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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: III**

Branch: Industrial Engineering and Management **Duration: 3 hrs.**

Course Code: 23IM3ESEPS **Max Marks: 100**

Course: Elements of Power 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.

			UNIT - I	*CO*	*PO*	Marks
1	a)		What is meant by "thermodynamic system"? Explain the various types of systems from a thermodynamics perspective.	CO1	PO1	**10**
	b)		A thermocouple with test junction at "t" ^{0}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 50 ^{0} C?	CO1	PO2	**10**
			OR			
2	a)		Explain the difference between a microscopic and macroscopic approach in thermodynamics. Give an example where each approach is used.	CO1	PO1	**10**
	b)		State the Zeroth Law of Thermodynamics and explain its significance.	CO1	PO1	**10**
			UNIT - II			
3	a)		Derive the Steady Flow Energy Equation for a Steam Turbine. All assumptions made must be clearly stated.	CO2	PO1	**10**
	b)		At the inlet of a 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 sq. cm and the specific volume at inlet is 0.187 m^3/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**
			OR			

	4	a)	Define heat and work in thermodynamics. How do they differ in terms of path dependency?	CO2	PO1	**10**
		b)	State the First Law of Thermodynamics and explain its application to a closed system undergoing a cycle.	CO2	PO2	**10**
			UNIT - III			
	5	a)	Derive the equation for an Air Standard Otto Cycle, with usual notations.	CO2	PO1	**10**
		b)	A reversible heat engine operates between 700 ^{0} C and 50^0 C. The engine drives a reversible refrigerator operating between reservoirs at temperatures between 50^0 C and -25^0C. Heat transfer to the engine is 2500 KJ and network 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 i), if efficiency of Heat Engine and COP of Refrigerator are each 45 % of maximum possible values.	CO2	PO2	**10**
			OR			
	6	a)	A food factory uses 40 tons of refrigeration. Freezing temperature is -35^0 C, while ambient temperature is 30^0 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.	CO2	PO2	**10**
		b)	In an Air Standard diesel cycle, compression ratio is 16, and at the beginning of isentropic compression, temperature is 15^0C and pressure is 0.1 MPa. Heat is added till temperature at the end of constant pressure process is 1480^0C. Calculate i) Cut-off ratio ii) Cycle efficiency iii) m.e.p.	CO3	PO2	**10**
			UNIT - IV			
	7	a)	Determine the total pressure on a circular plate of 1.5 m dia. which is placed vertically in water in such a way that the center of the plate is 3 m below the free surface of water. Also, find the position of the center of pressure.	CO4	PO2	**10**
		b)	Find the volume of the water displaced and position of center of buoyancy for a wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally in water. The density of block is 650 kg/m^3 and length is 6 m.	CO4	PO2	**10**
			OR			
	8	a)	Derive the basic equation for fluid statics and explain how pressure varies in a static fluid.	CO4	PO2	**10**
		b)	Explain the concept of buoyancy and stability in fluids, and provide the condition for an object to float.	CO4	PO2	**10**
			UNIT - V			
	9	a)	Derive the equation for Venturimeter flow rate.	CO4	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.	CO4	PO2	**10**
			OR			
	10	a)	Derive Bernoulli's Equation of motion from Euler's equations. State the assumptions made clearly.	CO4	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) the discharge of oil and ii) the pressure difference between the entrance and throat sections. Take Cd as 0.98.	CO4	PO2	**10**

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