SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: THERMODYNAMICS (23ME0303)

Course & Branch: B.Tech (ME) **Year & Sem: II & I** **Regulation: R23**

UNIT I

INTRODUCTION

1.	**a)**	Define System in thermodynamics.	**[L1][CO1]**	**[2M]**
	b)	What do you mean by Boundary.	**[L1][CO1]**	**[2M]**
	c)	Explain the term Surroundings.	**[L2][CO1]**	**[2M]**
	d)	Enumerate the term Universe.	**[L1][CO1]**	**[2M]**
	e)	Write short notes on control volume?	**[L3][CO1]**	**[2M]**
2.	**a)**	Differentiate between Macroscopic and Microscopic view points	**[L4][CO1]**	**[5M]**
	b)	Explain reversible process with an example	**[L2][CO1]**	**[5M]**
3.		Convert the following readings of pressure to kPa assuming that barometer Reads 760 mm of Hg. (i) 80 cm of Hg (ii) 30 cm Hg vacuum (iii) 1.35 m H_2O gauge (iv) 4.2 bar	**[L2][CO1]**	**[10M]**
4.		Discuss the types of system in detail with neat sketches.	**[L2][CO1]**	**[10M]**
5.	**a)**	Differentiate between reversible and irreversible process with examples.	**[L4][CO1]**	**[5M]**
	b)	What are the causes for irreversibility	**[L1][CO1]**	**[5M]**
6.		Write short notes on following terms in detail a)State b) Process c) Property d) Cycle	**[L3][CO1]**	**[10M]**
7.	**a)**	Distinguish between intensive and extensive property.	**[L4][CO1]**	**[5M]**
	b)	A vacuum recorded in the condenser of a steam power plant is 740 mm of Hg. Find the absolute pressure in the condenser in Pa. The barometric reading is 760 mm of Hg	**[L1][CO1]**	**[5M]**
8.		Elaborate thermodynamic equilibrium and its Types in detail	**[L2][CO1]**	**[10M]**
9.	**a)**	On a piston of 10 cm diameter a force of 1000 N is uniformly applied. Find the pressure on the piston	**[L1][CO1]**	**[5M]**
	b)	Comment whether the following quantities can be called as properties or not (i) PdV , (ii) Vdp ,and (iii) pdV + Vdp	**[L2][CO1]**	**[5M]**
10.		Explain quasi static process in detail with neat sketches.	**[L2][CO1]**	**[10M]**
11.	**a)**	Determine the work done by the air which enters into an evacuated vessel from atmosphere when the valve is opened. The atmospheric pressure is 1.013 bar and 1.5 m3 of air at atmospheric condition enters into the vessel	**[L4][CO1]**	**[5M]**
	b)	Write a short note on Irreversibility	**[L3][CO1]**	**[5M]**

1.	**a)**	Define the term work.	**[L1][CO2]**	**[2M]**
	b)	Enumerate the term heat.	**[L1][CO2]**	**[2M]**
	c)	What do you mean by Thermal reservoir?	**[L1][CO2]**	**[2M]**
	d)	Explain Enthalpy.	**[L2][CO2]**	**[2M]**
	e)	State PMM-1.	**[L1][CO2]**	**[2M]**
2.		Explain about Work and Heat transfer. And classify the work transfers.	**[L2][CO2]**	**[10M]**
3.		What do you understand by path function and point function and show that work is a path function and not a property.	**[L2][CO2]**	**[10M]**
4.		Write a short notes in detail with neat sketches a) zeroth law of thermodynamics b) First law of Thermodynamics.	**[L2][CO2]**	**[10M]**
5.		Elaborate Joule's Experiment in detail with neat sketch	**[L4][CO2]**	**[10M]**
6.		A piston and cylinder machine contains a fluid system which passes through a complete cycle of four processes. During a cycle the sum of all heat transfer is - 170 KJ and the system completes 100cycles/ minute Complete the following table showing the method for each item, and computes the net rate of work output in kW.	**[L2][CO2]**	**[10M]**

Process	Heat transfer in KJ/min	Work done in KJ/min	Change in internal energy KJ/min
a-b	0	2170	-
b-c	21,000	0	-
c-d	-2,100	-	-36,600
d-a	-	-	-

