R18

Code No: 157DK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech IV Year I Semester Examinations, July/August - 2023
REFRIGERATION AND AIR CONDITIONING
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Define term Coefficient Of Performance (COP) of a refrigeration system.	[2]
b)	Why Bell coleman cycle is better suited for refrigeration system of aircrafts?	[3]
c)	Draw the P-h diagram of vapour compression system.	[2]
d)	What do you understand by insenthalpic process? Name the component used.	[3]
e)	Explain the function of evaporator.	[2]
f)	What are the desirable physical properties of a good refrigerant?	[3]
g)	How to estimate the max COP of vapour absorption refrigeration system?	[2]
h)	Explain the principle of thermoelectric refrigeration system.	[3]
i)	Define the terms specific humidity and relative humidity of moist air.	[2]
j)	What are the human comfort condition for design of air conditioning system?	[3]

PART – B

(50 Marks)

2.a) Draw the schematic diagram for air refrigeration system and explain along with the corresponding thermodynamic diagrams.

b) In refrigerating plant, water at 25^0C is producing ice at -4^0C at 4 tons per day. The temperature range in the compressor is 30^0C and -5^0C. Calculate the power required to drive the compressor. Latent heat of ice is 340 kJ/kg, specific heat of ice is 2.2 kJ/kgK. [5+5]

OR

3.a) Differentiate between open cycle and dense air refrigeration system with suitable examples.

b) In a Bell-Coleman refrigerator air is taken in at 1 bar and a temperature of -8^0 C. The compression ratio is 4. The expansion and compression follow the law $PV^{1.2}$ = Constant. The air is cooled at the upper pressure to 25^0C. Calculate the power required, net refrigerating effect and COP of the system. [5+5]

4.a) Draw the actual vapour compression refrigeration system and explain how is it different from ideal system.

b) Explain the influence of sub cooling and super heating on the performance of vapour compression refrigeration system. [5+5]

OR

5.a) Discuss the influence of condenser pressure and evaporator pressure on net refrigerating effect, power requirement and COP of vapour compression refrigeration system.

b) A refrigerator plant works between temperature limits of -5^0C and 25^0C. The working fluid ammonia has a dryness fraction of 0.62 at entry to compressor. If the machine has a relative efficiency of 55%, calculate the amount of ice formed during a period of 24 hours. The ice is to be formed at 0^0C from water at 15^0C and 6.4 kg of ammonia is circulated per minute. Specific heat of water is 4.187 kJ/kg and latent heat of ice is 335 kJ/kg. The properties of NH_3. [5+5]

Temp^{0}C	Specific heat of liquid kJ/kg	Latent heat kJ/kg	Entropy of liquid kJ/kg
25	298.9	1167.1	1.124
-5	158.2	1280.8	0.630

6.a) Explain the principle of operation of evaporative condenser used in the refrigeration units.

b) A R12 compressor working between -18^0C and 35^0C. Determine the dimensions of the compressor taking the data, D/L=1.25, N= 1400 rpm, Capacity = 15TR, number of cylinders = 4. Assume the system works on simple saturation cycle. [5+5]

OR

7.a) What are the important desirable properties of the better refrigerant to minimize ozone depletion and global warming? Explain.

b) Explain the advantages and disadvantages of hermitically sealed compressors used in vapour compression refrigeration system. [5+5]

8.a) Draw the line diagram of three fluid refrigeration system and discuss the constructional and operational features.

b) What are the components required in steam jet refrigeration system? Explain their operating principles. [5+5]

OR

9.a) How to make use of Hilsch tube for achieving the refrigeration process? Explain in detail with a simple diagram.

b) Describe the importance of condenser, generator and evaporator in vapour absorption refrigeration system. [5+5]

10.a) What is the need of ventilation air in the air conditioning system? How does it influence the comfort of human beings? Explain.

b) The air enters a duct at 10^0C and 80% RH at the rate of 150 m^3/min and is heated to 30^0C without adding or removing any moisture. The pressure remains constant at 1 atm. Determine the relative humidity of air at exit from the duct and the rate of heat transfer. [5+5]

OR

11.a) Explain the concept of concept of human comfort for air conditioning system and discuss the importance of effective temperature.

b) An air-conditioned hall of 1100 m^3 volume is maintained at 22^0C DBT and 52% RH. When outdoor air conditions are 45^0C DBT and 26^0C WBT. The hall sensible heat load is 23 kW. The fresh air is 22% of the total air- supplied. The ADP is 10^0C and its bypass factor is 0.12. Calculate i) the condition .and mass flow rate of the supply air (ii) the latent heat gain of the room (iii) the cooling load on the refrigeration plant. [5+5]

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