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QUESTION BANK (DESCRIPTIVE)

Subject with Code : Refrigeration & Air Conditioning (16ME325)
Course & Branch: B.Tech –Agricultural Engineering
Year & Sem: IV-B.Tech & I-Sem **Regulation:** R16

UNIT –I
Introduction

1	a	Define the following terms. i).Refrigeration ii).Heat Engine	L1	C01	6M
	b	Explain the working of Bell-Coleman cycle air refrigeration with P-v and T-S diagrams.	L2	C02	6M
2	a	Define Unit of Refrigeration	L1	C01	5M
	b	Explain the working of a Reversed Carnot cycle of refrigeration with P-V and T-S Diagrams.	L5	C01	7M
3	a	Define C.O.P	L1	C03	5M
	b	With neat sketch Explain the working of Simple air refrigeration system	L2	C01	7M
4	a	What are the limitations of Carnot cycle of refrigeration	L1	C04	5M
	b	Describe Boot strap air refrigeration system, with a schematic diagram and show the cycle on T-S Diagram.	L1	C01	7M
5	a	State the applications of refrigeration	L3	C02	6M
	b	Explain, with a neat sketch the working principle of Regenerative Air refrigeration system.	L5	C05	6M
6	a	What is the Necessity of refrigeration	L1	C03	6M
	b	Describe with a neat sketch a Reduced ambient air refrigeration system	L1	C01	6M
7		In a refrigeration plant working on Bell Coleman cycle, air is compressed to 5 bar from 1 bar. Its initial temperature is 10 ˚ C. After compression, the air is cooled up to 20 ˚ C in a cooler before expanding to a pressure of 1 bar. Determine the theoretical C.O.P of the plant and net refrigerating effect. Take Cp = 1.005 KJ/Kg K and Cv = 0718 KJ/Kg K.	L5	C02	12M
8		A refrigerator working on Bell Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at 10 ˚ C, compressed and then it is cooled to 30 ˚ C before entering the expansion cylinder. The expansion and compression follows the law $PV^{1.3}$= constant. Determine the theoretical C.O.P of the system.	L5	C03	12M
9		An air refrigerator working on Bell Coleman cycle takes the air into the compressor at 1 bar and -7 ˚ C and is compressed isentropically to 5.5 bar and it is further cooled to 18˚ C at the same pressure. Find the C.O.P of the system if (a). The expression is isentropic (b). The expression follows the	L1	C01	12M

		law $PV^{1.25}$ = constant. Take $\gamma = 1.4$ and Cp = 1 KJ/Kg K.			
10		An air refrigerator used for food storage provides 50 tons of refrigeration. The temperature of air entering the compressor is 7 °C and the temperature before entering into expander is 27 °C .Assuming 30 % more power is required than theoretical, find (a).Actual C.O.P of the cycle (b).KW capacity required to run the compressor.	L1	C02	12M

UNIT –II
Vapour Compression Refrigeration System

1	a	What are the advantages of vapour compression refrigeration system over air refrigeration system?	L1	C03	6M
	b	With a neat sketch, explain the working principle of vapour compression refrigeration system.	L5	C01	6M
2	a	State the functions of expansion device.	L1	C02	6M
	b	Construct Pressure – Enthalpy (p-h) chart of Vapor compression cycle	L6	C01	6M
3		The temperature limits of an ammonia refrigerating system are 25°C and -10 °C. If the gas is dry at the end of compression, calculate the coefficient of performance of the cycle assuming no under cooling of the liquid ammonia. Use the following table for properties of ammonia.	L5	C04	12M

Temperature °C	Liquid Heat (Kj / kg)	Latent Heat (Kj / kg)	Liquid Entropy (Kj / kg K)
25	298.9	1166.94	1.1242
-10	135.37	1297.68	0.5443

4		A Vapour compression refrigerator works between the pressure limits of 60 bar and 25 bar. The working fluid is just dry at the end of compression and there is no under cooling of the liquid before the expansion valve. Determine (i). C.O.P of the cycle (ii). Capacity of the refrigerator if the fluid flow is at the rate of 5 kg/min.	L5	C01	12M