7.	**a)**	In an air motor cylinder the compressed air has an internal energy of 450 kJ/kg at the beginning of the expansion and an internal energy of 220 kJ/kg after expansion. If the work done by the air during the expansion is 120 kJ/kg, calculate the heat flow to and from the cylinder.	**[L3][CO2]**	**[5M]**
	b)	One kg of Air is heated from 20^0C to 105^0 C. Find the change of internal energy and change of enthalpy. Assume C_p=1.01 KJ/KgK and C_v=0.72 KJ/Kgk.	**[L1][CO2]**	**[5M]**
8.		To a closed system 150 kJ of work is supplied. If the initial volume is 0.6 m^3 and pressure of the system changes as p = 8 – 4V, where p is in bar and V is in m^3, Determine the final volume and pressure of the system.	**[L4][CO2]**	**[10M]**
9.	**a)**	An Iron casting of mass 10Kg has an original temperature of 200^0C. It is cooled to 50^0 C. Find the direction and magnitude of heat transfer. Assume Specific Heat of iron as 0.477KJ/Kg K.	**[L1][CO2]**	**[5M]**
	b)	List out the directions of Heat and work transfers in detail	**[L1][CO2]**	**[5M]**
10.	**a)**	The properties of a closed system change following the relation between pressure and volume as pV = 3.0 ,p is in bar V is in m^3. calculate the work done when the pressure increases from 1.5 bar to 7.5 bar.	**[L3][CO2]**	**[5M]**
	b)	Explain free expansion process in detail	**[L2][CO2]**	**[5M]**
11.	**a)**	In an internal combustion engine, during the compression stroke the heat rejected to the cooling water is 50 kJ/kg and the work input is 100 kJ/kg. Calculate the change in internal energy of the working fluid stating whether it is a gain or loss.	**[L3][CO2]**	**[5M]**
	b)	Differentiate between heat engine and heat pump.	**[L3][CO2]**	**[5M]**

UNIT - III

1.	**a)**	Explain second law of thermodynamics.	**[L2][CO3]**	**[2M]**
	b)	Write a short notes on Third law of thermodynamics.	**[L1][CO3]**	**[2M]**
	c)	Enumerate the term Entropy.	**[L1][CO3]**	**[2M]**
	d)	What is PMM-II?	**[L1][CO3]**	**[2M]**
	e)	Define available energy	**[L1][CO3]**	**[2M]**
2.		An iron cube at a temperature of 400°c is dropped into an insulated bath containing 10 kg water at 25^0c. The water finally reaches a temperature of 50^0c at steady state. Given that the specific heat of water is equal to 4186 J/kgK. Find the entropy changes for the iron cube and water.	**[L1][CO3]**	**[10M]**
3.		Define Statements of second law of thermodynamics i) Clausius statement. ii) Kelvin-plank statement.	**[L1][CO3]**	**[10M]**
4.		Explain in detail Clausius inequality statement in detail	**[L2][CO3]**	**[10M]**
5.		Develop an expression for Carnot Cycle and efficiency of cycle.	**[L6][CO3]**	**[10M]**
6.	**a)**	Derive an equation for Gibbs and Helmholtz functions.	**[L4][CO3]**	**[5M]**
	b)	Write the Maxwell relations.	**[L1][CO3]**	**[5M]**
7.		A Carnot operates source and sink temperatures 250°c and -15^0c. if the system receives 90KJ from the source Find i) Efficiency of the system ii) Network transfer iii) Heat rejected to sink	**[L1][CO3]**	**[10M]**
8.		A Carnot engine working between 400^0 C and 40^0 C produce 130 KJ of work. Determine i) The thermal efficiency. ii) the heat added iii) The entropy changes during the heat rejection process.	**[L4][CO3]**	**[10M]**
9.	a)	Two Carnot engines work in series between the source and sink temperatures of 550 K and 350 K. If both engines develop equal power determine the intermediate temperature	**[L4][CO3]**	**[5M]**
	b)	Enumerate the Unavailable energy in detail	**[L1][CO3]**	**[5M]**
10.		An ice plant working on a reversed Carnot cycle heat pump produces 15 tons of ice per day. The ice is formed from water at 0°C and the formed ice is maintained at0°C. The heat is rejected to the atmosphere at 25°C. The heat pump used to run the ice plant is coupled to a Carnot engine which absorbs heat from a source which is maintained at 220°C by burning liquid fuel of 44500 kJ/kg calorific value and rejects the heat to the atmosphere. Determine : (i) Power developed by the engine. (ii) Fuel consumed per hour. Take enthalpy of fusion of ice = 334.5 kJ/kg.	**[L4][CO3]**	**[10M]**
11.		0.04 m^3 of nitrogen contained in a cylinder behind a piston is initially at1.05 bar and 15°C. The gas is compressed isotherm ally and reversibly until the pressure is 4.8 bar. Calculate : i) The change of entropy, ii)The heat flow, and The work done. iii) Sketch the process on a p-v and T-s diagram. Assume nitrogen to act as a perfect gas. Molecular weight of nitrogen = 28	**[L3][CO3]**	**[10M]**

