Total No. of Questions : 10]

SEAT No :

P 2977

[Total No. of Pages :4

[5154]-531
B.E.(Mechanical)
REFRIGERATION AND AIR CONDITIONING
(Semester-I) (402041) (2012 Course) (Endsemester)

Time : 2½ Hours] *[Max. Marks : 70*

Instruction to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Assume suitable data, if necessary and mention it clearly.***
4) ***Use of steam table is allowed.***

Q1) a) Explain in detail the commercial refrigeration system used for ice plant. **[5]**

b) A vapour compression refrigeration system works between the pressures of 4.98 bar and 1.86 bar. The vapour is superheated at the end of compression, its temperature being 25°C. The liquid is sub cooled to 9°C before throttling. The vapor is 95% dry before compression. Using the data given below find COP of the refrigerator. The specific heat at constant pressure of superheated vapor is 0.65 kJ/kgK and that of liquid is 0.97 kJ/kgK. **[5]**

Pressure (bar)	Temp(°C)	h_f(kJ/kg)	h_{fg}(kJ/kg)
4.98	14.45	49.22	148.3
1.86	–15	21.74	162

OR

Q2) a) Explain how practical VCC deviates from simple saturated VCC. **[6]**

b) What is the necessity of multi-pressure systems? Name the commonly used multipressure systems. **[4]**

Q3) a) Explain the use of following components in vapour compression system:

i) Accumulator; ii) Receiver;

iii) Filter / dryer; iv) liquid suction heat exchanger **[4]**

b) A dense air refrigerating system operating between pressures of 17.5 bar and 3.5 bars is to produce 10 tonnes of refrigeration. Air leaves the refrigerating coils at –7°C and it leaves the air cooler at 15.5°C. Neglecting losses and clearance, calculate the net work done per minute and the COP. For air C_P=1.005 kJ/kgK and γ=1.4. **[6]**

OR

P.T.O.

Q4) a) Discuss ODP, GWP and LCCP of refrigerant. **[6]**

b) Find out the generator temperature for an absorption system having evaporator and absorber temperatures as 250 K and 310 K respectively. Maximum C.O.P. is to be 1.30. If the saturated steam is supplied at a temperature 15 K above the generator temperature, what is the steam pressure? **[4]**

Q5) a) Moist air at saturated atmospheric pressure is passed over a cooling coil. The inlet state-DBT 30°C, RH 50% and exit state-DBT 15°C, RH 90%. Show the process on psychrometric chart. Determine the amount of heat and moisture removed per kg of dry air. **[6]**

b) Calculate; 1. Relative humidity 2. Humidity ratio 3. Dew point temperature 4. Density 5. Enthalpy of atmospheric air when the DBT is 35°C, WBT is 23°C and barometer reads 100kPa. **[10]**

OR

Q6) a) Derive an expression for specific humidity and show that it is a function of vapour pressure and barometric pressure of air. **[6]**

b) A building has the following calculated cooling loads: **[10]**

RSH gain = 310 kW, RLH gain = 100 kW

The space is maintained at the following conditions:

Room DBT = 25°C Room RH = 50%.

Outdoor air is at 28°C and 50% RH. And 10% of mass of air supplied to the building is outdoor air. If the air supplied to the space is not to be at a temperature lower than 18°C, Find.

i) Minimum amount of air supplied to space in m^3/s

ii) Volume flow rates of return air, exhaust air and outdoor air

iii) State and volume flow rate of air entering the cooling coil

iv) Capacity ADP,BPF and SHF of cooling coil.

Q7) a) State the factors which should be taken into consideration while selecting a system of air-conditioning. **[6]**

b) Explain the following control devices. **[8]**

i) Thermostats ii) Automatic humidity control

c) Enumerate the functional elements of a control unit. **[4]**

OR

Q8) a) Explain briefly the following types of reciprocating compressors: **[6]**

i) Semi sealed type ii) Hermetically sealed type

b) Give the main types of condensers with specific application of each type. **[6]**

c) Explain Flooded type evaporator with neat sketch. **[6]**

Q9) a) Define the following as applied to 'Air distribution': **[12]**
Intake, Outlet, Grille, Register, Diffuser, Throw, Drop and Primary air

b) The main supply air duct of an air-conditioning system is 100cm×90cm in cross section and carries 10 m^3/s of air. It branches off in to two ducts, one 80cm×80cm and the other 80cm×60cm. If the mean velocity in the larger branch is 9 m/s, find the mean velocities in the main duct and smaller branch. **[6]**

OR

Q10)a) Explain any two of the following air distribution system: **[8]**

i) Ejector system

ii) Downward system

iii) Upward system

b) A centrifugal fan with90cm X 70cm outlet is moving standard air at a rate of 11.5 m^3/s through a system which consists of straight inlet and outlet ducts. The inlet duct is 90cm in diameter and 15m long. The outlet duct is 100cm in diameter and 60m long. There is a fan diffuser between the fan discharge and the 100cm diameter duct for which thepressure loss is onethird the difference in velocity pressures. The pressure drop at the filter, damper and cooling coil (AC apparatus) in the inlet duct is 150 Pa. The loss at the entry to the inlet is 0.5 × velocity pressure. The friction factor for the outlet duct is 0.0035 and that for the inlet duct is 0.004. Determine the fan total pressure. The air is sucked in by the inlet duct and delivered by the oulet at atmospheric pressure. **[10]**

