AU/ME-803

B. E. (Eighth Semester) EXAMINATION, June, 2012

(Common for AU & ME Engg. Branch)

REFRIGERATION AND AIRCONDITIONING

Time : Three Hours Maximum Marks: 100 Minimum Pass Marks : 35

Note : Attempt five questions in all selecting one question from each Unit. Assume suitable missing/misprint data (if any). Use of standard properties table and charts of refrigerants and psychrometric chart is permissible in the examination.

Unit-I

1. (a) What is refrigeration ? Define 1 ton of refrigeration. 6

(b)What is the principle of operation of vortex tube ? 6

(c)The relative C. O. P. of a refrigeration system operating between temperature limits - 13°C and 39°C is 0-5. Obtain the amount of ice that can be obtained from the machine if it takes 5 kW. The ice is formed at - 10°C from water available at 33°C. 8

Or

2- (a) What is COP ? What value of COP is desired large or small and why ? 5

j(b) The following data refer to a simple aircfaft '

refrigeration system : 15

Temp, at the end of compression = 517°C

Room air temp. = 27°C

Cabin pressure= 1-01 bar

Pressure at inlet to cooling turbine = 4-85bar

Heat rejection to heat exchanger = 105 kW

and G = 0-9

Obtain the following :

(i) mass flow rate of air for refrigeration

(ii)tonnage

(iii)power and C. O. P. of the system

Unit-II

3.(a) Explain the working of the saturated reversed Carnot refrigeration on T-S diagram. 8

(b) A vapour compression refrigeration system operates between the evaporating and condensing temperatures of 258 K and 313 K respectively. Calculate : 12

(i) Tonnage - (il) Volume handled by compressor

(iii)CO. Heat transfer to condenser

The compressor power input is 10 kW. The refrigerant used in R-22 and enthalpy at the end of isentropic compression is h_2 = 287*07 kJ/kg.

Or

4.(a) Which of two factors (increase in upper pressure limit ,

and decreasing lower pressure limit) has more adverse effect on C. O. P. of a vapour compression refrigeration system ? Explain. 6

(b) A single stage ammonia ice plant operates on simple saturation cycle at the condensing temp, of 40°C and evaporating temp, of - 15^{D}C. It produces 10 ton of ice per day at - 5°C from water at 30°C. 1 Determine : f 14

(i) Capacity of refrigeration plant

(ii)Mass flow rate of refrigerant '.

(iii)Isentropic diacharge temp.

(iv)Compressor dimensions if its volumetric efficiency is assumed at 65%. The compressor is to run at 1400 r. p. m. Take L/D ratio as 1-2.

(v)Theoretical and Actual C. O. P.

Unit-III

5.(a) Discuss the advantages and disadvantages of vapour absorption system. 10

(b) Explain the principle and working of steam jet refrigeration system. 10, Or

6.(a) Why is ammonia-water vapour absorption system so popular ? Explain its working in detail. 10

(b) What is a refrigerant ? Discuss desired thermodynamic -properties of refrigerant. 10
Unit-IV
7.(a) Define specific humidity, relative humidity, psychrometry and wet and dry bulb temperature. 10
(b) A mixture of dry air and water vapour is at a temp, of 23°C under a total pressure of 736 mm of Hg. The dew point temp, is 16°C.
Find : 10 (i) Partial pressure of water vapour, -(ii) Relative humidity
(iii)Specific humidity
(iv)Specific enthalpy of water
(v)Enthalpy of air per kg of dry air
Or
8.(a) What is bypass factor ? Explain its usefulness. 5
(b) Given for the air-conditioning of a room :
Room conditions = 26-5° DBT and 50% RH
Room sensible heat gain = 26 ■ 3 kW
Room sensible heat factor =0-82 Find: 15
(i) The room latent heat gain.
(ii)The apparatus dew point.
(iii)The volume flow rate of air if it is supplied to the room at apparatus dew point.
(iv)Volume flow rate of air if it is supplied to the room at 17°C,
Unit-V
9.A retail shop located in a city at 30°N has the following loads : \20
Room sensible heat = 58-15 kW
Room latent heat = 14 -54 kW
The summer outside and inside design conditions are :
Outside - 42° DBT, 27° WBT
Inside -25 DBT, 40% RH
70 cmm of ventilation air is used.
Determine :
(i) Ventilation load
(ii) Grand total heat
(iii)Effective sensible heat factor
(iv)Apparatus dew point
(v)Dehumidified air quantity
(vi)Condition of air entering and leaving apparatus. Assume B. F. =0-15

Or

10.The following data refers to an air-conditioning system for a restaurant for capacity of 50 persons :
Heat transfer through structure = 22000 kJ/hr.,
Solar heat gain= 7000 kJ/hr.,
Sensible heat gain due to various
experiments = 10000 kJ/hr.
Latent heat gain by equipments = 5000 kJ/hr.,
Ventilation and infiltration of air = 2000 mVhr.
Ambient condition = T_{db} = 308 K,
T^ = 299 K,
Inside temperature T_{db} = 300 K
and <p - 55%.
Air supply temperature = 290 K
and there are five service men.
Calculate : 20
(i)Air supply to room
(ii)Percentage of make up air
(iii)Tonnage of cooling coil
(iv)ADP and Bypass factor