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B.Tech.
(SEM. VI) THEORY EXAMINATION 2017-18
REFRIGERATION & AIR CONDITIONING

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections.
2. If require any missing data; then choose suitably.
3. Refrigeration data book and charts are allowed.

SECTION A

1. Attempt *all* questions in brief. **2 x10 = 20**

a. Explain the C.O.P. for Refrigerator and Heat Pump.
b. What are the steam ejectors?
c. What do you mean by Ramming Process?
d. Write the chemical name of refrigerants R-134 and R-22.
e. A metal beaker contains water initially at room temperature and the water is cooled by gradually adding ice water to it. When the water temperature reaches 13℃, the moisture from room air begins on the beaker. Make calculation for the specific humidity.
f. What is bypass factor? Explain it.
g. What do you mean by DART?
h. Define Fouling Factor in condenser.
i. Enlist demerits of Air refrigeration System.
j. What is the defrosting in refrigeration?

SECTION B

2. Attempt any *three* of the following: **10 x 3 = 30**

a. Describe with a neat schematic diagram, two stage multi compression refrigeration system. Represent the cycle on T-s and P-h plots.
b. Explain the working of Li-Br vapour absorption refrigeration system with neat sketch
c. An ammonia refrigerating machine fitted with an expansion valve works between the temperature limits of -100^0C and 300^0C. The vapor is 95% dry at the end of compression and the fluid leaving the condenser is at 300 ^{0}C. Assuming actual COP as 60% of the theoretical, calculate the kg of ice produced per kW hour at 0^0C from water at 100^0C. Latent heat of ice is 335kJ/kg.
d. The atmospheric air at 25º C dry bulb temperature and 12º C wet bulb temperature is flowing at the rate of 100 m^3/min through the duct. The dry saturated steam at 100º C is injected into the air stream at the rate of 72 kg/hour. Calculate the specific humidity and the enthalpy of the leaving air. Also determine the dry bulb temperature, wet bulb temperature and the relative humidity of the leaving air.
e. What is the basic function of refrigerant in a refrigeration cycle and how they are classified? Explain in brief.

SECTION C

3. Attempt any *one* part of the following: **10 x 1 = 10**

(a) The following data refers to a reduced ambient air refrigeration system used for an aircraft. Speed of aircraft = 1200km/h; ambient pressure and temp. 0.8 bar and 5^0C; ram efficiency = 100%; pressure of cooled air leaving the first cooling turbine = 0.8 bar; temperature of cooled air leaving the H.E. = 100^0C; pressure ratio of the main compressor = 3; pressure loss between the second cooling turbine and cabin = 0.1 bar; pressure and temperature in the cabin = 1 bar and 22^0C; load in the cabin = 10 TR; isentropic efficiency of compressor = 85%; efficiencies of cooling turbine = 80%. Calculate the temperature of different points of the cycle, also find: (1). Mass flow of

air passing through the second cooling turbine; **(2).** Qty. of ram air passing through the H.E. if the rise in temperature is limited to 80K; **(3).** C.O.P. of the system.

(b) Explain Bell-Coleman cycle with P-V and T-S diagrams and derive its COP.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) Discuss the effect of suction pressure, Discharge pressure, super heating and sub-cooling on the performance of a vapour compression system with suitable diagrams.

(b) Air at 15 ^{0}C dry bulb temperature and 25% relative humidity is heated and humidified at 30 ^{0}C dry bulb temperature and 50% relative humidity. Calculate the heat and moisture added to air and the sensible heat factor for the process.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) A food storage locker requires a refrigeration system of 2400 KL/min. capacity at an evaporator temperature of 263 K and a condenser temperature of 303 K. the refrigeration used is Freon -12 and sub-cooled by 8 ^{0}C before entering the expansion valve and vapour is superheated by 70^{0}C before leaving the evaporator coil. The refrigeration compressor is two cylinder single-acting with stroke equal to 1.25 times the bore and operates at 1000 rpm. Liquid specific heat= 1.235 kJ/kg^{o}C, vapour specific heat= 0.733 kJ/kg^{o}C. Determine (a) Refrigeration effect per kg. (b)Mass of refrigerant to be circulated per minute. (c)Theoretical piston displacement per minute.(d)Theoretical power required to run the compressor, in Kw.

(b) Explain the function of the following components of the Vapour Absorption Refrigeration System.

i. Rectifier
ii. Generator
iii. Analyser
iv. Absorber

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) A simple saturation cycle using R-12 is designed for taking a load of 10 tones. The refrigerator and ambient temperature are 0^{0}C and 30^{0}C. A minimum temperature difference of 5^{0}C is required in the evaporator and condenser for heat transfer find; 1. Mass flow rate thorough the system; 2. Power required in kW; 3.COP and cylinder dimension assuming L/D = 1.2 for a single cylinder, single acting compressor if it runs at 300 r.p.m. with volumetric efficiency of 90%.

(b) What is the Psychometry? Plot Psychrometric chart(s) and explain common Psychrometric processes on this chart. Explain and discuss these properties in brief.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain the Performance Characteristics of Reciprocating Compressor mentioning the effect of the following points :-

(i) Suction temperature on compressor on refrigerating capacity.
(ii) Condenser temperature.

(b) Define Condenser and explain the working of a Condenser in a Refrigerating System. Classify them. Also discuss what are the factors affecting the Condenser Capacity