Pressure (Bar)	Temperature °C	Enthalpy (kj / kg)		Entropy (Kj / kg K)	
		Liquid	Vapour	Liquid	Vapour
60	295	151.96	293.29	0.554	1.0332
25	261	56.32	322.58	0.226	1.2464

5		28 tonnes ice from and at 0 °C is produced per day in an ammonia refrigerator. The temperature range in the compressor is from 25°C to -15 °C .The vapour is dry and saturated at the end of compression and an expansion valve is used. There is no liquid sub cooling .Assuming actual C.O.P of 62 % of the theoretical, Calculate the power required to drive the compressor. Following properties of ammonia are given	L5	C02	12M

Temperature ◦ C	Enthalpy (kj / kg)		Entropy (Kj / kg K)	
	Liquid	Vapour	Liquid	Vapour
25	298.9	1465.84	1.1242	5.0391
-15	112.34	1426.54	0.4572	5.5490

6		A refrigeration machine using R-12 as refrigerant operates between the pressures 2.5 bar and 9 bar. The compression is isentropic and there is no undercooling in the condenser. The vapour is in dry saturated condition at the beginning of the compression. Estimate theoretical C.O.P. If the actual C.O.P is 0.65 of theoretical valve, calculate the net cooling produced per hour. The refrigerant flow is 5 kg/min. Properties of refrigerant are	L6	C01	12M

Pressure (Bar)	Temperature ◦ C	Enthalpy (kj / kg)		Entropy of saturated vapour, kj / kg K
		Liquid	Vapour	
9	36	70.55	201.8	0.6836
2.5	-7	29.62	184.5	0.7001

7		What is an azetrope? Give some examples to indicate its importance.	L1	C04	12M
8	a	State the desirable properties of refrigerants.	L1	C05	6M
	b	Name the different refrigerants generally used.	L1	C01	6M
9		A vapour compression refrigeration plant works between pressure limits of 5.3 bar and 2.1 bar. The vapour is super-heated at the end of compression, its temperature being 37 ˚ C .The vapour is super-heated by 5 ˚ C before entering the compressor. If the specific heat of super-heated vapour is 0.63 kj / kg k, find the coefficient of performance of the plant. Use the data given below	L1	C02	12M

Pressure (Bar)	Temperature ◦ C	Liquid Heat (kj /kg)	Latent Heat (kj/kg)
5.3	15.5	56.15	144.9
2.1	-14	25.12	158.7

10		Sketch and explain a two-stage cascade refrigeration system.	L2	C03	12M

UNIT –III

Other Refrigeration Systems

1	a	Advantages of vapour absorption refrigeration system over vapour compression refrigeration system.	L5	C02	6M
	b	Define the terms nozzle efficiency and entrainment efficiency in steam jet refrigeration system.	L1	C01	6M
2	a	Discuss properties of refrigerant and absorbent combination used in vapour absorption system	L6	C03	6M
	b	State the advantages and limitations of VAR	L1	C05	6M
3		Explain with a neat sketch the working of lithium-bromide vapour absorption system	L2	C01	12M
4		Explain with help of a neat sketch, the working of a steam jet refrigeration system.	L2	C02	12M
5		Comparison between two fluid VAR system and three fluid VAR system	L4	C01	12M

6		Illustrate the working principal of Electrolux refrigeration system	L2	C01	12M
7		Differentiate between vapour absorption and vapour compression refrigeration systems.	L4	C03	12M
8		Describe the working of a vapour absorption refrigeration system with the help of a neat sketch.	L1	C02	12M
9		Explain thermo-electric refrigeration system with sketch	L2	C01	12M
10		Describe the working of Vortex tube with a neat sketch and its merits and demerits	L1	C03	12M

