

Hall Ticket Number:

--	--	--	--	--	--	--	--	--	--

R23

KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR
23ME28 PC305

II.B. Tech. I. Semester Regular Examinations, Dec. 2024/Jan. 2025

THERMODYNAMICS
(MECHANICAL ENGINEERING)

Time: 3 Hours

Max.Marks:60

Note: Question paper consists of Part-A & Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- Part A** is compulsory, consists of 10 sub questions from all units carrying equal marks.
- Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.
- Steam Tables are allowed**

PART-A		(10Marks)	
Q.No	Questions	Marks	BTL
1.a)	Define Quasi – Static Process.	1	1
1.b)	Define Specific Heat and Internal Energy.	1	1
1.c)	What is heat pump? How it is differ from a Refrigerator.	1	1
1.d)	State the Kelvin – Planck & Clausius Statements of Second law of Thermodynamics.	1	1
1.e)	Derive Relation between Specific heats and Characteristic gas constant for a Perfect gas.	1	3
1.f)	Define equation of state.	1	1
1.g)	Write a short note on Vanderwaal's equation.	1	1
1.h)	Explain briefly Gibb's Dalton law of partial pressures.	1	2
1.i)	What is Mean Effective Pressure.	1	1
1.j)	Define Swept Volume and Thermal Efficiency.	1	1
PART-B		(50Marks)	
Q.No.	Questions	Marks	BTL
2. a)	State the operating Principle of Constant Volume Gas Thermometer. Explain its Working.	5M	2
b)	Define system. Explain different types of systems with suitable examples.	5M	2
OR			
3. a)	A New Scale N of Temp is divided in such a way that the Freezing point of ice is 100°N and the Boiling Point is 400°N. What is the temperature reading on this New Scale when the Temperature is 150°C? At What Temperature both the Celsius and the new Temperature scale reading would be same?	5M	4
b)	Distinguish between Macroscopic & Microscopic point of view.	5M	2
4. a)	Air at 100 kPa and 280 K is compressed steady to 600 kPa and 400 K. The mass flow rate of air is 0.02 kg/s and heat losses of 16 kJ/kg Occurs during the process. Assuming the changes in Potential Energy and Kinetic Energies are Negligible. Determine the necessary power input to the compressor.	5M	4

b)	Prove that the Kelvin Planck and Clausius's statements of the second law of thermodynamics are equivalent to each other.	5M	3
OR			
5.	2 kg of water at 50°C is mixed with 3 kg of water at 100°C in a steady flow process. Calculate the temperature of resulting mixture, state whether the mixing is isentropic. If not, what is the entropy change and unavailable energy with respect to surrounding at 50°C.	10M	4
6. a)	Derive Clausius Clapeyron Equation.	5M	3
b)	Steam Initially at a pressure of 15 bar and 0.95 Dryness expands isentropically to 7.5 bar and is then throttled until it is just dry. Determine per kg of steam: Change in entropy, change in Enthalpy, and change in Internal Energy using steam tables.	5M	4
OR			
7.	Dry Saturated steam at 100 bar expands isothermally and reversibly to a pressure of 10 bar. Calculate per kg of steam. i) The Heat Supply ii) The Work done.	10M	4
8. a)	A Mixture consists of 60% Nitrogen and 40% Carbon dioxide by mass. If the mixture is compressed from 2 bar, 5°C to 5 bar, 170°C. What is the entropy change of the mixture?	5M	4
b)	The Gravimetric Analysis of air is 23.14% oxygen, 75.53% Nitrogen, 1.28% Argon and 0.05% Carbon dioxide. Calculate the volumetric analysis and the partial pressure of each constituent in the mixture, when the total pressure is 1 bar.	5M	4
OR			
9.	Using the following terms DBT=30°C, WBT=28°C, barometric pressure=760mm of Hg. Determine Partial pressure of water vapour, Dew point temperature, Specific humidity, Relative humidity, Enthalpy of moist air.	10M	4
10	Explain the Diesel cycle with a neat P-V and T-S diagram and derive the Thermal Efficiency of Equation.	10M	2
OR			
11.	An Engine working on Otto cycle has a total volume of 0.45 m ³ , pressure 1 bar and temperature 27°C at the beginning of the compression stroke. At the end of the compression stroke, the pressure is 11 bar, and 210 kJ of heat is added at constant volume. Calculate (a) The Pressure, Temperature and Volume at the salient points in the cycle (b) Percentage Clearance Volume (c) Net work done per cycle.	10M	4

—ooOoo—