CBCS Scheme

15MR45

USN

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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 steam table and HMT data hand book is required.***

Module-1

1 a. Explain the working principle reciprocating compressors. **(04 Marks)**

b. What is meant by the term isothermal efficiency? Derive an expression for the isothermal work done by reciprocating compressor of a single stage with neglecting clearance volume. **(08 Marks)**

c. Explain the effect of clearance volume on work of compression. **(04 Marks)**

OR

2 a. Obtain the condition for minimum work of a compression in a two stage reciprocating compressor with perfect intercooling. **(08 Marks)**

b. A single stage air compressor running at 80 rpm, compresses air from pressure of 1 bar and temperature of 15°C to a pressure of 5 bar. The clearance volume is 5% of swept volume which is 0.42 m^3. Assuming that the compression to follow the law $PV^{1.3} = C$. Determine the power required to drive the compressor. **(08 Marks)**

Module-2

3 a. What is the principle of refrigeration? **(04 Marks)**

b. Define one ton of refrigeration. **(02 Marks)**

c. Explain the following terms:
i) Refrigerator
ii) Refrigerant
iii) Capacity of refrigerator
iv) Refrigeration effect
v) COP (coefficient of performance) **(10 Marks)**

OR

4 a. Explain the different methods of improving the COP of a single compression refrigeration cycle. **(08 Marks)**

b. A cold storage is to be maintained at –5°C while the surroundings are at 35°C. The heat leakage from the surroundings into the cold storage is estimated to be 29 KW. The actual COP of the refrigeration plant is one third of an ideal plant working between the same temperatures. Find the power required to drive the plant. **(08 Marks)**

Module-3

5 a. Draw the layout of typical refrigeration plant. **(08 Marks)**

b. Explain the method of trouble shooting in refrigeration plant. **(08 Marks)**

OR

6 a. Explain with a neat sketch thermostatic expansion valve. **(08 Marks)**
b. Explain with a neat sketch shaft seal in the refrigeration plant. **(05 Marks)**
c. Describe the maintenance of the refrigerant plant. **(03 Marks)**

Module-4

7 a. Write a short note on the following terms:
i) Saturated and unsaturated air
ii) Dry bulb and wet bulb temperature
iii) Sensible heating and cooling
iv) Humidification and Dehumidification **(08 Marks)**
b. With neat sketch, explain summer air conditioning system. **(08 Marks)**

OR

8 a. Explain the controls of humidity of air. **(04 Marks)**
b. What are the trouble shooting of air conditioning? **(04 Marks)**
c. Discuss in detail of air coolers fans of air conditioning system in cargoships. **(08 Marks)**

Module-5

9 a. Derive an expression for LMTD for counter flow heat exchanger. **(08 Marks)**
b. In a certain double pipe heat exchanger hot water flows at a rate of 50000 kg/h and gets cooled from 95°C to 65°C. At the same time 50000 kg/h of cooling water at 30°C enters the heat exchanger. The flow conditions are such that overall heat transfer coefficient remains constant at 2270 W/m^2K. Determine the heat transfer area required and the effectiveness. Assuming two streams are in parallel flow. Assume for the both the steams Cp = 4.2 kJ/kgK. **(08 Marks)**

OR

10 a. Classify the heat exchanger. **(06 Marks)**
b. Derive an expression for effectiveness in terms of NTU for parallel flow heat exchanger. **(10 Marks)**

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