Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Examination January 2010

Subject code: 711003 **Subject Name: Advanced Refrigeration**

Date: 25 / 01 / 2010 **Time: 12.00 – 2.30 pm**

Total Marks: 60

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of charts & tables are allowed.**

Q.1 **(a)** Discuss the advantages of Multistaging in vapor compression cycle. **06**

(b) What is cold storage? State types of the cold storages and discuss the different types of refrigeration loads on cold storage? **06**

Q.2 **(a)** Explain balancing of compressor and condenser for vapor compressor system. **06**

(b) What are the eco-friendly refrigerants? What are the alternatives of R-22 & R- 12? Give name and chemical formula for the above and how they are identified? **06**

OR

(b) Compare A dual compressor system with individual expansion valves Vs A dual compressor with multiple expansion valve with the help of neat sketches and *p*-h diagrams. **06**

Q.3 **(a)** A two stage NH3 refrigeration system operates between overall pressure limits of 15 bar and 2 bar respectively. The liquid is sub-cooled to 30°C. The temperature of de-superheated vapor leaving the water intercooler is also 30°C. The flash chamber separates the dry vapor at 5 bar pressure. The liquid refrigerant then expands to 2 bar, the evaporator pressure. The load on the evaporator is 50 kW. Calculate (1) the mass flow rate in differential lines (2) power required (3)COP. **08**

(b) Explain sectionalizing. **04**

OR

Q.3 **(a)** Give thermodynamic analysis of cascade refrigeration neat sketches on p-V diagram & T-s diagram. **06**

(b) Explain Heating cycle and Cooling cycle of heat pump refrigeration cycle. **06**

Q.4 **(a)** A stream of 15 kg/s of aqua ammonia (c_1=0.8) at 0°C and 5 bar mixes adiabatically with another saturated liquid stream with the flow rate 10 kg/s and 100°C at the same pressure. Establish the state points on h-c diagram and obtain mixture concentration, mixture enthalpy, isotherm through the mixture state and amount of liquid and vapor after mixing. Further, find the state of outcoming mixture and concentration of liquid and vapor if there is heat transfer to the system at a rate of 5000 kJ/s. **06**

(b) Explain the air refrigeration cycle with regeneration by neat sketch. **06**

OR

Q.4 **(a)** Explain desirable properties of refrigerant and absorber for vapor absorption system. Which is a preferable among LiBr- H_2O combination over $NH_3 – H_2O$? Why? **06**

(b) For a simple air craft refrigeration $\eta_c = 0.85$, effectiveness of condenser $\varepsilon = 0.8$, $T_1 = 30^oC$, $P_1 = 1.1$ bar, $P_2 = 4.4$ bar $T_e = 27^oC$ the cooling turbine efficiency is 0.81. Find for 5 ton of refrigeration requirement: (1) temperature of air entering the cabin (2) air bled from the main compressor (3) COP and (4) power required to drive the blower for heat exchanger. The cabin pressure is 1 atm. Notations are as usual. **06**

Q.5 **(a)** A steam jet refrigeration system is supplied with motive steam at 700 kPa dry and saturated. The chilled water temperature is to be 7^oC. The make-up water is supplied at 17^oC. The condenser operates at 40^oC, $\eta_{nozzle} = 90\%$, $\eta_{entrainment} = 65\%$, $\eta_{compressor} = 80\%$. The quality of motive steam and flashed vapor is 0.92 dry at the beginning of compression. Determine the mass of motive steam required /min/ton. Assume that vapour coming out of the flash chamber is saturated. Also find out the COP of the system. **12**

OR

Q.5 **(a)** Discuss in short - Freezing and Food preservation **06**

(b) Discuss the advantages of Thermoelectric refrigeration system. **06**

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