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BME-053

DIPLOMA IN MECHANICAL ENGINEERING (DME)

Term-End Examination

00095

December, 2014

BME-053 : APPLIED THERMAL ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : *Answer any* ***five*** *questions. Assume any missing data suitably. Use of scientific calculator is allowed.*

1. (a) Derive an expression for thermal efficiency of Otto cycle. 7

(b) In an air standard Diesel cycle, the compression ratio is 16 and at the beginning of isentropic compression, the temperature is 15°C and the pressure is 1 bar. Heat is added until the temperature at the end of the constant pressure process is 1480°C. Calculate (i) cut-off ratio (ii) heat supplied per kg of air and (iii) the thermal efficiency of the cycle.

Given : $C_p = 1{\cdot}005$ kJ/kg-K and

$C_v = 0{\cdot}718$ kJ/kg-K 7

2. (a) Give comparison between 2-stroke and 4-stroke engines. *4*

(b) Define the following terms : *10*

(i) Mechanical efficiency
(ii) Volumetric efficiency
(iii) Indicated thermal efficiency
(iv) Brake thermal efficiency
(v) Relative efficiency
(vi) Specific fuel consumption

3. (a) Explain the basic requirements of IC engine fuels. *4*

(b) Name the fuels which are used in IC engines. List the advantages and disadvantages of gaseous fuels in IC engines. *10*

4. (a) Describe the working of a capacitance discharge ignition system with the help of a neat sketch. *7*

(b) What is the need of ignition advance ? Describe the working of centrifugal advance mechanism. *7*

5. (a) Why are anti-freeze mixtures used with cooling water in radiators of an engine ? List the names of different mixtures and also write the properties which a good anti-freeze mixture must possess. *8*

(b) In which engines is air cooling done ? Describe the air cooling system of an engine with the help of a neat sketch. *6*

6. (a) Define the following properties of lubricating oils : 6

(i) Flash point

(ii) Fire point

(iii) Cloud point

(iv) Pour point

(v) Neutralization number

(vi) Film strength

(b) List the important parts of lubrication system of an automobile and describe them with the help of suitable sketches. 8

7. (a) Describe the performance of a multi-cylinder CI engine at constant speed and varying load. Show the variation of bsfc, bmep, torque and brake power. 6

(b) A 4-cylinder, 4-stroke engine has been tested to measure its performance. The following data is given :

Cylinder Diameter = 10 cm

Stroke = 12 cm

Speed = 2,000 rpm

Fuel consumption = 16 kg/hr

Brake power = 32·0 kW

Mechanical efficiency = 80%

Calorific value of fuel = 44,000 kJ/kg

Determine (i) bsfc, (ii) indicated mean effective pressure and (iii) brake thermal efficiency. 8

8. (a) Draw the gas turbine cycle on p-V diagram and write the names of different processes it consists of. Also write the formula of its thermal efficiency in terms of its pressure ratio. *6*

(b) Which fuels can be used in gas turbines ? Explain in brief. *4*

(c) State the main characteristics of closed cycle gas turbine plants. *4*