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18MR45

Fourth Semester B.E. Degree Examination, July/August 2022 Marine Heat Engine and Air Conditioning

Time: 3 hrs.

Max. Marks: 100

Note : 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Refrigeration table is allowed.

Module-1

- 1 a. Define the following with respect to Reciprocating Compressor :
- i) Volumetric efficiency ii) Free Air capacity iii) Indicated power
iv) Mechanical efficiency v) Isothermal efficiency. (10 Marks)
- b. A single cylinder single acting air compressor has a swept volume of 0.035m^3 and a clearance volume of 0.0012m^3 and runs at 400 rpm. The air is compressed from 1 bar and 27°C to 5.5 bar. The index of compression and expansion is 1.28. Sketch the P – V diagram for the cycle. Calculate
- i) Volumetric efficiency ii) The mass of air delivered per second. (10 Marks)

OR

- 2 a. Briefly explain with the help of line diagram and P – V diagram, two stage reciprocating compressor. (10 Marks)
- b. In a single acting , two stage air compressor , the mass compressed is 7.5kg of air per minute from 1.013 bar and 15°C through a pressure ratio of 12.25 : 1. The stage pressure ratios are equal and the index of compression and expansion is 1.28. Inter cooling is perfect and the bore of each cylinder is 220mm. The clearance volume of each stage is 4% of the respective swept volume and the speed of rotation is 320 rpm. Determine i) The indicated power
ii) The volumetric efficiency of each stage iii) The stroke of each stage. (10 Marks)

Module-2

- 3 a. Write down the flow diagram of Vapour Compression system indicating all pressure and temperature. (10 Marks)
- b. Define the following with respect to Refrigeration : i) Refrigerating effect
ii) Compression work iii) Coefficient of performance iv) Capacity of Refrigeration
v) Cooling load. (10 Marks)

OR

- 4 a. Write down the desirable properties of Refrigerant. (06 Marks)
- b. Write down the T – S diagram of the Theoretical Vapour – Compression system. (04 Marks)
- c. A Refrigerating machine is driven by a motor of output 2.25 kw and 2.5 tonne of ice at -7°C is made per day from water 18°C . Calculate the coefficient of performance of the machine and express its capacity in terms of tones of ice per 24 hours and at 0°C taking the following values : Specific heat of water = 4.2 kJ/kg K ; Specific heat of ice = 2.04 kJ/kg K
Enthalpy of fusion of ice = 335 kJ/kg . (10 Marks)

Module-3

- 5 a. Sketch a Thermostatic expansion control valve as fitted in a refrigeration system, label the parts. (10 Marks)
- b. Write a note on : i) H P cutout ii) L. P cutout iii) Shaft Seal. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, $42+8=50$, will be treated as malpractice.

OR

- 6 a. Write down the typical marine refrigeration system of a Reefer vessels. (10 Marks)
 b. Write a note on : i) Defrost system ii) Oil rectifier. (10 Marks)

Module-4

- 7 a. With a neat sketch, explain Typical Air Conditioning System. (10 Marks)
 b. How is Freon gas effect the Ozone and effect the climate? (05 Marks)
 c. How does a port state control inspection carried out for a Air Conditioning System? (05 Marks)

OR

- 8 a. What are the basic principles of Air Conditioning? (06 Marks)
 b. What is called Central Air Conditioning and how is it carried out? (06 Marks)
 c. Enumerate the standard maintenance carried out in a Refrigeration / Air Condition System. (08 Marks)

Module-5

- 9 a. Briefly classify Heat Exchangers. (04 Marks)
 b. Derive an expression for Parallel flow heat exchanger in terms of L.M.T.D. (08 Marks)
 c. Exhaust gas flowing through a tubular heat exchanger at the rate of 0.3 kg/s are cooled from 400 to 120°C by water initially at 10°C. The specific heat capacities of exhaust gases and water may be taken as 1.13 and 4.19 kJ/kg K respectively and the overall heat transfer coefficient from gases to water is 140 W/m² K. Calculate the surface area required when the cooling water flow is 0.4 kg/s. i) for parallel flow ii) for counter flow. (08 Marks)

OR

- 10 a. Write a note on Shell and tube heat exchanges. (10 Marks)
 b. Write a short note on :
 i) Duct insulation ii) Deck insulation iii) Condenser. (10 Marks)
