Indian Maritime University

(A Cventral University, Govt of India)

Supplementary Examinations – March/April 2025

Programme Name: B Tech (ME)

Semester: IV

Subject Code: UG11T4408

Subject Name: REFRIGERATION AND AIR CONDITIONING

Date: 09.04.2025	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.
(iii) Psychrometric chart to be used.

Section A

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

1. The practical unit of refrigeration "1-TR is the amount of heat removed from one ton of water at 0°C to become ice in
   (a) 1 hour
   (b) 12 hours
   (c) 8 hours
   (d) 24 hours

2. The function of halide torch is
   (a) Defrosting of the cooling coil
   (b) Superheating the vapour refrigerant
   (c) Detecting leakage of the refrigerant
   (d) Facilitating better lubrication in the refrigerator

3. What should be the appropriate material used for Ammonia refrigerant
   (a) Brass
   (b) Copper
   (c) Bronze
   (d) None of the above

4. If relative humidity is 100%, then
   (a) Dry bulb temperature is greater than wet bulb temperature
   (b) Wet bulb temperature is greater than dry bulb temperature
   (c) Dry bulb temperature is one-half of the wet bulb temperature
   (d) Dry bulb temperature is equal to the wet bulb temperature

5. When two refrigerants are mixed in the proper proportions, the mixture forms a third refrigerant called,
   (a) Synthetic refrigerant
   (b) Refrigerant mixture
   (c) High pressure refrigerant
   (d) Azeotrope

6. Environmental protection agencies advice against the use of chloro-fluoro-carbon refrigerants since
   (a) These react with water vapour and cause acid rain
   (b) These react with plants and cause greenhouse effect
   (c) These react with oxygen and cause its depletion
   (d) These react with ozone layer

7. The refrigerant supplied to a compressor must be
   (a) Superheated vapour refrigerant
   (b) Dry saturated liquid refrigerant
   (c) A mixture of vapour and liquid refrigerant
   (d) None of the above

9. In case of sensible heating of air, the coil efficiency is given by (where B.P.F. = Bypass factor)
   (a) B.P.F.-1
   (b) 1- B.P.F.
   (c) 1+ B.P.F.
   (d) 1/ B.P.F.

10. In summer air conditioning, the air is
   (a) Cooled and humidified
   (b) Cooled and dehumidified
   (c) Heated and humidified
   (d) Heated and dehumidified

Section B

Five Questions of 02 Marks each

11. Explain (in brief) the objective of refrigeration and air conditioning on ships.
12. If the refrigerant is designated as R-12 then write the chemical formula for it.
13. State the factors that determine human comfort
14. Write in brief about defrosting and what are methods for it.
15. Define Psychrometric and what the importance of it.

Section C

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

16. (a) What will be the effect of superheating and subcooling on the performance of Vapour Compression refrigeration system (express with suitable diagram either in T-S or P-H curve). 5

(b) What are the desirable properties of refrigerant for use in ships? Describe refrigerant leak detection maintenance procedures on a vapour compression refrigeration system. 5

17. A vapour compression (VC-cycle) refrigeration cycle based refrigerator operates between temperature limit of -12 °C and 22 °C. The refrigerant enters the condenser as saturated vapour and leaves as saturated liquid. The properties of the refrigerant are given in the Table. If the flow rate of the refrigerant is 5 kg/min, then find the

(a) Coefficient of Performance and
(b) Capacity of the refrigerator in TR.

The properties of refrigerant are given in Table

Saturated Temperature (°C)	h_f (KJ/Kg)	h_g (KJ/Kg)	S_f (KJ/Kg K)	S_g (KJ/Kg K)	specific heat for liquid (KJ/Kg K)	specific heat for vapour (KJ/Kg K)
22	151.96	293. 29	0.554	1.0332	--	2.492
-12	56.32	322.58	0. 226	1. 2464	4.556	2.903

10

18. (a) Describe (in brief) refrigeration components, i.e., evaporator, compressor, condenser and metering device. 5

(b) Describe the marine type Ammonia refrigerant system. 5

19. (a) How is the liquid refrigerant added to the refrigeration system when the system is out of refrigerant. 5

(b) Explain about oil pressure safety controls. What are the advantages of using an electronic oil safety controller over a mechanical safety controller? 5

20. (a) Describe how the scroll compressor compresses refrigerant gases. 5

(b) Explain thermostatic expansion valve and their components. 5

21. (a) Atmospheric air at 1.013 bar and 35°C (Dry bulb temperature) has a relative humidity of 60% and the saturation pressure of water vapour at 35°C is the 5.628 KPa. Then find the specific humidity of moist air per Kg vapour to per Kg of dry air. 5

(b) What you understand by the specific humidity and relative humidity and how both are differentiated with each other. 5

22. Atmospheric air at a dry bulb temperature of 16°C and 25% relative humidity passes through a furnace and then through a humidifier in such a way that the final dry bulb temperature is 30°C and 50% relative humidity. Determine

(a) Heat added

(b) Sensible heat factor 10

Psychrometric chart used for solving the problem must be attached with answer sheet and has to be duly endorsed by invigilator.