UNIT –IV

Introduction to Air Conditioning

1	a	What do you understand by the term psychrometry?	L1	C01	6M
	b	Define the following (i).Specific humidity (ii).Absolute Humidity	L1	C02	6M
2		A room 7m × 4m× 4m is occupied by an air-water vapour mixture at 380C. The atmospheric pressure is 1 bar and the relative humidity is 70%. Determine the humidity ratio, dew point, mass of dry air and mass of water vapour. If the mixture of air-water vapour is further cooled at constant pressure until the temperature is 100C. Find the amount of water vapour condensed	L1	C04	12M
3	a	Define Sensible heat factor	L1	C01	5M
	b	With help of psychrometric chart, Explain the following processes (i).Sensible hearting (ii) Sensible cooling	L5	C03	7M
4		Atmospheric air at 0.965 bar enters the adiabatic saturator. The wet bulb temperature is 200C and dry bulb temperature is 310C during adiabatic saturation process. Determine (i) humidity ratio of the entering air (ii) vapour pressure and relative humidity at 310C and (iii) dew point temperature.	L5	C01	12M
5	a	With help of psychrometric chart, Explain the Heating and dehumidification processes	L5	C02	6M
	b	With help of psychrometric chart, Explain the cooling and humidification processes	L5	C03	6M
6	a	Define relative humidity, absolute humidity	L1	C02	6M
	b	Define saturated air, degree of saturation	L1	C01	6M
7		Explain the procedure to draw a grand sensible heat factor line on a psychrometric chart.	L5	C01	12M
8		Explain the concept of effective room sensible heat factor with neat diagram.	L5	C05	12M
9		A room has a sensible heat gain of 24 KW and a latent heat gain of 5.2 KW and it has to be maintained at 26 $^\circ$ C DBT and 50 % RH.180 m^3 / min of air is delivered to the room. Determine the state of supply of air.	L5	C01	12M

10		Define the following terms (i)Infiltration (ii)Natural ventilation (iii) Forced ventilation	L1	C02	12M

UNIT –V
Air Conditioning Systems and Distribution of Air

1		Explain year round air conditioning system with sketch	L2	C01	12M
2		Compare winter air conditioning system with summer air conditioning system.	L5	C02	12M
3		With neat diagram explain the working of summer air conditioning system	L2	C04	12M
4		Explain the working of domestic refrigerator with a neat sketch	L2	C01	12M
5	a	Define the terms static and velocity pressure in a duct.	L1	C05	6M
	b	Define the term duct. Explain the needs	L1& L2	C02	6M
6		Explain winter air conditioning system with sketch	L2	C04	12M
7	a	Derive an expression for continuity equation in ducts.	L4	C01	6M
	b	The main air supply duct of an air conditioning system is 800 mm X 600 mm in cross section and carries 300 m^3 / min of standard air. It branches into two ducts of cross section 600 mm X 500 mm and 600 mm X 400 mm. If the mean velocity in the larger branch is 480 m / min. Find (i) Mean velocity in the main duct and the smaller branch (ii) mean velocity pressure in each duct.	L1	C02	6M
8		Following data refers to an air conditioning system to be designed for an industrial process for hot and wet climate. Outside conditions 30 ˚ C DBT and 75 % RH, Inside conditions 20 ˚ C DBT and 60 % RH. The require condition is to be achieved first by cooling and dehumidifying and then by heating. If 20 m^3 of air is absorbed by the plant every minute. Find (i) Capacity of the cooling coil in tonnes of refrigeration (ii) Capacity of the heating coil in KW (iii) Amount of water removed per hour. Take h_1=81.8 kj/kg, h_2=34.2 kj/kg, h3=42.6 kj/kg, W_1=0.0202 kj/kg, W_2=0.0088 kj/kg, V_{s1}=0.886 m^3/kg.	L1	C01	12M
9	a	Why the ducts are used in an air conditioning system.	L1	C05	6M
	b	Which material is commonly used for making ducts in air conditioning systems?	L1	C03	6M
10		An air conditioning plant is required to supply 60 m^3 of air per minute at a DBT of 21˚C and 55 % RH. The outside air is at DBT of 28 ˚ C and 60 % RH. Determine the mass of water drained and capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then to cool the air. Take W_1=0.0142, W_2=0.0084 kj /kg of dry air, V_{s2}=0.845 m^3 / kg, h_1=64.8 kj/kg, h_2=42.4 kj/kg.	L5	C02	12M

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