

CBCS Scheme

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15MR45

Fourth Semester B.E. Degree Examination, June/July 2018 Marine Heat Engine and Air Conditioning

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing one full question from each module.
2. Use of refrigeration table is allowable.

Module-1

- 1 a. Define the following with respect to reciprocating compressor:
i) Volumetric efficiency
ii) Free air capacity
iii) Mechanical efficiency
iv) Isothermal efficiency (08 Marks)
- b. A single cylinder single acting air compressor has a swept volume of 0.035 m^3 and a clearance volume of 0.0012 m^3 , and runs at 400 rev/min. The air is compressed from 1 bar and 27°C to 5.5 bar. The index of compression and expansion is 1.28.
i) Sketch the P-V diagram for the cycle.
ii) Calculate the volumetric efficiency.
iii) The mass of air delivered per second. (08 Marks)

OR

- 2 a. With the help of P-V and line diagram, briefly explain two stage reciprocating compressor. (06 Marks)
- b. Derive expression for the intermediate pressure which gives minimum power in a two stage compressor with perfect intercooling. (06 Marks)
- c. Write a note on air motors. (04 Marks)

Module-2

- 3 a. Describe with a line diagram its operation showing various pressure and temperature of a vapour compression cycle refrigeration system. (10 Marks)
- b. List out the desirable properties of a refrigerant. (06 Marks)

OR

- 4 a. Define the following:
i) Refrigerating effect
ii) Ton refrigeration
iii) Refrigerating load
iv) Relative COP (08 Marks)
- b. In a Freon-12 refrigerator, the Freon leaves the condenser as a saturated liquid at 20°C , the evaporator as a vapour 0.97 dry. Calculate:
i) The dryness fraction as the evaporator inlet.
ii) The cooling effect per kg of refrigerant.
iii) The volume flow of refrigerant entering the compressor if the mass flow is 0.1 kg/s . (08 Marks)

Module-3

- 5 a. Sketch a thermostatic expansion control valve (TEV) as fitted in a refrigeration system, label the parts and state the location in the refrigeration system. (08 Marks)
- b. Write short notes on maintenance of the following refrigeration system equipments:
- Condensers
 - Oil separators
 - Filters and driers
- (08 Marks)

OR

- 6 a. What are the readings taken and recorded of a domestic refrigeration system during watch keeping on board a ship? (06 Marks)
- b. Draw a neat sketch of an oil separator fitted to a refrigeration compressor and name its parts. Why is oil separator required and how does it work? (10 Marks)

Module-4

- 7 a. Draw a block diagram of an automatic accommodation air conditioning unit and label the parts and indicate the directions of airflow. (10 Marks)
- b. What is humidity and how is it controlled on board ship? (06 Marks)

OR

- 8 a. What are the basic considerations taken into consideration in calculating the capacity of air conditioning plant required for installation on a ship? (10 Marks)
- b. What are the factors taken into consideration for optimum comfort level in air conditioning system? (06 Marks)

Module-5

- 9 a. Classify heat exchangers based on fluid flow direction with sketch. (08 Marks)
- b. Calculate the log mean temperature difference for a hot fluid at 71°C enters a double pipe heat exchanger and is cooled to 27°C . The cold fluid enters at 10°C and is warmed to 21°C ,
- For counter flow
 - For parallel flow
- If the hot fluid ($C_p = 2.20 \text{ kJ/kgK}$) flowing at 0.12 kg/s . The cold fluid $C_p = 4.18 \text{ kJ/kgK}$. Determine the rate of heat transfer and the mass flow rate of cold fluid. (08 Marks)

OR

- 10 a. With a neat sketch explain shell and tube heat exchanger. (08 Marks)
- b. Write a note on air distribution and duct insulation. (08 Marks)

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