SIDDHARTH GROUP OF INSTITUTIONS :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code : Refrigeration & Air Conditioning (18ME0335)**Course & Branch**: B.Tech -AGRI
Year & Sem: III-B.Tech & I-Sem **Regulation:** R18

UNIT –I
Introduction

1		Define the following terms. i)Refrigeration ii)Heat Engine iii)Unit of Refrigeration iv)Draw PV chart & TS chart for regenerative air cooling system v)list the application of refrigeration system	 L1 L1 L1 L3 L1	 C01 C01 C01 C01 C01	 2M 2M 2M 2M 2M
2	a	Explain the working of Bell-Coleman cycle air refrigeration with P-v and T-S diagrams.	L1	C01	5M
	b	Explain the working of a Reversed Carnot cycle of refrigeration with P-V and T-S Diagrams.	L5	C01	5M
3	a	Define C.O.P	L1	C03	3M
	b	With neat sketch Explain the working of Simple air refrigeration system	L1	C01	7M
4	a	What are the limitations of Carnot cycle of refrigeration	L1	C04	3M
	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	L2	C02	3M
	b	Explain, with a neat sketch the working principle of Regenerative Air refrigeration system.	L5	C05	7M
6	a	What is the Necessityof refrigeration	L1	C03	3M
	b	Describe with a neat sketch a Reduced ambient air refrigeration system	L1	C01	7M
7		In a refrigeration plant working on Bell Coleman cycle, air is compressed to 5 bar from 1 bar. Its initial temperature is 10 $^{\circ}$C. After compression, the air is cooled up to 20 $^{\circ}$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	10M
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 $^{\circ}$C, compressed and then it is cooled to 30 $^{\circ}$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	10M

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 law $PV^{1.25}$= constant. Take γ = 1.4 and Cp = 1 KJ/Kg K.	L1	C01	10M
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	10M

UNIT –II
Vapour Compression Refrigeration System

<table>
<tr><td>1</td><td></td><td>i)Explain the function of expansion valve.
ii)Draw TS chart and PH chart for sub cooling in vapor compression cycle
iii)Explain about zeotropic refrigerant mixture.
iv)Differentiate condenser and evaporator
v)list the application of cascade refrigerant system.</td><td>L1
L3
L1
L4
L1</td><td>C02</td><td>2M
2M
2M
2M
2M</td></tr>
<tr><td>2</td><td>a</td><td>What are the advantages of vapour compression refrigeration system over air refrigeration system?</td><td>L2</td><td>C02</td><td>5M</td></tr>
<tr><td></td><td>b</td><td>With a neat sketch, explain the working principle of vapour compression refrigeration system.</td><td>L6</td><td>C01</td><td>5M</td></tr>
<tr><td>3</td><td></td><td>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.
<table>
<tr><td>Temperature ◦ C</td><td>Liquid Heat (Kj / kg)</td><td>Latent Heat (Kj / kg)</td><td>Liquid Entropy (Kj / kg K)</td></tr>
<tr><td>25</td><td>298.9</td><td>1166.94</td><td>1.1242</td></tr>
<tr><td>-10</td><td>135.37</td><td>1297.68</td><td>0.5443</td></tr>
</table></td><td>L5</td><td>C04</td><td>10M</td></tr>
<tr><td>4</td><td></td><td>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.
<table>
<tr><td rowspan="2">Pressure (Bar)</td><td rowspan="2">Temperature ◦ C</td><td colspan="2">Enthalpy (kj / kg)</td><td colspan="2">Entropy(Kj / kg K)</td></tr>
<tr><td>Liquid</td><td>Vapour</td><td>Liquid</td><td>Vapour</td></tr>
<tr><td>60</td><td>295</td><td>151.96</td><td>293.29</td><td>0.554</td><td>1.0332</td></tr>
<tr><td>25</td><td>261</td><td>56.32</td><td>322.58</td><td>0.226</td><td>1.2464</td></tr>
</table></td><td>L5</td><td>C01</td><td>10M</td></tr>
<tr><td>5</td><td></td><td>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</td><td>L5</td><td>C02</td><td>10M</td></tr>
</table>

