Total No. of Questions : 10]

SEAT No. :

P4365

[Total No. of Pages : 4

[5461] - 530
B.E. (Mechanical)
REFRIGERATION AND AIR CONDITIONING
(2015 Pattern)

Time :2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or 2, 3or 4, 5or 6, 7or 8, 9 or 10.***
2) ***Draw Neat diagrams wherever necessary.***
3) ***Use of scientific calculator & steam table are allowed.***
4) ***Assume suitable data wherever necessary.***
5) ***Figures to the right indicate Full marks.***

Q1) a) Prove that $COP \frac{1}{r^{\left(\frac{y-1}{y}\right)}-1}$ for Bell Coleman Cycle. **[6]**

b) 2.5 kW per TR is required to maintain the temperature of -20°C in the refrigerator if the refrigeration cycle works on Carnot cycle. Determine the followings a) COP b) T_H c) Q_H d) COP for heating application. **[4]**

OR

Q2) a) State desirable Properties of refrigerants. **[5]**

b) Draw and label LiBr vapour absorption cycle. **[5]**

Q3) a) The temperature limits of an ammonia refrigerating system are 25 °C and – 10°C. If the gas is dry at the end of compression. Calculate the coefficient of performance of the cycle assuming no under-cooling of the liquid ammonia. Use the following table for properties of ammonia: **[8]**

Temperature (°C)	Liquid heat (KJ/kg) (h_f)	Latent heat h_{fg} (KJ/kg)	Liquid entropy (KJ/kg k) (S_f)
25	298.90	1166.94	1.1242
–10°C	135.37	1297.68	0.5443

b) Define the following terms i) SEER ii) IPLV **[2]**

P.T.O.

OR

Q4) A multi evaporator refrigeration system with individual compressors and an individual expansion valves using R-22 as the refrigerant as shown in Fig.1 Neglecting undercooling of liquid and superheating of vapour refrigerant. Find i) Power required to run the system ii) COP **[10]**

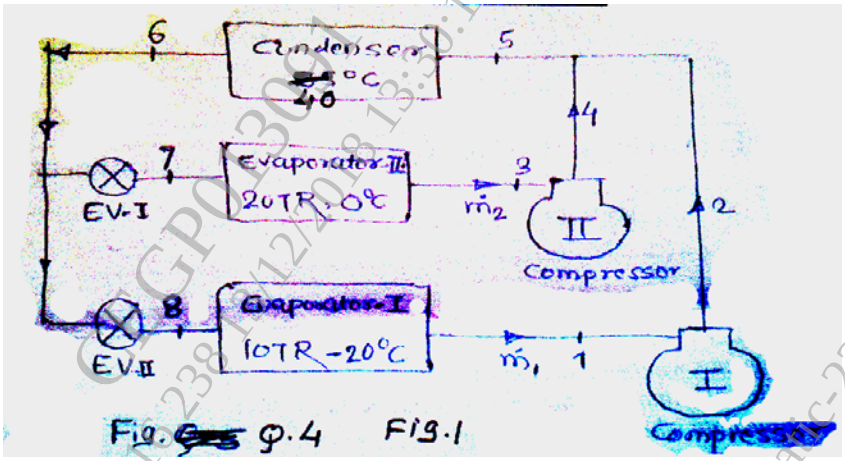


Fig. Q.4 Fig.1

Q5) a) Write note on **'Human Comfort Chart'**. **[6]**

b) Moist air enters a duct at 10 °C, 80% relative humidity, and a volumetric flow rate of 150 m^3 / min. The mixture is heated as it flows through the duct and leaves at 30°C. No moisture is added or removed and the mixture pressure remains approximately constant at 1bar. For steady-state operation. determine **[10]**

i) the rate of heat transfer, and

ii) relative humidity at exit. Use a psychrometric chart for the solution.

OR

Q6) a) Derive an expression of Bypass Factor of coil **[4]**

b) A mixture of dry air and water vapour is at a temperature of 21°C under a total pressure of 736 mm Hg. The dew point temperature is 15°C. Find. **[12]**

i) Partial pressure of water vapour

ii) Relative humidity

iii) Humidity ratio

iv) Enthalpy of air per kg of dry air

v) Specific volume of dry air per kg of dry air.

