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KAMALA INSTITUTE OF TECHNOLOGY & SCIENCE, SINGAPUR
23ME28PC305

II.B. Tech. I. Semester Supplementary Examinations, June-2025

THERMODYNAMICS

(ME)

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**.

PART-A		(10Marks)	
Q. No	Questions	Marks	BTL
1.a)	What is meant by closed system? Give an example.	1	1
1.b)	What is zeroth law of thermodynamics?	1	1
1.c)	Define PMM – I.	1	1
1.d)	Mention the COP of Heat Pump.	1	1
1.e)	Define Triple point.	1	1
1.f)	Define Universal gas constant.	1	1
1.g)	Define mole fraction.	1	1
1.h)	Define DBT.	1	1
1.i)	Draw the Basic Otto cycle.	1	1
1.j)	What are the four basic processes of OTTO cycle?	1	1
PART-B		(50Marks)	
Q.No.	Questions	Marks	BTL
2. a)	Define the terms. (i) System (ii) Boundary (iii) Surroundings (iv) Cycle	5M	2
b)	A piston-cylinder device operates 1 kg of fluid at 20 atm. Pressure. The initial volume is 0.04 m ³ . The fluid is allowed to expand reversibly following a process $pV^{1.4} = \text{constant}$ so that the volume becomes double. The fluid is then cooled at a constant pressure until the piston comes back to the original position. Keeping the piston unaltered, heat is added reversibly to restore it to the initial pressure. Calculate the work done in the cycle.	5M	4
OR			
3. a)	Distinguish between reversible process and irreversible process.	5M	2
b)	A stationary mass of gas is compressed without friction from an initial state of 0.3 m ³ and 0.105 MPa to final state of 0.15 m ³ and 0.105 MPa, the pressure remaining constant during the process. There is a transfer of 37.6 kJ of heat from the gas	5M	4

	during the process. How much does the internal energy of the gas change?		
4. a)	State Kelvin-Planck and Clausius statements.	5M	2
b)	Steam enters a turbine at steady state with a mass flow rate of 4600 kg/h. The turbine develops a power output of 1000 kW. At the inlet the pressure is 0.05 MPa, the Temperature is 400 °C, and the velocity is 10 m/s. At the exit, the pressure is 10 kPa, the quality is 0.9, and the velocity is 50 m/s. Calculate the rate of heat transfer between the turbine and surroundings, in kW.	5M	3
OR			
5. a)	A heat engine receives heat at the rate of 1500 kJ/min and gives an output of 8.2 kW. Determine i) The thermal efficiency ii) the rate of heat rejection.	5M	3
b)	Discuss the significance of Gibbs and Helmholtz functions.	5M	2
6. a)	Write short notes on “Mollier diagram”. Why do isobars on the Mollier diagram diverge from one another?	5M	2
b)	A sealed tank contains 5 kg of water at 100°C. The tank is heated until the pressure inside the tank is 10 bar. Determine the final temperature and specific volume of the water.	5M	4
OR			
7. a)	Explain the free expansion process.	5M	2
b)	A pressure cooker holding 2 kg of steam at 5 bar and 90% dry is being cooled slowly. What quantity of heat has to be extracted so as to reduce the steam quality down to 60%? Also calculate the pressure and temperature of the steam that remains in the pressure cooker after the heat rejection.	5M	4
8. a)	Explain the concept of Gravimetric and volumetric Analysis	5M	3
b)	State Dalton’s law of additive pressures.	5M	3
OR			
9. a)	What do you understand by dry bulb temperature and wet bulb temperatures? When do the DBT, WBT and DPT become equal?	5M	3
b)	What is a Psychrometric chart and what is the use of this chart?	5M	3
10.a)	Derive an expression for thermal efficiency of brayton cycle.	5M	3
b)	For an air standard Brayton cycle, having air intake as 1 bar and 323 K, maximum temperature is 823K and pressure ratio is 6 and heat addition at constant pressure. Determine the thermal efficiency of the cycle.	5M	4
OR			
11.a)	An Otto cycle has a compression ratio of 6. The air-fuel mixture is compressed from 1.5 bar and 37°C. The heat added during the constant volume process is 1200 kJ/kg. Calculate: (i) The temperature and pressure after heat addition (ii) The net work output per cycle	10M	4