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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

April 2024 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 23AS3ESTDN **Max Marks: 100**
Course: Thermodynamics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.
3. Use of Thermodynamics steam data handbook is permitted to use

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Compare (i) Open and Closed system (ii) Microscopic and Macroscopic approaches (iii) Intensive and Extensive properties (iv) Cyclic and Non-cyclic processes	*CO 1*	*PO 1* *PO2*	**08**
	b)	Derive an expression for work done during Isentropic process and show the process on PV diagram	*CO 1*	*PO 1* *PO 2*	**06**
	c)	The e.m.f. in a thermocouple with the test junction at t°C on gas thermometer scale and reference junction at ice point is given by $e = 0.20\ t - 5 \times 10^{-4}\ t^2$ mV The millivoltmeter is calibrated at ice and steam points. What will this thermometer read in a place where the gas thermometer reads 50°C?	*CO 1*	*PO 1* *PO 2*	**06**
		UNIT - II			
2	a)	Explain the first law of thermodynamics for a closed system undergoing a cyclic process.	*CO 2*	*PO 3*	**08**
	b)	Prove that Total Energy, E a property of a system.	*CO 2*	*PO 3*	**06**
	c)	A turbine, operating under steady-flow conditions, receives 4500 kg of steam per hour. The steam enters the turbine at a velocity of 2800 m/min, an elevation of 5.5 m and a specific enthalpy of 2800 kJ/kg. It leaves the turbine at a velocity of 5600 m/min, an elevation of 1.5 m and a specific enthalpy of 2300 kJ/kg. Heat losses from the turbine to the surroundings amount to 16000 kJ/h.	*CO 2*	*PO 3*	**06**
		UNIT - III			
3	a)	Explain Clausius and Kelvin – Planck statements of the second law of thermodynamics.	*CO 2*	*PO 3*	**10**
	b)	Discuss Carnot corollaries.	*CO 2*	*PO 3*	**04**

		c)	A cyclic heat engine operates between a source temperature of 1000°C and a sink temperature of 40°C. Evaluate the least rate of heat rejection per kW net output of the engine.	*CO 2*	*PO 3*	**06**
			OR			
	4	a)	Explain Clausius inequality.	*CO 2*	*PO 3*	**08**
		b)	Discuss Available and unavailable energy.	*CO 2*	*PO 3*	**06**
		c)	A fluid undergoes a reversible adiabatic compression from 0.5 MPa, 0.2 m^3 to 0.05 m^3 according to the law. $PV^{1.3}$ = constant. Determine the change in enthalpy, internal energy and entropy and the heat transfer and work transfer during the process.	*CO 2*	*PO 3*	**06**
			UNIT - IV			
	5	a)	Explain (i) Ideal and Real gases (ii) Compressibility chart	*CO 1*	*PO 2*	**08**
		b)	Explain (i) Law of corresponding states (ii) Dalton's Law of partial pressure	*CO 1*	*PO 2*	**06**
		c)	One kg of CO_2 has a volume of 1 m^3 at 100°C. Compute the pressure by (i) Van der Waals' equation (ii) Perfect gas equation.	*CO 3*	*PO 1*	**06**
			OR			
	6	a)	Explain Sub-cooled liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapor states of pure substances.	*CO 1*	*PO 2*	**08**
		b)	Explain P-T diagram for a pure substance.	*CO 1*	*PO 2*	**06**
		c)	What amount of heat would be required to produce 4.4 kg of steam at a pressure of 6 bar and temperature of 250°C from water at 30°C ? Take specific heat for superheated steam as 2.2 kJ/kg K	*CO 3*	*PO 1*	**06**
			UNIT - V			
	7	a)	Derive an expression for air standard efficiency of Diesel cycle in terms of compression ratio, cutoff ratio and ratio of specific heats.	*CO 4*	*PO 1* *PO2*	**08**
		b)	Describe the working operations of Rankine cycle. Draw the T-S diagram.	*CO 4*	*PO 1* *PO 2*	**06**
		c)	An engine of 250 mm bore and 375 mm stroke works on Otto cycle. The clearance volume is 0.00263 m^3. The initial pressure and temperature are 1 bar and 50°C. If the maximum pressure is limited to 25 bar, Solve for the following: (i) The air standard efficiency of the cycle. (ii) The mean effective pressure for the cycle. Assume the ideal conditions.	*CO 4*	*PO 1* *PO 2*	**06**

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