Vellore – 632014, Tamil Nadu, India

SCHOOL OF MECHANICAL ENGINEERING

FALL SEMESTER 2023-2024

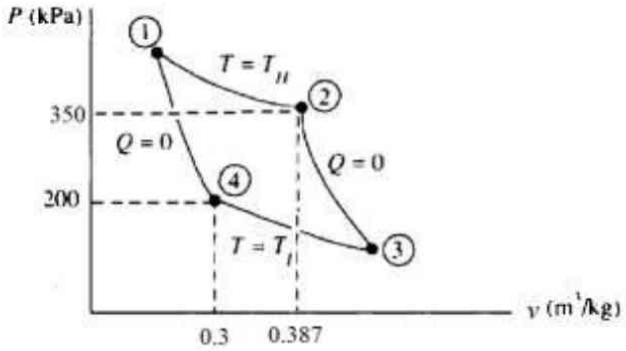
SLOT: D1+TD1

CONTINUOUS ASSESSMENT TEST – II

Programme Name & Branch	: B.Tech- Automotive, Mechanical, Manufacturing Engineering
Course Code	: BMEE203L
Course Name	: Engineering Thermodynamics
Class Number(s)	: VL2023240101709, VL2023240101879, VL2023240101707, VL2023240101706, VL2023240101708, VL2023240101017
Faculty Members	: Dr. Edison G, Dr. Porpatham E, Dr. M.Senthil Kumar, Dr. Immanuel Selwynraj A, Dr. Tapano Kumar hotta, P .Senthilkumar
Date of Examination	: 18.10.2023
Duration	: 90 minutes Max. Marks: 5 x 10=50

General instruction(s): **1.** ***Assume suitable data, if required,***
2. Steam Tables, Mollier chart and ph chart are permitted

Answer ALL the Questions

Q. No	Question	Marks
1 a.	Determine the thermal efficiency of the Carnot cycle shown in Fig.1. Assume the working fluid is air.  Fig. 1 **[5]**	10
1 b.	In a reversible isothermal process, heat transfer is equal to work transfer. Is this statement agreeying with or violates Kelvin Planck statement of second law of thermodynamics? Explain **[3]**	
1 c.	Is it possible to maintain a pressure of 10 kPa in a condenser that is being cooled by river water entering at 20°C? Explain **[2]**	
2	A reversible heat engine is supplied with 3000 kJ/cycle of heat from a reservoir at 1500°C and the engine rejects heat to a common sink. The work output from the engine is used to drive a reversible refrigerator. The refrigerator absorbs	10

	heat from a reservoir at 25°C and deliver heat to the same common sink. If the total heat transfer into the common sink is 8000 kJ/cycle, (i) Calculate the efficiency of the heat engine (ii) Calculate the COP of the refrigerator	
3	A metal cube at a temperature of 673 K is dropped into an insulated bath containing 10 kg of water at 298 K. The water finally reaches a temperature of 323 K at steady state. Determine (a) the entropy change of the metal cube (b) the entropy change of water (c) Comment on the process with reasons (reversible or irreversible)	10
4	In a thermal power plant, steam at a temperature of 600°C and entropy of 7.019 kJ/kgK delivered from the boiler. The steam is supplied to the turbine without pressure losses. Assume isentropic expansion in the steam turbine. The pressure maintained in the condenser is 20 kPa. At the end of condensation water is saturated. Neglect the pressure losses in the condenser and pump work. (a) Draw the cycle either in T-s, h-s or p-h coordinates **[2]** (b) What is the boiler pressure? **[2]** (c) Calculate the heat supplied in the boiler **[2]** (d) Calculate the work transfer in the turbine **[2]** (e) Determine the condition of the steam at end of expansion in the turbine. If it is wet steam, mention the dryness fraction **[2]**	10
5	Refer to the problem no.4, (f) Determine the Carnot efficiency **[2]** (g) Determine the actual efficiency of the cycle **[2]** (h) Verify the first law of thermodynamics **[2]** (i) Verify the Clausius inequality **[2]** (j) Calculate the amount of heat rejected in the condenser if the cycle is reversible **[2]**	10