGINEERING

Time : 3 hours   *Maximum Marks : 70*

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

1. (a) Enumerate and describe briefly the gaseous fuels which can be used in IC engines.   *5*

   (b) Explain the various factors that influence the flame speed.   *5*

2. (a) What are the properties of CNG ? Explain the advantages and disadvantages of CNG over petrol as SI engine fuel.   *5*

   (b) Explain the phenomena of knocking in SI engine. What are the different factors which influence the knocking ? Describe the methods used to suppress it.   *5*

3. (a) What are the different methods used in CI engines to create turbulence in the mixture? Explain its effect on power output and thermal efficiency of the engine. *5*

(b) What is meant by ignition delay? Explain the difference between ignition timing and firing order. *5*

4. (a) What do you mean by pre-ignition? How can it be detected? *5*

(b) How are CI engine combustion chambers classified? What type of swirl is used in these chambers? *5*

5. An SI engine operating at 1,200 rpm has a 10·2 cm bore with spark plug offset by 6 mm from the centre. The spark plug is fired at 20° before TDC. It takes 6·5° of engine rotation for combustion to develop and get into flame propagation mode, where the average flame speed is 15·8 m/s.

Calculate : *10*

(a) Time of one combustion process (i.e. time for flame front to reach the farthest cylinder wall) in seconds;

(b) Crank angle position at the end of combustion.

6. Find the required air-fuel ratio in a gas turbine whose turbine and compressor efficiencies are 85% and 80% respectively. Maximum cycle temperature is 875°C. The working fluid can be taken as air (C_p = 1·0 kJ/kg K, γ = 1·4) which enters the compressor at 1 bar and 27°C. The pressure ratio is 4. The fuel has calorific value of 42,000 kJ/kg. There is a loss of 10% of calorific value in the combustion chamber. *10*

7. A 4-cylinder two-stroke cycle petrol engine develops 30 kW at 2,500 rpm. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder. For each cylinder, stroke to bore ratio is 1·5. Also calculate the fuel consumption of the engine, if brake thermal efficiency is 28%. The calorific value of fuel is 43,900 kJ/kg. *10*

8. (a) What should be the primary considerations in the design of combustion chambers for CI engines ? *5*

   (b) "Auto-ignition is the cause of detonation." Justify the statement. *5*

9. (a) How does the mixture composition in the combustion chamber of a CI engine differ from that of an SI engine ? *5*

(b) "The factors that tend to increase detonation in SI engine tend to reduce knocking in CI engine." Discuss the above statement with reference to the following influencing factors : *5*

(i) Compression ratio

(ii) Inlet temperature

(iii) Inlet pressure

(iv) Self-ignition temperature of fuel

(v) Combustion chamber wall temperature

10. (a) Why is the rate of pressure rise during combustion limited to a certain value ? *5*

(b) What do you mean by adiabatic flame temperature and what is its significance ? *5*

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