Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU

School of Engineering

Mid - Term Examinations - November 2024

Semester: III | **Date**: 06-11-2024

Course Code: PET2009 | **Time**: 11:45am to 01:15pm

Course Name: Thermodynamics of Reservoir Fluids | **Max Marks**: 50

Program: B. Tech | **Weightage**: 25%

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 2 marks. **5Qx2M =10M**

1	Define Reversible process and Irreversible process.	**2 Marks**	**L1**	**CO1**
2	Define thermodynamics system and list the types of system.	**2 Marks**	**L1**	**CO1**
3	Define Entropy.	**2 Marks**	**L1**	**CO1**
4	List the equation of Gibbs function and Helmholtz Function.	**2 Marks**	**L1**	**CO2**
5	Reproduce the expression of second law efficiency for engine and pump.	**2 Marks**	**L1**	**CO2**

Part B

Answer ALL Questions. Each question carries 10 marks. **4QX10M=40M**

6		The laws of thermodynamics are fundamental principles that govern the behaviour of energy and matter in physical systems. Explain in detail about the Zeroth, First and Second law of thermodynamics.	**10 Marks**	**L2**	**CO1**
		or			
7		With proper explanation, explain the fact that the Internal energy is a point function.	**10 Marks**	**L2**	**CO1**
8	**8a**	The heat engine exemplifies the practical application of thermodynamic laws, converting heat into useful work, which is fundamental in power generation, internal combustion engines,	**5 Marks**	**L5**	**CO1**

	and various industrial applications. Its operation hinges on the efficient management of energy transfer and entropy. A cyclic heat engine operates between a source temperature of 800°C and a sink temperature of 30°C. evaluate the heat rejection per kW net output of the engine.			
8b	The refrigerator is a practical application of thermodynamic principles, playing a vital role in everyday life by using work to control heat flow and maintain lower temperatures in a confined space A domestic food freezer maintains a temperature of -15°C (minus 15). The ambient air temperature is 30°C. If heat leaks into the freezer at the continuous rate of 1075kJ/s. evaluate the least power necessary to pump this heat put continuously.	**5 Marks**	**L5**	**CO1**
	or			
9	A certain process follows the relationship PV = constant. Interpret the process and obtain the relationship for work. A piston cylinder device initially contains 0.4m^3 of air at 100kPa and 80°C.The air is now compressed to 0.1 m^3 in a such a way that the temperature inside the cylinder remains constant. Determine the work done during this process.	**10 Marks**	**L2**	**CO1**
10	A reversible heat engine operates between two reservoirs at temperatures of 600°Cand 40°C.The engine drives a reversible refrigerator which operates between reservoirs at temperature of 40°C and -20°C(minus 20). The heat transfer to the heat engine is 2000kJ and the net work output of the combined engine refrigerator is 360kJ. Solve for the heat transfer to the refrigerant and net heat transfer to the reservoir at 40°C	**10 Marks**	**L3**	**CO1**
	or			
11	The refrigerating effect is a fundamental parameter in the design, operation, and optimization of refrigeration and air conditioning systems. It provides valuable information for assessing system performance, ensuring energy efficiency, and addressing economic and environmental considerations. You have been assigned to estimate the cooling effect of a combined heat engine and refrigerator so that overall cooling can be done for the following situation. A reversible heat engine operates between 600°Cand 40°C.This engine derives a reversible refrigerator operating between 40°Cand -18°C(minus 18°C), still there is a network output of 370KJ while the heat received by the engine is 2100KJ. Estimate the cooling effect of the refrigerator.	**10 Marks**	**L5**	**CO1**

12 Demonstrate the steps of viscosity determination of Natural gas by Carl-Kobayashi-Burrows method at high temperature and normal pressure with expressions **10 Marks** **L3** **CO1**

or

13 Determination of various properties of gas is one of most important tasks for successful application of thermodynamic concepts. You have been assigned to a gas whose composition is known to you and you have been told to evaluate the apparent molecular weight, specific gravity of the gas**.** **10 Marks** **L5** **CO1**

Compound	**yi**	**Mwi**
C_1	0.775	16.04
C_2	0.083	30.07
C_3	0.021	44.1
i-C_4	0.006	58.12
n-C_4	0.002	58.12
i-C_5	0.003	72.15
n-C_5	0.008	72.12
C_6	0.001	86.18
C_{7+}	0.001	114.23
N_2	0.05	28.02
CO_2	0.03	44.01
H_2S	0.02	34.08