Total No. of Questions : 10]

SEAT No. :

P3523

[Total No. of Pages : 5

[4959]-1044

B.E. (Mechanical)

REFRIGERATION AND AIR-CONDITIONING EQUIPMENT DESIGN

(2012 Course) (Elective - III) (Semester - II) (402049 A)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer three questions out of 6.***
2) ***Solve Q1 or 2, Q3 or 4, Q5 or 6,***
3) ***All the three questions should be solved in one answer book and attach extra supplements if required.***
4) ***Draw Diagrams wherever necessary.***
5) ***Use of scientific calculator is allowed.***
6) ***Assume suitable data wherever necessary.***

Q1) What is dry ice? Explain with schematic diag. the method of manufacturing dry ice. **[10]**

OR

Q2) A two cylinder, single acting reciprocating compressor with 5% clearance is used in a R-12 refrigerating cycle to take refrigerating capacity at 7.2 TR at 5°C(3.6 bar) refrigerating temperature and 40°C (9.6 bar) condensing temperature. The compressor index is 1.15. The speed of the piston is limited to 3 m/s. Take L/D =0.8, specific volume as 0.0525 m^3/kg. Determine **[10]**

i) Power

ii) Volumetric efficiency

iii) COP

iv) Bore & stroke

v) RPM

Temperature (°C)	Pressure (bar)	h_f	h_g
5	3.6	40.69	189.65
40	9.6	74.59	203.2

P.T.O.

Q3) a) Discuss specific types of insulations used for low temperature applications. **[5]**

b) Explain the construction working of pilot-operated solenoid valve. **[5]**

OR

Q4) a) Write a short note on defrost method for multiple evaporator systems. **[5]**

b) Sketch and explain Claude cycle using T-s and p-h diagram. **[5]**

Q5) a) Explain the operational considerations of condensers. **[4]**

b) Design R-22 condenser to meet the following conditions; **[12]**

Refrigeration load	30 TR
Condensing temperature	37.78°C
Evaporating temperature	-1.11°C
Water inlet temperature	25.55°C
Water flow rate per TR	0.00757 m^3/min
Heat rejection factor	1.013
Maximum tube length & diameter	3.6576 m & 2.54 cm
Fouling factor	0.001 m^2K/W
HTC inner & outer side respectively	6000 $W/m^2.K$ & 1500 $W/m^2.K$

State the selection basis of condenser.

OR

Q6) a) Write a short note on "Pump Circulation System". **[8]**

b) Explain design considerations of evaporator. **[8]**

Q7) A test is performed on an induced draft counter flow cooling tower. The following observations are made: **[16]**

Water flow rate: 12.67 kg/s

Air flow rate: 11.9 kg/s

Water entering temperature: 36.3°C

Water leaving temperature: 32.1°C

Ambient air conditions: 43.3°C DBT, 25.6°C WBT

If the dimensions of the tower are length L = 3.9624 m, width W = 2.616 m and height H = 2.438 Determine the following:

a) Value of the performance coefficient.

b) The wetted area of tower if air HTC is 83 W/m^2K.

c) Value of mass transfer coefficient.

d) Tower efficiency.

OR

Q8) a) Discuss various types of non-mechanical draft cooling tower. **[8]**

b) Explain the thermal analysis of cooling tower. **[8]**

Q9) a) In steam jet refrigeration the dry saturated motive steam is supplied at 6 bar. The amount of motive steam per unit mass of flash vapour is 2 kg/kg. The quality of vapour at the beginning of compression is 0.9. The condensing and flash vapour temperature is 40°C and 5°C respectively. The compression efficiency is 0.78. Obtain the TR of the system for 0.8 kg/s of motive steam and volume of vapour handled by the ejector. **[12]**

P (bar)	T_{sat} (°C)	V_f (m^3/kg)	V_g (m^3/kg)	h_f (kJ/kg)	hfg (kJ/kg)	hg (kJ/kg)	Sf (kJ/kgK)	Sfg (kJ/kgK)	Sg (kJ/kgK)
6	158.85	1.1006	.316	670.56	2086. 3	2756.8	1.9312	4.8288	6.76
0.07384	40	1.0078	19.52	167.57	2406.7	2574.3	.5725	7.6845	8.2570
0.00872	5	1.0001	147.12	20.98	2489.6	2510.6	0.0761	8.9496	9.0.57

b) What is heat pipe? Explain advantages of heat pipe over other heat transport material. **[6]**

