PAPER ID-311578 Roll No:

BTECH
(SEM III) THEORY EXAMINATION 2023-24
THERMODYNAMICS

TIME: 3HRS M.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

Q no.	Question	Marks	CO
a.	Define System, Surrounding, Boundaries and Universe.	2	1
b.	Explain Zeroth law of thermodynamics with its application.	2	1
c.	Differentiate between work and heat.	2	2
d.	Explain about PMM-1.	2	2
e.	Differentiate between Reversible and irreversible processes.	2	3
f.	Explain Available and unavailable energy.	2	4
g.	Explain triple point with diagram.	2	5

SECTION B

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

Q no.	Question	Marks	CO
a.	A temperature scale of certain thermometer is given by the relation $t = a \ln p + b$ where a and b are constants and p is the thermometric property of the fluid in the thermometer. If at the ice point and steam point the thermometric properties are found to be 1.5 and 7.5 respectively what will be the temperature corresponding to the thermometric property of 3.5 on Celsius scale.	7	1
b.	Explain First Law for closed system. Also derive Work and Heat Transfer relation in adiabatic process.	7	2
c.	Derive the entropy change of pure substance in adiabatic processes.	7	3
d.	Define the co-efficient of : (i) Volume expansion (ii) Isothermal compressibility (iii) Adiabatic compressibility	7	4
e.	Explain the method of measurement of dryness fraction.	7	5

SECTION C

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

Q no	Question	Marks	CO
a	Explain Macroscopic and Microscopic viewpoints of thermodynamics also explain Concept of Continuum.	7	1
b	Steam at a 6 87 bar, 205°C, enters in an insulated nozzle with a velocity of 50 m/s It leaves at a pressure of 1.37 bar and a velocity of 500 m/s. Determine the final enthalpy of steam.	7	1

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

Q no.	Question	Marks	CO
a.	0.2 m^3 of air at 4 bar and 130°C is contained in a system. A reversible adiabatic expansion takes place till the pressure falls to 1.02 bar. The gas is then heated at constant pressure till enthalpy increases by 72.5 kJ. Calculate the work done. Take cp = 1 kJ/kg K, cv = 0.714 kJ/kg K.	7	2
b.	Derive Steady Flow Energy Equation and apply it to throttling device and pump.	7	2

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

Q no.	Question	Marks	CO
a.	State Kelvin Planck and Clausius statements of second law of thermodynamics and justify equivalence of the two statements.	7	2
b.	A fish freezing plant requires 40 tons of refrigeration. The freezing temperature is –35°C while the ambient temperature is 30°C. If the performance of the plant is 20% of the theoretical reversed Carnot cycle working within the same temperature limits, calculate the power required.	7	2

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

Q no.	Question	Marks	CO
a.	Explain Helmholtz & Gibb's function in detail.	7	4
b.	1 kg of ice at 0°C is mixed with 12 kg of water at 27°C. Assuming the surrounding temperature as 15°C, calculate the net increase in entropy and unavailable energy when the system reaches common temperature : Given : Specific heat of water = 4.18 kJ/kg K ; specific heat of ice = 2.1 kJ/kg K and enthalpy of fusion of ice (latent heat) = 333.5 kJ/kg.	7	4

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

Q no.	Question	Marks	CO
a.	Write notes on following terms related to water/steam: 1. Dryness fraction and its relation 2. Sub cooled liquid and its enthalpy 3. Superheated steam and its enthalpy	7	5
b.	Explain simple Rankine cycle and derive its efficiency relation.	7	5