R18

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, February/March - 2022
REFRIGERATION AND AIR CONDITIONING
(Mechanical Engineering)

Time: 3 Hours   **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

1.a) Draw p-V and T-s diagrams of actual air refrigeration system and discuss the salient points.
  b) In a Bell-Coleman cycle of a refrigerator system, air is taken in at 1 bar and a temperature of -8^0C. The compression ratio maintained in the compressor is 4 by following the law of compression and expansion as $PV^{1.2}$ = Constant. If the maximum temperature of the cycle is 25^0C, then find mean effective pressure, work required, net refrigerating effect and COP.   [7+8]

2.a) What are the advantages, limitations and different applications of air refrigeration system? Explain.
  b) A simple vapour compression cycle using F-12 is designed to take a load of 10 tons. The refrigerator and ambient temperatures are 0^0C and 30^0C respectively. A minimum temperature of -5^0C is required in evaporator and condenser for heat transfer. Find (i) mass flow rate through the system (ii) Power required in kW (iii) cylinder dimensions assuming L/D ratio as 1.2 for a single cylinder and single acting compressor running at 300 rpm with a volumetric efficiency of 0.9.   [7+8]

3.a) How does the sub cooling and super heating influence the performance of vapour compression refrigeration system? Explain.
  b) Explain the important components required for the operation of simple vapour compression refrigeration system.   [7+8]

4.a) A single stage, single acting reciprocating compressor has a bore of 200 mm and a stroke of 300 mm. If receives vapour refrigerant at 1 bar and delivers it at 5.5 bar. If the compression and expansion follows the law $PV^{1.3}$ = constant and the clearance volume is 5% of the stroke volume, then determine (i) The power required to drive the compressor, if it runs at 500 rpm and (ii) The volumetric efficiency of the compressor.
  b) Explain the principle of operation of evaporative condenser used in the refrigeration system.   [7+8]

5.a) Differentiate between Azeotropes and Zeotropes and discuss their importance with respect to Ozone depletion and global warming.
  b) Describe the constructional and operational features of Li-Br vapour absorption refrigeration system.   [7+8]

6.a) How does the Hilsch tube refrigeration system function? Explain by drawing the suitable line diagram.
  b) Derive the equation for the estimation of max COP of vapour absorption refrigeration system and how does it affect with the generator temperature?   [7+8]

7.a) Air at 1 bar and 29^0C has a wet-bulb temperature of 23^0C. Determine (i) the partial pressure of water vapour (ii) the humidity ratio, (iii) the relative humidity (iv) the dew point, and (v) the enthalpy of air, and (vi) the degree of saturation per kg of dry air. Solve the problem analytically and check the results using Psychometric chart.

b) What is the need of ventilation air in the air conditioning system? Discuss the method to supply the ventilation air. [8+7]

8.a) Why does the enthalpy of an air-vapour mixture remain constant during an adiabatic saturation process?

b) The following data refer to an air conditioning system for industrial process for hot and wet summer conditions: outdoor conditions = 33^0C DBT and 78% RH, required conditions = 20^0C DBT and 73% RH, amount of out-door air supplied = 220 m^3/min, coil dew point temperature = 12^0C. 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 0.18. [7+8]

--ooOoo--