Code No: **R201254** **R20** **SET - 1**

I B. Tech II Semester Regular/Supplementary Examinations, July/August - 2023
THERMODYNAMICS

(Only Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

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UNIT-I

1 a) Show that heat is a path function and not a property. [7M]

b) What are different forms of work energy? Explain each briefly. [7M]

(OR)

2 a) Distinguish between closed and open systems by giving practical examples. [7M]

b) A new scale N of temperature is divided in such a way that the freezing point of ice is 100^0N and the boiling point is 400^0N. What is the temperature reading on this new scale when the temperature is 150^0C? At what temperature both the Celsius and the new scale reading would be the same? [7M]

UNIT-II

3 a) State the limitations of the First law of thermodynamics. [5M]

b) 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 transfers is -170kJ. The system completes 100cycles/minute. Complete the following table showing the method for each item and compute net rate of work output in kW. [9M]

Process	Q(kJ/min)	W(kJ/min)	ΔE(kJ/min)
a-b	0	2170	----
b-c	21000	0	----
c-d	-2100	----	-36600
d-a	----	----	----

(OR)

4 a) Derive the expression for work done in isothermal process. [7M]

b) A domestic refrigerator is loaded with food and the door closed. During a certain period the machine consumes 1 KW-hour of energy and the internal energy of the system drops by 5000 KJ. Find the net heat transfer for the system. [7M]

UNIT-III

5 a) Briefly discuss about reversibility and irreversibility concepts. [5M]

b) A reversible heat engine operates between two reservoirs at temperature of 600^0C and 40^0C. The engine drives a reversible refrigerator which operates between reservoirs at temperature of 40^0C and -20^0C. The heat transfer to the heat engine is 2000 kJ and the net work output of the combined engine refrigerator plant is 360 kJ. Evaluate the heat transfer to the refrigerant and the net heat transfer to the reservoir at 40^0C. [9M]

(OR)

6 a) Show that the COP of heat pump is greater than COP of refrigerator by unity. [7M]

b) 2 kg of water at 80^0C is mixed adiabatically with 3 kg of water at 30^0C in a constant pressure process of 1 atmosphere. Find the increase in entropy at the total mass of water due to the mixing process. Take Cp of water has 4.187 kJ/kgK. [7M]
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UNIT-IV

7 a) Discuss about triple point, critical temperature and critical pressure. [7M]

b) In a separating and throttling calorimeter the pressure of the steam before throttling is 10bar. The pressure and temperature of steam after throttling is 1.1 bar and 110^0C respectively. At the separator 0.6 kgs of water is trapped and 3.4 kgs of condensed water is collected from the condenser. Determine the dryness fraction of steam in the main pipeline. Take Cp for superheated steam 2.1 kJ/kg k. [7M]

(OR)

8 a) Write the clapeyron equation and point out its utility. [7M]

b) Steam initially at 0.3 MPa, 250^0C is cooled at constant volume. [7M]

i) At what temperature will steam become superheated vapour?

ii) What is the quality of steam at 80^0C?

iii) What is the heat transferred per kg of steam in cooling from 250^0C to 80^0C.

UNIT-V

9 a) Derive Vanderwaals state equation. [7M]

b) An air-water vapor mixture at 0.1 MPa, 30^0C, 80% relative humidity has a volume of 50 m^3. Calculate Specific humidity, Dew point, WBT, mass of dry air and mass of water vapor. [7M]

(OR)

10 a) A certain gas has Cp=1.968 and Cv=1.507kJ/kg K. Find its molecular weight and the gas constant. [7M]

b) Moist air at 1 atm. pressure has a dry bulb temperature of 32^0C and a wet bulb temperature of 26^0C. Calculate i) the partial pressure of water vapor, ii) humidity ratio, iii) relative humidity, iv) dew point temperature, v) density of dry air in the mixture, vi) density of water vapor in the mixture and vii) enthalpy of moist air using perfect gas law model and psychrometric equations. [7M]

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