Registration No. :

Total number of printed pages – 2

B. Tech

· PCME 4402

Seventh Semester Examination – 2013
REFRIGERATION AND AIR-CONDITIONING
### BRANCH : MECH
QUESTION CODE : C-266
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 of Refrigerant charts and tables is allowed.

1. Answer the following questions :   2 ×10

   (a) Show that 1 TR is equal to 3.5167 kW.

   (b) Write the demerits of a Reverse Carnot cycle used for refrigeration systems.

   (c) What is the advantage of using air cycle refrigeration for aircraft air-conditioning ?

   (d) What is known as 'wire drawing effect' ?

   (e) Why is it desirable to go for subcooling in vapour compression refrigeration system ?

   (f) What is the advantage of using a liquid to gas heat exchanger between the evaporator and compressor ?

   (g) Why the thermoelectric refrigeration system has not yet been fully commercialised ?

   (h) Why rectification coloumn is used in NH_3-H_2O vapour absorption system ?

   (i) What is called 'humid specific heat' ?

   (j) Define Room Sensible Heat Factor and By-Pass Factor.
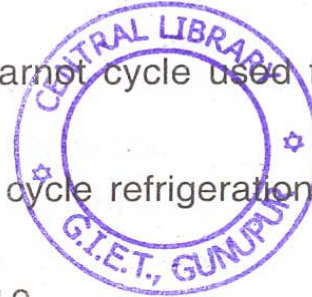
P.T.O.

2. Describe a thermoelectric refrigeration system and discuss its advantages and disadvantages over vapour compression refrigeration system. Give an account of 'Figure of Merit'. 10

3. An aircraft is flying at a speed of 1000 km/h. The ambient condition at that altitude is -15°C and 0.35 bar. The pressure ratio of the compressor is 4.0. The heat exchanger heat effectiveness is 0.8. The cabin pressure is 1.03 bar and air leaves the cabin at 22°C. If the aircraft cabin needs a refrigerating load of 10 TR, Calculate the volume flow rate of air and the COP of the system. 10

4. The condensing and evaporating temperature in a refrigerating system of 100TR capacity are -30°C and 30°C. The refrigerant at the suction of compressor is dry and saturated and at the exit of condenser it is subcooled by 10°C. The actual COP is 80% of the theoretical COP. Determine the mass flow rate, actual and theoretical COP and compressor power. 10

5. (a) The dry bulb temperature and the dewpoint temperature of moist air are $30\,^\circ$C and $20\,^\circ$C respectively. Determine the humidity ratio, relative humidity, specific volume and specific enthalpy, if the atmospheric pressure is 736 mm of Hg. 6

   (b) The human comfort condition is not fixed at a particular DBT and RH, rather it is a zone. Justify it on the basis of effective temperature. 4

6. (a) Describe the ancient method of producing ice. 4

   (b) Write 6 desirable thermodynamic properties of a refrigerant. 6

7. Discuss, with a neat sketch, the working principle of a three fluid refrigeration system. 10

8. The total cooling load is estimated to be 750 kW. The indoor condition is 27°C, 60% RH. Ambient air is at DBT 40°C and WBT 30°C. The by-pass factor of cooling coil is 0.15 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