|BME-053|

DIPLOMA IN MECHANICAL ENGINEERING (DME)

Term-End Examination

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June, 2018

BME-053 : APPLIED THERMAL ENGINEERING

Time : 2 hours   *Maximum Marks : 70*

Note : *All questions are compulsory. All questions carry equal marks. Use of scientific calculator is permitted.*

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1.   Choose the correct answer from the given four
     alternatives.   *7×2=14*

     (a)   Which of the following gases has the
           maximum value of specific heat ratio (γ) ?
           (i)   Oxygen
           (ii)   Helium
           (iii) Methane
           (iv)   Carbon dioxide

     (b)   For the same maximum pressure and
           temperature of the cycle and for the same
           heat rejection, this air standard cycle has
           the maximum efficiency.
           (i)   Otto cycle
           (ii)   Diesel cycle
           (iii) Dual cycle
           (iv)   Brayton cycle

(c) An ideal gas at 27°C is heated at constant pressure till the volume becomes three times. The temperature of the gas will then be

(i) 81°C

(ii) 900°C

(iii) 627°C

(iv) 927°C

(d) High air-fuel ratio in gas turbine would

(i) increase thermal efficiency

(ii) increase power output

(iii) decrease the outlet temperature

(iv) All of the above

(e) The thermal efficiency of theoretical Otto cycle

(i) increases with increase in compression ratio

(ii) increases with increase in isentropic index (γ)

(iii) does not depend upon the pressure ratio

(iv) follows all of the above

(f) In a four-stroke cycle diesel engine, during suction stroke

(i) only air is sucked in

(ii) only fuel is sucked in

(iii) mixture of fuel and air is sucked in

(iv) None of the above

(g) For a petrol engine for vehicles, the air-fuel ratio for maximum power generation is of the order of

    (i)   8 : 1

    (ii) 12 : 1

    (iii) 18 : 1

    (iv) 20 : 1

2. Answer any *two* of the following :   *2×7=14*

    (a) Explain the following terms as applied to I.C. engines :

        (i)   Bore

        (ii) Stroke

        (iii) TDC

        (iv) Clearance volume

        (v) Swept volume

        (vi) Compression ratio

        (vii) Piston speed

    (b) An inventor claims that a new heat cycle will develop 0·4 kW for a heat addition of 32·5 kJ/min. The temperature of heat source is 1990 K and that of sink is 850 K. Is his claim possible ? Justify your answer.

    (c) The efficiency of an Otto cycle is 60% and $\gamma = 1·5$. What is the compression ratio ?

3. Answer any *two* of the following :   *2×7=14*

    (a) What do you mean by stoichiometric air-fuel ratio ? Enumerate the methods by which air-fuel ratio can be calculated when analysis of combustion products is known.

(b) The volumetric analysis of a fuel gas is :
CO_2 = 14%, CO = 1%, O_2 = 5%, and N_2 = 80%.
Calculate the fuel gas composition by weight.

(c) With the help of a neat sketch, explain the working principle of a simple carburettor.

4. Answer any *two* of the following : 2×7=14

(a) What are the various desired properties of a lubricant ? Explain how additives help to achieve the desired properties.

(b) Why is cooling necessary for I.C. engines ? What kind of cooling system is employed in automobile vehicles ? Explain any one of them with a neat diagram.

(c) Describe with a neat sketch the construction and working principle of a single-stage single-acting reciprocating air compressor.

5. Write short notes on any *four* of the following : $4×3\frac{1}{2}=14$

(a) Open cycle gas turbine

(b) Super charger

(c) Oil filters

(d) Knocking

(e) Battery ignition system

(f) Nozzle