

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-I Regular Examination January / February 2011****Subject code: 711003N****Subject Name: Advanced Refrigeration****Date: 02 /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 Refrigerant properties tables is permitted.

- Q.1** (a) Draw the flow diagram of simple vapour compression cycle. Also explain with p-h diagram refrigeration effect, power required and C.O.P. **07**
- (b) Describe the advantages of Compound compression with inter cooler over single stage compression refrigeration system. **07**

- Q.2** (a) Explain working of compound compression with flash cooler refrigeration system by flow diagram and p-h diagram. **07**
- (b) A two stage compound vapour compression refrigeration system with flash intercooler operates with ammonia as refrigerant. The evaporator and condenser temperatures are -30°C and 40°C respectively. If the capacity of the plant is 25 tonnes of refrigeration, estimate the total minimum work of compression and C.O.P. **07**

OR

- (b) A simple air cooled system is used for an aircraft having a load of 9 TR. The atmospheric pressure and temperature are 0.9 bar and 10°C respectively. During ramming pressure increases to 1.013 bar. In the heat exchanger the temperature of air is reduced by 55°C . the pressure in the cabin is 1.01 bar and the temperature of air leaving the cabin is 25°C . Determine power required for cooling in the cabin and C.O.P. **07**

- Q.3** (a) Describe with a schematic and T-s diagram the Boot-strap air refrigeration system for air craft. **07**
- (b) Differentiate between primary refrigerants and secondary refrigerants. **07**

OR

- Q.3** (a) Describe the working of a steam jet refrigeration system with schematic diagram. **07**
- (b) Enlist various Ecofriendly refrigerants. Also give their desirable properties. **07**

- Q.4** (a) Explain the use of Heat Pump for heating and cooling cycle with neat diagram. **07**
- (b) Derive the expression for the current corresponding to maximum C.O.P. of thermoelectric refrigeration system in terms of Figure of Merit, temperature of cold body, resistance and thermal conductance. **07**

OR

- Q.4** (a) Give the desirable properties of Thermoelectric materials for refrigeration. Also give various combinations of thermoelectric materials. **07**
- (b) In a thermoelectric cooling system each couple has total electric resistance $0.003\ \Omega$, total electric resistance $0.025\ \text{W/K}$ and thermoelectric power of $420 \times 10^{-6}\ \text{V/K}$. Calculate the figure of merit. If $T_h = 310\ \text{K}$, $T_c = 270\ \text{K}$ and $I = 20\ \text{A}$, find the cooling capacity in tones of refrigeration for 100 nos. of couples are used. **07**

- Q.5 (a)** Justify the need of balancing of various components of the refrigeration system. **07**
- (b)** In an absorption type refrigerator, the heat is supplied to the generator by steam of 2 bar pressure with 0.9 dry. The evaporator temperature is -10°C . The outside temperature is 45°C . Find the maximum C.O.P. If the refrigeration load is 20 TR, and actual C.O.P. is 70% of the maximum, find the mass of the steam supplied per hour. Take saturation temperature of steam as 120°C at 2 bar pressure. **07**

OR

- Q.5 (a)** Define Food Preservation. Explain Air blast freezing method for food preservation. **07**
- (b)** The following data refer to a single stage vapour compression refrigeration system charged with R-134a. **07**
- Condensing temperature : 35°C and Evaporator temperature : -10°C
Compressor speed : 2800 rpm and Swept volume : 269.4 cm^3
Clearance to swept volume ratio : 0.03
Compression efficiency : 80 % and Condensate subcooling : 5°C
Determine TR, Power, C.O.P. and Heat rejected.
Assume suction vapour is dry and saturated and isentropic compression ($\gamma = 1.12$). Sp.heat of vapour and liquid at 8.87 bar are 1.1 kJ/kgK and 1.458 kJ/kgK.
