Code No : ME-601A

Time : 2 hrs.

Branch : Architecture

Full Marks : 50.

Use separate Answerscripts for each half
The questions are of equal value
Answer Four questions taking two from each half
Use of steam table,Psychrometric chart are allowed.

### FIRST HALF

1.a) What is quality of temperature ?

 b) Define and prove the Zeroth Law of Thermodynamics.

2. a) Starting from first principles drive the expression of thermal efficiency for Otto
   cycle.

 b) Show that for the maximum work to be done per kg. of air in Otto cycle between
   given upper and lower limits of absolute temperatures $T_3$ and $T_1$ respectively,
   the ratio of compression should have the value $\left(\frac{T_3}{T_1}\right)^{1.25}$ when $\gamma = 1.4$

3. Write short notes on any two of the followings :-

   a)  Vapour Compression Refrigeration system
   b)  Vapour Absorption Refrigeration cycle
   c)  Important Refrigerants.

4. (a) At what state on the psychrometric chart are the dry-bulb, wet-bulb, and dew-point temperatures identical?

(b) How do constant-enthalpy and constant wet-bulb temperature lines compare on the psychrometric chart?

(c) An air-conditioning system is to take in out door air at 10°C and 30 % relative humidity at a steady rate of 45 m³/min and to condition it to 25° C and 60% relative humidity. The out door air is first heated to 220° C and then humidified by injection of hot steam in the humidifying section. Assume that the entire process take place at 100 kPa. Determine (i) the rate of heat supplied in the heating section, (ii) the mass flow rate of steam required in the humidifying section?

5. (a) Explain different types of air conditioning processes.

(b) What are the essential differences between dry air filter and wet air filter?

(c) A room measuring 5m x 5m x 5m suffers sensible heat gain of 5 kW and is to be maintained at 22° C dry bulb by a supply of cooled air. If the supply air temperature is 13° C dry bulb, calculate (i) the mass flow rate of air, which must be supplied in kg s⁻¹, (ii) the volume flow rate that must be supplied in m³/s, (iii) the volume flow rate that must be extracted, assuming that no infiltration or exfiltration occurs.

6. Write short notes on the following topics. :

    (a) Components of Heating and cooling load.

    (b) Ideal performance criteria of an elevator.

    (c) Self-cleaning viscous filters.

    (d) Sling psychrometer