Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 712102N

Subject Name: Advanced Refrigeration

Date: 01 / 02 /2011 **Time: 02.30 pm – 05.00 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 refrigeration charts and tables is permitted**

Q.1 (a) State method of balancing of compressor and capillary tube in vapour compression refrigeration system and its effects on unbalanced system. **07**

(b) Discuss suitability of refrigerant for following systems with justification: **07**

1. Fish preservation plant
2. Split air conditioning
3. Hospital air conditioning
4. Central air conditioning

Q.2

(a) State desired physical, chemical and thermodynamic properties of refrigerants. **07**

(b) A two stage Ammonia 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 vapour leaving the water inter-cooler is also 30°C. The flash chamber separates the dry vapour at 5 bar pressure. The liquid refrigerant then expands to 2 bar, the evaporator pressure. The load on evaporator is 50 KW. Calculate the mass flow rate in different lines , power required and COP. **07**

OR

(b) A refrigeration installation using R-134a consists of one compressor, one condenser, and three evaporators of 35KW, 52KW, 70KW. The temperature to be maintained in evaporators is corresponding to pressure of 4 bar 10°C, 2 bar -10°C, and 1 bar -30°C respectively. There is no sub cooling. Calculate mass flow rate in each evaporator, compressor power, COP. Assume condenser pressure of 10 bar. **07**

Q.3

(a) List advantages and limitations of air cycle refrigeration and factors to be considered for selecting refrigeration system for air craft. **07**

(b) In an ammonia absorption system , the pressure are 12 bar and 3 bar. The concentration of strong solution, weak solution , vapour after generator, and vapour before condenser may be taken as 0.4, 0.3, 0.96, and 0.99 resply. The reflux temperature is 60 °C, A heat exchanger is between the absorber and generator , calculate **07**

1. Heat received or rejected in the generator, condenser, and evaporator
2. HCOP
3. Exergetic efficiency

OR

Q.3 (a) What is role of heat exchanger in vapour absorption cycle?Draw schematic diagram of absorption cycle with heat exchanger and explain how it improves operating efficiency. **07**

(b) Prove that maximum value of ratio of bell-coleman cycle of carnot cycle is given by $\frac{(COP)_{bellcoleman}}{(COP)_{carnot}} = \frac{(Ta-Tr)^2}{Tr^2}$ **07**

Ta is environmental temperature and Tr is refrigeration temperature where rise in temperature of air passing through cooler is same in both cases and constant.

Q.4

(a) With neat sketch explain working of steam jet refrigeration system. **07**

(b) Explain analysis of thermoelectric system and list advantages of thermoelectric refrigeration system. **07**

OR

Q. 4 (a) Explain working of heat pump with neat sketch when used for following purpose **07**

1. Concentrating juices preparation
2. Making drinking water from sea water
3. Heating swimming pool

(b) A steam ejector refrigeration system is supplied with motive steam at 7 bar saturated with water in flash chamber at 4.5 °C. The make- up water is supplied to the cooling system at 18°C and condenser is operated at 0.058. bar. The nozzle efficiency is 88%, the entrainment efficiency is 65% and compression efficiency is 80%. The quality of steam flash vapour at the beginning of compression is 92%. Determine **07**

1. Mass of motive steam required per kg of flash vapour
2. Quality of vapour flashed from flash chamber
3. Refrigeration effect per kg of flash vapour.

Q.5

(a) Discuss operational problems faced in transport refrigeration system. State modifications in design of refrigeration system to rectify such problems. **07**

(b) Why a good refrigeration system is required in meat packing plant. What different refrigeration methods are used for meat packing plant? **07**

OR

Q.5 (a) Describe design methodology of refrigeration system for cold store plant. **07**

(b) Compare following freezing techniques **07**

1. Air blast and contact freezing
2. Immersion freezing and cryogenic freezing

****