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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: Industrial Engineering and Management **Duration: 3 hrs.**
Course Code: 19IM3DCEES **Max Marks: 100**
Course: Elements of Energy Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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.

			CO	PO	Marks
		UNIT - I			
1	a)	Explain the following basic terms: i) Open System ii) Closed System iii) Isolated System iv) Control Volume v) Boundary Wall	*CO2*	*PO1*	**10**
	b)	A thermocouple with test junction at t deg. C on a Gas thermometer scale, and reference junction at ice point, has an emf given by $e = 0.20t - 5 \times 10^{-4} t^2$ mV. The multi voltmeter is calibrated at ice and steam points. What will this thermometer read when gas thermometer reads 55 deg. C?.	*CO3*	*PO2*	**10**
		UNIT - II			
2	a)	Obtain the S.F.E.E. for an Air Compressor. Clearly state all assumptions made	*CO2*	*PO1*	**10**
	b)	At the inlet to a certain nozzle the enthalpy of fluid passing is 2800 kJ/kg, and the velocity is 50 m/s. At the discharge end the enthalpy is 2600 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. (i) Find the velocity at exit of the nozzle. (ii) If the inlet area is 900 cm2 and the specific volume at inlet is 0.187 m3/kg, find the mass flow rate. (iii) If the specific volume at the nozzle exit is 0.498 m3/kg, find the exit area of nozzle	*CO2*	*PO2*	**10**
		UNIT - III			
3	a)	A reversible heat engine operates between 700 deg. C and 50 deg. C. The engine drives a reversible refrigerator operating between reservoirs at temperatures between 50 deg. C and -25 deg. C. Heat transfer to the engine is 2500 KJ and net work output of combined engine refrigeration plant is 400 KJ. i) Determine Heat transfer to the refrigerant and heat transfer to the reservoir at 50 deg. C ii) recalculate , if efficiency of Heat Engine and COP of Refrigerator are each 45 % of maximum possible values.	*CO3*	*PO2*	**10**

		b)	A food factory uses 40 tons of refrigeration. Freezing temperature is -35 deg. C, while ambient temperature is 30 deg. C. If performance of plant is 20 % of theoretical reversed Carnot Cycle with same temperature limits, calculate the power required. Take 1 ton = 210 Kj/min.	*CO3*	*PO2*	**10**
			OR			
	4	a)	Derive the equation for an Air Standard Otto Cycle, with usual notations.	*CO2*	*PO2*	**10**
		b)	In an Air Standard diesel cycle, compression ratio is 16, and at the beginning of isentropic compression, temperature is 15 deg. C and pressure is 0.1 MPa. Heat is added till temperature at the end of constant pressure process is 1480 deg. C. Calculate i) Cut-off ratio ii) Cycle efficiency iii) m.e.p.	*CO3*	*PO2*	**10**
			UNIT - IV			
	5	a)	Derive Bernoulli's Equation of motion from Euler's equations. State the assumptions made clearly.	*CO2*	*PO2*	**10**
		b)	A 30 cm X 15 cm diameter venturimeter is provided in a vertical pipe carrying oil of sp.gr. Of 0.9 and the flow being upwards. The difference in elevation of throat section and entrance section of the venturimeter is 30 cm. The differential manometer shows a mercury gauge deflection of 25 cm. Calculate i) the discharge of oil and ii) the pressure difference between the entrance and throat sections. Take Cd as 0.98.	*CO3*	*PO2*	**10**
			OR			
	6	a)	Derive the equation for Venturimeter flow rate.	*CO2*	*PO2*	**10**
		b)	Water is flowing through a pipe having diameters of 200 mm and 100 mm at section 1 and at section 2 respectively. The rate of flow through the pipe is 35 litres /s. The section 1 is 6 m above the datum and section 2 is 4 m above the datum. i) Draw a neat labeled diagram of the section ii) If the pressure at the section 1 is 39.24 N/cm^2 , find the intensity of pressure at section 2.	*CO3*	*PO2*	**10**
			UNIT - V			
	7	a)	Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s using i) Darcy's Equation ii) Chezy's Formula. Take C = 60 and ν =0.01 stoke for water.	*CO3*	*PO2*	**10**
		b)	Estimate the loss of head when a pipe of diameter 200 mm is suddenly enlarged to 400 mm. The rate of flow of water through the pipe is 250 litres /second.	*CO3*	*PO2*	**10**

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