PRESIDENCY UNIVERSITY

BENGALURU

Make Up Examinations – December 2025

Date: 26 – 12- 2025   **Time:** 1.00pm to 04.00pm

School: SOE	**Program:** B.Tech	
Course Code : MEC4001	**Course Name :** Basic Thermodynamics	
Semester: MK	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	24	24	26	26	–

Instructions:
> *(i) Read all questions carefully and answer accordingly.*
> *(ii) Do not write anything on the question paper other than roll number.*

Part A

Answer ALL the Questions. Each question carries 2marks.   **10Q x 2M=20M**

1	Define reversible heat engine.	2 Marks	L1	CO1
2	Define a real gas	2 Marks	L1	CO1
3	What is entropy? Define properly.	2 Marks	L1	CO2
4	Give the value of triple point pressure and temperature for water?	2 Marks	L1	CO2
5	State Kelvin Plank Statement of 2nd Law of thermodynamics.	2 Marks	L1	CO3
6	What is heat? Explain.	2 Marks	L1	CO3
7	What is unavailable available energy?	2 Marks	L1	CO3
8	Define Pure substance.	2 Marks	L1	CO4
9	What is triple point? Explain.	2 Marks	L1	CO4
10	Define Ideal Gas.	2 Marks	L1	CO4

Part B

Answer ALL Questions. Each question carries 20 marks.				4QX20M=80M	

11.	a.	Differentiate between Macroscopic and Microscopic approaches.	08 Marks	L2	CO1
	b.	The readings t_A and t_B of two Celsius Thermometers A and B agree at the ice point (0^oC) and steam point (100°), but elsewhere they are related by the equation, $t_A = l + m\, t_B + n\, t_B^2$ where, l, m and n are constants. When both the thermometers are immersed in a well stirred bath, A registers 55^oC whereas B registers 52^oC. (a) Determine the reading on B when A registers 34^oC and (b) which thermometer is correct?	12 Marks	L3	CO1

or

12.	a.	Explain thermodynamic equilibrium.	08 Marks	L2	CO1
	b.	The e.m.f. in a thermocouple with the test junction at t^oC on the gas thermometric scale and reference junction at ice point is given by $\varepsilon = 0.22\, t - 6 \times 10^{-4}\, t^2$ mV. The mili-volt meter is calibrated at the ice and steam points. What will be the thermocouple read in a place where the gas thermometer reads 60^oC?	12 Marks	L3	CO1

13.	a.	Show that heat is a path function.	08 Marks	L2	CO2
	b.	Consider the expansion of air inside a cylinder as shown in figure below. The initial volume is 0.035 m^3 and the initial pressure is 10 MPa. If the air undergoes quasi-static process, according to the law, $pV^{1.3}$ = constant to a final volume of 0.23 m^3, determine (i) total work done by air, and (ii) amount of work done against the spring. Assume atmospheric pressure to be 101.325 kPa.	12 Marks	L3	CO2

or

14.	a.	What is work? List the different types of work and explain any two.	08 Marks	L2	CO2
	b.	One kg of a fluid is flowing steadily in a rotary device in which 25 kJ of heat is transferred out of the device. The fluid properties at the entry are, 6 bar, 227degC, 52 m/s and 0.77 cubic meters /kg.	12 Marks	L3	CO2

		The corresponding properties at the exit are, 1 bar, 56degC, 100 m/s and 0.96 cubic meters /kg. If the inlet manifold is 5.1 m above the exit manifold, find the work output in kJ/kg. Take internal energy as a function of temperature only and Cv = 0.72 kJ/kg K.			

15.	a.	Explain the Principle of increase of Entropy of the Universe.	08 Marks	L2	CO3
	b.	The COP of a heat pump is 6 and the power required to drive it is 36 kW. (a) Evaluate the heat transfers from and to the working fluid. (b) the heat transfer from the heat pump is used to heat the water circulating the radiators of a building. Determine the mass flow rate of water required, if its temperature increases by 22° C.	12 Marks	L3	CO3

Or

16.	a.	State and prove 2nd law of thermodynamics with violation of any one statement.	08 Marks	L2	CO3
	b.	A heat engine operating in a cycle receives heat from a high temperature heat reservoir T_H and rejects heat to a low temperature heat reservoir, T_L. Determine whether the engine is reversible, irreversible or impossible for the following cases if T_H =1100 K and T_L = 250 K: i) Heat received by engine = 1000 J and work output = 800 J ii) ii) Heat received by engine = 1800 J and heat rejected by engine = 320 J iii) Work out put = 900 J and heat rejected by the engine = 500 J	12 Marks	L3	CO3

17.	a.	What are the different properties available on the steam table? Explain.	08 Marks	L2	CO4
	b.	8 kg of water at 2.1 bar and 35ºC is heated at constant pressure until its temperature reaches 280ºC. Determine the changes in volume, enthalpy, internal energy and entropy. Also determine the heat transfer for the process.	12 Marks	L3	CO4

Or

18.	a.	With the help of T-h diagram, explain the formation of steam at constant temperature.	08 Marks	L2	CO4
	b.	A rigid vessel of volume 0.85 m³ contains 1 kg of steam at a pressure of 3 bar. Evaluate the specific volume, temperature, dryness fraction, internal energy, enthalpy and entropy of steam. The above vessel is heated to raise its temperature to 250°C. Show the process on p-v diagram and evaluate the final pressure, change in enthalpy, change in entropy and the heat transfer for the process. Also evaluate the pressure at which steam becomes dry saturated	12 Marks	L3	CO4

***** BEST WISHES *****