Course Code:18ME0336 R18

SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY :: PUTTUR
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QUESTION BANK (DESCRIPTIVE)

Subject with Code : R & AC (18ME0336) **Course & Branch: B.Tech -ME**
Regulation: R18 **Year & Sem**: IV-B.Tech & I-Sem

UNIT –I
Introduction

1	a	Define the term Refrigeration.	[L1]	[C01]	[2M]
	b	Define the term Heat Pump.	[L1]	[C01]	[2M]
	c	Define C.O.P.	[L1]	[C01]	[2M]
	d	State any four applications of refrigeration.	[L3]	[C01]	[2M]
	e	Draw P-V and T-S diagram of Bell-Coleman cycle.	[L1]	[C01]	[2M]
2	a	Define Unit of Refrigeration.	[L1]	[C01]	[4M]
	b	Explain the working of a Reversed Carnot cycle of refrigeration with P-V and T-S Diagrams.	[L5]	[C01]	[6M]
3		With neat sketch Explain the working of Simple air refrigeration system	[L1]	[C01]	[10M]
4	a	What are the limitations of Carnot cycle of refrigeration?	[L1]	[C01]	[5M]
	b	Describe Boot strap air refrigeration system, with a schematic diagram and show the cycle on T-S Diagram.	[L1]	[C01]	[5M]
5	a	State the applications of refrigeration.	[L3]	[C01]	[5M]
	b	Explain, with a neat sketch the working principle of Regenerative Air refrigeration system.	[L5]	[C01]	[5M]
6	a	What is the Necessity of refrigeration?	[L1]	[C01]	[5M]
	b	Describe with a neat sketch a Reduced ambient air refrigeration system	[L1]	[C01]	[5M]
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 = 0.718 KJ/Kg K.	[L5]	[C01]	[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 ° C, compressed and then it is cooled to 30 ° C before entering the expansion cylinder. The expansion and compression	[L5]	[C01]	[10M]

		follows the law PV $^{1.3}$= constant. Determine the theoretical C.O.P of the system.			
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 $\gamma = 1.4$ and Cp = 1 KJ/Kg K.	[L4]	[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.	[L5]	[C01]	[10M]

UNIT –II
Vapour Compression Refrigeration System

1	a	Draw P-H diagram of VCR cycle.	[L1]	[C02]	[2M]
	b	State purpose of accumulator in VCR system.	[L5]	[C02]	[2M]
	c	Mention the uses of flash chamber.	[L2]	[C02]	[2M]
	d	Draw T-S of VCR cycle.	[L1]	[C02]	[2M]
	e	What are the functions of compressor in vapour compression refrigeration system?	[L1]	[C02]	[2M]]
2	a	State the functions of expansion device.	[L1]	[C02]	[5M]
	b	Construct Pressure – Enthalpy (p-h) chart of Vapor compression cycle	[L6]	[C02]	[5M]
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]	[C02]	[10M]

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]	[C02]	[10M]

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

<table>
<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 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></td><td>[L5]</td><td>[C02]</td><td>[10M]</td></tr>
<tr><td>6</td><td></td><td>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></td><td>[L6]</td><td>[C02]</td><td>[10M]</td></tr>
<tr><td>7</td><td>a</td><td>What is an azetrope? Give some examples to indicate its importance.</td><td>[L1]</td><td>[C02]</td><td>[5M]</td></tr>
<tr><td></td><td>b</td><td>What are the advantages of vapour compression refrigeration system over air refrigeration system?</td><td>[L1]</td><td>[C02]</td><td>[5M]</td></tr>
<tr><td>8</td><td>a</td><td>State the desirable properties of refrigerants.</td><td>[L1]</td><td>[C02]</td><td>[5M]</td></tr>
<tr><td></td><td>b</td><td>Name the different refrigerants generally used.</td><td>[L1]</td><td>[C02]</td><td>[5M]</td></tr>
<tr><td>9</td><td></td><td>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
<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></td><td>[L4]</td><td>[C02]</td><td>[10M]</td></tr>
<tr><td>10</td><td>a</td><td>Sketch and explain a two-stage cascade 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>[L5]</td><td>[C02]</td><td>[5M]</td></tr>
</table>