Q7) a) Explain with neat sketch 'Summer Air Conditioning System' **[6]**

b) Explain the working of scroll compressor with a schematic. **[6]**

c) Explain working of Capillary tube and list its advantages and disadvantages. **[6]**

OR

Q8) a) Explain with neat sketch '**All Year Air Conditioning System**'. **[6]**

b) Discuss the advantages of variable refrigerant flow air conditioning system. **[6]**

c) Explain with neat sketch **'Evaporative Condensers'** **[6]**

Q9) a) A rectangular duct of 0.15 m × 0.12 m is 20 m long and carries standard air at the rate of 0.3 m^3/s. Calculate the total pressure required at the inlet of the duct in order to maintain this flow and the air power required. Take friction factor, f = 0.005 **[8]**

b) Explain air flow through simple duct system. **[8]**

OR

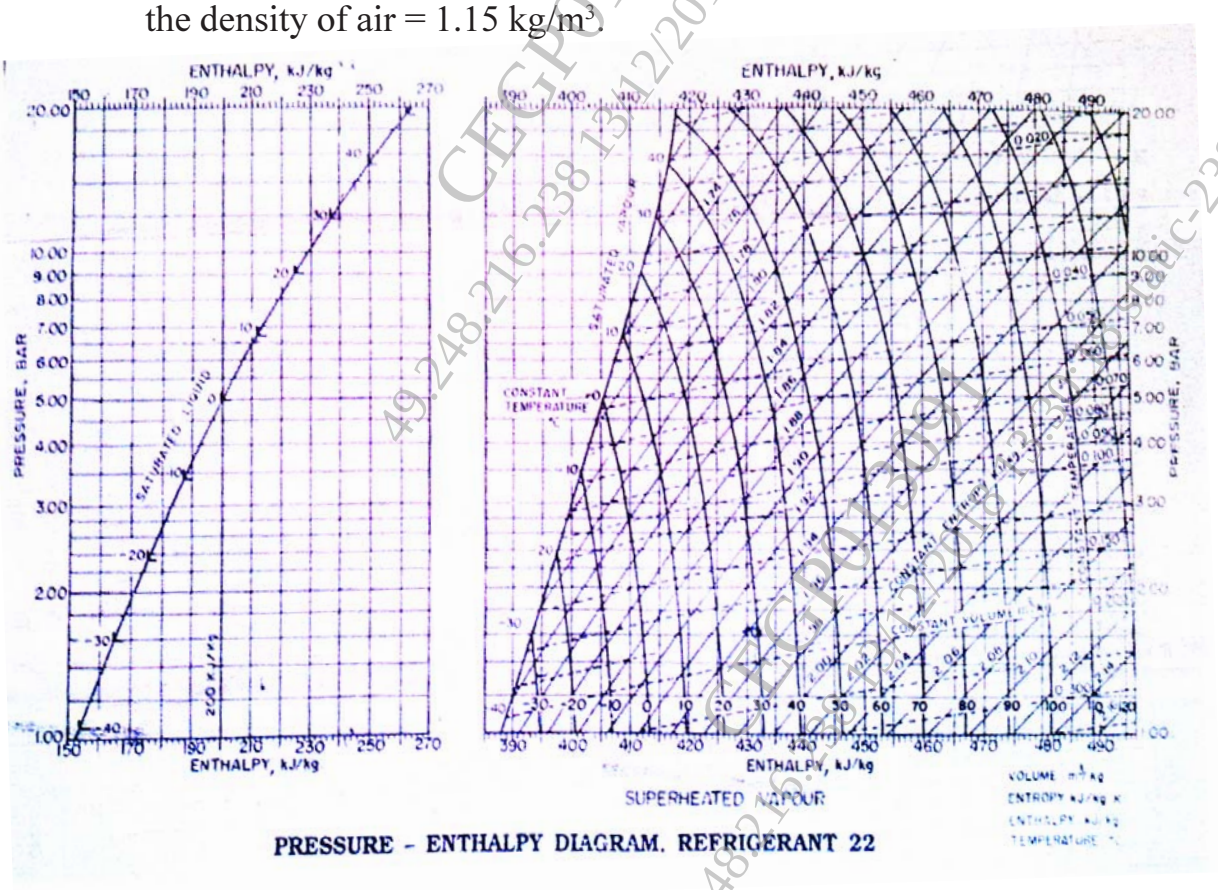
Q10)a) Draw an air handling unit and state its components with their function (s) **[8]**

b) A circular duct of 40 cm diameter is used to carry air in an air conditioning system at a velocity of 440 m/min. If this duct is to be replaced by a rectangular duct of aspect ratio of 1.5, find out the size of rectangular duct for equal friction method when. **[8]**