UNIT- IV

1.	**a)**	Define the term pure substance.	**[L1][CO4]**	**[2M]**
	b)	What do you mean by triple point?	**[L1][CO4]**	**[2M]**
	c)	Write a short notes on dryness fraction.	**[L1][CO4]**	**[2M]**
	d)	Enumerate about steam Calorimeter.	**[L1][CO4]**	**[2M]**
	e)	Explain Mollier chart?	**[L2][CO4]**	**[2M]**
2.		Find the specific volume, enthalpy and internal energy of wet steam at 18 bar, dryness fraction 0.85	**[L1][CO4]**	**[10M]**
3.		Build the phase equilibrium diagram for a pure substance P-V , P-T T-S plot with relevant constant property line.	**[L6][CO4]**	**[10M]**
4.		An insulated cylinder of volume capacity 4 m^3 contains 20 kg of nitrogen. Paddle work is done on the gas by stirring it till the pressure in the vessel gets increased from 4 bar to 8 bar. Determine : (i) Change in internal energy, (ii) Work done, (iii) Heat transferred, and (iv) Change in entropy. Take for nitrogen : C_p = 1.04 kJ/kg K, and C_v = 0.7432 kJ/kg K.	**[L4][CO4]**	**[10M]**
5.		Determine the amount of heat, which should be supplied to 2 kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry.	**[L4][CO4]**	**[10M]**
6.		A certain gas has c_p = 1.968 kJ/kg K, and c_v = 1.507 kJ/kg K. Find its molecular weight and gas constant. A constant volume chamber of 0.3m^3 capacity contains 2kg of this gas at 5^0C. Heat is transferred to the gas until the temperature is 100^0C. Find i) work done ii) Heat transferred iii) Change in Internal energy iv) Enthalpy and Entropy.	**[L1][CO4]**	**[10M]**
7.		Derive the Clausius- Clapeyron equation with neat sketch.	**[L4][CO4]**	**[10M]**
8.	**a)**	Calculate the dryness fraction (quality) of steam which has 1.5 kg of Water in suspension with 50 kg of steam.	**[L3][CO4]**	**[5M]**
	b)	Explain about Triple point in Phase diagram.	**[L2][CO4]**	**[5M]**
9.		Determine the amount of heat, which should be supplied to 2 kg of water at 25°C to convert it into steam at 5 bar and 0.9 dry.	**[L4][CO4]**	**[10M]**
10.		Steam enters an engine at a pressure 10 bar absolute and 400°C. It is exhausted at 0.2 bar. The steam at exhaust is 0.9 dry. Find : (i) Drop in enthalpy (ii) Change in entropy.	**[L1][CO4]**	**[10M]**
11.		A vessel having a capacity of 0.05 m^3 contains a mixture of saturated water and saturated steam at a temperature of 245°C. The mass of the liquid present is 10 kg. Find the following : (i) The pressure, (ii) The mass, (iii) The specific volume, (iv) The specific enthalpy (v) The specific entropy.	**[L1][CO4]**	**[10M]**

UNIT –V

1.	**a)**	What is meant by refrigeration?	**[L1][CO5]**	**[2M]**
	b)	Explain about air conditioning?	**[L2][CO5]**	**[2M]**
	c)	Define COP.	**[L1][CO5]**	**[2M]**
	d)	Enumerate about the term refrigerant.	**[L1][CO5]**	**[2M]**
	e)	Write short notes on psychometry.	**[L1][CO6]**	**[2M]**
2		Describe a simple Vapour compression cycle with the help of P-H and T-S diagram.	**[L2][CO5]**	**[10M]**
3	**a)**	Explain the types of refrigerant in brief with examples.	**[L1][CO5]**	**[5M]**
	b)	What are the factors that affect human comfort?	**[L1][CO5]**	**[5M]**
4		Derive an expression for C.O.P. for an air refrigeration system working on Bell Coleman cycle.	**[L4][CO5]**	**[10M]**
5		State the functions of the following parts of a simple Vapour compression system : (*i*) Compressor (*ii*) Condenser (*iii*) Expansion valve and (*iv*) Evaporator	**[L1][CO5]**	**[10M]**
6		A refrigerating system operates on the reversed Carnot cycle. The higher temperature of the refrigerant in the system is 35°C and the lower temperature is – 15°C. The capacity is to be 12 tones. Neglect all losses. Determine: i) Co-efficient of performance. ii) Heat rejected from the system per hour.(iii) Power required	**[L4][CO5]**	**[10M]**
7		Explain the psychometric properties in brief.	**[L2][CO5]**	**[10M]**
8		Describe any five psychometric processes with neat sketches.	**[L2][CO5]**	**[10M]**
9		200 m^3 of air per minute at 15ºC DBT and 75% R.H. is heated until its temperature is 25ºC. Find : i) R.H. of heated air ii)Wet bulb temperature of heated air. iii) Heat added to air per minute	**[L1][CO6]**	**[10M]**
10	**a)**	State the requirements of human comfort in brief	**[L1][CO6]**	**[5M]**
	b)	Define the following terms: a)sensible heat load b) latent heat load	**[L1][CO6]**	**[5M]**
11		Explain the desirable properties of refrigerant in detail.	**[L1][CO5]**	**[10M]**