Total No. of Questions : 12]

SEAT No. :

P2262

[Total No. of Pages : 6

[4758]-20
T.E. (Mechanical)
REFRIGERATION AND AIR CONDITIONING
(2008 Course) (Semester-II) (302051)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of psychrometic chart, land steam tables are allowed.***
6) ***Assume suitable data, if necessary, state clearly the assumption made.***
7) ***Use of calculator is allowed.***

SECTION-I

Q1) a) Draw skeleton of p-h diagram and mark the property lines on it. Sketch ideal vapour compression cycle on T-s and p-h diagrams and mark the name of processes. **[6]**

b) Air enters the compressor of an ideal Brayton Refrigeration Cycle at 1atm and 270 K with a volumetric flow rate of 1.5 m^3/s. If the compressor pressure ratio is 3 and the turbine inlet temperature is 300 K, determine, **[8]**

i) The net power input,

ii) The refrigeration capacity,

iii) Coefficient of performance.

Take $\gamma = 1.4$ and $C_p = 1.005$ kJ/kg.K.

c) State any four applications of refrigeration. **[2]**

OR

Q2) a) State advantages and disadvantages (four each) of air refrigeration. **[4]**

P.T.O.

b) An ideal vapour compression system uses R-12 as refrigerant. The system uses an evaporation temperature of 0°C and condenser temperature of 40°C, the capacity of the system is 7 TR. Determine: **[8]**

i) The mass flow rate of refrigerant.

ii) Power required to run the compressor,

iii) Heat rejected in the condenser, and

iv) COP of the system.

Use the properties of R-12 from table given below:

Temp	Pressure	h_f	h_g	s_f	s_g
°C	bar	kJ/kg	kJ/kg	kJ/g	kJ/kg.K
0	3.087	36.05	187.53	0.142	0.696
40	9.609	74.59	203.2	0.727	0.682

Take C_p for superheated vapour as 0.6 kJ/kg.K.

c) Explain any one non-conventional refrigeration process with graphical support. **[4]**

Q3) a) Discuss the effect of condenser and evaporator pressures on performance of VCC with the help of p-h or T-s diagram. **[8]**

b) Explain with suitable diagram the working lithium bromide vapour absorption system. **[7]**

c) State any three desirable properties of refrigerant solvent combination. **[3]**

OR

Q4) a) Compare vapor absorption system with vapour compression system. **[4]**

b) Draw actual vapour compression cycle on p-h diagram and discuss the losses in the cycle and its effect on its performance. **[8]**

c) Prove that the maximum COP of an ideal vapour absorption refrigeration system is given by

$$COP_{max} = \left(\frac{T_L}{T_C - T_L}\right) \times \left(\frac{T_G - T_C}{T_G}\right)$$

Where T_L = evaporator temperature, T_C = Condenser temperature and T_G = generator temperature. **[6]**

Q5) a) Draw the neat sketch of vapour compression system with two evaporators equipped with individual compressors and expansion valve and common condenser. Sketch it on p-h diagram and deduce mathematical formulation of its COP. **[10]**

b) State desirable properties of refrigerant. List some eco-friendly refrigerant and state why eco-friendly refrigerant must be used. **[6]**

OR

Q6) a) State any four limitation of single stage vapour compression refrigeration cycle. **[4]**

b) Sketch the block diagram of two stage VCC with flash inter-cooling. Draw its p-h diagram. Mark the components and processes. **[4]**

c) Write a short note on any two from followings: **[8]**

i) Global warming potential (GWP).

ii) Cascade refrigeration system.

iii) Refrigerant recovery, reclaim and recharge.

SECTION-II

Q7) a) Define: **[6]**

i) SHF,

ii) Relative Humidity,

iii) Dew point temperature.

b) Explain process of adiabatic mixing of two air streams with a psychometric chart. **[4]**

c) A mixture of dray air and water is at a temperature of 21°C under a total pressure of 736 mm of Hg. The dew point temperature is 15°C. Find: **[6]**

i) Partial pressure of water vapour.

ii) Relative humidity.

iii) Specific humidity.

OR

Q8) a) Define: **[6]**

i) GSHF,

ii) Specific Humidity,

iii) Wet bulb temperature.

b) Explain process of adiabatic saturation with a psychometric chart. **[4]**

c) In a heating application, moist air enters a steam heating coil at 10°C, 50% RH and leaves at 30°C. Calculate the sensible heat if mass flow rate is 100 kg d.a./sec. Also calculate the mass flow rate of steam if it enters at 100°C, saturated and condensate leaves at 80°C. **[6]**

