

Code No: 126AM

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech III Year II Semester Examinations, May - 2016

REFRIGERATION AND AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B. Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART - A**

(25 Marks)

- 1.a) Distinguish between Engine and Refrigerator. [2]
- b) What is the difference between expander and compressor? [3]
- c) State the various types of evaporations used in refrigeration and air conditioning systems. [2]
- d) Explain about recuperation. [3]
- e) What are the properties of ideal refrigerant? [2]
- f) Differentiate between expansion cylinder and expansion valve. [3]
- g) What is the meaning of air conditioning? [2]
- h) Explain the relation between wet bulb temperature, sensible heaters, sensible cooling. [3]
- i) Explain how to calculate load on occupants. [2]
- j) Explain infiltration load. [3]

**PART - B**

(50 Marks)

2. A Carnot refrigerator operates between the temperatures of  $-50^{\circ}\text{C}$  and  $50^{\circ}\text{C}$ . Determine COP of the refrigerator. If the COP is to be made 4 by changing the temperatures such that increase or decrease in upper temperature is equal to decrease or increase in lower temperature, determine the new temperatures. [10]

**OR**

3. A refrigerator working on Bell – Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from the cold chamber at  $10^{\circ}\text{C}$ . Air coming out of compressor is cooled to  $30^{\circ}\text{C}$  before entering the expansion cylinder. Expansion and compression follow the law  $p.v^{1.35} = \text{constant}$ . Determine C.O.P. of the system. Take  $\gamma = 1.4$  and  $C_p = 1 \text{ kJ/kg -k}$  for air. [10]

4. Explain with neat sketch the working principle of a screw compressor. [10]

**OR**

5. Explain with a neat sketch the working principle of Evaporative condenser. [10]

6. In an absorption type refrigerator, the heat is supplied to  $\text{NH}_3$  generator by condensing steam at 2 bar and  $90^{\circ}\text{C}$  dry. The temperature to be maintained in the refrigerator is  $-5^{\circ}\text{C}$ . The temperature of the atmosphere is  $30^{\circ}\text{C}$ . Find the maximum C.O.P. is 70% of the refrigerator. If the refrigeration load is 20 tons and actual C.O.P. is 70% of maximum C.O.P. Find the mass of steam required per hour. [10]

OR

7. Draw a neat line diagram of Electrolux refrigerator and explain its working principles. What is the important role of hydrogen in this refrigeration system? [10]

8. A four rows coil with a face velocity of 150 m/min has a contact factor of 0.85. Calculate the contact factors for the following cases:

- a) Face velocity 200 m/min and four rows.
- b) Face velocity 100 m/min and four rows
- c) Face velocity 150 m/min and eight rows
- d) Face velocity 150 m/min and two rows.

[10]

OR

9. A stream of moist air at 2<sup>0</sup>C dry bulb and 80 per cent relative humidity mixes with another stream of moist air at 30<sup>0</sup>C dry bulb and 10<sup>0</sup>C dew point in the ratio by mass of one part of the first to two parts of the second. Calculate the temperature and specific humidity of the air after mixing. [10]

10. A spray cooling coil is chosen to operate under the following conditions:

Air –inlet condition .....28<sup>0</sup>C DBT and 21<sup>0</sup>C WBT

Air-outlet conditions.....10<sup>0</sup>C DBT and 6<sup>0</sup>C WBT

Total amount of air flow ..... 2000 m<sup>3</sup>/min.

The chilled water inlet and outlet temperatures are 7<sup>0</sup>C and 12<sup>0</sup>C respectively

Find the following:

- a) The cooling load on the coil.
- b) Water flow rate through the coil.

[5+5]

OR

11. Differentiate between Central, District and Unitary air-conditioning systems. [10]

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