* R N - 7 4 6 9 / 2 0 0 *

RN-7469

B. E. IV (Sem. VII) (Mechanical) Examination

May / June – 2010

Advanced Refrigeration & Air-Conditioning

Time : 3 Hours] [Total Marks : 100

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. 4 (Sem. 7) (Mechanical)

Name of the Subject :

☛ Advanced Refrigeration & Air-Conditioning

☛ Subject Code No. : 7 4 6 9 ☛ Section No. (1, 2,.....) : 1&2

Seat No. :

Student's Signature

(2) Attempt all questions.
(3) Use separate answer books for each section.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Use of steam table, molier diagram, refrigeration charts are permitted.

SECTION-I

1 **(a)** Chemical name of R-12 and R-22 refrigerants are _____ and _____ respectively. **10**

(b) An Electrolux refrigerator is called a
(i) Single fluid (ii) two fluid (iii) three fluid (iv) none of the above

(c) The lowest temperature produced by adiabatic demagnetization of paramagnetic salt is _____K approximately.

(d) Those material which are weakly attracted by a magnet are called_____

(e) _____ related the heat absorbed or evolved in a single conductor to the temperature gradient along it and current flowing through it.

2 **Attempt any two** **10**

(a) Describe main types of condensers in use with specific application of each

(b) What do you understand by hermetic sealed compressor? Give its advantage

(c) Why capillary is used as expansion device in small or domestic units.

3 **Attempt any two** **30**

(a) The following data refer to a steam jet refrigeration system:
Condition of steam supplied from the boiler: 8 bar, dry saturated
Temperature of water in the flash chamber: 5°C

Temperature at which make-up water enters into flash chamber: 20°C
Pressure maintained in the condenser: 0.06 bar
Nozzle efficiency: 86%
Entrainment efficiency: 64%
Thermo-compressor efficiency: 80%
The quality of steam and flash vapour at the beginning of compression:90%
Determine following by using Mollier diagram:

7. Mass of motive steam required per kg of flash vapour
8. The quality of vapour flashed from the flash chamber
9. Refrigerating effect per kg of flash vapour
10. Mass of motive steam required per hour per tonne of refrigeration
11. Volume of vapour removed from the flash chamber per hour per tonne of refrigeration
12. COP of the system

(b) In an acqua-ammonia absorption refrigeration system of 9 tonnes refrigeration capacity the vapours leaving the generator are 100% pure NH_3 saturated at 40 °C. The evaporator, absorber, condenser and generator temperatures are -20°C, 30°C, 40°C and 170°C respectively. At absorber exit the concentration of ammonia in solution is x =0.35 and enthalpy is h= 22 kJ/kg. At generator exit x = 0.1 and h = 695 kJ/kg.

(iv) Determine the mass flow rate of ammonia in the evaporator

(v) Carry out overall mass concentration and mass conservation of ammonia of absorber to determine mass flow rate of weak and strong solution

(vi) Determine the heat rejection in absorber and condenser, heat added in generator and COP.

(c) The following data refer to a LiBr + H_2O absorption system
Generator temperature: 80°C
Temperature of condenser and absorber: 30°C
Evaporator temperature: 10°C
Condensate temperature: 25°C
Steam enters the generator heating coil at 120°C (dry-saturated state steam) and leaves it at 100°C as condensate.

Concentration of liquid leaving generator is 0.65 and its enthalpy -75 kJ/kg, concentration of liquid leaving absorber is 0.51 and its enthalpy -170 kJ/kg. Enthalpy of vapour leaving generator is 2620 kJ/kg. Flow rate through evaporator is 0.4 kg/s. Determine the following

(xi) Pressures in generator, condenser, evaporator and absorber

(xii) Tonnage

(xiii) Heat rejection to condenser and absorber

(xiv) Rate of mass leaving absorber

(xv) COP

SECTION – II

Q-4 (a) In comfort chart the effective temperature is represented by_____ lines. 10

(b) _____are employed for cleaning air.

(c) _____is defined as unwanted sound.

(d) _____ is grille provided with damper

(e) A_____ tube is used in most of the pressure gauges.

Q-5 Answer **any two** 10

(a) Sketch comfort chart and show on it the comfort zone

(b) Discuss how will you minimize the solar gain load and infiltration load

(c) Principal of thermoelectric refrigeration

(d) Concept of thermoacoustic refrigeration

Q-6 30

(a) Explain 'static regain method of duct design for air conditioning. Under what situation is this recommended? What are its main disadvantages?

(b) For given air conditioned space
Room sensible heat gain 20 kW
Room latent heat gain 5 kW
Inside design conditions: 25°C DBT, 50 % RH
Bypass factor of the cooing coil 0.1
The return air from the space is mixed with the outside air before entering the cooling coil in the ratio of 4 : 1 by weight
Determine:
(a) ADP
(b) Condition of air leaving cooling coil
(c) Dehumidified air quantity
(d) Ventilation air mass and volume flow rates
(e) Total refrigeration load o the air conditioning plant

(c) A Shop with a capacity of 50 persons is to be air conditioned with the following conditions:
Outside conditions 30°C DBT and 70%RH
Inside conditions 23°C DBT and 55%RH
Volume of air supplied 0.5m^3/min/person
The desired conditions are achieved by cooling, dehumidifying and then heating.
Determine
a. capacity of cooling coil in tonne of refrigeration
b. capacity of heating coil
c. amount of water removed by dehumidifier
By pass factor of the heating coil if its surface temperature is 35°C.