Code :R7320304

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III B.Tech II Semester(R07) Regular & Supplementary Examinations, April/May 2011
REFRIGERATION & AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours
Max Marks: 80

Answer any FIVE questions
All questions carry equal marks
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1. (a) Discuss the advantages closed air refrigeration system over an open air refrigeration system.

   (b) In Bell-Coleman refrigerator, air is taken in at 1 bar and a temperature of -8^{0}C. The compression ratio is 4. The expansion and compression follow the law $pV^{1.2}$=Constant. The air is cooled at the upper pressure to 25^{0}C. find out M.E.P of the cycle and C.O.P.

2. A refrigrerant R-12 vapour compression system operating at a condenser temperature of 40^{0}C and evaporate temperature of -5^{0}C, develops 15 tons of refrigeration. Determine

   (a) The mass flow rate of the refrigerant.

   (b) The piston displacement per Ton of Refrigeration

   (c) The theoretical power of the compressor and power per Ton of the refrigeration

   (d) Actual C.O.P of the cycle.

3. (a) What are the advantages and disadvantages of reciprocating compressors over centrifugal compressors used in vapour compression refrigeration systems?

   (b) Explain the working principle of a screw compressor with neat sketch.

4. (a) Explain the working of practical Ammonia-water vapour absorption refrigeration system.

   (b) What is the function the rectifier and analyzer in Ammonia-water vapour absortion refrigeration.

5. (a) What are the advantages and disadvantages of steam jet refrigeration system over other types of refrigeration systems.

   (b) Draw the T-s and h-s diagrams fro a set jet refrigeration system and write the expressions for the following efficiencies.
       i. Nozzle efficiency
       ii. Entrainment efficiency
       iii. Compression efficiency

6. (a) Establish the following expression for air-vapour mixture
       Specific humidity $w = 0.622 X \frac{P_V}{P_b - P_v}$
       Where P$_v$= partial pressure of water vapour and P$_b$=Barometric pressure.

   (b) Define the following:
       i. Specific humidity
       ii. Absolute humidity
       iii. Relative humidity
       iv. Dew point temperature.

7. (a) State factors that determine human comfort.

   (b) Define the team "effective temperature" and explain the significance in the design of air conditioning systems.

8. (a) How are air filters classified ? With a neat sketch describe the working of an electronic filter and state the merits and demerits of this method.

   (b) Explain the advantages and disadvantages of viscous filters over dry filters.

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1. (a) How is ideal reversed carnot cycle modified to result in Bell-Coleman cycle ?

    (b) The capacity of a refrigerator is 150 TR when working between -6^{0}C and 25^{0}C. Determine the mass of ice produced per day from water at 25^{0}C. Also find the power required to drive the unit. Assume that the cycle operates on reversed cannot cycle. Latent heat of ice can be taken as 335kJ/kg.

2. (a) Explain the air refrigeration by Bell coleman cycle with the help of p-V and T-s diagram.

    (b) What are the merits and demerits of vapour compression refrigeration system over vapour absorption system.

3. (a) Describe the important components of centrifugal compressor with the help of a neat sketch.

    (b) Explain the working principle of an automatic expansion valve with neat sketch.

4. (a) Mention the function of each fluid in a three-fluid vapour absorption system.

    (b) Draw a neat diagram of lithium bromide water absorption system and explain its working. List the major field of applications of this system.

5. In a steam jet refrigeration installation, the steam is available at 6.5 bar dry and saturated and chilled water flash chamber is kept at 5 cm of Hg. The mixture of steam and flashed vapour at entry to the diffuser has a quality of 0.90. assuming nozzle efficiency 0.90, mixing efficiency 0.67 and diffuser efficiency 0.78 and make up water at 28^{0}C, determine:

    (a) Mass of motive steam per kg of flashed vapour.

    (b) Mass of motive steam per ton of refrigerating effect.

    (c) The coefficient of performance of the system.

6. (a) Explain the following:
       (i) Wet-bulb temperature and Dew-point temperature
       (ii) Degree of saturation and Relative humidity.

