Total No. of Questions :12]

SEAT No. :

P1706

[Total No. of Pages :5

[4859]-47

B.E. (Mechanical)

d:ADVANCED AIR-CONDITIONING & REFRIGERATION

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

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 Ejector type transcritical refrigeration cycle. **[8]**

b) Explain actual vapour compression cycle using p-h and T-s diagram. **[10]**

OR

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

b) 3TR HFC -134a refrigerating machine operates between a condenser temperature of 40°C and an evaporator temperature of 0°C. Calculate the increase (%) in the theoretical piston displacement/TR and the power consumption/TR of the cycle: take c_p of gas as 1.4 kJ/kg.K **[12]**

i) If the evaporating temperature is reduced to -30°C.

OR

ii) If the condensing temperature is increased to 60°C.

Ts(°C)	h_f(kJ/kg)	h_g(kJ/kg)	S_f(kJ/kg)	S_g(kJ/kg)	V(m^3/kg)
-30	162.33	387.08	-	1.7766	0.2240
0	200	405.17	-	1.7511	0.0689
40	256.43	426.17	1.1930	1.7350	0.0199
60	288.34	433.91	1.2893	1.7263	0.0114

P.T.O.

Q3) a) Discuss various types of cooling tower. **[10]**

b) Discuss the principal dimensions of reciprocating compressor. **[6]**

OR

Q4) a) A single cylinder, single acting reciprocating compressor with 5% clearance is used in a refrigeration cycle to take volumetric capacity 50 cmm at $5^{o}C$ (3.6 bar) refrigeration temperature and $40^{o}C$(9.6 bar) condensing temperature. The compresssor index is 1.15. The speed of the piston is limited to 3 m/s. Take L/D=1, specific volume as 0.0525 m^3/kg. Determine: **[8]**

i) Power consumption of the compressor.

ii) Volumetric efficiency.

iii) Bore, stroke and RPM of the compressor.

b) Write a short note on: **[8]**

i) Electronic expansion valve

ii) Design aspects of evaporator

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

b) Explain the following: **[8]**

i) Thermal overload protection for hermetic motors.

ii) Reduced voltage protection.

iii) Motor over current protection.

iv) Adjustable speed drives.

OR

Q6) a) Explain the methods of purging noncondensables. **[8]**

b) Draw & explain electric circuit for oil pressure failure control. **[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 7 am and 6 pm is given in the table. Determine the average 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.

Reflectivity of plaster, = 0.4 **[12]**

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}) = 42.14°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: **[4]**

Sol-air temperature

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

c) Discuss the factors affecting ETD. State the corrections applied for calculating ETD. **[8]**

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

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

OR

Q10)a) Write a short note on "Air-conditioning of Multiplexes". **[4]**

b) Draw and explain air-to-liquid heat pump circuit. **[6]**

c) A heat pump is used for heating a building with a design load of 50000kJ/hr. Water at 10°C is available as a heat source and air supplied to the room is to be at 40°C. If the actual EPR attained is 60% of reverse Carnot cycle operating between the same temperatures, determine **[6]**

i) Actual EPR of the heat pump system

ii) The power input if motor efficiency is 80%

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

b) Determine the following for a Linde system with air as working fluid when the system is operated between 1 bar and 200 bar at 300K. **[10]**

i) Ideal work

ii) Liquid yield

iii) Work per unit mass of compression

iv) Work per unit mass of liquefaction

v) Figure of merit

OR

Q12)a) Discuss 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 claude cycle. Assume that 60% of the total mass of air compressed passes through the expander. The temperature of air entering the expander is -80°C, while the temperature of air leaving the expander is -140°C. The make-up air 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 air. **[10]**

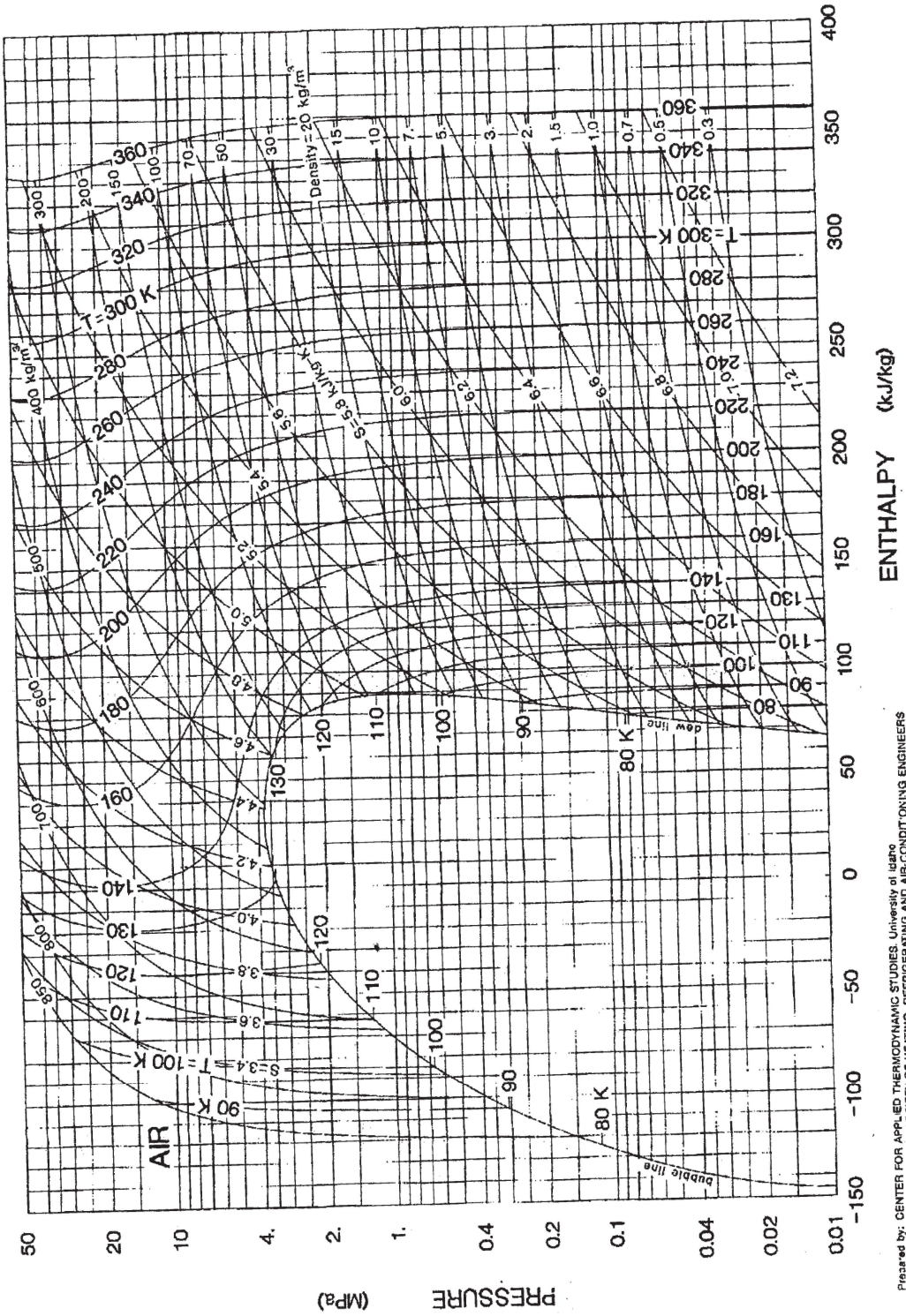

Fig. 36 Pressure-Enthalpy Diagram for Refrigerant 729 (Air)

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