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	VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS) DEPARTMENT OF MECHANICAL ENGINEERING **B.E. II/IV - MECHANICAL (SECTION – A)** **I – SEMESTER, 2016-17**	**A**
8TH OCT, 2016	**ME 2020 :: THERMODYNAMICS** **ASSIGNMENT - 2 (UNIT :: III)**	**Due Date** **15TH OCT, 16**

1 Draw the schematic diagrams of (i) heat engine (ii) heat pump and (iii) refrigerator.

2 What is *perpetual motion machine of second kind*?

3 Prove that *Kelvin Planck* and *Clausius* statements of second law of thermodynamics are equivalent.

4 State and prove (a) Clausius theorem, (b) Clausius inequality.

5 Define Helmholtz and Gibbs functions.

6 State *Carnot's Theorem*.

7 Show that heat transfer through a finite temperature difference is irreversible.

8 Why II-law thermodynamics is called the *law of degradation of energy*? Explain.

9 State the principle of *increase of entropy*.

10 Represent *constant pressure* and *constant volume* processes, for an ideal gas, on *T-S* co-ordinates. Which curve has greater slope and why?

11 Prove that two reversible adiabatics never cross each other.

12 Show that entropy is a property of a system.

13 (a) *One kg* of water at *273 K* is brought into contact with a reservoir at *373 K*. Find the *entropy change* of the *water*, of the *heat reservoir* and of the *universe* at the thermal equilibrium condition.
(b) If the above heating of water is done by first bringing it in contact with a thermal reservoir at *323 K* and then with a reservoir at *373 K*, what will be the *entropy change* of the *universe*?
(c) Explain how water might be heated from *273 K* to *373 K* with almost no change in the entropy of the universe.

14 A reversible heat engine as shown in Fig. 6-8 below, during a cycle of operations draws *5 MJ* from the *400 K* reservoir and does *840 kJ* of work. Find the *amount* and *direction* of *heat interaction* with other reservoirs.

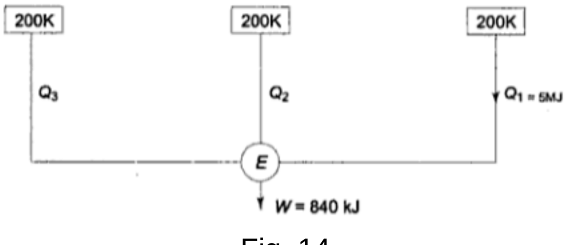

Fig. 14

15 Three identical finite bodies of constant heat capacity are at temperatures 300 K, 100 K, and 300 K. If no work and 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?

16 A reversible heat engine draws *200 J* of energy from a reservoir at the normal boiling point of water and rejects heat to the reservoir at the triple point of water. Determine (i) the *efficiency* of the heat engine, (ii) *work output*, and (iii) the *heat rejected* to the lower temperature reservoir.

17 Two identical finite bodies of *constant heat capacity* are at temperatures T_1 and T_2 $(T_1 > T_2)$. Prove that the *maximum possible work* derived from the two given finite bodies is $\boldsymbol{W_{max} = C_p (\sqrt{T_1} - \sqrt{T_2})^2}$.

18. Two identical finite bodies of constant heat capacity are at the same initial temperature T_i. A refrigerator operates between these two bodies until one body is cooled to a desired temperature T_2. If the bodies remain at constant pressure and do not undergo any phase change, show that the *minimum work* needed to do this is $\boldsymbol{W_{min} = C_p \{(T_i^2/T_2) + T_2 - 2T_i\}}$.

19. Write a *brief summary* of the article on *Entropy* in your own words. (1 mark)