		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 <table><tr><td rowspan="2">Temperature ◦ C</td><td colspan="2">Enthalpy (kj / kg)</td><td colspan="2">Entropy (Kj / kg K)</td></tr><tr><td>Liquid</td><td>Vapour</td><td>Liquid</td><td>Vapour</td></tr><tr><td>25</td><td>298.9</td><td>1465.84</td><td>1.1242</td><td>5.0391</td></tr><tr><td>-15</td><td>112.34</td><td>1426.54</td><td>0.4572</td><td>5.5490</td></tr></table>			
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 <table><tr><td rowspan="2">Pressure (Bar)</td><td rowspan="2">Temperature ◦ C</td><td colspan="2">Enthalpy (kj / kg)</td><td rowspan="2">Entropy of saturated vapour, kj / kg K</td></tr><tr><td>Liquid</td><td>Vapour</td></tr><tr><td>9</td><td>36</td><td>70.55</td><td>201.8</td><td>0.6836</td></tr><tr><td>2.5</td><td>-7</td><td>29.62</td><td>184.5</td><td>0.7001</td></tr></table>	L5	C01	10M
7		What is an azetrope? Give some examples to indicate its importance.	L1	C04	10M
8	a	State the desirable properties of refrigerants.	L1	C05	5M
	b	Name the different refrigerants generally used.	L2	C01	5M
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 $^{\circ}$ 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 <table><tr><td>Pressure (Bar)</td><td>Temperature ◦ C</td><td>Liquid Heat (kj /kg)</td><td>Latent Heat(kj/kg)</td></tr><tr><td>5.3</td><td>15.5</td><td>56.15</td><td>144.9</td></tr><tr><td>2.1</td><td>-14</td><td>25.12</td><td>158.7</td></tr></table>	L1	C02	10M
10		Sketch and explain a two-stage cascade refrigeration system.	L1	C03	10M

UNIT –III

Other Refrigeration Systems

1		i)Explain the function of vapor absorption system. ii)Explain principle of evaporation in cooling system iii)State PELTIER EFFECT iv)Compare two fluid with three fluid in VAR system v)what is the function of vortex spin chamber.	L1 L1 L1 L4 L1	C03	2M 2M 2M 2M 2M
2	a	Advantages of vapour absorption refrigeration system over vapour compression refrigeration system.	L6	C03	5M
	b	State the advantages and limitations of VAR	L1	C05	5M
3		Explain with a neat sketch the working of lithium-bromide vapour absorption system	L5	C01	10M

4		Explain with help of a neat sketch, the working of a steam jet refrigeration system.	L5	C02	10M
5		Comparison between two fluid VAR system and three fluid VAR system	L4	C01	10M
6		Illuminate the working principal of Electrolux refrigeration system	L2	C01	10M
7		Differentiate between vapour absorption and vapour compression refrigeration systems.	L4	C03	10M
8		Describe the working of a vapour absorption refrigeration system with the help of a neat sketch.	L1	C02	10M
9		Explain thermo-electric refrigeration system with sketch	L1	C01	10M
10		Describe the working of Vortex tube with a neat sketch and its merits and demerits	L1	C03	10M

UNIT –IV

Introduction to Air Conditioning

1	a	i)What do you understand by the term psychrometry? ii)Define Specific humidity iii)Define Absolute Humidity iv)Differentiate DBT & WBT v)Explain the concept of RSHF	L1 L1 L1 L4 L1	C04	2M 2M 2M 2M 2M
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	10M
3	a	Define Sensible heat factor	L5	C01	5M
	b	With help of psychrometric chart, Explain the following processes (i).Sensible hearting (ii) Sensible cooling	L5	C03	5M
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	10M
5	a	With help of psychrometric chart, Explain the Heating and dehumidificationprocesses	L5	C02	5M
	b	With help of psychrometric chart, Explain the cooling and humidificationprocesses	L5	C03	5M
6	a	Define relative humidity, absolute humidity	L1	C02	5M
	b	Define saturated air, degree of saturation	L1	C01	5M
7		Explain the procedure to draw a grand sensible heat factor line on a psychrometric chart.	L5	C01	10M

8		Explain the concept of effective roomsensible heat factor with neat diagram.	L5	C05	10M
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 ˚ 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	10M
10		Define the following terms (i)Infiltration (ii)Natural ventilation (iii) Forced ventilation	L1	C02	10M

UNIT –V

Air Conditioning Systems and Distribution of Air

1		i)What is mean by human comfort? ii)Define Effective Temperature. iii)Explain the purpose of humidifier in winter air conditioning system iv)How the ducts are classifieds. v)compare winter and summer air conditioning system.	L1 L1 L1 L1 L4	C05	2M 2M 2M 2M 2M
2		Explain the difference between winter air conditioning and summer air conditioning	L5	C02	10M
3		With neat diagram explain the working of summer air conditioning system	L5	C04	10M
4		Explain the working of domestic refrigerator with a neat sketch	L5	C01	10M
5	a	Define the terms static and velocity pressure in a duct.	L1	C05	5M
	b	Define the term duct. Explain the needs	L1	C02	5M
6		Explain winter air conditioning system with sketch	L5	C04	10M
7	a	Derive an expression for continuity equation in ducts.	L1	C01	5M
	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	5M
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	10M
9	a	Why the ducts are used in an air conditioning system.	L1	C05	5M
	b	Which material is commonly used for making ducts in air conditioning systems?	L1	C03	5M

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 $^{\circ}$ 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.	L1	C02	10M

Prepared by: Mr.V.KARTHIKEYAN