Printed Page:- 04 **Subject Code:- AME0602**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)
B.Tech
SEM: VI - THEORY EXAMINATION (2023- 2024)
Subject: Refrigeration and Air-Conditioning

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. One ton refrigeration is equivalent to: (CO1) 1

(a) 3.5 kW
(b) 1.5 kW
(c) 2.5 kW
(d) 5.5 kW

1-b. The cooling system used for supersonic aircrafts and rockets is (CO1) 1

(a) simple air cooling system
(b) boot-strap air cooling system
(c) reduced ambient air cooling system
(d) regenerative air cooling system

1-c. Environment friendly refrigerant R134a is used in the new generation domestic refrigerators. Its chemical formula is: (CO2) 1

(a) CH ClF2
(b) C2 Cl3 F3
(c) C2 Cl2 F4
(d) C2 H2 F4

1-d. A good refrigerant should have (CO2) 1

(a) Large latent heat of vaporisation and low operating pressures
(b) Small latent heat of vaporisation and high operating pressures

(c) Large latent heat of vaporisation and large operating pressures

(d) Small latent heat of vaporisation and low operating pressures

1-e. Waste heat can be effectively used in which one of the following refrigeration systems? (CO3) 1

(a) Vapour compression cycle

(b) Vapour absorption cycle

(c) Air refrigeration cycle

(d) Vortex refrigeration system

1-f. Which of the following is correct about VARS and VCRS? (CO3) 1

(a) VARS use mechanical energy, and VCRS use heat energy

(b) VARS use heat energy, and VCRS use mechanical energy

(c) Both use mechanical energy

(d) Both use heat energy

1-g. The wet bulb depression is zero, when relative humidity is equal to (CO4) 1

(a) 1

(b) 0.6

(c) 0.5

(d) 0.1

1-h. On a Psychrometric chart, what does a vertical downward line represent? (CO4) 1

(a) Adiabatic saturation

(b) Sensible cooling

(c) Dehumidification

(d) Humidification

1-i. A refrigerant compressor is used to (CO5) 1

(a) raise the pressure of the refrigerant

(b) raise the temperature of the refrigerant

(c) circulate the refrigerant through the refrigerating system

(d) all of the above

1-j. The reciprocating refrigerant compressors are very suitable for (CO5) 1

(a) small displacements and low condensing pressures

(b) large displacements and high condensing pressures

(c) small displacements and high condensing pressures

(d) large displacements and low condensing pressures

2. Attempt all parts:-

2.a. what is supersonic and sonic velocity? (CO1) 2

2.b. What is under cooling and superheating before compression and after compression? (CO2) 2

2.c. Write the formula for maximum COP of VARS.(CO3) 2

2.d.	What are the factors that affecting comfort air conditioning? (CO4)	2
2.e.	What is heat rejection ratio in condenser? (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	A machine working on a Carnot cycle operates between 305K and 260K. Determine the C.O.P. when it is operand as: (i). a refrigerating machine; (ii). a heat pump; and (iii). a heat engine. (CO1)	6
3-b.	Explain about isentropic efficiency of compressor and turbine. (CO1)	6
3-c.	Describe the mechanism of a simple vapour compression refrigeration system. (CO2)	6
3-d.	Explain the effect of subcooling of condensate with the help of T-s and p-h diagrams in vapour compression refrigeration systems systems. (CO2)	6
3.e.	What is the function of the following components in an absorption system : (i) Absorber (ii) Rectifier (iii) Analyser (iv) Heat exchangers. (CO3)	6
3.f.	Explain 'comfort chart' and show on it the 'comfort zone' . (CO4)	6
3.g.	Describe the working of an evaporative condenser. (CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Describe the Bell-Coleman cycle with neat sketch. Derive an expression for COP assuming compression and expansion to be isentropic. (CO1)	10
4-b.	Draw and explain the boot-strap evaporative type of air refrigeration system. (CO1)	10

5. Answer any one of the following:-

5-a.	Sketch the T-S and p-h diagrams for the vapour compression cycles when the vapour after compression is: (CO2) i. Dry saturated ii. Wet iii. Super heated and	10
5-b.	A vapour compression refrigerator uses R-12 as refrigerant and the liquid evaporator is -15°C. the temperature of this refrigerant at the delivery from the compressor is 15°C when the vapour is condensed at 10°C. find the COP if (i) there is no under cooling (ii) the liquid is cooled by 5°C before expansion throttling. Take Cp for superheated vapour as 0.64 kJ/kg-k and that for liquid as 0.95 kJ/kg-k. (CO2)	10

6. Answer any one of the following:-

6-a.	Illuminate the working principal of Electrolux refrigeration system with the help of block diagram. (CO3)	10
6-b.	Briefly explain construction and working of Practical vapour absorption refrigeration system.Also mention the advantages of this system. (CO3)	10

7. Answer any one of the following:-

7-a.	The amount of air supplied to an air conditioned hall is 300 m3 /min. The atmospheric conditions are 35°C DBT and 55% RH. The required conditions are 20°C DBT and 60% RH. Find out the sensible heat and latent heat removed from the air per minute. Also find sensible heat factor for the system. (CO4)	10
7-b.	The atmospheric air at 20° C and 60% relative humidity is heated and humidified in such a way that the final dry bulb temperature is 30° C and relative humidity is 50%. Determine the heat and moisture added to the air per minute, if the volume of entering air is 100m3/min. (CO4)	10

8. Answer any <u>one</u> of the following:-

8-a.	Explain working and construction of shell and coil evaporator with neat sketch. (CO5)	10
8-b.	Explain in detail about the methods of food preservations.(CO5)	10