Total No. of Questions : 12]

SEAT No. :

P1534

[Total No. of Pages :4

[4759] - 46

B.E. (Mechanical)

ADVANCED AIR-CONDITIONING & REFRIGERATION

(Elective - III) (2008 Pattern) (402049) (Semester - II)

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

Instructions to the candidates:

1) ***Answer three questions from each section.***
2) ***Answer to the two sections should be written in separate answer-books.***
3) ***Draw Diagrams wherever necessary.***
4) ***Use of scientific calculator is allowed.***
5) ***Assume suitable data wherever necessary.***

SECTION - I

Q1) a) Explain vortex tube transcritical refrigeration cycle. **[8]**

b) What is dry ice? Explain with schematic diagram ammonia - CO_2 cascade refrigeration cycle. **[10]**

OR

Q2) a) Write a short note on "Secondary Refrigerant". **[6]**

b) Write a short note on: **[12]**

i) Vapor defrosting

ii) HP/LP receivers

iii) reverse cycle defrosting

Q3) a) Explain the principle of operation of cooling tower with psychometric chart. **[6]**

b) Explain the procedure of estimating length and pressure drop of capillary tube. **[10]**

OR

Q4) a) Design a condenser for a 150kW refrigeration system using R-717. The condenser temperature is 313K and the condensate is subcooled by 10K. Enthalpies at the beginning & end of compression are 1320 kJ/kg and 1530 kJ/kg. The refrigerant flow rate is 0.1 kg/s. The economic water velocity is 1.5 m/s and is related with the overall HTC (on outer dia).

$1/U = 0.13 + 0.5/V^{0.8}$. (kW/m^2K).

Pipe diameters are di = 15 mm and do = 20mm and pipe lengths not to exceed 3000mm. The water temperature rise is 5 K with inlet temperature 303 K. Obtain the number of tubes & passes. **[10]**

b) Discuss the types of compressors with applications. **[6]**

P.T.O.

Q5) a) Describe the methods of controlling IAQ. List the pollutants & contaminants present in the air with source. **[8]**

b) Discuss various types of following: **[8]**

i) Float switches

ii) safety valves

iii) level controller.

OR

Q6) a) Discuss the main characteristics of filter. **[8]**

b) Explain the construction working of externally compensated regulating valve. **[8]**

SECTION - II

Q7) a) A 25 cm brick wall with plaster on both sides exposed to the periodic temperature and incident radiant variation on an hourly basis between 7am and 6pm is given in the table. Determine the aveage and peak load on the air conditioner maintaining the room at 23°C per unit area of the wall. Also determine the heat gain at 5 pm and time of peak load. Use time lag & decrement method. **[12]**

Absorptivity of surface, a = 0.8

Thermal conductivity of plaster, k = 0.14 W/mK

Thickness of plaster material = 3 mm

Thermal conductivity, k = 1.5 W/mK

Outside wall coefficient, h_o = 23 W/m^{2}K

Inside wall coefficient, h_i = 7 W/m^{2}K

Average sol-air temperature (T_{em}) = 44.14°C

Time lag = 5hrs; Decrement factor = 0.455

Time	7 am	8 am	9 am	10 am	11 am	12 noon	1 pm	2 pm	3 pm	4 pm	5 pm	6 pm
T_o(°C)	29	31.5	33.5	35.5	37	38.5	39.5	40.5	41.5	39.5	39	38
I (W/m^2)	186	390	640	814	954	1000	960	825	645	385	190	47

b) Discuss inside design conditions of followings; **[6]**

i) Cold storage.

ii) Industrial air conditioning.

iii) Comfort air conditioning.

OR

Q8) a) Write a short note on: **[6]**

i) Sol-air temperature

ii) Air Spaces

b) Explain the purpose and scope of ECBC. **[6]**

c) State the conditions for calculating ETD and also state the corrections applied for calculating ETD. **[6]**

Q9) a) Discuss the HVAC design criteria for IT centres. **[8]**

b) Draw and explain liquid-to-liquid heat pump circuit. **[8]**

OR

Q10)a) What is clean room? How do clean rooms HVAC different from a normal comfort air conditioned space. **[8]**

b) Draw and explain air-to-air heat pump circuits: -Fixed refrigerant circuit. **[8]**

