GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 712102N   **Date: 02-12-2014**

Subject Name: Advanced Refrigeration

Time: 10:30 am - 01:00 pm   **Total Marks: 70**

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1 **(a)** Explain the balancing of compressor and capillary tube in VCR system and effects of unbalanced conditions in compressor-capillary tube system **07**

(b) Why is R22 needed to be phased out? Name the refrigerants which can replace R22 in air conditioners. **07**

Q.2 **(a)** Describe the VCR cycle with P-h diagram having multiple evaporators with multiple expansion valve and multiple compression system. **07**

(b) The condenser and evaporator temperatures are 40°C and - 40°C respectively for a two-stage NH3 refrigeration system. A flash chamber at an intermediate pressure Pi = 3.413 bar is used to intercool the LP vapour up to saturated state. Find the tonnage of the system, power requirements of compressor and COP of the system if the refrigerant flow rate through evaporator is 0.5 kg/s. **07**

OR

(b) In an ammonia system one evaporator is to provide 180 kW of refrigeration at -30°C and another evaporator is to provide 200 kW at 5°C. The system uses two-stage compression with flash intercooling. The condensing temperature is 40°C. Calculate the power required by the compressors. **07**

Q.3 **(a)** A boot strap cooling system of 20 TR capacity is required for an aeroplane cabin. The temperature and pressure conditions of the atmosphere are 20°C and 0.8 bar. The pressure of air is increased from 0.8 bar to 0.96 bar due to ramming action. The pressure of air leaving the main compressor and auxiliary compressors are 3.5 bar and 5.25 bar respectively. The isentropic efficiency of both the compressor is 85% and of turbine is 80%. 60% of total heat of air leaving the main compressor is removed in the first heat exchanger and 35 % of total heat of the air leaving the auxiliary compressor is removed in the second heat exchanger. **07**

Assuming that ramming is isentropic and cabin pressure is 1.03 bar, find the followings

    (a) kW required to take the load in the cabin

    (b) COP of the system

Temperature of air leaving the cabin should not exceed 27°C

(b) Draw a neat diagram of "Electrolux refrigerator" and explain its working principle. What is the important role of Hydrogen in this system? **07**

OR

Q.3 **(a)** In an aqua ammonia absorption system, the highest and lowest pressures are 20 bar and 3.5 bar respectively. The concentration of strong solution is 0.42 and degassing range is 0.36. With suitable assumption find COP of the system. **07**

(b) Describe with a neat sketch Reduced ambient cycle of air refrigeration. **07**

Q.4 (a) The steam at 8 bar pressure saturated passes to steam ejector water vapour refrigeration system. The temperature of water in flash chamber is 5°C. Make up water is supplied at 20°C. The absolute pressure in the condenser is 0.06 bar. The nozzle efficiency 86%, the entrainment efficiency is 64 % and compression efficiency is 80 %. The quality of the motive steam and flashed vapour mixed together at the beginning of compression is 90 % dry. Determine **07**
(i) Mass of motive steam required per kg of flashed vapour
(ii) Refrigeration effect per kg of flashed vapour.

(b) Explain cascade refrigeration system with a neat sketch and p-h diagram. **07**

OR

Q.4 (a) Define Seebeck effects, Thomson effect and Peltier effect in connection with thermoelectric refrigeration system. **07**

(b) Describe with neat sketch air to air heat pump **07**

Q.5 (a) Describe working of cold storage plant. **07**
(b) Discuss various methods of food preservation. Mention the field of application of freezing preservation methods. **07**

OR

Q.5 (a) Explain the various methods of transport refrigeration **07**
(b) What are non-azeotropic and azeotropic mixture refrigerants? **07**

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