JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, November/December - 2015
REFRIGERATION AND AIR CONDITIONING
(Mechanical Engineering)

Time: 3 hours
Max. Marks: 75

Answer any five questions
All questions carry equal marks
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1.a) In an air craft cooling system, air enters the compressor at 0.1 MPa, 4^0C and is compressed to 0.3 MPa with an isentropic efficiency of 72%. After being cooled to 55^0C at constant pressure in a heat exchanger the air then expands in a turbine to 0.1 MPa with an isentropic efficiency of 78%. The low temperature air absorbs a cooling load of 3 TR at constant pressure before reentering the compressor which is driven by the turbine. Assuming air to be an ideal gas, determine the COP of the refrigerator, the driving power required and air mass flow rate.
  b) What are advantages and disadvantages of using air as a refrigerant?   [10+5]

2.a) Compare the performance of vapour compression refrigeration system (VCRS), using the same T-s diagram, with that of the reversed Carnot cycle.
  b) A commercial refrigerator operates with R-12 between 1.2368 bar and 13.672 bar. The vapour is dry and saturated at the compressor inlet. Assuming isentropic compression, determine the theoretical COP of the plant. The isentropic discharge temperature is 64.86^0C. if the actual COP of the plant is 80% of the theoretical, calculate the power required to run the compressor to obtain a refrigerating capacity of 1TR. If the liquid is sub-cooled through 10^0C after condensation, calculate the power required. Take specific heat of liquid is 1.055 kJ/kgK.   [7+8]

3.a) Define primary refrigerant and discuss desirable properties of primary refrigerants' Give the refrigerant number for the following: $CHClF_2$, C_2H_6, CO_2, CH_2F-CF_3
  b) Explain the working principle of thermostatic expansion valve with the help of neat diagram.   [8+7]

4.a) Draw the schematic of actual vapour absorption based refrigeration system (NH_3-H_2O based) and explain its working procedure.
  b) In an absorption type refrigerator the heat is supplied to NH_3 generator by condensing steam at 3 bar 80% quality. The evaporator temperature is -3^0C. Determine the maximum COP possible. If refrigeration load is 15TR and actual COP is 60% of maximum COP, Find the weight of the steam required per hour. Take ambient temperature is 27^0C.   [8+7]

5.a) Explain the difference between n-type and p-type semi-conductors. Which are more useful for thermoelectric refrigeration system?
  b) Explain the various components of steam jet refrigeration system and clearly discuss the function of each component.   [6+9]

6.a) Air at 10^0C DBT and 90% RH is to be brought to 35^0C DBT and 22.5^0C WBT with the help of winter air conditioner. If the humidified air comes out of the humidifier at 90% RH, draw the various processes involved on a skeleton psychometric chart and find the temperature to which the air should be preheated.

b) Explain the following terms using temperature-entropy diagram: (i) Dew point temperature of air (ii) Saturation Temperature of air (iii) Wet bulb temperature

If the total atmospheric pressure remains constant at a location, prove that the specific humidity is approximately a linear function of the partial pressure of the vapour in the atmosphere   [9+6]

7.a) What is comfort air-conditioning? What do you mean by effective temperature?

b) What are the different factors considered in load estimation for comfort application?   [8+7]

8.a) What is an heat pump? How a VCRS can be used to cool and dehumidify in summer and heat in winter?

b) Write a short note on different equipment used in year round air-conditioning system.   [8+7]

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