CBCS SCHEME

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BAE401

Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Aero Engineering Thermodynamics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following : i) Microscopic and Macroscopic approaches. ii) Zeroth Law of Thermodynamics. iii) Point and path functions. iv) Intensive and Extensive properties. v) Open system and closed system.	10	L1	CO1
	b.	The temperature 'T' on a thermometric scale is defined as $T = a\ell nK + b$. where a and b are constants. The values of 'K' are found to be 1.83 and 6.78 at 0°C and 100°C respectively. Calculate the temperature for a value of K = 2.42.	10	L2	CO1
		OR			
Q.2	a.	Define Work and Heat, also list the similarities and dissimilarities between work and heat.	10	L1	CO1
	b.	Starting from a convenient common state point on a p – v diagram. Show four expansion processes for n = 0 , n = 1 , n = γ and n = ∞. What are the processes called and also write the work done during these processes.	10	L2	CO1
		Module – 2			
Q.3	a.	State First Law of thermodynamics for a closed system undergoing a cyclic process and also outline in detail Joules experiment.	10	L2	CO2
	b.	With the relevant assumptions, derive an expression for Steady Flow Energy Equation (SFEE) for an open system.	10	L3	CO2
		OR			
Q.4	a.	Discuss PMMI and show Energy is a property of the system.	10	L2	CO2
	b.	Develop for an closed system $Q_{1-2} = \frac{\gamma - n}{\gamma - 1} W_{1-2}$.	10	L3	CO2
		Module – 3			
Q.5	a.	State Kelvin Plank's statement of Second Law of Thermodynamics. Show the violation of Kelvin Plank's statement leads to violation of Clausius statement.	10	L2	CO2
	b.	A reversible heat engine operates with two Environments. In the First it draws 1200kW from a source at 400°C and in the second it draws 2500kW a source at 100°C. In both the operations the engine rejects heat to a thermal sink at 20°C. Determine the operation in which the engine delivers more power.	10	L4	CO2

		OR			
Q.6	**a.**	Define Entropy and show Entropy is a property of the system.	**10**	**L2**	**CO3**
	b.	A 30kg of steel ball at 427°C is dropped in 150kg of oil at 27°C. The specific heats of oil and steel are 2.5kJ/kg – K and 0.5kJ/kg – K respectively. Estimate the entropy change of steel, oil and that of the system containing steel and oil.	**10**	**L4**	**CO3**
		Module – 4			
Q.7	**a.**	Sketch and explain P – T diagram of water.	**10**	**L2**	**CO3**
	b.	A vessel contains 10kg of Oxygen , 8kg of Nitrogen and 25kg of CO_2 at 375 K temperature and 250 Kpa pressure. Calculate the capacity of the vessel and the partial pressure of each gas present in the vessel, when the temperature is raised to 460K.	**10**	**L4**	**CO3**
		OR			
Q.8	**a.**	Derive and explain Maxwell's equation.	**10**	**L2**	**CO3**
	b.	Determine the pressure exerted by the CO_2 in a container of $1.5m^3$ capacity when it contains 5kg at 27°C. i) Using ideal gas ii) Using Vander Waal's equation.	**10**	**L4**	**CO3**
		Module – 5			
Q.9	**a.**	With the help of p-v and T-S diagram, derive an expression for the air standard efficiency of a petrol engine (Otto cycle).	**10**	**L3**	**CO4**
	b.	The compression ratio of a diesel cycle is 14 and cut off ratio is 2.2. At the beginning of the cycle air is at 0.98 bar and 100°C. Find i) Temperature and pressure at salient points ii) Air standard efficiency.	**10**	**L4**	**CO4**
		OR			
Q.10	**a.**	With the help of T – S diagram, deduce the expression for Rankine cycle efficiency.	**10**	**L3**	**CO4**
	b.	A steam power plant operating on Rankine cycle gets steam at 40 bar dry saturated. Ager doing work steam is exhausted at 0.30 bar. If the steam flow rate is 60kg/sec determine i) Pump work ii) Turbine work iii) Cycle efficiency.	**10**	**L4**	**CO4**

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