UNIT –III

Other Refrigeration Systems

1	a	List the primary Refrigerants.	[L2]	[C03]	[2M]

	b	Mention any four desirable properties of refrigerant and absorbent pair.	[L1]	[C03]	[2M]
	c	List the secondary refrigerants.	[L1]	[C04]	[2M]
	d	What are the refrigerants used in Electrolux refrigeration system	[L4]	[C04]	[2M]
	e	What are the factors to be considered while selecting a refrigeration system?	[L1]	[C04]	[2M]
2	a	Discuss properties of refrigerant and absorbent combination used in vapour absorption system	[L4]	[C03]	[5M]
	b	State the advantages and limitations of Vapour absorption refrigeration system	[L1]	[C03]	[5M]
3		Explain with a neat sketch the working of lithium-bromide vapour absorption system.	[L2]	[C03]	[10M]
4		Explain with help of a neat sketch, the working of a steam jet refrigeration system.	[L2]	[C03]	[10M]
5	a	Comparison between two fluid VAR system and three fluid VAR system .	[L4]	[C03]	[5M]
	b	Define the terms nozzle efficiency and entrainment efficiency in steam jet refrigeration system.	[L1]	[C03]	[5M]
6	a	Illustrate the working principal of Electrolux refrigeration system	[L2]	[C04]	[5M]
	b	Advantages of vapour absorption refrigeration system over vapour compression refrigeration system	[L5]	[C04]	[5M]
7		Differentiate between vapour absorption and vapour compression refrigeration systems.	[L4]	[C04]	[10M]
8		Describe the working of a vapour absorption refrigeration system with the help of a neat sketch.	[L1]	[C04]	[10M]
9		Explain thermo-electric refrigeration system with sketch	[L2]	[C04]	[10M]
10		Describe the working of Vortex tube with a neat sketch and its merits and demerits	[L1]	[C04]	[10M]

UNIT –IV
Introduction to Air Conditioning

1	a	Define Dew point Depression.	[L1]	[C05]	[2M]
	b	Define the term effective temperature.	[L1]	[C05]	[2M]
	c	Define term air conditioning.	[L1]	[C05]	[2M]
	d	Write the classifications of air conditioning systems.	[L1]	[C05]	[2M]
	e	Define psychrometry.	[L1]	[C05]	[2M]
2		A room 7m × 4m× 4m is occupied by an air-water vapour mixture at 38◦C. 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 10◦C. Find the amount of water vapour condensed	[L5]	[C05]	[10M]

3	a	Define Sensible heat factor.	[L1]	[C05]	[5M]
	b	With help of psychrometric chart, Explain the following processes (i).Sensible hearting (ii) Sensible cooling	[L5]	[C05]	[5M]
4		Atmospheric air at 0.965 bar enters the adiabatic saturator. The wet bulb temperature is 20◦C and dry bulb temperature is 31◦C during adiabatic saturation process. Determine (i) humidity ratio of the entering air (ii) vapour pressure and relative humidity at 31◦C and (iii) dew point temperature.	[L5]	[C05]	[10M]
5	a	With help of psychrometric chart, Explain the Heating and dehumidification processes	[L5]	[C05]	[5M]
	b	With help of psychrometric chart, Explain the cooling and humidification processes	[L5]	[C05]	[5M]
6	a	Define relative humidity, absolute humidity.	[L1]	[C05]	[5M]
	b	Define saturated air, degree of saturation.	[L1]	[C05]	[5M]
7	a	Explain the procedure to draw a grand sensible heat factor line on a psychrometric chart.	[L5]	[C05]	[5M]
	b	What do you understand by the term psychrometry?	[L1]	[C05]	[5M]
8	a	Explain the concept of effective room sensible heat factor with neat diagram.	[L5]	[C05]	[5M]
	b	Define the following (i).Specific humidity (ii).Absolute Humidity	[L1]	[C05]	[5M]
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]	[C05]	[10M]
10		Define the following terms (i)Infiltration (ii)Natural ventilation (iii) Forced ventilation	[L1]	[C05]	[10M]

UNIT –V

Air Conditioning Systems and Distribution of Air

1	a	List out characteristics of good distribution system.	[L2]	[C06]	[2M]
	b	What is comfort chart?	[L1]	[C06]	[2M]
	c	What are the materials used for duct.	[L1]	[C06]	[2M]
	d	Write continuity equation in ducts.	[L1]	[C06]	[2M]
	e	Define Duct.	[L1]	[C06]	[2M]
2		Explain winter air conditioning system with sketch	[L2]	[C06]	[10M]
3		With neat diagram explain the working of summer air conditioning system.	[L2]	[C06]	[10M]
4	a	Explain the working of domestic refrigerator with a neat sketch.	[L2]	[C06]	[5M]
	b	Explain year round air conditioning system with sketch.	[L2]	[C06]	[5M]
5	a	Define the terms static and velocity pressure in a duct.	[L1]	[C06]	[5M]
	b	Define the term duct. Explain the needs.	[L1] &L2]	[C06]	[5M]

6		Compare winter air conditioning system with summer air conditioning system.	[L2]	[C06]	[10M]
7	a	Derive an expression for continuity equation in ducts.	[L4]	[C06]	[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.	[L5]	[C06]	[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.	[L5]	[C06]	[10M]
9	a	Why the ducts are used in an air conditioning system.	[L1]	[C06]	[5M]
	b	Which material is commonly used for making ducts in air conditioning systems?	[L1]	[C06]	[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 ° 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]	[C06]	[10M]

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