The required condition is to be achieved first by cooling and dehumidifying and then by heating. If $20m^3$ of air is absorbed by the plant per minimum, find:

i) Capacity of the cooling coil in TR

ii) Capacity of the heating coil in kW and

iii) Amount of water removed / hr.

OR

10. a) Explain following factors affecting comfort air conditioning system:

i) Temperature ii) Humidity

iii) Purity iv) Motion of air.

b) An air conditioned hall is to be maintained at 27°C DBT and 21°C WBT. It has a sensible heat load of 46.5 kW and latent heat load of 17.5 kW. The air supplied from outside atmosphere at 38°C DBT and 27°C WBT, is $25M^3$/min directly into the room. Outside air to be conditioned is passed through the cooling coil whose apparatus dew point is 15°C. The quantity of re-circulated air from the hall is 60%. This quantity is mixed with the conditioned air after the cooling coil. Determine

i) Condition of air after the coil and before the re-circulated air mixes with it,

ii) Condition of air entering the hall i.e, after mixing with re-circulated air.

iii) Mass of fresh air entering the cooler

iv) B.P.F of the cooling coil

Total No. of Questions :10] *[Total No. of Printed Pages :6*

Roll No .....

AU/ME - 803

B.E. VIII Semester

Examination, June 2014

Refrigeration and Air Conditioning

Time : Three Hours

rgpvonline.com *Maximum Marks : 70*

Note: All questions are compulsory or as directed.Draw necessary diagram and assume suitable data, if required. Use of steam table, refrigeration table and psychrometric chart is allowed.

Unit - I

1. a) Write the names of various methods of air refrigeration system. Briefly explain any one of them with flow and T-S diagram.

b) A cold storage plant is required to store 18 tonnes of fish. The fish is supplied at a temperature of 30°C .The specific heat of fish above freezing point is 2.93 kJ/kg-k and that of below freezing point is 1.26kJ/kg-k. The fish is stored in cold storage which is maintained at –8°C. The freezing point of fish is –4°C. The latent heat of fish is 235kJ/kg. If the plant requires 80kW to drive it, calculate

OR

2. a) Define the following
   i) Ton of refrigeration
   ii) COP
   iii) Relative COP

   b) With the help of diagram, show the difference between a heat pump, refrigerator and heat pump. Also derive that the COP of a heat pump is always greater than one.

   c) A simple air cooled system is used for an aeroplane having a load of 12 TR. The atmospheric pressure and temperature are 0.9 atmosphere and 10°C respectively. The pressure increases to 1 atmosphere due to romming the temperature of the air is reduced by 50°C (fifty) in the heat exchanger. The pressure in the cabin is 1.03 atmosphere and the temperature of air leaving the cabin is 25°C. Determine
      i) Power required to take the load of cooling in the cabin,
      ii) COP of the system. Assume that all the expansions and compressions are isentropic. The pressure of compressed air is 3.5 atmosphere. Also show that system on T-S diagram.

Unit - II

3. a) Explain with the help of flow and p-h diagram, three stage compression with flash chamber.

   b) The following data refers to a 18TR ice plant using ammonia as refrigerant. The temperature of water entering and leaving the condenser are 20°C and 27°C respectively. The temperature of condensation of ammonia is 25°C and temperature of brine is –15°C. Before entering the expansion value, ammonia is cooled to 20°C and it enters the compressor dry saturated. Calculate
      i) Power expended per TR,
      ii) The amount of cooling water in the condenser and
      iii) COP of the Plant. Also represent the system on T-S and P-H diagram.

   Use the properties given table below:

Saturation Temp.	Enthalpy in kJ/kg		Entropy in kJ/kg-k		Specific heat in kJ/kg-k	
in °C	liquid	vapour	liquid	vapour	liquid	vapour
-15	112.34	1426.54	0.4572	5.5490	4.396	2.303
25	298.90	1465.84	1.1242	5.0391	4.606	2.805

OR

4. a) What do you mean by dry ice? With the help of diagrams, explain production process of dry ice.

   b) A vapour compression system with ammonia as the refrigerant works between the pressure limits of 2 bar and 12 bar with three stage compression and water intercooler. The vapours leaving the water intercooler, at 4bar and 8bar in a saturated state. If the load is 12TR, find
      i) Power required to drive the three compressors and
      ii) Compare the COP of this system with that of a

Unit - III

5. a) Write advantages and disadvantages of vapour absorption refrigeration system over vapour compression refrigeration system.

   b) Derive the expression for mass of motive steam required in steam jet refrigeration system.

OR

6. a) Explain Lithium - Bromide absorption refrigeration system, with necessary diagram.

   b) Explain thermodynamic, chemical and physical properties of refrigerant. Also write desirable properties of refrigerants on above basis.

Unit IV

7. a) Define the following terms:

   i) Dry air ii) Moist air

   iii) Saturated air iv) Degree of Saturation

   v) Humidity vi) Absolute humidity

   vii) Relative Humidity viii) DBT

   ix) WBT x) Dew point temperature.

   b) Air at 15°C DBT and 90% R.H. is to be heated and humidified to 35°C DBT and 22°C WBT. The air is preheated sensibly before passing to the air washer in which water is recirculated. The R.H. of the air coming out of the air washer is 90%. This air is again reheated sensibly to obtain the final desired condition. Find

   i) The temperature to which the air should be preheated

   ii) The total heating required

   iii) The makeup water required in the air washer

   iv) The humidifying efficiency of the air washer.

OR

8. a) Show that $W = 0.622 \frac{P_v}{P_b - P_v}$, Where W = humidity ratio, P_v = partial pressure of water vapour, P_a = Partial pressure of dry air, $P_b = P_a + P_v$ Also explain total enthalpy of moist air.

   b) Saturated air at 21°C DBT is passed through a dryer so that its final R.H. is 20%. The air is then passed through a cooler until its final temperature is 21°C without a change in specific humidity. Determine:

   i) The temperature of the air at the end of drying process

   ii) The heat rejected during the cooling process

   iii) The final R.H.

   iv) The dew point temperature at the end of the drying process and

   v) The moisture removed during the drying process.

Unit - V

9. a) Explain with the help of neat diagram "year round air conditioning system".

   b) Following data refers to an conditioning system to be designed for an industrial process for hot and wet climate : Initial or outside conditions = 30°C DBT and