Code: 13A03603 **R13**

B.Tech III Year II Semester (R13) Regular Examinations May/June 2016

REFRIGERATION & AIR CONDITIONING

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Define Ton of Refrigeration.

(b) Define coefficient of performance.

(c) What are the disadvantages of wet compression?

(d) If the C.O.P of 1 TR ammonia – water absorption refrigeration plant is 0.5, then the heat supplied in the generator is ------

(e) The fluids used in the Electrolux refrigerator are -----

(f) Factors Affecting Comfort Air Conditioning are ----

(g) What is the condition of air that enters the room in summer air conditions?

(h) The object of Duct Design is -----

(i) A Fan which consists of rotating wheel which is surrounded by a stationary housing is known as -----

(j) The chemical formula of R12 is -----

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 A machine working on a Carnot cycle operates between 305 K and 260 K. Determine the C.O.P. when it is operated as: (i) A refrigerating machine. (ii) A heat pump. (iii) A heat engine.

OR

3 Two refrigerators A and B operate in series. The refrigerator A absorbs energy at the rate of 1 kJ/s from a body at temperature 300 K and rejects energy as heat to body at temperature T. The refrigerator B absorbs the same quantity of energy which is rejected by the refrigerator A from the body at temperature T, and rejects energy as heat to a body at temperatures 1000 K. If both the refrigerators have the same C.O.P calculate: (i) The temperature T of the body. (ii) The C.O.P of the refrigerators. (iii) The rate at which energy is rejected as heat to the body at 1000 K.

UNIT – II

4 A refrigeration machine using R-12 as refrigerant operates between the pressures 2.5 bar and 9 bar. The compression is isentropic and there is no under cooling in the condenser. The vapor is in dry saturated condition at the beginning of the compression. Estimate the theoretical coefficient of performance. If the actual coefficient of performance is 0.65 of theoretical value, calculate the net cooking produced per hour. The refrigerant flow is 5 kg per minute. Properties of refrigerant are:

Pressure bar	Saturation Temperature (℃)	Enthalpy (kJ/kg)		Entropy of saturated Vapor
		Liquid	Vapour	
9.0	36	70.55	201.88	0.6836
2.5	-7	29.62	184.5	0.7001

OR

5 A simple saturation cycle using R-12 is designed for taking a load of 10 tonnes. The refrigerator and ambient temperature are −0℃ and 30℃ respectively. A minimum temperature difference of 5℃ is required in the evaporator and condenser for heat transfer. Find: (i) Mass flow rate through the system. (ii) Power required in kW. (iii) C.O.P. (iv) Cylinder dimensions assuming L/D = 1.2, for a single cylinder, single acting compressor if it runs at 300 r.p.m with volumetric efficiency of 90%.

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UNIT – III

6 Explain Lithium Bromide Absorption Refrigeration System with a neat sketch.

OR

7 The total pressure maintained in an Electrolux refrigerator is 14.71 bar. The temperature obtained in the evaporator is -15^0C. The quantities of heat supplied in the generator are 418.7 kJ to dissociate 1 kg of vapor and 1465.4 kJ/kg for increasing the total enthalpy of NH_3. The enthalpy of NH_3 entering the evaporator is 335 kJ/kg. Take the following properties of NH_3 at -15^0C:

Pressure = 2.45 bar;
Enthalpy (h) of NH_3 vapour = 1666 kJ/kg
Specific volume (v_s) = 0.5 m^3/kg
The hydrogen enters the evaporator at 25^0C
Gas constant for H_2 = 4.218 kJ/kgK;
C_P for H_2 = 12.77 kJ/kgK.

Find the C.O.P of the system. Assume NH_3 leaves the evaporator in saturated condition.

UNIT – IV

8 The humidity ratio of atmospheric air at 28^0C dry bulb temperature and 760 mm of mercury is 0.016 kg /kg of dry air. Determine: (i) Partial pressure of water vapor.
(ii) Relative humidity.
(iii) Dew point temperature.
(iv) Specific enthalpy.
(v) Vapor density.

OR

9 With the help of psychometric chart, explain the following processes:
(a) Sensible heating and sensible cooling process.
(b) Heating and dehumidification process.

UNIT – V

10 An air handling unit in an air conditioning plant supplies a total of 4500 m^3/min of dry air which comprises by mass 20% of fresh air at 40^0C DBT and 27^0C WBT and 80% re-circulated air at 25^0C DBT and 50% RH. The air leaves the cooling coil at 13^0C saturated. Calculate the total cooling load and room heat gain. The following data can be used:

Condition	DBT (^{o}C)	WBT(^{o}C)	RH %	Sp. humidity of water vapor Kg of dry air	Enthalpy kJ/kg of dry air
Outside	40	27	-	17.2	85
Inside	25	-	50	10.0	51
ADP	13	-	100	9.4	36.8

OR

11 Draw a neat labeled diagram of a year-round and unitary central air conditioning system.

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