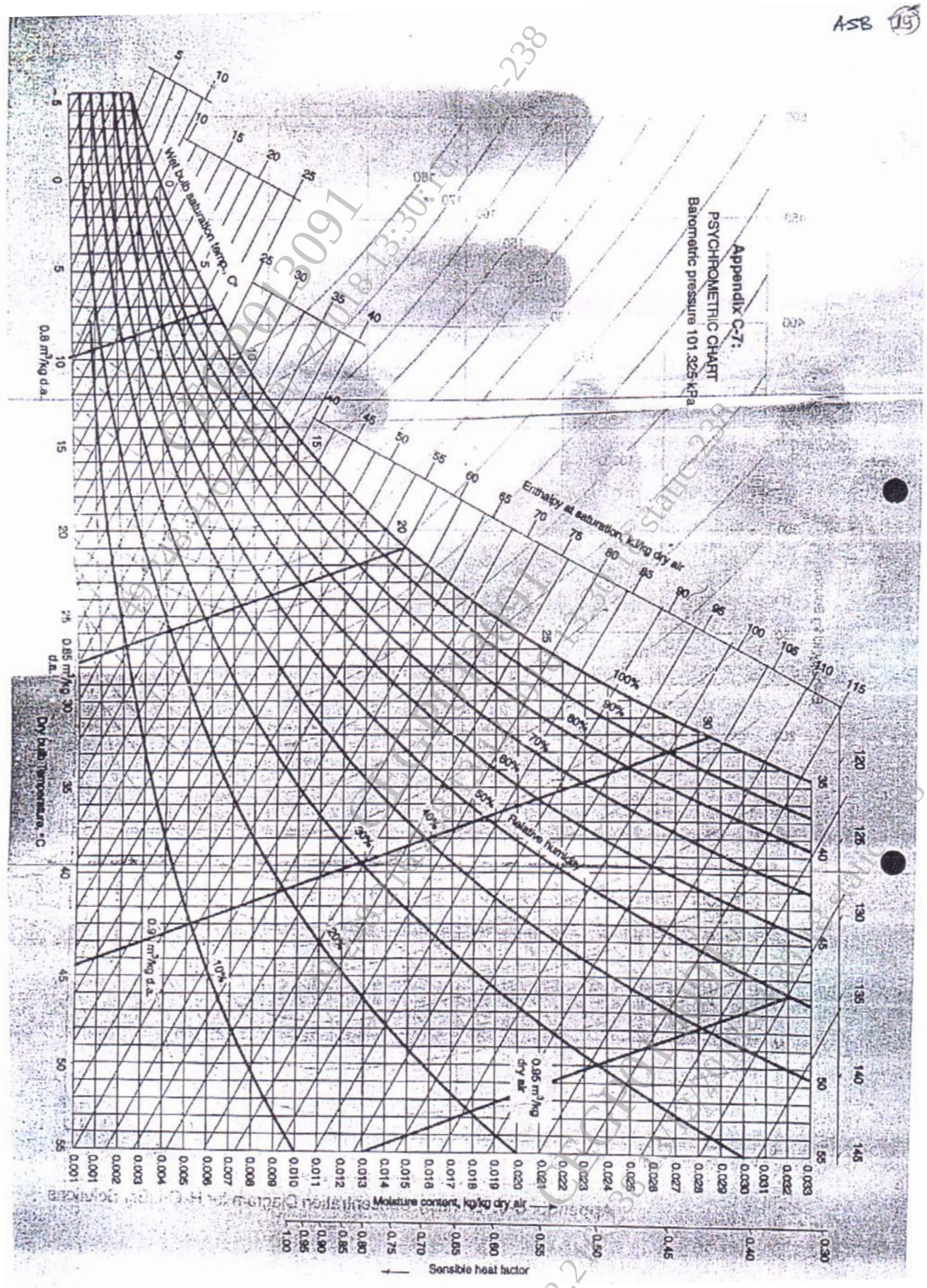
i) Velocity of air in two ducts is same.

ii) The discharge rate of air in two ducts is same.

If f = 0.015, find out the pressure loss per 100 m length of the duct. Take the density of air = 1.15 kg/m^3.



PRESSURE - ENTHALPY DIAGRAM. REFRIGERANT 22


ASB 15
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