(3 Hours)   [Total Marks: 80]

N.B.: (1) Question No. 1 is compulsory.
  (2) Answer any three from the remaining five questions.
  (3) Assumptions made if any should be justified.
  (4) Use of Refrigerant Charts, Psychrometric Chart, Friction Chart and Steam
    Tables are allowed.

1. Answer any four of the following.   [20]
  a) Draw simple vapour compression cycle on P-h diagram and explain the processes.
  b) What are non conventional refrigeration systems ? Explain any one type.
  c) Air at T_{db}=30°C and RH=40% undergoes a constant humidity process until the final
    state is 20°C. Find   i)Enthalpy of air at final state.   ii)Cooling produced by the
    coil if the air flow is 200 CMM.
  d) List down types of aircraft refrigeration systems. Draw simple air cooling systems
    with neat schematic and T-s diagram.
  e) What is human comfort ? Explain with help of ASHRAE Comfort chart..
  f) What are primary and secondary refrigerants? Gives examples with application of
    each type.

2. a) A bootstrap air refrigeration system of 30 TR capacity is used for an aeroplane   [12]
    flying at an altitude of 2000 m. The ambient air pressure and temperature are 0.8 bar
    and 0 C. The ram air pressure and temperature are 1.05 bar and 17 C. The pressure of
    air after isentropic compression in the main compressor is 4 bar. This air is now cooled
    to 27 C in another auxillary heat exchanger and then expanded isentropically upto the
    cabin pressure of 1.01 bar. If the air leaves the cabin at 25 C and the efficiencies for
    the main compressor, auxillary compressor and the cooling turbine are 80 %, 75 % and
    80 % respectively; find : i) Power required to operate the system and ii. COP of the
    system
  b) Classify refrigeration compressors. Explain each type in brief.   [08]

3. a) Define the terms DBT, WBT, DPT and RH.   [04]
  b) What are the different types of Cooling Towers? Explain in brief.
    Define Range and Approach.   [06]
  c) Draw a neat diagram of Electrolux vapour absorption refrigeration system and
    explain its working.   [10]

4. a) A vapour compression system using Ammonia works between -25 ^{0}C and   [12]
    40 ^{0}C as evaporator and condenser temperature respectively. Using P-h Chart,
    determine

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      i) COP   ii) Mass of refrigerant per TR

    iii) Piston displacement per TR using volumetric efficiency = 83 %

    iv) Heat rejected in the condenser per TR

    v) Ideal COP

  b). Draw a neat sketch of Year Round Air Conditioning system and explain working of its components.   [08]

5. a) What are the sources of cooling load for a Restaurant ? Discuss in details.   [06]

  b) Define body temperature regulation and effects of extremes of hot and cold   [06] climate on human body.

  d) A sling psychrometer reads 40 ^{0}C DBT and 28 ^{0}C WBT when atmospheric pressure is 750 mm of Hg.   [08]

Calculate using Steam Tables only   i). Specific humidity   ii). Relative humidity
iii). Dew point temperature   iv). Enthalpy

6. Write short notes on any four.   [20]

    a) Liquefaction of Gases

    b) Duct Design Methods

    c) Desirable Properties of Refrigerants

    d) Thermoelectric Refrigeration

    e) Star Rating of Air Conditioners

    f) DART rating of Air Refrigeration Systems

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