

Code: 23ES1302

II B.Tech - I Semester – Supplementary Examinations - MAY 2025**THERMODYNAMICS
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.

2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.

3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.

4. All parts of Question paper must be answered in one place.

PART – A

1.a)	State difference between open system and closed system.
1.b)	What are the types of thermodynamics systems?
1.c)	What is a point function and path function?
1.d)	State the First Law of Thermodynamics.
1.e)	Why is the Principle of Maximum Mechanism (PMM-II) a violation of the Second Law of Thermodynamics?
1.f)	State the Clausius Inequality.
1.g)	What does the P-V-T surface represent for a pure substance?
1.h)	Define the critical point in thermodynamics.
1.i)	Why is the Dual Combustion cycle considered a combination of the Otto and Diesel cycles?
1.j)	What is the working principle of an Air Refrigeration system?

PART – B

					Max. Marks
UNIT-I					
2	a)	Distinguish between terms Change of state, path, and process?	5 M		
	b)	A gas Contained in a piston cylinder arrangement expands flow 0.75 m ³ volume to 1.20 m ³ volume until the pressure remains constant at 200 kpa if the gases system receives 80 kJ of work from a paddle Wheel, determine net work done by the system.	5 M		
OR					
3	a)	What do you understand by macroscopic and microscopic viewpoints?	4 M		
	b)	A mass of 1.5 kg of air is compressed in a quasi-static process from 0.1 MPa to 0.7 MPa for which pv = constant. The initial density of air is 1.16 kg/m ³ . Find the work done by the piston to compress the air.	6 M		
UNIT-II					
4	State the Zeroeth Law of Thermodynamics and explain its significance in defining temperature. How does this law enable the establishment of thermometric scales?				10 M
OR					
5	a)	Describe the operation of a heat engine. Explain its basic components and how it converts heat energy into work.			5 M

	b)	A heat engine operates between 600K and 300K and absorbs 1500kJ of heat from the high-temperature reservoir. Calculate the work done by the engine and its thermal efficiency.	5 M
UNIT-III			
6		Explain the Second Law of Thermodynamics and discuss the Kelvin-Planck and Clausius statements. How are these statements equivalent? Provide a detailed explanation with examples.	10 M
OR			
7		A Carnot engine operates between two temperatures: $T_{\text{hot}} = 800 \text{ K}$, and $T_{\text{cold}} = 400\text{K}$. If the engine absorbs 1000kJ of heat from the hot reservoir, calculate: (i) The thermal efficiency of the Carnot engine. (ii) The amount of work done by the engine. (iii) The heat rejected to the cold reservoir. Explain the special features of the Carnot cycle in terms of its efficiency.	10 M
UNIT-IV			
8	a)	Describe the purpose and construction of a T-S diagram and an h-s diagram for a pure substance. How are these diagrams used to analyze thermodynamic processes?	5 M
	b)	A vessel of volume 0.04m^3 contains a mixture of saturated water steam at a temperature of 250°C . The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume and enthalpy.	5 M
OR			

9	A steam generator operates with steam at a pressure of 1.5 MPa and a temperature of 250°C. Using the Mollier chart, determine the following: i) The specific enthalpy (h) of the steam. ii) The specific entropy (s) of the steam. iii) State whether the steam is in the superheated region or saturated region.		10 M
UNIT-V			
10	a)	Briefly describe the otto cycle with PV and TS diagrams.	5 M
	b)	A gas engine working on otto cycle has a cylinder diameter of 180 mm and a stroke of 320 mm, the clearance is 0.0022 m ³ . Find the air standard efficiency for the engine.	5 M
OR			
11	Discuss the psychrometric properties of air in detail, including dry bulb temperature, wet bulb temperature, humidity, and enthalpy.		10 M