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AU/ME-803

B.E. VIII Semester

Examination, June 2017

Refrigeration and Airconditioning

Time : Three Hours

Maximum Marks : 70

Note: Answer any five questions out of eight. All questions carry equal marks. Use of refrigerant property tables and psychrometic chart is permitted in the exam.

1. a) A refrigeration system operates on the reverse Carnot Cycle. The higher temperature of the refrigeration in the system is 35°C and the lower temperature is –15°C. The capacity is to be 12 tonnes. Neglecting all losses determine
    i) C.O.P
    ii) Heat rejected from the system
    iii) Power required
    b) Explain with a neat sketch a Boot strap cycle of air refrigeration.

2. An aircraft refrigeration plant has to handle a cabin load of 27 tonnes. The atmospheric temperature is 17°C. The atmospheric air is compressed to a pressure of 0.95 bar and temperature of 30°C due to ram action. This air is then further compressed in a compressor to 4.75 bar, cooled to 67°C in a heat exchanger and expanded in a turbine to 1 bar pressure and supplied to cabin. The air leaves the cabin at a temperature of 27°C. The isentropic efficiency of both compressor and turbine are 0.9 each. Calculate the mass of air circulated per minute and COP. For air $c_p = 1.004$ kJ/kg K and $C_p/C_v = 1.4$

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3. Discuss the effects of the following on the performance of a vapour compression system
    i) Effect of suction pressure   ii) Effect of superheating
    iii) Effect of subcooling of liquid

4. An ammonia refrigeration system rejects 100 kW of heat to condenser while operating between –10°C and 40°C temperature limits. The compression efficiency is 0.8 and $vc/vs = 0.04$ and $n = 1.28$. Determine
    i) Refrigerant flow rate   ii) Compressor power
    iii) Tonnage   iv) COP and
    v) Swept volume of $N = 10$ rps

5. a) Why is a vapour absorption system very popular.
    b) Discuss favourable properties of a ideal refrigerant.

6. a) Show the following process on the psychrometric chart
       i) Sensible heating process
       ii) Cooling and dehumidification process
    b) At a place the barometric reading is 680mmHg, $T_{db} = 35$°C and $T_{wb} = 25$°C. Determine
       i) Specific humidity   ii) Specific volume
       iii) Specific and relative enthalpy

7. It is required to design an air conditioned system for an industrial process for the following condition
    Outdoor condition = 32°C DBT and 65% RH
    Required air inlet condition = 25° DBT and 60% RH
    Amount of free air circulated = 250 m^3/min
    Coil Dew point temperature = 13°C
    The required condition is achieved by first cooling and dehumidifying and then by heating. Calculate
    i) The cooling capacity of cooling coil and its bypass factor
    ii) Heating capacity of the heating coil in kw and its temperature of the bypass factor is 0.3.
    iii) The mass of water vapour removed per hour

8. Write short notes on any two:
    a) Cascade system   b) Steam jet refrigeration
    c) Air liquefaction system

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