Registration No. :

Total number of printed pages – 2

Seventh Semester (Special) Examination – 2013
REFRIGERATION AND AIR CONDITIONING

BRANCH : MECH

QUESTION CODE : D 427

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.
The figures in the right-hand margin indicate marks.
Use the Refrigeration charts and tables is allowed.

1. Answer the following questions :   2×10

    (a) Write atleast 4 methods of achieving lower temperature.

    (b) Write two demerits of using air as a refrigerant in domestic refrigerators.

    (c) How atmospheric pressure is maintained in an aircraft cabin at a higher altitude ?

    (d) How a decrease in evaporator pressure affects the system performance ?

    (e) Why dielectric strength of refrigerant is considered ?

    (f) What is a secondary refrigerant ?

    (g) In the h-c diagram of a binary mixture, what is an auxillary line ?

    (h) Why water particles remain in vapour state in atmospheric air ?

    (i) What is a split airconditioning unit ?

    (j) Define 'humid specific heat'.

2. Write and explain 10 fluid properties (5 thermodynamic, 3 physical and two chemical properties) considered for selecting refrigerants.   10

3. In a Bell-Coleman refrigeration plant, the air is drawn from cold chamber at 1 bar and 10°C and compressed to 5 bar. The same is cooled to 25°C in the cooler before expanding in the expansion cylinder to cold chamber pressure of 1 bar. Determine   10

(i) The theoretical COP of the plant and the theoretical net refrigeration effect per kg of air. The compression and expansion be assumed isentropic. Assume y =1.41, Cp=l.009 kJ/kg-K

(ii) If the compression and expansion both follow $PV^{1.35}$ = const., how will the result be modified ?

4. A refrigeration installation using R-22 comprises one compressor, one condenser and two evaporators of capacities 10 ton and 20 ton respectively. The temperature to be maintained in the evaporators is 5°C and −10°C respectively. Each evaporator is filled with an individual expansion valve. The condenser pressure is to be maintained at 9.5944 bar (saturation temperature 40°C). The exit conditions from the evaporator are to be dry saturated vapour and the liquid is sub cooled by 10°C in the condenser. Determine :   10

(i) refrigerating effect/kg in each evaporator,

(ii) mass flow rate in each evaporator and total flow rate,

(iii) compressor power and

(iv) COP of the system.

5. Describe with a neat sketch the working principle of a 3-fluid refrigeration system.   10

6. Discuss the working principle of a thermoelectric refrigeration system and find out the COP of the system.   10

7. The total cooling load is estimated to be 100000 kJ /Hr. The indoor condition is 27°C, 60% RH. Ambient air is at DBT 40°C and WBT 30°C. The bypass factor of cooling coil is 0.13 and the ADP being 5°C lower than that of DPT corresponding to the room indoor condition. Find the

(a) ADP,

(b) Volume of supplied air,

(c) Tonnage of cooling coil.   10

8. Write short notes on the following :   2.5×4

(a) Wet bulb temperature

(b) Rectification coloumn

(c) Chemical dehumidification

(d) Multipressure compression system