Indian Maritime University

(A Central University, Govt of India)

Supplementary Examinations– September/October2024

Programme Name: B Tech (Marine Engineering)

Semester: IV

Subject Code: UG11T3406

Subject Name: MARINE HEAT ENGINE AND AIR CONDITIONING

Date: 11.09.2024	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. Steam turbines work on _____
a) Dual cycle
b) Rankine cycle
c) Otto cycle
d) None of the mentioned

2. Gas turbines work on which of the following cycle?
a) Diesel cycle
b) Brayton cycle
c) Rankine cycle
d) None of the mentioned

3.If the COP of refrigerator is 5 then what is the COP of heat pump working between same temperature-
a) 5
b) 6
c) 7
d) 8

4. A Gas Turbine is which type of combustion plant?
a) external
b) open
c) internal

d) cannot say

5. Which of the following process is used in winter air conditioning?
a) Cooling and Dehumidification
b) Heating and Humidification
c) Dehumidification
d) Humidification

6. On which of the following cycle the air conditioning systems are based in transport aviation?
a) Reversed Joule's cycle
b) Otto cycle
c) Reversed Carnot cycle
d) Reversed Brayton cycle

7. Which of the following represents sensible cooling on the psychrometric chart?
a) Inclined line
b) Curve
c) Horizontal line
d) Vertical line

8. Cornish boiler is an example of which type of boiler?
a) Fire tube boiler
b) Water tube boiler
c) Vertical tube boiler
d) Externally fired boiler

9. Water level indicator _____
a) indicates the amount of steam in the boiler
b) indicates the amount of water in the boiler
c) indicates the amount of water converted to steam
d) indicates the amount of steam left in the boiler

10. What is the function of fusible plug?
a) Protects the boiler from overheating
b) Prevents mixing of water and steam
c) Regulated the flow of steam outside boiler
d) It is opened to increase the flow of air for combustion

Section B

Five Questions of 02 Marks each

11. Explain the degree of reaction in steam turbine.

12. What is the difference between impulse turbine and reaction turbine ?
13. Show on the psychrometric chart -
(a) heating and dehumidification
(b) heating and humidification
14. What is the difference between refrigeration and air-conditioning ?
15. Define volumetric efficiency and free air delivery(FAD).

Section C

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

16. A simple impulse turbine has a mean blade speed of 200m/s . The Nozzles are inclined at 20° to the plane of rotation of the blades. The steam velocity from nozzles is 600m/s . The turbine uses 3500 kg/hour of steam. The absolute velocity at exit is along the axis of the turbine. Determine-
(i) The inlet and exit angles of the blades.
(ii) The power output of the turbine.
(iii) The diagram efficiency.
(iv) The axial thrust (per kg steam per second)
(v) Draw the velocity diagram
Assume inlet and outlet angles to be equal. (10 Marks)

17. The following readings were obtained during a boiler trial of 6 hour duration-
mean stem pressure = 12 bar
mass of steam generated =40000 kg
mean dryness fraction = 0.85
mean feed water temperature =30°C
coal used =4000 kg
Calorific value of coal =33400kj/kg.
Calculate:-
(i) Factor of equivalent evaporation
(ii) Equivalent evaporation from and at 100° C
(iii) Efficiency of the boiler . (10 Marks)

18. A refrigeration machine using R-12 as refrigerant operates between the pressure 2.5 bar and 9 bar . The compression is isentropic and there is no under cooling in the condenser . The vapour is in dry saturated condition at the beginning of the compression . Estimate the theoretical COP. if the actual COP is 0.65 of the theoretical value, calculate the net cooling produced per hour. The refrigerant flow is 5 kg/min. The properties of refrigerant are-

Pressure(bar)	Saturation temperature °C	Enthalpy(kj/kg) Liquid	Enthalpy(kj/kg) Vapour	Entropy of saturated vapour (kj/kgK)
9	36	70.55	201.8	0.6836

2.5	-7	29.62	184.5	0.7001

Take Cp for superheated vapour at 9 bar as 0.64 kj/kgK (10 Marks)

19. A restaurant with a capacity of 100 % persons is to be air conditioned with the following conditions-
Outside conditions =30°C DBT and 70% RH
Desired inside conditions =23°C DBT and 55% RH
Quantity of air supplied =0.5 m3/min/person
The desired conditions are achieved by cooling, dehumidifying and then heating. Determine-
1- Capacity of cooling coil in tonnes of refrigeration
2- Capacity of heating coil
3- Amount of water removed by dehumidifier
4- By-pass factor of the heating coil if its surface temperature is 35 °C.

20.
(A) What are the factors affecting the optimum effective temperature .(5 Marks)
(B) Define Dew point temperature and wet bulb temperature. (5 Marks)

21.
(A) Explain the vapour compression refrigeration cycle. (5 Marks)
(B) Define Absolute humidity and relative humidity. (5 Marks)

22.
(A) Write the desirable property of an ideal refrigerant. (5 Marks)
(B) Explain the defrosting in evaporator. (5 Marks)