

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2538

Roll No.

--	--	--	--	--	--	--	--	--	--

B.Tech.

(SEM. VI) EVEN THEORY EXAMINATION 2012-13
REFRIGERATION AND AIR CONDITIONING

Time : 3 Hours

Total Marks : 100

Note :- (i) Attempt **all** questions.

(ii) Notations used have usual meaning.

(iii) Use of steam tables, refrigeration tables and charts is permitted.

1. Attempt any **two** out of the following : **(10×2=20)**
- (a) What is the standard rating of a refrigeration machine ? Differentiate among 'refrigeration', 'refrigeration system' and 'refrigerated system'.
 - (b) Explain with a neat sketch, the working of 'reduced ambient air refrigeration system'.
 - (c) An aircraft refrigeration plant has to handle a cabin load of 9 tonnes. The atmospheric pressure and temperature are 0.9 bar and 10°C. The atmospheric pressure increases to 1.013 bar due to ramming action. The temperature of air is reduced by 55°C in the heat exchanger. The pressure in the cabin is 1.01 bar and the temperature of air leaving the cabin is 25°C. The pressure of the compressed air is 4 bar.

Assuming expansion and compression to be isentropic, calculate :

- power required to take the cabin load and
- coefficient of performance of the system.

Take specific heat of air as 1.005 kJ/kgK and ratio of specific heats as 1.4.

2. Attempt any two out of the following : (10×2=20)

- Discuss the effect of following on the performance of vapour compression system :

- effect of suction pressure
- effect of sub-cooling of liquid.

- In a standard vapour compression refrigeration cycle operating between an evaporator temperature of -10°C and a condenser temperature of 40°C, the enthalpy of the refrigerant, Freon 12, at the end of compression is 220 kJ/kg. Show the cycle on the T-s plane. Calculate

- coefficient of performance of the cycle and
- the refrigerating capacity and the compressor power assuming a refrigerant flow rate of 1 kg per minute. Use the extract of Freon-12 property table given below :

t(°C)	p(MPa)	h _f (kJ/kg)	h _g (kJ/kg)
-10	0.2191	26.85	183.1
40	0.9607	74.53	203.1

- Explain with a neat sketch the functioning of a two stage cascade system. Show the cycle on p-h and T-s diagrams.

3. Attempt any two out of the following : (10×2=20)

- How is the function of compressor achieved in vapour absorption system ? Draw the schematic diagram of a practical vapour absorption system. Write down the ideal properties of an absorbent.

- The heat is supplied to NH₃ generator by condensing steam at 2 bar and 88 percent dry, in an absorption type refrigerator. The temperature in the refrigerator is to be maintained at -4°C. Find the maximum coefficient of performance possible. If the refrigeration load is 18.1 tonnes and actual coefficient of performance is 72.5 percent of the maximum coefficient of performance, find the mass of steam required per hour. Take atmospheric temperature as 25°C.

- What is a required secondary refrigerant ? Where is it used ? Discuss the substitutes for chlorofluorocarbons.

4. Attempt any two out of the following : (10×2=20)

- Prove that relative humidity, ϕ is given by

$$\phi = \frac{\mu}{1 - (1 - \mu)(p_{vs} / p_t)}$$

Where, μ = degree of saturation

P_{vs} = saturation pressure of vapour in moist air

P_t = total pressure of moist air.

- 107 m³ of air per minute at 5°C DBT and 2.5°C WBT is passed through a heating coil which gives 49 kW energy to the air. Saturated steam at 110°C and with a rate of 40 kg per hour is mixed with the air leaving the heater.

Determine the DBT and WBT of the air after mixing the steam. The enthalpy of saturated steam at $110^{\circ}\text{C} = 2691 \text{ kJ/kg}$.

- (c) Discuss the thermodynamics of human body. What is effective temperature ?

5. Attempt any two out of the following : (10×2=20)

- (a) What do you understand by food preservation ? State the factors which contribute to food spoilage. How is pasteurization achieved ?
- (b) With the help of neat sketch, describe the working of a pressure type water cooler.
- (c) Why are ducts used in air conditioning system ? Name the factors due to which pressure of air falls in a duct. Which material is most commonly used for making ducts in the air conditioning system. Write down the disadvantages of equal friction method of determining the duct size.