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BIME-023

DIPLOMA - VIEP- MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

00986

June, 2016

BIME-023 : ENGINEERING THERMODYNAMICS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt **five** questions in all. Question no. **1** is **compulsory**. All questions carry equal marks. Scientific calculator is allowed. Assume missing data, if any. Use of steam table is permitted.*

1. Answer the following questions by choosing the best one out of the four given options : *7×2=14*

(a) In S.I. units, the value of the universal gas constant is

(i) 0·8314 J/mol/K

(ii) 8·314 J/mol/K

(iii) 8314 J/mol/K

(iv) 83·14 J/mol/K

(b) Kelvin Planck's law deals with

(i) conservation of energy

(ii) conservation of heat

(iii) conservation of mass

(iv) conversion of heat into work

(c) Entropy may be expressed as a function of

(i) Pressure and Temperature

(ii) Temperature and Volume

(iii) Heat and Work

(iv) All of the above

(d) The specific volume of water, when heated at 0°C

(i) first increases then decreases

(ii) first decreases then increases

(iii) increases steadily

(iv) decreases steadily

(e) For same compression ratio

(i) thermal efficiency of Otto cycle is greater than that of diesel cycle.

(ii) thermal efficiency of Otto cycle is lesser than that of diesel cycle.

(iii) thermal efficiency of Otto cycle is equal to that of diesel cycle.

(iv) thermal efficiency of Otto cycle cannot be predicted.

(f) Petrol commercially available in India for Indian passenger cars has octane number in the range

(i) 40 – 50

(ii) 60 – 70

(iii) 80 – 85

(iv) 95 – 100

(g) Gibbs function is expressed as

(i) (U + pV – TS)

(ii) (U + pV – TdS)

(iii) (U + pdV – TdS)

(iv) (U + pV – SdT)

2. (a) What is thermodynamic system ? Differentiate between open system, closed system and isolated system, with examples. *8*

(b) A tube contains an oil of specific gravity 0·9 to a depth of 120 cm. Find the gauge pressure at this depth in kN/m^2. *6*

3. (a) Explain the first law of thermodynamics, as referred to a closed system, undergoing a cyclic change. *6*

(b) In an air motor cylinder, the compressed air has an internal energy of 450 kJ/kg at the beginning of the expansion and an internal energy of 220 kJ/kg after expansion. If the work done by the air during the expansion is 120 kJ/kg, calculate the heat flow to and from the cylinder. *8*

4. (a) Give the following statements of the second law of thermodynamics : *6*

(i) Clausius Statement

(ii) Kelvin-Planck Statement

(b) The coefficient of performance of a refrigerator operating on a reversed Carnot cycle is 5·6, when it maintains the temperature in the evaporator as $-4°C$. Determine the condenser temperature and refrigerating effect of the refrigerator, if the power required to run the refrigerator is 4·125 kW. *8*

5. (a) Define the term availability. Also explain the concept of available and unavailable energy. What are the availability functions of flow and non-flow processes ? *6*

(b) How is the analysis of the products of combustion done ? Also discuss the methods to determine the composition of flue gases. *8*

6. (a) Explain Mollier diagram in brief. Also discuss its use. *8*

(b) What amount of heat should be required to produce 4·4 kg of steam at a pressure of 6 kgf/cm^2 absolute and a temperature of 210°C from water at 30°C ? Take C_v for superheated steam as 0·5. *6*

7. (a) What is air standard cycle ? Also discuss the assumptions made on air standard cycles. *6*

(b) Make a comparison between Carnot cycle and Rankine cycle. Also, drawing both the cycles on PV and TS diagram, discuss which one is more efficient. *8*