Q9) a) Compare: Unitary and Central air conditioning system. **[6]**

b) Write a note on Summer Air Conditioning. **[4]**

c) Explain any one expansion device with a neat sketch. **[6]**

OR

Q10)a) Explain Fan Coil Unit with a neat sketch. **[6]**

b) Write a note on Winter Air Conditioning. **[4]**

c) Explain any one type of condenser with a neat sketch. **[6]**

Q11)a) How ducts are classified? **[3]**

b) Write a note on Cold Storage. **[6]**

c) Explain any one method of duct design. **[6]**

c) Write a note on Duct Materials. **[3]**

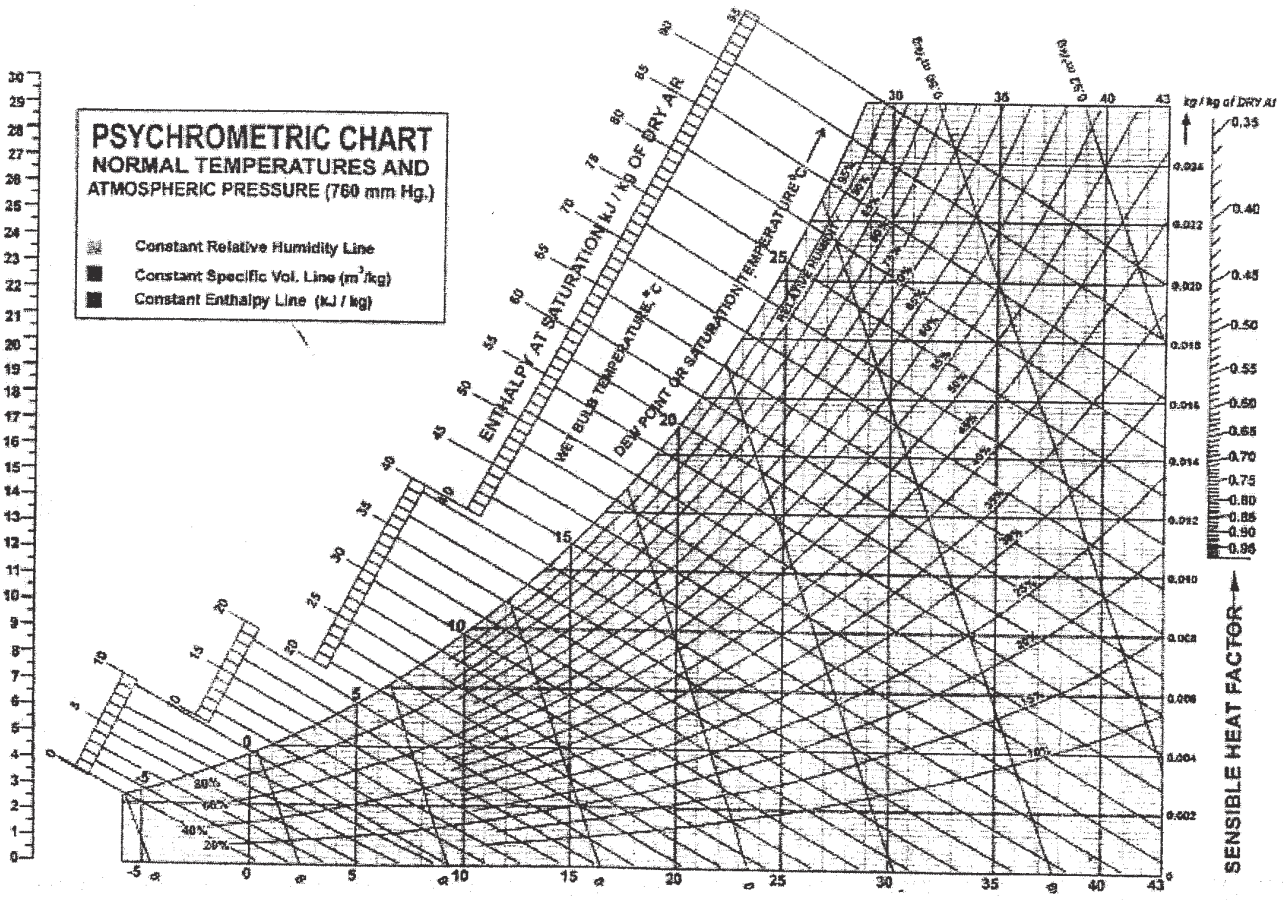
OR

Q12)a) What are the methods of Food Preservation? **[4]**

b) Write a note on CAMA Storage. **[6]**

c) Derive expressions for equivalent diameter of a rectangular duct when the velocity of air passing through the rectangular and circular duct is same.

Hence find the size of a rectangular duct of aspect ratio 1.5 which should replace a circular duct of 40cm diameter and velocity of air is 440 m/ min. **[8]**


PSYCHROMETRIC CHART
NORMAL TEMPERATURES AND
ATMOSPHERIC PRESSURE (760 mm Hg.)
Constant Relative Humidity Line
Constant Specific Vol. Line (m³/kg)
Constant Enthalpy Line (kJ / kg)
ENTHALPY AT SATURATION kJ / kg OF DRY AIR
WET BULB TEMPERATURE °C
DEW POINT OR SATURATION TEMPERATURE °C
RELATIVE HUMIDITY
kg / kg of DRY AI
SENSIBLE HEAT FACTOR

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