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BME-019

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) / BTMEVI

00403 **Term-End Examination**

June, 2018

BME-019 : ENGINEERING THERMODYNAMICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. All questions carry equal marks. Use of calculator, steam table and Mollier chart is permitted.*

1. (a) Explain the macroscopic and microscopic point of view with the help of example. 5

(b) What is meant by Thermodynamic Equilibrium ? 5

2. A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle, the sum of all heat transfer is – 170 kJ. The system completes 100 cycles per minute. Complete the following table showing the method for each item, and calculate the net rate of work output in kW. *10*

Process	Q(kJ/min)	W(kJ/min)	ΔE(kJ/min)
a – b	0	2,170	–
b – c	21,000	0	–
c – d	– 2,100	–	– 36,600
d – a	–	–	–

3. Using an engine of 30% efficiency to drive a refrigerator having a COP of 5, what is the heat input into the engine for each MJ removed from the cold body by the refrigerator ?

   If this system is used as a heat pump, how many MJ of heat would be available for heating each MJ of heat input to the engine ? *10*

4. There identical finite bodies of constant heat capacity are at temperatures 300, 300 and 100 K. If no work or heat is supplied from outside, what is the highest temperature to which any one of the bodies can be raised by the operation of heat engines or refrigerators ? *10*

5. (a) Show that the entropy is a property of a system. 5

(b) Establish the equivalence of Kelvin–Planck and Clausius statements of the second law of thermodynamics. 5

6. (a) Explain the difference between point and path function with the help of suitable examples. 5

(b) Find the enthalpy, entropy and volume of steam at 1·4 MPa, 380°C. 5

7. Steam at 20 bar, 360°C is expanded in a steam turbine to 0·08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. (i) Assuming ideal processes, find per kg of steam, the net work and the cycle efficiency. (ii) If the turbine and the pump each have 80% efficiency, find the percentage reduction in the net work and cycle efficiency. 10

8. (a) What are the different types of compressors used in vapour compression plants and what are their applications ? 5

(b) What is a tonne of refrigeration ? Explain the effect of superheat and subcooling on the vapour compression cycle ? 5

9. Write short notes on any ***four*** of the following : $4 \times 2\frac{1}{2} = 10$

(a) Heat Pump

(b) Refrigerator

(c) Carnot Cycle

(d) Different Forms of Energy

(e) Heat Engine