

Indian Maritime University
(A Central University, Govt of India)
End Semester Examinations – June 2026
Programme Name: B Tech ME
Semester: IV
Subject Code: UG11T5407
Subject Name: Marine Refrigeration and Air Conditioning

Date: 19.06.2026

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 of 01 Mark each – Choose the correct answer as applicable.

1. One tonne of refrigeration is equal to
 - (a) 2100 kJ/min
 - (b) 21 kJ/min
 - (c) 210 kJ/min
 - (d) 21000 kJ/min
2. The main purpose of refrigeration on ships is:
 - (a) Heating fuel
 - (b) Preserving food and cargo
 - (c) Increasing engine efficiency
 - (d) Producing steam
3. Compared to vapour compression systems, vapour absorption systems generally have:
 - a) Higher COP
 - b) Lower COP
 - c) Same COP
 - d) No COP
4. What is the primary reason for performing refrigerant recovery in marine refrigeration systems?
 - a) To safely remove refrigerant from the system
 - b) To increase system efficiency
 - c) To dispose of refrigerant
 - d) To enhance system cooling

5. Superheating in Vapour Compression refrigeration Cycle occurs at:
a) Condenser
b) Compressor
c) Evaporator outlet
d) Expansion valve
6. The ratio of Heat Absorbed by the refrigerant while passing through the evaporator to the Work Output required to compress the refrigerant in the compressor is termed as:
(a) Efficiency of Refrigeration System
(b) Efficacy of the Refrigerant
(c) Coefficient of Performance
(d) Performance Point
7. An aqua-ammonia refrigeration system is basically:
a) Vapour Compression Refrigeration System
b) Vapour Absorption Refrigeration System
c) Steam Jet Refrigeration System
d) Thermo-Electric Refrigeration System
8. What is the main function of a filter drier in a refrigeration system?
a) To cool refrigerant
b) To remove moisture and contaminants
c) To expand refrigerant
d) To increase pressure
9. How is refrigerant reclaiming different from recycling?
a) Reclaiming restores refrigerant to industry purity standards
b) Reclaiming is conducted on-site
c) Reclaimed refrigerant is reused immediately
d) Both processes are identical
10. Psychrometry is the scientific study of:
a) Refrigerants
b) Chloro Fluoro Carbons
c) Moist Air
d) Ozone Depletion Potential

Section B

Five Questions of 02 Marks each

11. A refrigerator has working temperatures in the evaporator and condenser coils of -30°C and 35°C respectively. Estimate the maximum possible COP of this refrigerator.

12. What is superheating and sub-cooling in refrigeration system.
13. What is defrosting in refrigeration systems and why it is done?
14. What is meant by a secondary refrigerant? Provide one example for the same.
15. Distinguish between hermetic and semi-hermetic sealed refrigerant compressors.

Section C

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

16. Explain the functions of following parts of refrigeration system in brief: **10 Marks**
HP cut out, reservoir, refrigerant check valves, Discharge service valves, refrigerant sight glasses.
17. A refrigeration system employs R-134a as the working fluid and functions between the pressures of 3 bar and 10 bar. The compression process is isentropic, and it is assumed that no subcooling takes place in the condenser. At the beginning of the compression, the refrigerant is in dry saturated vapour state. **10 Marks**
 - (a) Draw the processes on P-h and T – S diagram.
 - (b) Determine the ideal coefficient of performance (COP) for this cycle.
 - (c) If the actual COP is 0.7 times the theoretical COP, estimate the cooling effect generated per hour.

Assume a refrigerant mass flow rate of 4.5 kg/min. The relevant properties of R-134a at the given conditions are:

Pressure, bar	Saturation Temperature, °C	Enthalpy, kJ/kg		Entropy of Saturated Vapour, kJ/kg·K
		Liquid	Vapour	
10	41	76.8	212.7	0.6795
3	-4	34.2	191.6	0.706

Use specific heat capacity of superheated vapour at 10 bars as 0.65 kJ/kg·K.

18. Draw a neat sketch of thermostatic expansion valves (TXV). Explain the construction and functions of following important parts: Valve body, diaphragm, needle and seat, spring, sensing bulb, and transmission tube. **10 Marks**

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19. Explain different type of refrigerant leaks. Also explain various refrigerant leak detection methods along with their specific applications, merits and demerits. **10 Marks**
20. Room air at 20°C DBT & 60% RH is mixed with outdoor air at 40°C & 40% RH in the ratio of 4:1. The mixture is passed through a cooling coil whose temperature (dew point) is maintained at 9°C and whose bypass factor is 0.25. Find (a) conditions of air at inlet of coil. (b) Conditions of air leaving the coil. (c) if $250\text{ m}^3/\text{min}$ of air is supplied to the room find the refrigeration load on the coil. **10 Marks**
21. Distinguish between summer, winter, year-round, unitary, centralized and split air conditioning systems. Also explain the method of cooling/heating load calculations for a ship to be air conditioned. **10 Marks**
22. Explain the following psychrometric processes. Also show them on a skeleton psychrometric chart: **10 Marks**
(i) sensible heating (ii) sensible cooling (iii) dehumidification (iv) humidification (v) cooling and dehumidification (vi) heating and humidification (vii) cooling and humidification (viii) heating and dehumidification
- TMI
- TMI
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