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B TECH
(SEM-III) THEORY EXAMINATION 2020-21
THERMODYNAMICS

Time: 3 Hours ***Total Marks: 70***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a.	Define thermodynamics.
b.	What is Zeroth law of thermodynamics?
c.	Explain PMM-1 and PMM-2.
d.	What is an entropy?
e.	What do you understand by high grade energy and low-grade energy?
f.	What do you understand by triple point?
g.	What is ton of refrigeration?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a.	A mass of gas is compressed in a quasi-static process from 80 kpa, 0.1 m3 to 0.4 Mpa, 0.03 m3. Assuming that the pressure and volume are related by pv^n = constant, find the work done by the gas system.
b.	A domestic refrigerator is loaded with food and the door closed. During a certain period, the machine consumed 1 kWh of energy and the internal energy of the system drops by 5000 kJ. Find the net heat transfer for the system.
c.	In a certain process, a vapor, while condensing at 420°C, transfers heat to water evaporating at 250°C. The resulting steam is used in a power cycle which rejects heat at 35°C. What is the fraction of the available energy in the heat transferred from the process vapor at 420°C that is lost due to the irreversible heat transfer at 250°C?
d.	Explain simple Rankine cycle with neat schematic diagram and show different processes involved in it on T-S diagram and P-V diagram.
e.	Explain vapor compression cycle with neat schematic diagram and show different processes involved in it on P-V diagram and T-S diagram.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Define and explain steady flow energy equation. A blower handles 1 kg/s of air at 20°C and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic air conditions. Take Cp of air is 1.005 kJ/kg-K.
(b)	Write short notes on the following: (i) first law of thermodynamic, (ii) macroscopic and microscopic viewpoints (iii) Concept of continuum.

4. Attempt any *one* part of the following: 7 x 1 = 7

(a)	One kg of water is heated from 273 K to 373 K by first bringing it in contact with a reservoir at 323 K and then with a reservoir at 373 K, what will the entropy change of the universe be?
(b)	What are limitations of the first law of thermodynamics? Discuss the statements of the second law of thermodynamics. Also prove that the violation of the Kelvin–Planck statement leads to the violation of the Clausius statement.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Derive Maxwell's equations. What are Helmholtz function and Gibbs function?
(b)	Discuss the Clapeyron equation and explain the Joule-Kelvin effect with help of inversion curve and inversion temperature.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a)	Define the following terms: (i)wet bulb temperature; (ii) sensible heating; (iii) dew point temperature.
(b)	Explain the Rankine cycle with the help of neat sketch, P-V and T-S diagram. If 5 kg of water at 45°C is heated at a constant pressure of 10 bar until it becomes superheated vapor at 300°C. Find the change in volume, enthalpy, internal energy, and entropy.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a)	State the functions of the following parts of a simple vapor compression system: (i) Compressor; (ii) Condenser; (iii) Expansion valve, and (iv) Evaporator.
(b)	Explain vapor absorption refrigeration system with neat sketch.