Marine Heat Engine and Air Conditioning VTU CBCS Question Paper Set 2018

CBCS Scheme

USN | | | | | | | | | | |

15MR45

Fourth Semester B.E. Degree Examination, June/July 2017
Marine Heat Engine & Air Conditioning

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing one full question from each module.***
2. (i) ***Steam table (ii) HMT data hand book are required.***

Module-1

1 a. What do you understand by multi stage compressor? **(03 Marks)**

b. Derive an expression for work done per kg of air for a single stage reciprocating compressor. **(05 Marks)**

c. Derive an expression for volumetric efficiency of reciprocating air compressor. **(08 Marks)**

OR

2 a. Prove that minimum compression work per kg of air in N stage air compressor with perfect inter cooling is given by. **(08 Marks)**

b. A single stage single acting air compressor 30 cm bore and 40 cm stroke is running at a speed of 100 rpm. It takes in air at 1 bar and 20°C and compresses it to a pressure of 5 bar, Find the power required to drive it when the compression is, (i) isothermal (ii) $PV^{1.2} = C$ and (iii) adiabatic. Also find the isothermal efficiencies for the cases (ii) and (iii). Neglect clearance. **(08 Marks)**

Module-2

3 a. With help of a simple sketch explain the working of a vapour compression refrigerator. **(08 Marks)**

b. What is C.O.P in refrigeration? Describe the methods for improving the same. **(08 Marks)**

OR

4 a. Describe in detail the desirable properties of refrigerant. **(10 Marks)**

b. 2 kW per ton of refrigeration is required to maintain the temperature of 40°C in the refrigerator. If the refrigerator works on carnot cycle. Determine (i) COP of the cycle (ii) Temperature of the sink (iii) Heat rejected in the sink perton of refrigeration and (iv) Heat supplied. **(06 Marks)**

Module-3

5 a. List the component of marine refrigeration plant. **(06 Marks)**

b. Explain with help of neat sketch LP cut off and HP cutout in a refrigeration plant. **(10 Marks)**

OR

6 a. Write a short note on:
(i) Pump-down cycle.
(ii) TEV with external equalizing connection.
(iii) Solenoid valve. **(08 Marks)**

b. Describe the charging of refrigerant in domestic refrigeration plant. **(08 Marks)**

Module-4

7 a. Write a short note on the following terms:
(i) Specific humidity (ii) Relative humidity (iii) Absolute humidity
(iv) Degree of saturation (v) Wet bulb temperature **(10 Marks)**

b. With help of neat sketch, explain air circulation system. **(06 Marks)**

OR

8 a. With neat schematic diagram, explain winter air conditioning system. **(10 Marks)**

b. A mixture of dry air and water vapor is at a temperature is 16°C. Find
(i) Partial pressure of water vapour and dry air.
(ii) Saturation pressure of water vapour at 22°C.
(iii) Specific humidity.
(iv) Mass of water vapour and dry air.
(v) Relative humidity.
(vi) Degree of saturation. **(06 Marks)**

Module-5

9 a. Derive an expression for LMTD of parallel flow heat exchanger. **(08 Marks)**

b. 16.5 kg/s of the product at 650°C (l_p = 3.55 KJ/kg°C) in a chemical plant, are to be used to heat 20.5 kg/s of the incoming fluid from 100°C (C_P = 4.2 KJ/kg°C). If the overall heat transfer co-efficient is 0.95 KW/m^2°C and the installed heat transfer surface is 44 m^2. Calculate the fluid outlet temperature for the counter flow and parallel flow arrangements. **(08 Marks)**

OR

10 a. Derive an expression for effectiveness NTU for parallel flow heat exchanger. **(10 Marks)**

b. Write a short note on the following terms:
(i) Air distribution and Duct insulation.
(ii) Cooling and heating load. **(06 Marks)**

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