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

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(ME) (2012 Onwards) (Sem.–7,8)

REFRIGERATION AND AIR CONDITIONING

Subject Code : BTME-802

M.Code : 71995

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

1. Write briefly :

a) Define coefficient of performance.

b) Enumerate various methods of aircraft refrigeration and air conditioning.

c) Differentiate between natural and mechanical refrigeration.

d) Derive the value of ton of refrigeration in SI units.

e) Explain the effect of suction pressure on COP of vapour compression refrigeration system.

f) Differentiate between zeotropes and azeotropes used in refrigeration and air conditioning equipment.

g) Explain the working principle of Vortex tube refrigeration system.

h) Differentiate between relative and specific humidity.

i) Define effective temperature.

j) Explain the function of adiabatic dehumidifiers.

SECTION-B

2. Differentiate between theoretical and actual vapour compression refrigeration systems giving appropriate P-v and T-s plots.

3. In a Bell Coleman refrigeration cycle, air is drawn from cold chamber at 1 bar and compressed to 6 bar in the compressor. The compression and expansion indices are 1.25 and 1.30 respectively. Obtain COP and Tonnage of the unit for an air flow rate of 0.5 kg/sec. Neglect the clearance volume and take temperatures at the beginning of compression and expansion to be 7°C and 37°C respectively. If the compression and expansion are isentropic, how the results will be modified.

4. The following data refers to a two stage compression with multiple expansion valves and flash inter-cooling :

   Condenser pressure : 9.634 Bar; Evaporator pressure : 1.828 Bar; Mass flow rate of refrigerant through evaporator: 0.2 kg/sec; intermediate pressure: 4.238 Bar; Refrigerant : R-12. Obtain the COP and capacity of the system and compare with a corresponding single-stage system operating between the above pressure limits.

5. 39.6 cm of a mixture of re-circulated room air & outdoor air enter a cooling coil at 31°C DBT & 18.5°C WBT. The effective surface temperature of the coil is 4.4°C. The surface area of the coil is such that it can produce 12.5 kW of refrigeration with the given entering air state. Determine the DBT & WBT of the air leaving the coil and the coil bypass factor.

6. Explain the working principle of Linde and Claude refrigeration system with the help of a neat sketch.

SECTION-C

7. a) An ammonia refrigeration machine has to produce refrigeration effect equal to the production of 20 tonnes of ice per day at –2°C from water at 9°C. If the system operates between the temperature limits of 27°C and –13°C. Calculate : Work input of compressor and actual COP if relative COP of system is 0.5

   b) A freon –22 refrigeration plant working between the temperature limits of 5°C & 40°C produces refrigeration capacity of 40 TR. What would be its capacity for food freezing for which the evaporator temperature is to be maintained at –35°C?

8. a) The barometer for atmospheric air reads 750 mm Hg. The DBT 33°C and WBT is 23°C. Determine relative humidity, humidity ratio, dew point temperature.

   b) Describe the environmental impact of CFC, HCFC and HFC refrigerants.

9. a) A cascade refrigeration system is designed to 10 TR at an evaporator temperature of –60°C and a condenser temperature of 25°C. The load at –60°C is absorbed by a unit using R-22 as a refrigerant and is rejected to a cascade condenser at –20°C. A unit using R-12 as the refrigerant and operating between –30°C evaporator temperature and 25°C condenser temperature cools the cascade condenser. The refrigerant leaving the R-12 condenser is sub-cooled to 20°C. The vapors leaving the evaporators are dry saturated. Determine: compression ratio for each unit, quantity of refrigerant circulated per minute for each unit, COP for each unit, COP of whole system, theoretical power required to run the system.

   b) Explain the working of Ammonia water vapour absorption refrigeration system giving a neat sketch.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.