Birla Institute of Technology & Science
Refrigeration and Air-conditioning, ME F461, MidSem Exam
(Closed book exam: Only Thermodynamics Tables and Calculator are allowed)
Part A

Time: 30 Minutes   **Marks: 20**

Name: **ID No.:**

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1. Give two specific reasons to justify that Superheating of vapour is beneficial:
   [2M]

2. Write the equation for the specific work input, w in reversible, polytrophic compression of a refrigerant vapour: **[2M]**

3. Write expression for LMTD of counter flow heat exchanger with known inlet temperatures (Thi & Tci) and outlet temperatures (Tho & Tco): **[2M]**

4. Define the Volumetric efficiency of the compressor ($\eta_{V,cl}$) with clearance (V_c) and indicate PV diagram: **[2M]**

5. The advantages of scroll compressors are: **[1M]**

   a) High volumetric efficiency
   b) Capacity is less sensitive to outdoor conditions
   c) Compactness
   d) Low noise and vibration
   e) All of the above

6. Which of the following statements are TRUE? **[1M]**

   a) Compared to water cooled condensers, the maintenance cost is low in air cooled condensers
   b) Normally, systems with water cooled condensers operate at lower condensing temperature as compared to systems with air cooled condensers
   c) The initial cost of water cooled condenser is high compared to air cooled condenser
   d) All of the above

7. Thermal design of evaporators is very complex due to: **[1M]**

   a) Continuous variation of heat transfer coefficient along the length
   b) Possibility of latent heat transfer on the external fluid side also
   c) Presence of lubricating oil affects heat transfer and pressure drop
   d) All of the above

8. Which of the following statements are TRUE? **[1M]**

   a) A float valve maintains a constant level of liquid in the float chamber
   b) A float valve maintains a constant pressure in the float chamber
   c) Low-side float valves are used with direct expansion type evaporators
   d) High-side float valves are used in flooded type evaporators

9. For a given condensing temperature, the volumetric work of compression of a standard VCRS increases initially with evaporator temperature reaches a maximum and then starts decreasing, this is because as evaporator increases: **[1M]**

   a) Both specific volume of refrigerant and work of compression increase
   b) Specific volume of refrigerant increases and work of compression decreases
   c) Both specific volume and work of compression decrease
   d) Specific volume decreases and specific refrigeration effect increases

10. Degree of superheating obtained using a Liquid to Suction Heat Exchanger (LSHX) is: **[1M]**

   a) Always greater than the degree of sub-cooling
   b) Always less than degree of sub-cooling

c) Always equal to degree of sub-cooling
d) Depends on the effectiveness of heat exchanger

11. Whether the maximum COP occurs when the suction condition is in two-phase region or not depends mainly on: **[1M]**

a) Properties of the refrigerant
b) Effectiveness of LSHX
c) Operating temperatures
d) All of the above

12. In actual VCRS, the system performance is affected mainly by: **[1M]**

a) Pressure drop and heat transfer in suction line
b) Pressure drop and heat transfer in discharge line
c) Heat transfer in compressor
d) All of the above

13. Assuming the refrigerant vapour to behave as an ideal gas and with perfect intercooling, the optimum intermediate pressure of a refrigeration system that operates between 4 bar and 16 bar is equal to: **[1M]**

a) 10 bar
b) 8 bar
c) 6 bar
d) 12 bar

14. In two-stage compression system with flash gas removal: **[1M]**

a) Refrigerant mass flow rates in both low and high stage compressors are equal
b) Refrigerant mass flow rates in high stage compressors is greater than that in low stage compressor
c) Refrigerant mass flow rates in high stage compressors is smaller than that in low stage compressor
d) Mass flow rates in low and high stage compressors are equal if the pressure ratios are equal

15. Multi-evaporator systems with a single compressor and a pressure reducing valve: **[1M]**

a) Yield very high COPs compared to multi-evaporator, single stage systems
b) Yield lower compressor discharge temperature compared to single stage systems

c) Yield slightly higher refrigeration effect in the low temperature evaporator compared to single stage systems
d) Yield slightly higher refrigeration effect in the high temperature evaporator compared to single stage systems

16. For a two-stage cascade system working on Carnot cycle and between low and high temperatures of –90ºC and 50ºC, the optimum cascade temperature at which the COP will be maximum is given by: **[1M]**

 a) –20ºC
 b) –30ºC
 c) –67ºC
 d) 0ºC