R20 Regulation *Subject code: 3P3CD*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech III Semester Supplementary Examinations, February 2024

THERMODYNAMICS

(MECH)

Maximum Marks: 70 Date: 23.02.2024 Duration: 3 hours

Note: **1. This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10X2M=20 Marks)		CO	Bloom Tx
1	Define Intensive and Extensive properties.	CO1	L2
2	State Zeroth law of thermodynamics.	CO1	L2
3	Differentiate Availability and Irreversibility	CO2	L2
4	What is a Gibbs function?	CO2	L1
5	Write a short note free expansion process.	CO3	L1
6	What do you mean by phase change.	CO3	L1
7	What is Avogadro's Law?	CO4	L1
8	What is mole fraction?	CO4	L1
9	Define mean effective pressure.	CO5	L2
10	Draw p-v and T-s diagrams of Atkinson Cycle	CO5	L2

Part-B

Answer All the following questions. (5X10M=50Marks)				
11	(a) What do you understand by path function and point function? What are exact and inexact differentials?	5M	CO1	L2
	(b) Explain what you understand by thermodynamic equilibrium.	5M		L3
	OR			
12	What is constant volume gas thermometer? Why is it preferred to a constant pressure gas thermometer?	10M	CO1	L1
13	State the first law of thermodynamics and write the first law equation	10M	CO2	L3
	OR			
14	(a) State and Prove Clausius Inequality.	5M	CO2	L3
	(b) The work output and heat input involved by a system in process A are 20 kJ and 15 kJ respectively. Another process B between the same end conditions involves a heat input of 10 kJ. Determine the change in internal energy involved and also the work done in process B. Show that if a cycle is formed using processed using processes A and B, the given data is consistent with the first law.	5M		

15	(a) Draw the phase equilibrium for a pure substance on h-s and T-s plot with relevant constant property lines. (b) What do you understand by triple point? Give the pressure and temperature of water at its triple point.	5M 5M	CO3	L2 L1
	OR			
16	(a) What is a throttling process? Explain. (b) A nozzle is a device for increasing the velocity of a steadily flowing steam. At inlet to a certain nozzle, the fluid parameters are: enthalpy=2850kJ/kg; velocity=50 m/s ; area=0.1 m^2 and specific volume is 0.18 m^3/kg. At the discharge end the enthalpy is 2650 kJ/kg and the specific volume is 0.49 m^3/kg. Determine the velocity of fluid at exit from the nozzle, mass flow rate of fluid, and the exit area of the nozzle. The nozzle is horizontal and there is negligible heat loss from it	5M 5M	CO3	L1 L3
17	A mass of 0.25 kg of an ideal gas have a pressure of 300 kPa, a temperature of 80°C, and a volume of 0.07m3. The gas undergoes an irreversible adiabatic process to a final pressure of 300 kPa and final volume of 0.10 m^3, during which the work done on the gas is 25 kJ. Evaluate the C_p and C_v of the gas and the increase in entropy of the gas	10M	CO4	L3
	OR			
18	(a) How is the partial pressure in a gas mixture related to the mole fraction? (b) A stationary mass of gas is compressed without friction from an initial state of 0.3m^3 and 0.105 MPa to a 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 during the process. How much does the internal energy of the gas change.	5M 5M	CO4	L1 L3
19	Compare Otto, and Diesel cycles with P-V and T-S plots.	10M	CO5	L3
	OR			
20	An engine working on the Otto Cycle is supplied with air at 0.1 MPa, 35°C. The compression ratio is 8. Heat supplied is 2100 KJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and the mean effective pressure. For air (c_p= 1.005kJ/kg K c_v=0.718kJ/kg K and R= 0.287 kJ/kgK.	10M	CO5	L3