Total No. of Printed Pages:3

SUBJECT CODE NO:- H-182
FACULTY OF SCIENCE AND TECHNOLOGY
B.E. (Mechanical)
Refrigeration and Air Conditioning
(REVISED)

[Time: Three Hours] **[Max.Marks: 80]**

Please check whether you have got the right question paper.

N.B
1. Solve three questions from each section.
2. Figure to the right indicate full marks.
3. Use of refrigerant table, steam tables & psychometric chart is allowed.

Section A

Q.1 a) Explain the Ton of refrigeration. Differentiate between refrigerator & heat pump. 06

b) Explain Reversed Carnot cycle for refrigeration. 07

Q.2 a) A refrigerating system operates on the reversed Carnot cycle. The higher temperature of the refrigerant in the system is 42^0C and lower temperature is -17^0C. The capacity of the machine is 15 tonnes. Neglecting all losses find coefficient of performance. 06
   i) Heat rejected from the system per hour.
   ii) Power required for driving the machine.

b) A reversed Carnot cycle working as a heat pump is delivering 6000 KJ/ min to heat the conditioned space & maintain it at 27^0C when the atmospheric temp. is 17^0C. Determine heat transfer in the conditioned space from atmosphere & power required to operate the cycle. 07

Q.3 The following data refer to a two stage compression ammonia refrigerating system with water intercooler. 13
Condenser pressure = 14 bar,
Evaporator pressure = 2 bar,
Intercooler pressure = 5 bar,
Load on the evaporator = 3 TR.
If the temperature of the de-superheated vapour & sub-cooled liquid refrigerant are limited to 32^0C, find.
   i) The power required to drive the system
   ii) C.O.P of the system
   iii) The swept volume of compressor if the volumetric efficiency of the compressor is 80%.

Q.4 An aircraft moving with speed of 1000km/hr uses simple gas refrigeration cycle for air-conditioning. The ambient pressure & temperature are 0.35 bar & -10^0C respectively. The pressure ratio of compressor is 4.5. The heat exchanger effectiveness is 0.95. The isentropic efficiencies of compressor & expander are 80% each. The cabin pressure & temperature are 1.06 bar & 25^0C. Determine temp & pressure at all points of cycle. Find the volume flow rate through compressor inlet & expander outlet for 100 TR. Take, $C_p = 1.005\ KJ/Kg.K$ 13

$R = 0.287\ KJ/Kg.K$

$\frac{C_p}{C_v} = 1.4$ for air

Q.5 Write short note on the following (any three) 14

i) Limitation of simple VCC
ii) Multi-evaporator system with multiple expansion valve.
iii) Necessity of air-craft refrigeration.
iv) Methods to improve COP of VCC
v) Two-stage compression with water intercooler.

Section B

Q.6 a) Advantages of vapour absorption refrigeration system over vapour compression refrigeration system. 07

b) Thermodynamic requirements of refrigerant-absorbent mixture. 06

Q.7 a) What is secondary refrigerant? Write desirable properties of ideal refrigerant. 06

b) Write down designation of following refrigerants. 07

i) Ammonia,
ii) Dichloro –difluoro methane
iii) Dichloro –tetrafluoro ethane
iv) Dichloro –mono-fluoro- methane

Q.8 a) The reading from a sling psychrometer are, $DBT = 30^0C, WBT = 20^0C$, Barometer reading =740 mm of Hg. Using steam table determine, 07

i) Dew point temp.
ii) Degree of saturation,
iii) Vapour density
iv) Specific humidity
v) Enthalpy of mixture per kg of dry air.

b) Describe psychrometric chart with all the lines which play an important role in chart. 06

Q.9 An air-conditioning plant is to be designed for a small office for winter conditions with the following data. 13

$Outside\ conditions = 10^0C\ DBT, 8^0C\ WBT, Requried\ indoor\ conditions = 20^0C\ DBT$ & 60% Relative humidity.

Amount of air circulation = 0.3 m^3/ min/ person.

Seating capacity of the office =50 persons. The required condition is achieved first by heating & then by adiabatic humidifying.

Find:

i) Heating capacity of the coil in KW and the surface temp. If the by-pass factor of the coil is 0.32.

ii) Capacity of the humidifier.

Q.10 Write a short note on (any three) 14

i) Winter air conditioning

ii) Window air conditioning

iii) Room sensible heat factor

iv) ODP & GWP

v) Secondary refrigerant