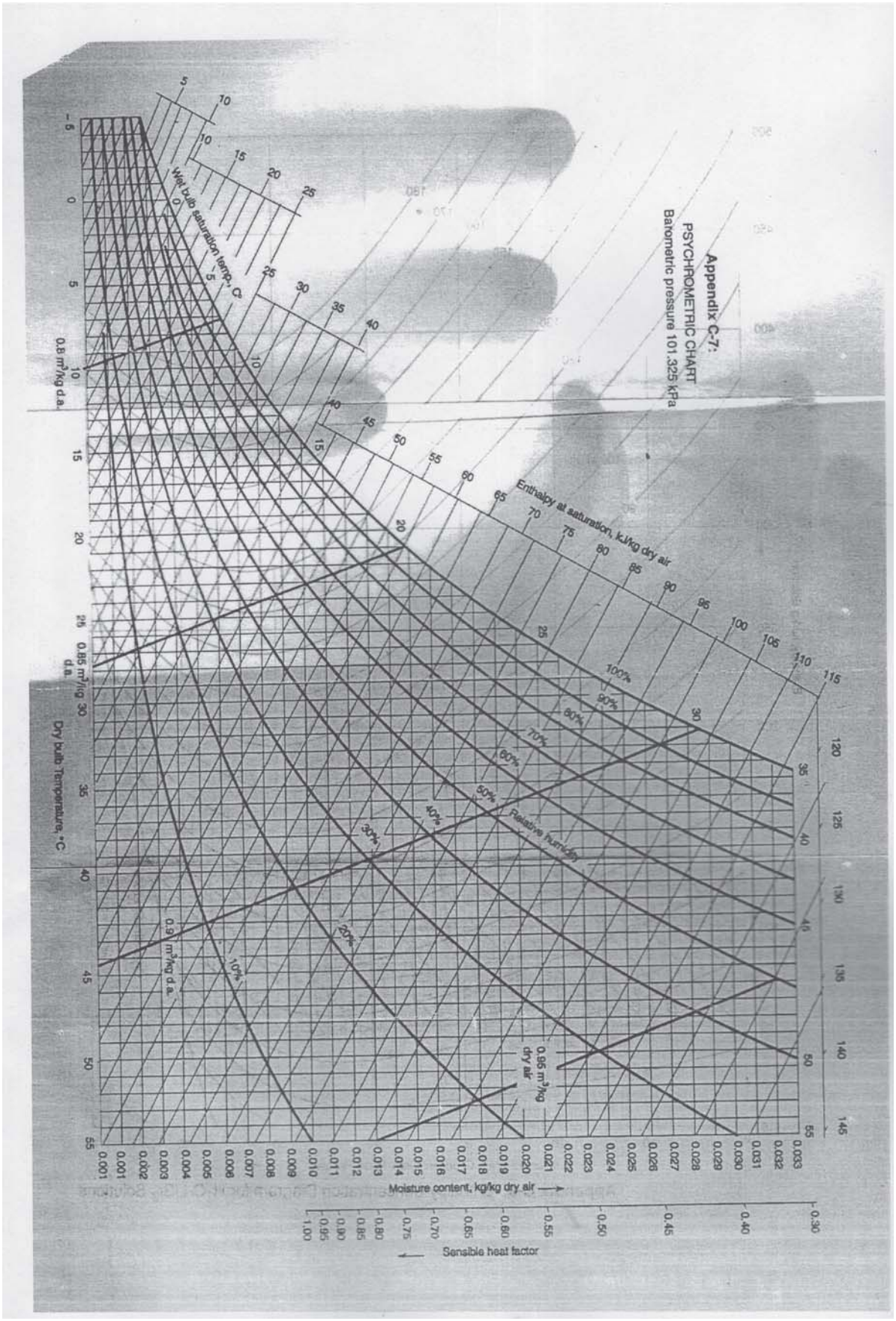
OR

Q10) Write a short note on: **[18]**

a) Vortex Tube.

b) Thermoelectric Refrigeration.

c) Magnetic Refrigeration.


Appendix C-7:
PSYCHROMETRIC CHART
Barometric pressure 101.325 kPa
Wet bulb saturation temp., °C
Enthalpy at saturation, kJ/kg dry air
Relative humidity
Dry bulb Temperature, °C
Moisture content, kg/kg dry air
Sensible heat factor
0.8 m³/kg d.a.
0.85 m³/kg d.a.
0.9 m³/kg d.a.
0.95 m³/kg dry air

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