Kadi Sarva Vishwavidyalaya

M.E.Sem –I

Subject: Advanced Refrigeration

Date: January 21st, 2013 Max. Marks: 70

Time: 3 Hrs.

Instructions: (1) Answer each section in separate Answer sheet
(2) Use of scientific calculator is permitted.
(3) Use of refrigerant charts and tables are allowed.

Section – I

Q.1 **Each carries equal marks:** [15]

[A] What is refrigerant? Classify its types in details and explain its desirable properties for a good refrigerant.

[B] Compare vapour –absorption system with vapour compression system giving suitable example.

[C] Discuss the importance of multi-staging in vapour compression refrigeration system.

OR

[C] A refrigeration system works on ammonia between pressure limits 2.36 and 15.54 bar. If the refrigerant is sub-cooled by 10 K before throttling, determine the improvement in COP over simple vapour compression cycle. If the refrigeration system had been designed corresponding to subcooled state as the upper situation temperature, then find improvement in COP?

Q.2

[A] What is balancing in vapour compression refrigeration system? Explain balancing between compressor and condenser of a refrigeration system with suitable example. [5]

[B] Derive the expression for COP of two stage vapor compression system with given intermediate pressure. Sketch the p-h diagram also. [5]

OR

Q.2

[A] Explain booster system of multi stage vapour compression refrigeration with neat sketch and find the change in tonnage capacity and power? [5]

[B] A vapour compression refrigeration system operates between -15°C and 40°C. The compressor has a bore of 80 mm and stroke of 75 mm and runs at 1500 RPM. Determine the compressor capacity for R- 22 using v_c/v_s and $n = 1.12$. [5]
If the condensing temperature is changed to 35°C, what would be the new capacity of compressor?

Q.3

[A] Explain ammonia – water vapour absorption refrigeration system and explain its analysis with H-x charts. [5]

[B] What is azeotropic mixtures and eco-friendly refrigerants? Give examples. Also explain how azeotropic refrigerants are better than normal refrigerants giving suitable examples? [5]

OR

P.T.O.

Q.3 [A] How two stage vapour absorption system is obtained? Explain any one method of two stage vapour absorption system with neat sketch. [5]

[B] Enlist the types of cascade system. Explain any one cascade refrigeration system with neat sketch and p-h diagram. [5]

Section – II

Q.4 **Each carries equal marks:** [15]

[A] Compare thermoelectric refrigeration system with vapour compression refrigeration system.

[B] Enlist the different types of heat pumps and explain any one type of heat pump. Represent it on a T-s diagram and derive expression for Performance Index

[C] Explain importance of food preservation and explain any two methods for food preservation.

OR

[C] Write a note on different types of freezers used for food preservation.

Q.5

[A] Draw the schematic diagram of air refrigeration cycle with regeneration and derive the expression for COP. Also represent the cycle on T-s diagram. [5]

[B] In a steam jet refrigeration, the dry-saturated motive steam is supplied at 6 bar. The amount of motive steam per unit mass of flash vapour is 2 kg/kg. the quality of vapour at the beginning of compression is 0.90. The condensing and flash vapour temperatures are 40°C and 5°C respectively. The compression efficiency is 0.78. Obtain the tonnage of the system for 0.8 kg/s of motive steam. [5]

OR

Q.5

[A] Explain working of steam jet refrigeration system with neat sketches. Derive the expression for COP and discuss its advantages and disadvantages. [5]

[B] For a simple air craft refrigeration system, η_{comp} =0.85, heat exchanger effectiveness ε=0.8, $T_1 = 30^{\circ}C$, $P_1 = 1.1$ bar $P_2 = 4.4$ bar $T_e = 27^{\circ}C$ and the cooling turbine efficiency is 0.81. [5]

Find for 5 ton of refrigeration requirement: temperature of the air entering the cabin, air bled from the main compressor, COP and power to drive the blower for heat exchanger. The cabin pressure is 1 atm.

Q.6

[A] Explain design of refrigeration system for transportation. [5]

[B] List out the industrial applications of refrigeration and discuss any two in short. [5]

OR

Q.6

[A] What is cold storage? Explain its importance and write a note on different types of cold storage with a line sketches. [5]

[B] Explain Peltier and Seeback effect for thermoelectric refrigeration. Give thermodynamic analysis of thermoelectric refrigeration system. [5]