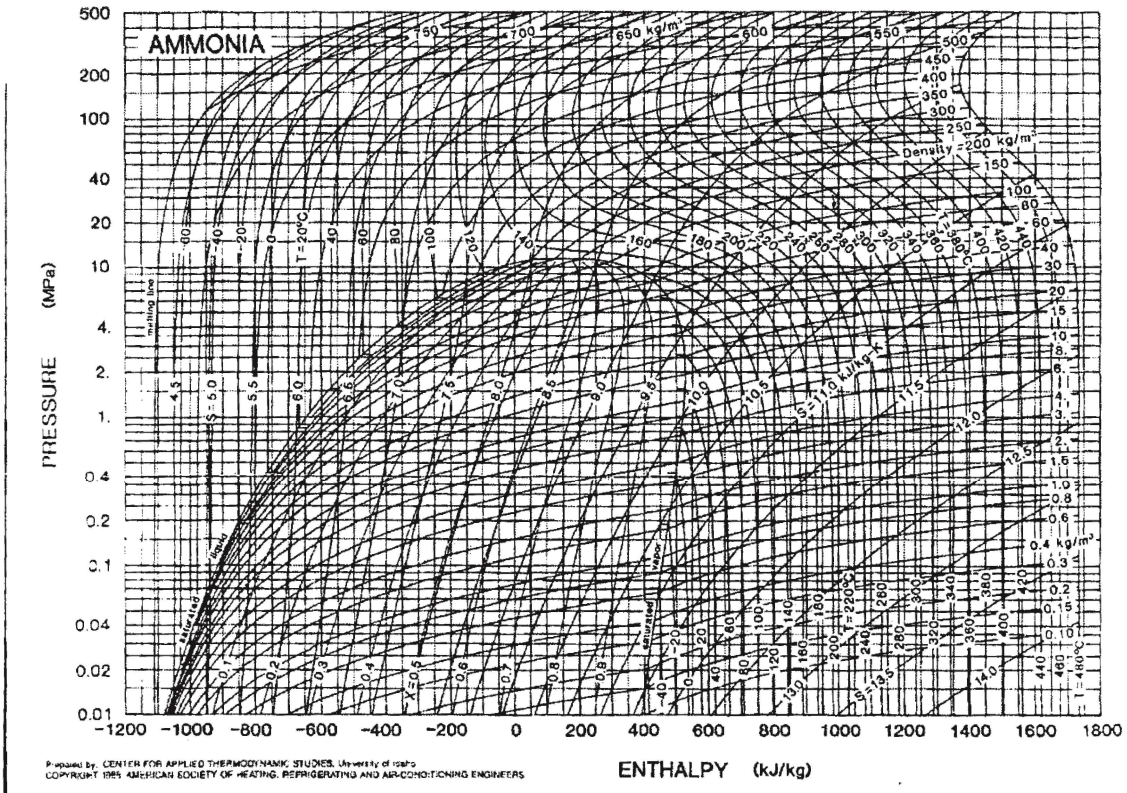
Q11)a) List out the limitations of VCS for the production of low temperatures. **[6]**

b) Discuss various applications of cryogenics. **[10]**

OR

Q12)a) Discuss specific types of insulations used for low temperature applications? **[6]**

b) 1 kg of air at 30°C and 1 bar compressed isothermally to 20 MPa in a compressor in a Linde cycle. The make-up nitrogen is supplied to the system at 30°C and 1 bar. Determine the yield of liquid and temperature of air before throttling. Draw the schematic diagram with T-s and p-h diagram. Use p-h chart of nitrogen. **[10]**


AMMONIA
PRESSURE (MPa)
ENTHALPY (kJ/kg)
Density = 200 kg/m³
0.4 kg/m³
melting line
saturated liquid
saturated vapor
Prepared by: CENTER FOR APPLIED THERMODYNAMIC STUDIES, University of Idaho
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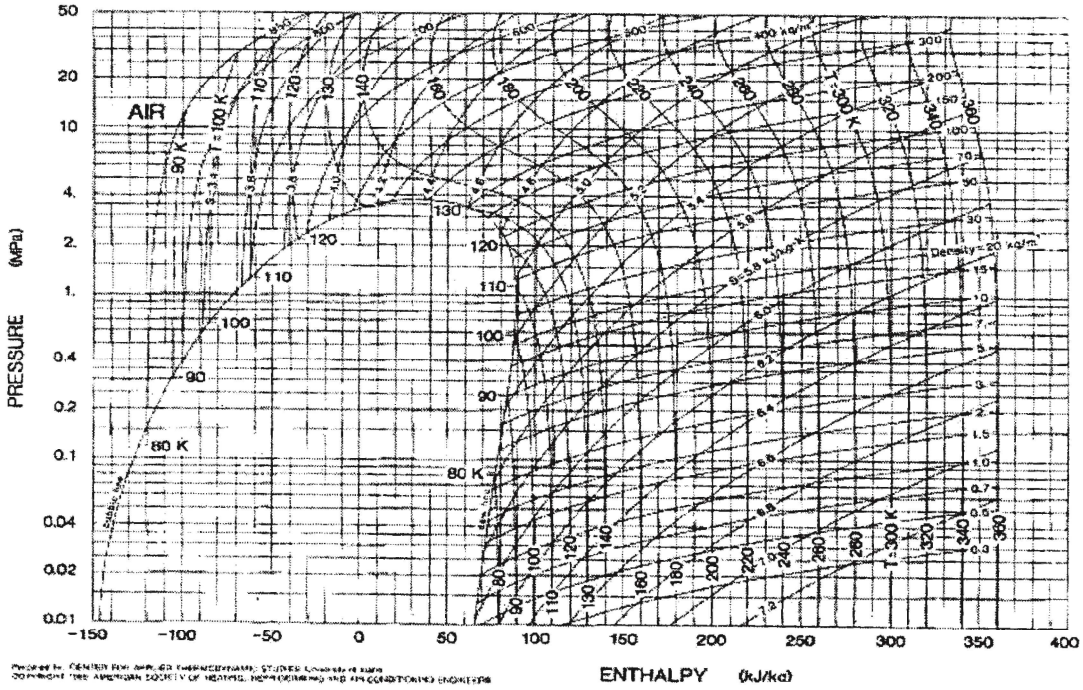
AIR
PRESSURE (MPa)
ENTHALPY (kJ/kg)
80 K
90
100
110
120
130
T = 300 K
Density = 20 kg/m³
triple line