

B.E. Eighth Semester (Mechanical Engineering) (C.B.S.)
Elective - II : Refrigeration & Air Conditioning (RAC)

P. Pages : 2

Time : Three Hours



NKT/KS/17/7586

Max. Marks : 80

- Notes :
1. All questions carry marks as indicated.
 2. Solve Question 1 OR Questions No. 2.
 3. Solve Question 3 OR Questions No. 4.
 4. Solve Question 5 OR Questions No. 6.
 5. Solve Question 7 OR Questions No. 8.
 6. Solve Question 9 OR Questions No. 10.
 7. Solve Question 11 OR Questions No. 12.
 8. Assume suitable data whenever necessary.
 9. Illustrate your answers whenever necessary with the help of neat sketches.
 10. Use of non programmable calculator is permitted.
 11. Use of refrigeration & air conditioning tables is permitted.

1. a) Explain the effect of superheating & subcooling in VCRS, with T-S & p-h charts. **5**
b) A food storage locker uses R12 as refrigerant for VCRC the refrigeration capacity is 10 TR & the evaporator temperature is -8°C and condenser temperature 30°C . The condensate is sub cooled by 5°C and the vapor is superheated to -2°C before leaving the evaporator. A two cylinder single acting reciprocating compressor is used with a speed of 1000 RPM. The stroke to bore ratio is 1.5 and the clearance volume is 2%. Assume $C_p(\text{liquid}) = 1.235 \text{ kJ/kg k}$ & $C_p(\text{Sup vapor}) = 0.733 \text{ kJ/kg k}$. Find the mass flow rate of refrigerant in kg/min, cylinder dimension power reqd. HP/TR & COP. **9**
2. a) What do you mean by Refrigerant. Explain about various desirable properties of refrigerants. **4**
b) Explain the working principle of practical vapor absorption refrigeration system. **7**
c) Explain what is montreal protocol, kyoto protocol. **3**
3. a) What are the advantages of multistaging in refrigeration system. **4**
b) A two stage compression ammonia refrigeration system with flash intercooling. Liquid subcooling and water intercooler operates between an overall pressure limits of 10 Bar and 2 Bar. The flash intercooler pressure is 5 Bar and the refrigerant leaving the water intercooler and liquid subcooler is 30°C . Find the COP of the system and the power Required to drive the system if the refrigeration load is 10TR. **10**
4. a) A R12 refrigeration plant comprises of three compressors of capacity 10TR at 30°C , 20TR at 5°C and 30TR at -10°C with individual compressors and individual expansion valves. The condenser temperature is 40°C and the liquid is subcooled at 30°C . Determine the refrigeration effect in each evaporator, mass flow rate in each evaporator, compressor power in HP and COP. **9**
b) Write a short note on compressors. What are the various types explain any one in detail. **5**

5. a) Explain steam jet refrigeration with neat sketch. 5
- b) Describe the working of thermoelectrics refrigeration. 4
- c) Explain in short working of Vortex tube refrigeration system. 4
6. a) Explain Bootstrap system of Air Cycle Refrigeration system with neat sketch. 5
- b) A simple Aircraft Refrigeration plant has to handle a cabin load of 30 Tonnes the atmospheric temperature is 17°C . The atmospheric air is compressed to a pressure of 0.95 bar & temperature of 30°C due to ram action. The air is further compressed to 4.75 Bar in a compressor cooled in a Heat exchanger to 67°C and expanded in a turbine to 1 Bar pressure and supplied to the cabin at 27°C . The isentropic efficiency of the compressor and turbine is 90%. Calculate the mass of Refrigerant required and the COP of the plant. 8
7. a) Sketch and explain Cascade Refrigeration system. What are its advantages. 5
- b) Explain the Claude's system used for liquefaction of air. 5
- c) What is Joule-Thompson coefficient and inversion curve. 3
8. Dry air at 20°C and 1Bar is to be liquefied by a simple Linde method. The air is isothermally compressed to 170 Bar. The makeup air is supplied to the system at 20°C and 1 Bar. Find the yield of liquid air in kg of air compressed and the temperature of air before throttling. 13
9. An air conditioned auditorium is to be maintained at 27°C DBT & 60% RH. The ambient conditions are 40°C DBT & 30°C WBT. The total sensible heat load is 100000 kJ/h and total latent heat load is 40000 kJ/h 60% of the return air is recirculated & mixed with 40% of makeup air after the cooling coil. The condition of air leaving the coil is at 18°C . Calculate RSHF condition of air entering the auditorium the amount of makeup air, ADP and BF of cooling coil. 13
10. a) Write a short note on different factors to be considered in heat load estimation. 5
- b) Explain comfort charts and its use. 4
- c) Write a short note on air washers. 4
11. a) Explain in short about the selection criteria of air distribution outlets for an AC system. 5
- b) Explain the utility of duct friction charts. 4
- c) What do you mean by air filter. Explain the various types of air filter. 4
12. a) What are the various methods used for duct design. Explain any one in detail. 5
- b) What are grills and diffusers. Explain the criteria for choosing them for certain application. 4
- c) Explain the following : 4
- i) Throw
- ii) Spread
- iii) Drop
