Indian Maritime University

(A Central University, Govt of India)

Mar/Apr'26 SE

Programme Name: B Tech (ME)

Semester: IV

Subject Code: UG11T4408

Subject Name: REFRIGERATION AND AIR CONDITIONING

Date: 02.04.2026	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.

Section A

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. Coefficient of Performance of a refrigerating system is
   a. A measure of how quickly the system is able to attain correct temperatures.
   b. Ratio of useful heating or cooling provided to the work required.
   c. The lowest temperature that the system can attain.
   d. Ratio of quantity of refrigerant required per Tonne of cooling attained.

2. The refrigerant after the expansion valve is
   a. In the form of vapour only
   b. A mixture of liquid and vapour at low pressure
   c. A mixture of liquid and vapour at high pressure
   d. In the form of liquid only

3. A hermetic compressor
   a. Has motor and compressor in two separated enclosures
   b. Has motor and compressor in one enclosure
   c. Can be repaired on board

d. None of these

4. Sub cooling of the liquid means
   a. Keeping the liquid at negative temperature
   b. Keeping the liquid below its boiling temperature
   c. Keeping the liquid at ambient temperature
   d. None of these

5. Despite being a toxic gas most people use ammonia in their homes and the business because------

   a. Ammonia is very cheap
   b. The amount of ammonia used is very less in homes and business so it's not hazardous at all if it leaks
   c. Ammonia is diluted with significant amount of water and is not used in the pure form in homes and business.
   d. None of the above

6. The sensible heat of the air is a function of.....

   a. Dry bulb temperature
   b. Dew point temperature
   c. Wet bulb temperature
   d. None of these

7.If the moisture content of the air increases it can be shown on the psychrometric chart by a.....

   a. Inclined line
   b. Horizontal line
   c. Vertical line
   d. Curved line

8. What is Air Conditioning?

   (a) Air Conditioning is the process of adding heat and increasing the humidity

   (b) Air Conditioning is the process of removing heat and controlling the humidity of air in a closed space

   (c) Air conditioning is the process of controlling air moisture in an open area by adding heat

   (d) None of the mentioned

9. One tonne of refrigeration is equal to-

   (a) 2100 kJ/min

   (b) 21 kJ/min

   (c) 210 kJ/min

(d) 21000 kJ/min.

10. Relative humidity on saturation curve has value of _____% at various dry bulb temperatures.
    (a) 0
    (b) 50
    (c) 10
    (d) 100

Section B

Five Questions of 02 Marks each

11. In case of refrigerant retrofitting explain why the baseline data is collected before retrofitting.
12. List out any six properties of refrigerant.
13. Explain evaporative cooling in brief.
14. Define specific humidity and relative humidity.
15. In a vapour compression cycle what do you understand by superheating and sub cooling?

Section C

Seven Questions of 10 Marks each of which any 05 questions to be answered.

16. An ammonia refrigerating machine fitted with an expansion valve works between the temperature limits of -10^{0}C and 30^{0}C. The vapour is 95% dry and at the end of the isentropic compression the fluid leaving the condenser is at 300C. Assuming the actual COP as 60% of the therotical, calculate the kg of ice produced per kw hr at 0^{0}C from water at 10^{0}C. Latent heat of the ice is 335kj/kg. Ammonia has the following properties:

Temperature ^{0}C	Liquid heat (hf)	Latent heat (hfg)	Liquid entropy (Sf)	Total entropy of dry saturated vapour
30	323.08	1145.8	1.2037	4.9842
10	135.37	1297.68	0.5443	5.4770

17. (a) What is the function of Expansion valve? List out different type of expansion valve. (5 Marks)

    (b) Explain the working principle of thermostatic expansion valve with a neat ketch. (5 Marks)

18. (a) Explain the following process and also show on psychometric chart

(5 Marks)

(i) Heating with Humidification

(ii) Cooling with dehumidification

(b) What is system evacuation? Also state the side effects if gas is not fully evacuated. (5 Marks)

19. State and give a brief information for all the types of refrigerant oils used in refrigeration system. (10 Marks)

20. Describe in detail three different methods of detecting leaks in a refrigeration system. (10 Marks)

21. a) Explain the functioning of sensing bulb in case of a thermostatic expansion valve. (4Marks)

b) Explain liquid charge, cross liquid charge, vapour charge and cross vapor charge with reference to the sensing bulb. (6 Marks)

22. An air conditioning plant is required to supply $60m^3$ of air per minute at a DBT of 21^0C and 55% RH. The outside air is at DBT of 28^0C and 60% RH. Determine the mass of water drained and the capacity of the cooling coil. Assume the air conditioning plant first to dehumidify and then cool the air.