## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME - SEMESTER-II EXAMINATION – SUMMER 2015

Subject Code: 2722109 Subject Name: Advanced Refrigeration Engineering Time: 02:30 PM to 05:00 PM Instructions: Date: 28/05/2015

**Total Marks: 70** 

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 (a) What are CFC and HCFC refrigerants? Why they are required to be phased out? 07
  - (b) Draw the T-s and h-s diagrams for a steam jet refrigeration system and write the 07 expression for the following efficiencies
    - I. Nozzle efficiency
    - II. Entrainment efficiency
    - III. Compressor efficiency.
- Q.2 (a) Explain briefly with neat sketch the working of thermostatic expansion valve. 07
  - (b) A boot strap cooling system of 9 TR capacity is required for an aeroplane cabin. The temperature and pressure conditions of the atmosphere are 20°C and 0.86 bar respectively. The pressure of air is increased from 0.86 bar to 1 bar due to ramming action of air. The pressure of air leaving the main compressor and auxiliary compressors are 3.2 bar and 4.2 bar respectively. The isentropic efficiency of both the compressor is 82% and of turbine is 86%. 45% of total heat of air leaving the main compressor is removed in the first heat exchanger and 32 % of total heat of the air leaving the auxiliary compressor is removed in the second heat exchanger.

Assuming that ramming is isentropic and cabin pressure is 0.92 bar, find the followings

(a) The power required to take the load in the cabin

(b) COP of the system

Temperature of air leaving the cabin should not exceed 21°C

OR

- (b) Differentiate between simple air refrigeration system and bootstrap air 07 refrigeration system
- Q.3 (a) Explain cascade refrigeration system with a neat sketch and also comment on 07 intermediate temperature T<sub>i</sub> if upper and lower stage system COP is same.
  - (b) A refrigeration plant comprises three evaporators of capacities 10 TR at 10°C, 07 20 TR at 5°C and 30 TR at -10°C with individual expansion values and individual compressors but one condenser operating at 40°C and sub cooling the liquid to 30°C. All the evaporators discharge dry saturated refrigerant R134a to the compressor. Assuming isentropic compression determine the compressor power required in each of the compressor.

## OR

Q.3 (a) Why is the balancing of components of the refrigeration system required? 07

- (b) Calculate power required to compress 3.5 kg/s of refrigerant 22 from saturated vapor at 100 kPa to a condensing pressure of 1000 kPa by using two stage compressions with intercooling at 300 kpa, using flash intercooling.
- Q.4 (a) Perform analysis of aqua ammonia refrigeration system using concentration- 07 enthalpy chart.
  - (b) Discuss differences between NH3-H2O vs LiBr-H2O vapour absorption system 07
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## OR

Q.4	(a) (b)	Explain with neat sketch double effect LiBr-H2O vapour absorption system. The generator of VAR system is having a saturated mixture of aqua ammonia at 20 bar pressure and 130°C temperature. Using h-c diagram evaluate enthalpy and concentration of the mixture in liquid as well as for vapour state.	07 07
Q.5	(a) (b)	Explain various methods of freezing for preservation of food. Discuss main sources of heat generation required to be considered while designing a Cold storage.	07 07
		OR	
Q.5	(a) (b)	Explain the various refrigeration systems used for transport. Describe the VCR cycle with P-h diagram having multiple evaporators with multiple expansion valve and individual compressors.	07 07

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