Code No: 126AM

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, May - 2017
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) Explain the term "tonne of refrigeration". [2]
b) Discuss the effect of sub -cooling on COP. Would you desire large sub-cooling and why? [3]
c) Give the advantages of hermetic sealed compressor? [2]
d) Differentiate between low-side float valve and high side float valve. [3]
e) Discuss the function of absorber in vapor absorption refrigeration system. [2]
f) Under what situation in steam jet refrigeration system recommended? What are its limitations? Can it be used for obtaining sub-zero temperatures? [3]
g) What do you understand by effective room sensible heat factor? [2]
h) With the help of psychrometric chart, explain sensible heating and sensible cooling process. [3]
i) Explain the importance of "throw" and "drop" in locating the grill. [2]
j) Explain the advantages and disadvantages of viscous filters over dry filters. [3]

PART – B

(50 Marks)

2.a) How does the increase in condenser temperature affect COP. Also explain the influence of evaporator temperature on COP. Which of the two temperatures have more influence on COP?
b) A R-12 refrigerating machine works on vapor compression cycle. The temperature of refrigerant in the evaporator is -20^0C. The vapor is dry saturated when it enters the compressor and leaves it in a superheated condition. The condenser temperature is 30^0C. Assuming specific heat at constant pressure for R-12 in the superheated condition as 1.884 kJ/kg K, determine:
i) Condition of vapor at the entrance to the condenser
ii) Condition of vapor at the entrance to the evaporator and
iii) Theoretical COP of the machine. [5+5]

OR

3.a) What is the difference between a refrigerator and a heat pump? Derive an expression for the performance factor for both if they are running on reserved Carnot cycle.

b) A vapor compression plant using R-12 operates between 35^0C condensing temperature and -5^0C evaporation temperature with saturated vapor leaving the evaporator. The plant consists of twin cylinder, single acting compressor with 100 mm diameter and 120 mm stroke running at 300 rpm. The volumetric efficiency is 85% and the mechanical efficiency is 90%. Assuming isentropic compression, determine: [5+5]

i) COP

ii) Power required

iii) Tonnage capacity of the plant.

4.a) Describe, with a sketch, a centrifugal compressor. Where are centrifugal compressors preferred over reciprocating compressors in refrigerating system?

b) Discuss the operation of a capillary tube in a refrigeration system. [5+5]

OR

5.a) Explain the dry expansion evaporator with the help of a neat sketch.

b) What are the points to be considered for selecting a condenser for a refrigeration system? [5+5]

6.a) Discuss the advantages of the dense air refrigerating system over an open air refrigeration system.

b) A dense air refrigerating system operating between pressures of 17.5 bar and 3.5 bar is to produce 10 tonnes of refrigeration. Air leaves the refrigerating coils at -7^0C and it leaves the air cooler at 15.5^0C. Neglecting losses and clearance, calculate the net work done per minute and the coefficient of performance. For air C_p=1.005 kJ/kg K and γ=1.4. [5+5]

OR

7.a) Explain the various components of steam jet refrigeration system and clearly discuss the function of each component; compare the system with vapor compression refrigeration system.

b) A refrigerating system working on Bell-Coleman cycle receives air from cold chamber at -5^0C and compresses it from 1 bar to 4.5 bar. The compressed air is then cooled to a temperature of 37^0C before it is expanded in the expander. Calculate the COP of the system when compression and expansion are i) isentropic and ii) follow the law $pv^{1.25}$=constant. [5+5]

8.a) Define room sensible heat factor. How room sensible heat factor line is drawn on the psychrometric chart?

b) The air at 35^0C DBT and 25^0C WBT is passed through a cooling coil at the rate of 280 m^3/ min. The air leaves the cooling coil at 26.5^0C DBT and 50% relative humidity. Find:

i) Capacity of the cooling coil in tonnes of refrigeration

ii) Wet bulb temperature of the leaving air

iii) Water vapor removed per minute

iv) Sensible heat factor. [5+5]

OR

9.a) Explain the procedure to draw a grand sensible heat factor line on psychrometric chart.

b) Air at 30^0C DBT and 60% RH is passed through a cooling coil at the rate of 250 m^3/ min. The air leaves the cooling coil at 14^0C DBT. If the by-pass factor of the cooling coil is 0.1. Find

i) Surface temperature of the cooling coil or ADP

ii) Relative humidity of the air leaving the cooling coil

iii) Capacity of the cooling coil in kW

iv) Sensible heat factor [5+5]

10.a) Which type of air cleaner would be selected for removing very small particles of dirt and smoke from the air? Explain the working principle of this cleaner.

b) Suggest the different constructional features used in "heat pump" to improve the overall EPR. [5+5]

OR

11.a) Give few industrial examples where heating and cooling is simultaneously required and explain why "heat pump" is more suitable for such applications.

b) What are the advantages and disadvantages of the backward blade fan over forward blade fan? [5+5]

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