Code No: 126AM **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, October/November - 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) Explain the cycle of Carnot refrigerator. [2]
b) What is the effect of superheating on COP of a system? [3]
c) Explain the effect of condenser pressure on the efficiency of the cycle. [2]
d) Bring out the principles of working of capillary tube. [3]
e) What are different refrigerant and absorbers are used in different applications. [2]
f) Explain the principle of steam jet refrigeration system. [3]
g) What is the need of ventilation in A/C applications? [2]
h) Draw comfort chart and indicate comfort zone. [3]
i) What is the role of Registers in the air conditioning systems? [2]
j) Explain the working of Air Washer. [3]

PART – B

(50 Marks)

2.a) Explain losses in VCR system and their effects.
b) A refrigeration system operates with R12 refrigerant. The evaporator and condenser temperature are at -5^0C and -35^0C, respectively. The actual suction to the compressor is at 15^0C. If superheating of refrigerant vapour from -10^0C to 20^0C does not add any refrigerating effect,
i) Determine the percentage increase in volume flow rate per ton of refrigeration compared with the saturation cycle;
ii) Compare the COP for saturated and superheated cycles; and
iii) Determine the power required per TR. [5+5]

OR

3.a) Explain the effect of superheating the suction vapour.
b) A refrigeration system operates with R12 and produces 1 ton refrigerating effect at the evaporator and condenser temperatures of -5^0C and 40^0C, respectively. If the liquid is sub cooled from 40^0C to 30^0C in the condenser, then calculate for the simple compression cycle and sub cooled cycle the following: (i) Refrigerating effect, (ii) Mass flow rate, (iii) Volume of vapour handled by the compressor, (iv) Power requirement, and (v) COP. [5+5]

4.a) Explain the principle of Ramming process in Air cooling system.

b) A simple air refrigeration system is used for an aircraft to take a load of 20 TR. The ambient pressure and temperature are 0.9 bar and 22^0C respectively. The pressure of air is increased to 1 bar due to isentropic ramming action. The air is further compressed in a compressor to 3.5 bar and then cooled in a heat exchanger to 72^0C. Finally the air is passed through the cooling turbine and then supplied to the cabin at 1.03 bar. The air leaves the cabin at 25^0C. Assuming the isentropic efficiency of compressor and turbine as 80% and 75% respectively, find

i) The power required to take the cooling load in the cabin.

ii) The COP of the system

Take C_p=1.005 kJ/kg-K; γ=1.4 [5+5]

OR

5.a) Draw the line diagram and explain the working of practical vapour absorption system.

b) In an absorption type refrigerator, the heat is supplied to NH_3 generator by condensing steam at 1.6 bar and 80% dry. The temperature in the refrigerator is to be maintained at -5^0C. Find the maximum COP possible. If the refrigeration load is 150 TR and the actual COP is 80% of the maximum COP, find the mass of the steam required per hour. Take the temperature of the atmosphere to be 30^0C. [5+5]

6.a) Explain the working of hermetically sealed compressor and explain its advantages and Limitations.

b) With the help of line diagram, explain the working of the flooded type of evaporator. [5+5]

OR

7.a) How the problems related to Air cooled condensers are solved using water cooled Condensers? Explain the working of water cooled condenser with a neat sketch.

b) With the help of neat diagram, explain the working of thermostatic Expansion valve. [5+5]

8.a) Explain the summer air conditioning system provided with ventilation Air with needed diagrams.

b) Room conditions: 26^0C DBT, 19^0C WBT

Outside conditions: 35^0C DBT, 27^0C WBT

Room heat gains:

Sensible heat: 11.1 kW

Latent heat: 3.9 kW

The conditioned air supplied to the room is 50 cm and 25% fresh air and 75% recirculated room air. Determine the following.

i) The DBT and WBT of supply air.

ii) The DBT and WBT of mixed fresh and recirculated air before the cooling coil.

iii) The apparatus dew point and bypass factor of the coil.

iv)The refrigeration load on the cooling coil and the moisture removed by the coil.[5+5]

OR

9.a) Explain with the help of chart, the human comfort chart.

b) An air conditioned space is maintained at 25^0C DBT and 50% RH. The outside conditions are 40^0C DB and 25^0C WB. The space has a sensible heat gain of 24.5 kW. Conditioned air is supplied to the space as saturated air at 10^0C. The equipment consists of an air washer. The air entering the air washer comprises 25% outside. Calculate the following.

i) Volume flow rate of air supplied to space.

ii) Latent heat gain of space.

iii) Cooling load of air washer. [5+5]

10.a) What is the purpose of deodorants and explain different deodorants used?

b) Using psychrometric chart, explain the method of cooling and dehumidification process and how do you get them practically? [5+5]

OR

11.a) Explain different filters and grills with the help of line diagrams and their working.

b) Draw the heat pump circuits and heat sources involved and explain their working details. [5+5]

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