R17

Code No: 5421AN

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech II Semester Examinations, June/July - 2019

REFRIGERATION AND AIR CONDITIONING

(Thermal Engineering)

Time: 3hrs Max.Marks:75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

5 × 5 Marks = 25

1.a) Discuss the concept of flash gas removal with multi stage compression in brief. [5]

b) Explain the working principle of lithium bromide-water vapour absorption refrigeration system with a neat diagram. [5]

c) What are the advantages of air cycle refrigeration with regard to its application in air craft refrigeration? [5]

d) Show that specific humidity is a function of partial pressure of water vapour only? [5]

e) Discuss in detail about air washer. [5]

PART - B

5 × 10 Marks = 50

2.a) What type of evaporator is used in domestic refrigerator? Explain it with a neat diagram?

b) A three stage ammonia refrigeration system with flash inter cooling operates between the overall pressure limits of 2 bar and 12 bar. The flash inter cooler pressures are 4 bar and 8 bar. If the load on the evaporator is 10 TR. Find the power required to run the system and compare COP of the system with that of simple saturation cycle working between the same temperature limits? [4+6]

OR

3.a) What is effect of condensing temperature and evaporating temperature of COP and refrigerating effect? Explain.

b) The following data refers to a three stage compression with three stage expansion valve and flash inter cooling. Condenser pressure=12 bar, Evaporator pressure=2 bar, Flash inter cooler pressures= 4bar and 8 bar, Load on the evaporator=10 TR. Find the power required to drive the system and compare the COP of the system with that of simple saturation cycle working between the same temperature limits? [4+6]

4.a) Explain the working principle of production of low temperatures by adiabatic demagnetization of a Paramagnetic salt with a neat diagram?

b) Dry air at 20^0 C and 1 bar is to be liquefied by the Claude method. The air is compressed isothermally at 20^0 C to 170 bar. Assume that 80% of the total mass of air is compressed passes through the expander. The temperature of air entering the expander is -80^0 C, while the temperature of air leaving the expander is -140^0 C. The makeup air is supplied at 20^0C and 1 bar. Determine the yield of liquid air in kg per kg of air compressed and temperature of air before throttling? [4+6]

OR

5.a) Describe with a neat sketch the working of Lithium-bromide vapour absorption systems.

b) In an absorption type refrigeration the heat is supplied to NH_3 generator by condensing steam at 2 bar and 90% dry. The temperature to be maintained in the refrigerator is -5^0 C. The temperature of the atmosphere is 30^0C. Find the maximum COP possible of the refrigerator. If the refrigeration load is 20 tons and actual COP is 70% of maximum COP, find the mass of steam required per hour. [5+5]

6.a) How will you estimate the amount of coolant required for a given flight of air craft?

b) A Bootstrap refrigeration system of 20 TR capacity is used for an aero plane flying at an altitude of 2000m. The ambient air pressure and temperature are 0.8 bar and 0^0 C. The ram air pressure and temperature are 1.05 bar and 17^0 C. The pressure of air after isentropic compression in the main compressor is 4 bar. The air is now cooled to 27^0 C in another auxiliary heat exchanger and then expanded isentropically up to the cabin pressure of 1.01 bar. If the air leaves the cabin at 25^0 C and the efficiencies for the main compressor, auxiliary compressor and the cooling turbine are 80%, 75% and 80% respectively. Find i) power required to operate the system ii) COP of the system. [5+5]

OR

7.a) Explain the meaning of P and N type thermoelectric elements.

b) Explain the working principle of pulse tube refrigeration system and explain the various applications of this system. [5+5]

8.a) What is effective temperature and what factors affect it?

b) Air at 10^0 C and 90% relative humidity is to be heated and humidified to 25^0C and 40% relative humidity by the following three processes. i) pre heating ii) adiabatic saturation in a recirculated air washer iii) reheating to a final state. Calculate: I) Heating required in two heaters II) make up water required in washer and temperature of washer. Assume effectiveness of washer as 80%. [4+6]

OR

9. A hall is to be maintained at 20^0 C DBT and 60% R.H. When ambient conditions are 40^0 C DBT and 26^0C WBT. The room sensible and latent heat gains are 70,000 KJ/hr and 22,000 KJ/hr respectively. The in filtered air is 30 m^3/min. 60% of the total air is recirculated and mixed with the conditioned air after the conditioner. Determine a) The condition of air leaving the conditioner and before entering the hall b) Volume of fresh air passing through the air-conditioner c) bypass factor d) Refrigeration load on the conditioner coil in TR e) Area of the cooling coil required if the overall heat transfer coefficient is 50 W/m^2 -^{0}C. Take ADP of cooling coil as 5^0 C. [10]

10.a) Explain the working principle of a thermostat in an A/C plant.

b) A library hall is to be maintained at 24^0 C DBT and 50% R.H. When ambient conditions are 38^0 C DBT and 40% R.H. The room sensible and latent heat gains are 1,25,000 kJ/hr and 68,000 kJ/hr respectively. The ventilation is 65 m^3/min. Determine i) Grand total heat ii) ERSHF iii) ADP iv) Dehumidified air quantity. Take bypass factor of cooling coil as 0.1. [5+5]

OR

11. a) Describe the different methods of Temperature Controls and Humidity Controls.

b) Which type of air cleaner would be selected for removing very small particles of dirt and smoke from the air? Explain the working principle of this cleaner. [5+5]

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