

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2013

Subject code: 711003N**Date: 03-01-2014****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.
4. Use of student's own tables and charts are allowed.

- Q.1** (a) Describe the cycle with P-h diagram of multiple evaporators with individual expansion valve and back pressure valve with single compressor. **07**
- (b) What are the possible effects of oversized condense and oversized evaporator. **07**

- Q.2** (a) Describe with a sketch Reduced ambient cycle of air refrigeration. **07**
- (b) A regenerative air refrigeration system is designed to take 18 tonnes of refrigeration load of an air craft cabin. The ambient air pressure 0.82 bar and temperature of 12°C is rammed isentropically till pressure rises to 1.22 bar. The air bled off the main compressor at 4.4 bar is cooled by the ram air in the heat exchanger whose effectiveness is 0.62. The air from the heat exchanger is further cooled to 64 °C in the regenerative heat exchanger with portion of the air bled after expansion in cooling turbine. The cabin is maintained at 22 °C and at pressure of 1 bar. If the isentropic efficiencies of compressor and turbine are 88 % and 82 % respectively determine C.O.P. of the system. **07**

OR

- (b) Enumerate the desirable properties of an ideal refrigerant. **07**
- Q.3** (a) Analyze thermoelectric refrigeration. **07**
- (b) The following data refers to thermoelectric refrigeration system. Each couple has total electrical resistance 0.001Ω , total thermal conductance 0.020 W/K and thermoelectric power of $400 \times 10^{-6} \text{ V/K}$. Calculate the figure of merit. $T_h = 300 \text{ K}$, $T_c = 250 \text{ K}$. $I = 20 \text{ A}$. Find the cooling capacity in tonnes of refrigeration if 50 couples are used. **07**

OR

- Q.3** (a) Explain cascade refrigeration system. **07**
- (b) Multiple evaporators with single compressor system is having following data. **07**

Refrigerant –R22

Condenser pressure- 10 bar

Evaporator 1 – 1bar 70 kW capacity

Evaporator 2 - 2 bar 52 kW capacity

Evaporator 3 - 4 bar 35 kW capacity

Assuming isentropic compression and vapour leaving each evaporator is dry and saturated find the COP of the system.

- Q.4** (a) How the refrigeration is achieved in absorption system? Describe practical absorption system. **07**
- (b) A stream of liquid aqua ammonia at 7 bar, 30 °C and $C = 0.6$ flowing at a rate of 6 kg /min. is mixed with another stream of aqua ammonia at the **07**

same pressure flowing at a rate of 3 kg/ min at 80 °C and $C = 0.3$. Determine concentration, enthalpy and temperature of the mixture and percentage vapour in the mixture after mixing.

OR

Q.4 (a) Analyze the steam jet refrigeration system on T-S chart and state its limitations. **07**

Q.4 (b) The steam at 7 bar pressure saturated to steam ejector water vapour refrigeration system. The temperature of water in flash chamber is 45°C. make up water is supplied at 18 °C. the pressure in the condenser is 0.68 bar. The nozzle efficiency 88 %, the entrainment efficiency is 65 % and compression efficiency is 92 % determine
(i) Mass of motive steam required per kg of flashed vapour
(ii) Refrigeration effect per kg of flashed vapour. **07**

Q.5 (a) Describe working of cold storage plant. **07**

(b) Explain freeze drying process and its advantages. **07**

OR

Q.5 (a) Write a short note on applications of heat pump. **07**

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