Birla Institute of Technology and Science Pilani, K K Birla Goa Campus
Second SEMESTER 2022-2023
ME F461 Refrigeration & Air-Conditioning
MID SEM Exam (Closed Book)
DATE: 18/03/2023 Time: 4:00 P.M. – 5:30 P.M. Maximum Marks: 30

Instructions

a) Use of steam-tables / data-book **NOT** permitted. Charts and data provided at the end.
b) Use of keywords, reasoning and use of schematics is preferred.
c) Answer each main question on a new page

Q1. Answer the following in **brief** **[8x2=16]**

a) Show the superheat horn and throttling loss region using the standard vapour compression system T-s diagram .

b) Report the ODP and GWP for the natural refrigerant R717.

c) Subcooling the refrigerant increases the refrigeration effect and also leads to less vapour at the inlet of the evaporator. Is this statement true? If yes, why is less vapour to the evaporator preferred?

d) What is the effect of lowering of evaporator pressure (condenser pressure is fixed) on the volumetric efficiency of the compressor. Use a P-V diagram to show this effect.

e) Compared to condensers design evaporators design is much more complicated. Provide your comments.

f) Name the expansion device commonly used in domestic refrigerators. How does the pressure reduction take place in this expansion device.

g) Draw the schematic showing the working of a Triple fluid vapour absorption system.

h) Mention two important differences between aqua ammonia & Lithium –Bromide vapour absorption refrigeration system.

Q.2 A standard vapour compression cycle developing 50kW of refrigeration using refrigerant R22 operates with a condensing temperature 35 ^{o}C and an evaporating temperature -10^{o}C . Draw the T-s and P-h diagram and Calculate (a) mass flow rate of the refrigerant (b) Throttling loss

[2+3]

Q3. (a) An R22 thermostatic expansion valve has a superheat setting of 8 ^{o}C while supplying refrigerant to the evaporator at 0^{o}C. Determine the difference of pressure on opposite sides of the diaphragm required to open the valve?

b) One of the major disadvantages of using capillary tube is that it cannot adjust itself to variation in load effectively. Draw the mass flow rate versus evaporator temperature plot (fixed condenser temperature) for the compressor and capillary tube showing the balance point (the point at which mass flow rate of compressor equals mass flow rate in capillary). Also comment on the shift of the balance point due to increase in load. **[2+2=4]**

Q.4 In a R22 based refrigeration; the system capacity is 180 kW at a temperature of -30 ^{o}C. The vapour from the evaporator is pumped by one compressor to the condensing pressure of 1400 kPa. Later the system is revised to a two stage compression operating on the cycle as shown below with intercooling but no flash gas removal.

(a) Find the power required by the single compressor in the original system

(b) Draw the p-h diagram for the schematic shown and find total power required by the two compressors in the revised system. **[1+4=5]**