M.E. / RAC / sem - VII

27/11/14

QP Code : 15345

(3 Hours) **[Total Marks : 100**

N. B. :

(1) Question 1 is compulsory.
(2) Attempt any 4 questions out of remaining 6 questions.
(3) Clearly mention the assumptions made if any.
(4) Use of Refrigerant, Psychometric charts and tables, steam table are permitted

1 Attempt any FOUR 20

a) Define Refrigeration. What are the applications of refrigeration in:
   i. Food Processing
   ii. Household
   iii. Industrial Sector

b) A machine working on a Carnot cycle operates between 310 K and 250 K. Determine COP when it is operated as
   i. A refrigerating machine ii. A heat pump

c) Explain the concept of Effective Temperature. Which are the factors governing effective temperature?

d) Explain working of simple VCR cycle with schematic, P-h and T-s diagram.

e) Explain equal pressure drop method used in duct designing

2 a) What is standard commercial ton of refrigeration 04

b) A regenerative air cooling system is used for an airplane to take 20 TR of refrigeration load. The ambient air at pressure 0.8 bar and temp 10 C is rammed isentropically till the pressure rises to 1.2 bar. The air bled off the main compressor at 4.5 bar is cooled by the ram air in the heat exchanger whose effectiveness is 60 %. The air from the heat exchanger is further cooled to 60 C in the regenerative heat exchanger with a portion of air bled after expansion in the cooling turbine. The cabin is to be maintained at a temp of 25 C and a pressure of 1 bar. If the isentropic efficiencies of the compressor and turbine are 90 % and 80 % respectively; find

Correction Attached

i. Mass of air bled from cooling turbine to be used for regenerative cooling ;
ii. Power required for maintaining the cabin at the required condition; and
iii. COP of the system.

Assume the temperature of air leaving to atmosphere from the regenerative he exchanger as 100 C. 12

c) Draw and explain schematic diagram and T-S diagram for the Boot strap air cooling system 04

3 a) Explain with neat schematic: liquid to vapour heat exchanger used in vapour compression refrigeration system 06

b) A vapour compression system using R12 works between -15 C and 35 C on the evaporator and condenser sides respectively. Using P-h chart determine :
i. COP,
ii. Mass flow rate of refrigerant per TR,
iii. Piston displacement per TR using volumetric efficiency of 80 %,
iv. Heat rejected in the compressor per TR, and
v. Ideal COP 10

c) Explain cascade refrigeration system? 04

3 a) Classify different types of Compressors. Explain each type in brief. 06

b) What are the types of expansion valves? Explain the working of thermostatic expansion valve with diagram 06

c) Draw a neat diagram of LiBr-Water absorption system and explain its working. List the major field of applications of this system. 08

5 a) The room sensible and latent heat loads, for an air conditioned space are 25 kW and 7.5 kW respectively. The room condition is 26 C dry bulb temperature and 50 % relative humidity. The outdoor condition is 40 C dry bulb temperature and 50 % relative humidity. The ventilation requirement is such that on mass flow rate basis 25 % of fresh air is introduced and 75 % of supply air is recirculated. The by-pass factor of the cooling coil is 0.15. Determine: i) Supply air flow rate ii) Outside air sensible heat iii) Outside air latent heat and iv) Grand total heat. 10

b) The readings from a sling psychrometer are as follows: 10

Dry Bulb Temperature: 34 C
Wet Bulb Temperature: 24 C
Barometer reading: 740 mm Hg

Without using Psychrometric Chart, calculate:

i) Dew Point Temperature
ii) Relative Humidity
iii) Specific Humidity
iv) Degree of Saturation
v) Enthalpy of mixture per Kg of dry air.

6 a) Define Ton of Refrigeration. If the COP of a 1.5 TR Window Air Conditioner is 3.3, calculate how much power will the compressor consume? 06

b) What is fog? Show on the psychrometric chart when two air streams yield fogged state of air. 08

c) Define RSHF and ERSHF. Explain how to draw RSHF, GSHF and ERSHF lines on the psychrometric chart 06

7 Write short notes ANY FOUR 20

a) Dry Ice and its applications
b) Deep sea water air conditioning
c) Noise and its control in A/C system
d) Liquefaction of gases
e) Defrosting

Course : Prog. 685 to 698 B.E. (ALL BRANCH) (SEM VII)

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Correction :

Q 3b sub question iv

Instead of Compressor please read **Condenser**

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