    (b) The atmospheric air has 35^{0}C dry bulb temperature and 50% relative humidity. Using psychometric chart, find

        i. wet bulb temperature

        ii. humidity ratio

        iii. dew point temperature and

        iv. enthalpy of air per kg of dry air.

7. The following data refer to an air conditioning system for industrial process for hot and wet summer conditions.
    Out door conditions $=30^{0}$C DBT and 75% RH
    Required conditions $= 22^{0}$C DBT and 70% RH
    Amount of out-door air supplied $= 200$ m^{3}/min
    Coil dew point temperature $= 14^{0}$C
    If the required condition is achieved by first cooling and dehumidifying and then by heating, find
    (i) The capacity of the cooling coil and its by-pass factor
    (ii) The capacity of the heating coil and surface temperature of the heating coil if the by-pass factor is 0.2.

8. Write the short notes on the following:

    (a) Applications of heat pump.

    (b) Dry filters

    (c) Fans and blowers

    (d) Grills.

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1. (a) What is the need of air conditioning of Aircraft at high altitudes where ambient temperature are very low?

   (b) Explain the air refrigeration by Bell coleman cycle with the help of p-V and T-s diagram.

2. (a) Explain the Actual vapour compression system on p-h chart clearly showing the typical variation from the theoretical system.

   (b) What are the merits and demerits of vapour compression refrigeration system over vapour absorption system.

3. (a) How are the refrigerants classified?

   (b) Discuss the factors to be considered in the selection of a refrigerant.

4. (a) Discuss the relative merits and field of applications of vapour absorption and vapour compression refrigeration systems.

   (b) Draw a neat line diagram of Electrolux refrigeration and explain its working principle what is the important role of the hydrogen in this refrigeration system.

5. (a) Define seebeck effect, peltier effect and Thomson effect and prove that their inter-relation is given by Equation.

   (b) Define the figure of merit related to thermo electric refrigeration system and explain its effect on C.O.P of the system.

6. The outside air at 31^0C dry bulb temperature and 18.5^0C wet bulb temperature enters a cooling coil at the rate of 40m3/min. The effective surface temperature of the cooling coil is 4.5^0C and its cooling capacity is 12.5kW of refrigeration. Find

   (a) dry bulb and wet bulb temperature of the air leaving the coil,

   (b) enthalpy of air leaving the coil, and

   (c) by-pass factor of the coil.

7. (a) Explain the concept of effective sensible Heat factor for room to be air conditioned. How is it useful to find the ADP for fixed room design condition.

   (b) Explain schematically on the Psychrometric Chart and by schematic diagram, summer air conditioning system and Winter air conditioning system.

8. (a) What are the different methods used to remove the odours from the air ? Explain any one of them in detail.

   (b) Explain the refrigerant circuit heat pump with the help of a line diagram.

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   (b) Explain the air refrigeration by Bell coleman cycle with the help of p-V and T-s diagram.

2. (a) What are the merits and demerits of vapour compression refrigeration system over vapour absorption system?

   (b) Explain the working of a simple vapour compression system with the help of a schematic diagram.

3. (a) What are the essential properties of a good refrigerant?

   (b) What are the advantages of water cooled condenser over air cooled condenser?

4. (a) With the help of neat diagram, explain the working of Lithium bromide-water absorption refrigeration system.

   (b) List out the major fields of applications Lithium bromide-water absorption refrigeration system.

5. (a) What are the advantages of vortex tube over other refrigeration systems ? List out the fields of its applications?

   (b) Explain the working principle of pulse tube refrigeration system. What are the fields of its applications.

6. (a) Explain how the psychometrics chart is prepared.

   (b) Draw a neat diagram of air-conditioning system required in winter season. Explain the working of different components in the circuit.
   Is it possible to use the steam for such air-conditioning system ?

7. (a) Define room sensible heat factor. How room sensible heat factor line is drawn on the psychometric chart.

   (b) Explain the procedure to draw a grand sensible heat factor line on a psychometric chart.

8. (a) List the variables which are involved in the estimation of load.

   (b) Enumerate and explain the components of cooling -load estimate.

   (c) What points should be considered while making heat load calculations?

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