Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ME) (2011 Onwards) (Sem.–7,8)

REFRIGERATION AND AIR CONDITIONING

Subject Code : BTME-802

Paper ID : [A3063]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1. Answer briefly :

(a) Explain why COP of a heat pump is different than that of a refrigerator.

(b) Define the terms: Energy efficient ratio, and EPR of a heat pump.

(c) Draw Bell Coleman cycle on PV and TS diagrams.

(d) Define the term *"Dry Air Rated Temperature (DART)"*.

(e) Show actual vapour compression refrigeration cycle on T-s diagram.

(f) Write desirable properties of absorption system refrigerants.

(g) Write various applications of cascade refrigeration systems.

(h) Define the terms: Degree of saturation, and Specific humidity.

(i) Explain briefly the significance of effective temperature in the design of air conditioning systems.

(j) What is the function of ducts, and suggest a suitable material for ducts of a refrigeration system?

SECTION-B

Q2. The 20 tonnes of fruit at a temperature of 30°C is supplied to a cold storage plant. The specific heat of fruit above freezing point is 2.93 kJ/kg K. The specific heat of fruit below freezing point is 1.26 kJ/kg K. The fruit is stored in cold storage plant which is maintained at –8°C. The freezing point of fruit is –4°C. The latent heat of fruit is 235 kJ/kg. If the plant requires 75 kW to drive it, find :

(a) The capacity of the plant, and (b) time taken to achieve cooling. Assume actual COP of the plant as 0.3 of the Carnot COP.

Q3. Explain the working of aqua-ammonia vapour absorption refrigeration system with help of a neat sketch.

Q4. Discuss various desirable thermodynamic and chemical properties of refrigerants.

Q5. What is *"effective temperature"*? What factors affect effective temperature? Explain its significance in the design of air conditioning systems.

Q6. What is the function of expansion device in a refrigeration system? Explain the working of any two expansion devices with neat sketches.

SECTION-C

Q7. A Simple air cooling system is being used to cool the cabin of an aeroplane which is flying at the speed of 333.3 m/sec. The cabin is to be maintained at 25°C and the pressure inside the cabin is 1 bar. The ambient air pressure and temperature are 0.85 bar and 30°C. The cabin load is 10 TR. Main compressor pressure raio is 4, ram efficiency is 90%, temperature of air leaving the heat exchanger and entering the cooling turbine is 60°C, pressure drop in the heat exchanger is 0.5 bar, pressure loss between the cooler turbine and. cabin is 0.2 bar. Assume the isentropic efficiencies of main compressor and cooler turbine are 80%, find the quantity of air passed through the cooling turbine and COP of the system. For air c_p=l kJ/kgK and c_p/c_v=1.4.

Q8. Find the dew point temperature of the coil and capacity of the air conditioning plant of an office having maximum seating capacity of 25 employees. The following data is given :

Outside design conditions = 34°C DBT, 28°C WBT

Office design conditions = 24°C DBT, 50% RH

Solar heat gain = 9120 W, Latent heat gain per employee = 105 W, Sensible heat gain per employee = 90 W, Lightening load = 2300 W, Sensible heat load from other sources = 11630 W, Infiltration load = 14 m^3/min.

Assume 40% of fresh air and 60% of recirculated air passing through the evaporator coil an the by-pass factor of 0.15.

Q9. (a) Explain the working of a simple vapour compression refrigeration system without liquid subooling and with superheated vapour after compression. Show the entire system on T-s and p-h planes. Why is superheating considered to be good in certain cases?

(b) Describe, with the help of schematic and p-h diagrams, the working of a two stage compression system with water intercooler, liquid intercooler and a liquid flash chamber.