U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary 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)	Define property of a system. Distinguish between extensive and intensive properties of a system.	CO1	PO1	**06**
	b)	A thermometer is calibrated at '0' degree mark with boiling point of carbon tetrachloride and 100 degree mark with melting of lead. When used to measure temperature of a system, the device indicates 16 degrees. Carbon tetrachloride boils at 76.75°C and lead melts at 327°C. Convert reading of device to the equivalent reading on Celsius scale.	CO1	PO1	**08**
	c)	Obtain an expression for displacement adiabatic work.	CO1	PO1	**06**
		UNIT - II			
2	a)	Precisely state the 1st law of thermodynamics for a closed system undergoing cyclic process and prove that internal energy is property.	CO2	PO2	**10**
	b)	A steam turbine operating under steady flow conditions receives steam at a steady rate of 0.5 kg/s. Conditions of steam at turbine inlet are: specific enthalpy h_1=2800 kJ/kg, velocity C_1=30m/s, elevation Z_1=4 m. The conditions at the turbine outlet are specific enthalpy h_2=2380 kJ/kg, velocity C_2 = 105 m/s and elevation z_2 = 1 m. Heat loss to the surroundings is 0.4 kJ/s. using steady flow energy equation, determine power out of the turbine in kW.	CO2	PO2	**10**
		UNIT - III			
3	a)	Define the two statement of II law of thermodynamics. Show that violation of Clausius statement of second law thermodynamics violates the Kelvin-Plank statement of II law of thermodynamics.	CO2	PO2	**10**
	b)	A Carnot engine receives heat at 750 K and rejects the waste heat to the environment at 300 K. The entire output of the heat engine is used to drive a Carnot refrigerator that removes heat from the cooled space at -15°C at a rate of 400 kJ/min and rejects to the same environment at 300 K. Determine i) the rate of heat	CO2	PO2	**10**

			supplied to the heat engine ii) the total rate of heat rejection to the environment.			
			OR			
	4	a)	Draw PV and Ts diagrams for Otto cycle and derive an expression for its thermal efficiency.	*CO3*	*PO2*	**10**
		b)	In a dual combustion cycle, the pressure and temperature at the start of compression are 1 bar and 27^{o}C respectively. The pressure at the end of the compression stroke is 30 bar and the maximum pressure is limited to 60 bar. Heat added at constant volume is equal to the heat added at constant pressure. Determine the net work output per kg of air and the thermal efficiency of the cycle.	*CO3*	*PO2*	**10**
			UNIT - IV			
	5	a)	Explain how you would find the resultant pressure on anp inclined surface immersed in a liquid.	*CO4*	*PO3*	**10**
		b)	Find the volume of the water displaced and position of centre of buoyancy for wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally in water. The density of wooden block is 650kg/m^3 and its length 6.0m.	*CO4*	*PO3*	**10**
			UNIT - V			
	6	a)	Derive Euler's equation of motion along a stream line for an ideal fluid stating clearly the assumptions.	*CO4*	*PO3*	**10**
		b)	The water is flowing through a pipe having diameter 20cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 liters/s. The section 1 is 6 m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2.	*CO4*	*PO3*	**10**
			OR			
	7	a)	What is venturimeter? Derive an expression for the discharge through a venturimeter.	*CO4*	*PO3*	**10**
		b)	Discuss the relative merits and demerits of orifice-meter with respective to venturimeter.	*CO4*	*PO3*	**03**
		c)	A pitot-tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100mm of mercury (vacuum). The stagnation pressure at the centre of pipe, recorded by the pitot-tube is 0.981 N/cm^2. Calculate the rate of flow of water through pipe, if the mean velocity of flow is 0.85 times the centre velocity. Take C_v = 0.98.	*CO4*	*PO3*	**07**

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