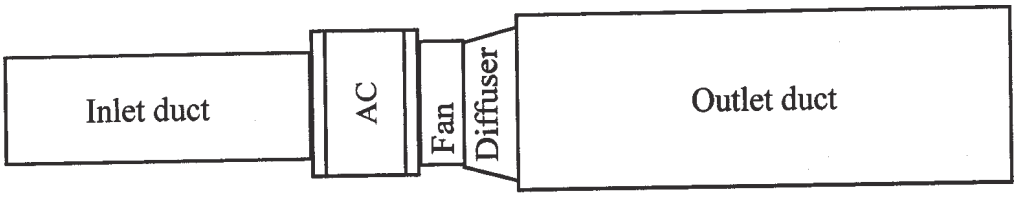

Fig. for Q. 10 b)

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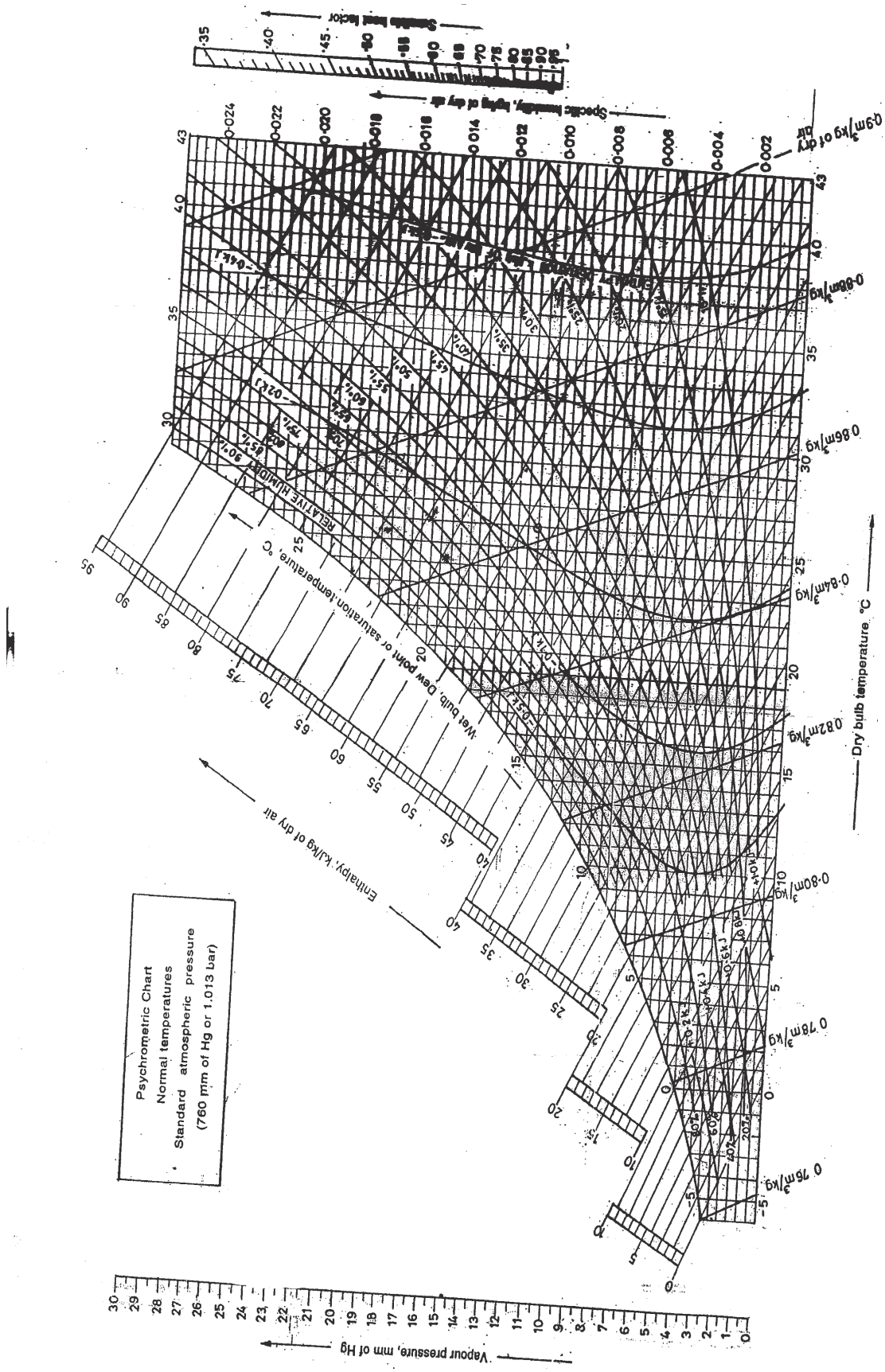
Psychrometric Chart
Normal temperatures
Standard atmospheric pressure
(760 mm of Hg or 1.013 bar)
Enthalpy, kJ/kg of dry air
Wet bulb, Dew point or saturation temperature, °C
Dry bulb temperature, °C
Vapour pressure, mm of Hg
Specific humidity, kg/kg of dry air
RELATIVE HUMIDITY
0.9m³/kg of dry air
0.88m³/kg
0.86m³/kg
0.84m³/kg
0.82m³/kg
0.80m³/kg
0.78m³/kg
0.76m³/kg