Code No: P21MET04

HALL TICKET NUMBER

PACE INSTITUTE OF TECHNOLOGY & SCIENCES::ONGOLE
(AUTONOMOUS)
II B.TECH I SEMESTER END SUPPLEMENTARY EXAMINATIONS, MARCH/APRIL - 2023
THERMODYNAMICS
(ME Branch)

Time: 3 hours Max. Marks: 70

Answer all the questions from each UNIT (5X14=70M)

Q.No.		Questions	Marks	CO	KL
		UNIT-I			
1.	a)	Define heat and work. Also prove of work is a path function with example.	[9M]	1	
	b)	Water is being heated in a closed pan on top of a range while being stirred by a paddle wheel. During the process, 30 kJ of heat is transferred to the water, and 5 kJ of heat is lost to the surrounding air. The paddle-wheel work amounts to 500 Nm. Determine the final energy of the system if its initial energy is 10 kJ.	[5M]	1	
		OR			
2.	a)	1.5 kg of the liquid having constant specific heat of 2.5 kJ/kgºC is stirred in a well insulated chamber causing the temperature to rise by 15ºC. find (i) Change in internal energy (ii) Work done for the process	[7M]	1	
	b)	Explain the First Law of Thermodynamics as referred to closed systems undergoing a cyclic change	[7M]	1	
		UNIT-II			
3.	a)	What do you mean by the term 'Entropy' and what are its characteristics?	[7M]	2	
	b)	A reversible heat engine operates between two reservoirs at temperatures 700°C and 50°C. The engine drives a reversible refrigerator which operates between reservoirs at temperatures of 50°C and – 25°C. The heat transfer to the engine is 2500 kJ and the net work output of the combined engine refrigerator plant is 400 kJ. (i) Determine the heat transfer to the refrigerant and the net heat transfer to the reservoir at 50°C ; (ii) Reconsider (i) given that the efficiency of the heat engine and the C.O.P. of the refrigerator are each 45 per cent of their maximum possible values.	[7M]	2	
		OR			
4.	a)	Enumerate the conditions which must be fulfilled by a reversible process. Give some examples of ideal reversible processes.	[7M]	2	
	b)	Air at 20°C and 1.05 bar occupies 0.025 m^3. The air is heated at constant volume until the pressure is 4.5 bar, and then cooled at constant pressure back to original temperature. Calculate : (i) The net heat flow from the air. (ii) The net entropy change. Sketch the process on T-s diagram	[7M]	2	
		UNIT-III			
5.	a)	Explain the following terms relating to steam formation : (i) Sensible heat of water, (ii) Latent heat of steam, (iii) Dryness fraction of steam, (iv) Enthalpy of wet steam	[7M]	3	
	b)	Find the internal energy of 1 kg of steam at 20 bar when (i) it is superheated, its temperature being 400°C ; (ii) it is wet, its dryness being 0.9. Assume superheated steam to behave as a perfect gas from the commencement of superheating and thus obeys Charle's law. Specific heat for steam = 2.3 kJ/kg K.	[7M]	3	

		OR			
6.	a)	Describe the different operations of Rankine cycle. Derive also the expression for its efficiency.	[7M]	3	
	b)	In a steam turbine steam at 20 bar, 360°C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes, find per kg of steam the net work and the cycle efficiency	[7M]	3	
		UNIT-IV			
7.	a)	Derive an expression for air standard efficiency of 'Atkinson cycle'.	[7M]	4	
	b)	Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 14 if the fuel cut-off is delayed from 5% to 8%.	[7M]	4	
		OR			
8.	a)	Derive the expression for mean effective pressure of Diesel cycle. Also represent it on a T-s and p-V diagrams.	[8M]	4	
	b)	For the same compression ratio and heat rejection which cycle is most efficient: Otto, Diesel or Dual? Explain with T-s and p-V diagrams.	[6M]	4	
		UNIT-V			
9.	a)	Explain the working of simple vapour compression refrigeration system with help of neat sketch. Also draw the p-h chart for the same.	[10M]	5	
	b)	Define the following terms: i. Specific humidity ii. Relative Humidity.	[4 M]	5	
		OR			
10.	a)	Discuss the effect of the following on the performance of a vapour compression system : (i) Effect of suction pressure (ii) Effect of delivery pressure (iii) Effect of superheating (iv) Effect of sub-cooling of liquid	[10M]	5	
	b)	What is the difference between 'Wet compression' and 'Dry compression'	[4M]	5	

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