Code No. 3082

## FACULTY OF ENGINEERING

**B.E. 3/4 (Mech./Prod.) II-Semester (Supplementary) Examination, January 2011**

### REFRIGERATION AND AIR CONDITIONING

Time : Three Hours]                                                    [Maximum Marks : 75

**Note :**— Answer *all* questions from Part A. Answer any *five* questions from Part B.

### PART—A (Marks : 25)

1.  What are the difference between refrigerator and heat pump ?

2.  List the Chemical and Physical properties of a refrigerant.

3.  What is the function of a flash intercooler provided in a compound vapour compression refrigerating system ?

4.  What are effects of discharge pressure in a vapour compression refrigeration system ?

5.  Define Seebeck and Peltier effect.

6.  What is the function of the following components in an absorption system ?
    (i)   Rectifier   (ii)  Analyser.

7.  When is dehumidification of air necessary and how it is achieved ?

8.  Sketch "comfort chart" and show on it the comfort zone.

9.  List the various industrial applications of air-conditioning system.

10. Why the ducts are used in an air-conditioning system ?

### PART—B (Marks : 5×10=50)

11. (a)  A refrigerating system working on Bell-Coleman cycle receives air from cold chamber at − 5°C and compresses it from 1 bar to 4·5 bar. The compressed air is then cooled to a temperature of 37°C before it is expanded in the expander. Calculate the C.O.P. of the system when compression and expansion are :
    (i)   Isentropic,     (ii)   follow the law $PV^{1.25}$ = constant.                          6

    (b)  Sketch and explain the boot-strap cycle of air refrigeration system.                4

12. A R-12 Refrigerating machine works on vapour compression refrigeration cycle. The temperature of the refrigerant in the evaporator is − 20°C. The vapour is dry saturated when it enters the compressor and leaves it in a superheated condition. The condenser

temperature is 30°C. Assuming specific heat at constant pressure for R-12 in the superheated condition as 1·887 kJ/kg K. Determine :

(i) Condition of vapour at the entrance to the condenser,

(ii) Condition of vapour at the entrance to the evaporator; and

(iii) The theoretical C.O.P of the machine.

Take the properties of R-12 from refrigerant tables.      10

13. (a) Draw the temperature-entropy and enthalpy-entropy diagram of a steam jet refrigeration system and write the expression for the following efficiencies :

     (i) Nozzle efficiency (ii) Entrainment efficiency (iii) Compression efficiency.      6

(b) Explain the working principle of thermoelectric refrigeration system. What are the advantages and disadvantages of this system ?      4

14. (a) Show the following processes on the Skeleton Psychrometric Chart and explain :

     (i) Dehumidification of moist air by cooling

     (ii) Adiabatic mixing of two air streams

     (iii) Heating and humidification.      6

(b) Define the term "Effective Temperature" and explain its importance in air-conditioning system.      4

15. An air conditioned auditorium is to be maintained at 27°C dry bulb temperature and 60% relative humidity. The ambient condition is 40°C dry bulb temperature and 30°C wet bulb temperature. The total sensible heat load is 100,000 kJ/hr and the total latent heat load is 40,000 kJ/hr. 60% of the return air is recirculated and mixed with 40% of the make-up air after the cooling coil. The conditions of air leaving the coil is at 18°C. Determine :

(i) Room sensible heat factor,

(ii) The condition of air entering the auditorium,

(iii) The amount of make-up air,

(iv) ADP, and

(v) By-pass factor of the cooling coil.

Show the process on Psychrometric Chart.      10

16. (a) Explain the difference between Winter air-conditioning and Summer air-conditioning.      6

(b) Explain the following functions of the air-conditioning system :

     (i) Filters (ii) Humidifier (iii) Grills.      4

17. (a) Compare the vapour compression refrigeration system with vapour absorption system.      6

(b) What are advantages, limitations and applications of cryogenics ?      4