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B.Tech.
(SEM II) Back Paper EXAMINATION, 2015-16
REFRIGERATION & AIR CONDITIONING

Note: (i) Attempt **ALL** questions. All questions carry equal marks.
(ii) Be precise in your answer.
(iii) Use of steam tables, refrigerant's property tables, h-c diagram and psychrometric charts is allowed.
(iv) Assume missing data suitably, if necessary.

1 Attempt any **TWO** parts of the following: **[10×2=20]**

(a) Why Carnot refrigeration cycle is not practical, discus the changes required to make it practical.
A refrigeration system working on Carnot cycle operates between temperature limits of 40 °C and -15 °C. Find the amount of ice that will be produced per kWh at – 10 °C from water available at 25 °C. Take specific heats of ice and water as: C_{pi}= 2.1 kJ/kg.K and C_{pw}= 4.2 kJ/kg.K, respectively and latent heat as 335 kJ/kg.

(b) Explain the working of Regenerative Air Craft Refrigeration system with the help of its schematic diagram and T-s (or P-h) diagram.

(c) For a simple air refrigeration system the power input required is 50 kW. The values of various parameters are as follows:
P_{ram}=1.2 bar, P_{comp}=6 bar, P_{cabin}=1atm,
η_{comp}=0.80, $\eta_{turbine}$=0.90, T_{ram}=20˚C,
If the air leaves the cabin at 27˚C and the effectiveness of heat exchangers is 0.9, determine COP and maximum temperature for cycle. What is the capacity of refrigeration system?

2 Attempt any **TWO** parts of the following: **[10×2=20]**

(a) A vapour compression refrigeration system operates between 25^{0}C and -10^{0}C. The refrigerant is sub-cooled to 20^{0}C before throttling. Wet vapour with dryness fraction of 0.97 enters the compressor. Find the COP and power requirement for the system if the capacity is 100 ton of refrigeration. Assume average specific heats for liquid and superheated vapour as 4.62 kJ/kg.K and 2.8 kJ/kg.K respectively. Use the following table for the properties of refrigerant.

Temperature (^{0}C)	Enthalpy		Entropy
	Liquid (kJ/kg)	Vapour (kJ/kg)	Liquid (kJ/kg.K)
25	537.6	1708.0	4.612
-10	376.3	1675.0	4.03

(b) What do you understand by flash gas, how it is removed? With the help of schematic diagram explain the function of a flash chamber/ flash intercooler in a multistage compression system.

(c) Answer the following:
(i) What is the effect of superheating of suction vapour and subcooling of liquid on the various parameters of vapor compressor refrigeration system? Why subcooling beyond a limit is not preferred?
(ii) Explain the effect of variation of condenser and evaporator pressure on the performance of vapour compression cycle.

3 Attempt any **TWO** parts of the following: [**10×2=20]**

(a) Explain the working of Simple Aqua Ammonia Vapour Absorption Refrigeration System. How the job of compressor is accomplished ?Discuss the role of accessories used to make it practical.

(b) Discuss various desirable thermodynamic properties of primary refrigerants. Give the refrigerant number for the following: CCl_2F_2, Butane, NH_3, $CH_2F\text{-}CF_3$, and C_2H_4

(c) Answer the following:
(i) Explain the method of obtaining temperature concentration diagram for a binary mixture
(ii) A saturated liquid stream of aqua ammonia having concentration of 0.8 and a pressure of 20 bar with flow rate of 10 kg/s mixes with another saturated liquid stream with flow rate of 5 kg/s at 80 °C at the same pressure. During mixing it receives heat at the rate of 5000 kJ/s. Determine mixture concentration, enthalpy, and mass of liquid and vapor phases after mixing.

4 Attempt any **TWO** parts of the following: [**10×2=20]**

(a) With the help of temperature-entropy diagram, explain dew point temperature anddegree of saturation. Comparerelative humidity with degree of saturation.

(b) Plot psychrometric chart(s) on your answer book and explain different psychrometric processes commonly used in air conditioning. How fog is formed?

(c) The Ambient air (at 45°C DBT and 50% RH) is mixed with return (from room) air (at 30°C DBT and 40% RH) in the ratio of 1:2 before entering the cooling coil. The by-pass factor for the cooling coil is 0.25 and the ADP is 5°C. Air flow rate over the cooling coil is 20 kg/s.
Determine:
(i) Condition of air at inlet and exit of the cooling coil.
(ii) RSHF (room sensible heat factor)
(iii) Capacity of the plant and
(iv) Rate of condensation

5 Attempt any **TWO** parts of the following: [**10×2=20]**

(a) What do understand by “Air Washer”?

(b) Write short note on Food Preservation and Cold Storage.

OR

What are the different types of expansion devices used in refrigeration and air conditioning units? Describe any two in brief.

(c) Explain the working of different types of compressors used in refrigeration and air conditioning units in brief.

OR

With the help of neat sketch, explain the working of “Refrigerator” and “Water Cooler”.