**Exam.Code:0943**
**Sub. Code: 6741**

**2123**

**B.E. (Mechanical Engineering)**

**Seventh Semester**

**MEC-701: Refrigeration and Air Conditioning**

**Time allowed: 3 Hours** **Max. Marks: 50**

***NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section. Use of Refrigeration and Air Conditioning tables and charts is allowed.***

*x-x-x*

1. (i) Define RSHF and Bypass factor.
   (ii) Subcooling with regenerative heat exchanger is used in a refrigeration cycle. The enthalpies at condenser outlet and evaporator outlet are 78 and 182 kJ/kg respectively. The enthalpy at outlet of isentropic compressor is 230 kJ/kg and enthalpy of sub-cooled liquid is 68 kJ/kg. The COP of the cycle is _____.
   (iii) Round the clock cooling of an apartment having a load of 300 MJ/day requires an air-conditioning plant of capacity _____
   (iv) Differentiate between Ventilation load and Infiltration load.
   (v) What is the effect of lowering the coil ADP on the bypass factor?

(5x2)

**Section - A**

2. A 32 ton ammonia plant operating between $-10°C$ and $40°C$ temperature limit is to be modified using booster compressor to meet a load for a 6 ton ice candy plant operating at $-30°C$. A low pressure booster compressor raises the vapour pressure from low temperature evaporator to the main evaporator. The modified system uses flash chamber and individual expansion valves. Find:
   (i) tonnage of the main evaporator under the modified form
   (ii) reduction in the tonnage of main plant
   (iii) mass flow through the main evaporator
   (iv) total power for the system
   (v) additional power for the system
   (vi) COP of the new system
   (vii) total tonnage of the new system

   Take enthalpies at the end of booster and main compressor outlets as 1502.6 and 1679.37 kJ/kg, respectively.

3. Explain the process of throttling for real gas in detail. A simple saturation ammonia compression system has a high pressure of $1.35 MN/m^2$ and low pressure of $0.19 MN/m^2$. Find per $405000 kJ/h$ of refrigeration capacity, the power consumption of the compressor and COP of the cycle.

4. A Bell-Coleman cycle works between 1 and 7 bar pressure limits. The compression and expansion indices are 1.25 and 1.3, respectively. Obtain COP and tonnage of the unit for an air flow rate of 0.5kg/s. Neglect clearance volume and take temperatures at the beginning of compression and expansion to be $7°C$ and $37°C$, respectively.

**(2x10)**

**P.T.O.**

## Section - B

5. A two-stage R 22 plant with flash intercooler for food freezing has two 45 mm bore and 40 mm stroke compressors as follows: LP Compressor ( Number of cylinders 6, rpm 1000, volumetric efficiency 70%), HP Compressor ( Number of cylinders 4, rpm 800, Volumetric efficiency 75%). Find the refrigerating capacity of the plant when operating at a condenser temperature of 40°C and evaporator temperature of −40°C. Also, find the inter-stage pressure.

6. Discuss in detail various thermodynamic, chemical, physical properties of refrigerants in detail?

7. A building has the following calculated loads:

$$\text{RSH gain} = 300 \text{ kW}$$
$$\text{RLH gain} = 110 \text{ kW}$$

The space is maintained at the following conditions:

$$\text{Room DBT} = 25°\text{C}$$
$$\text{Room RH} = 50\%$$

Outdoor air is at 28°C and 50% RH. And 10% by mass of air supplied to the building is outdoor air. If the air supplied to the space is not to be at a temperature lower than 18°C, find:

(i) Minimum amount of air supplied to space in $m^3/s$.

(ii) Volume flow rates of return(recirculated room) air, exhaust air, and outdoor air.

(iii) State and volume flow rate of air entering the cooling coil.

(iv) Capacity, ADP, BPF and SHF of the cooling coil.

**(2x10)**

X-X-X