Air-Conditioning & Refrigeration

BSc

Lecture 9

Course weekly Outline &

Ch.1 (Introduction to Air conditioning & Refrigeration)

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3.1: Inside air design conditions:

The general practice is to recommend the following optimum inside design conditions for comfort Summer air conditioning :

DBT = 25.0 ± 1.0 °C and RH = 50 ± 5 % . The corresponding room velocity is 0.4 m/s .

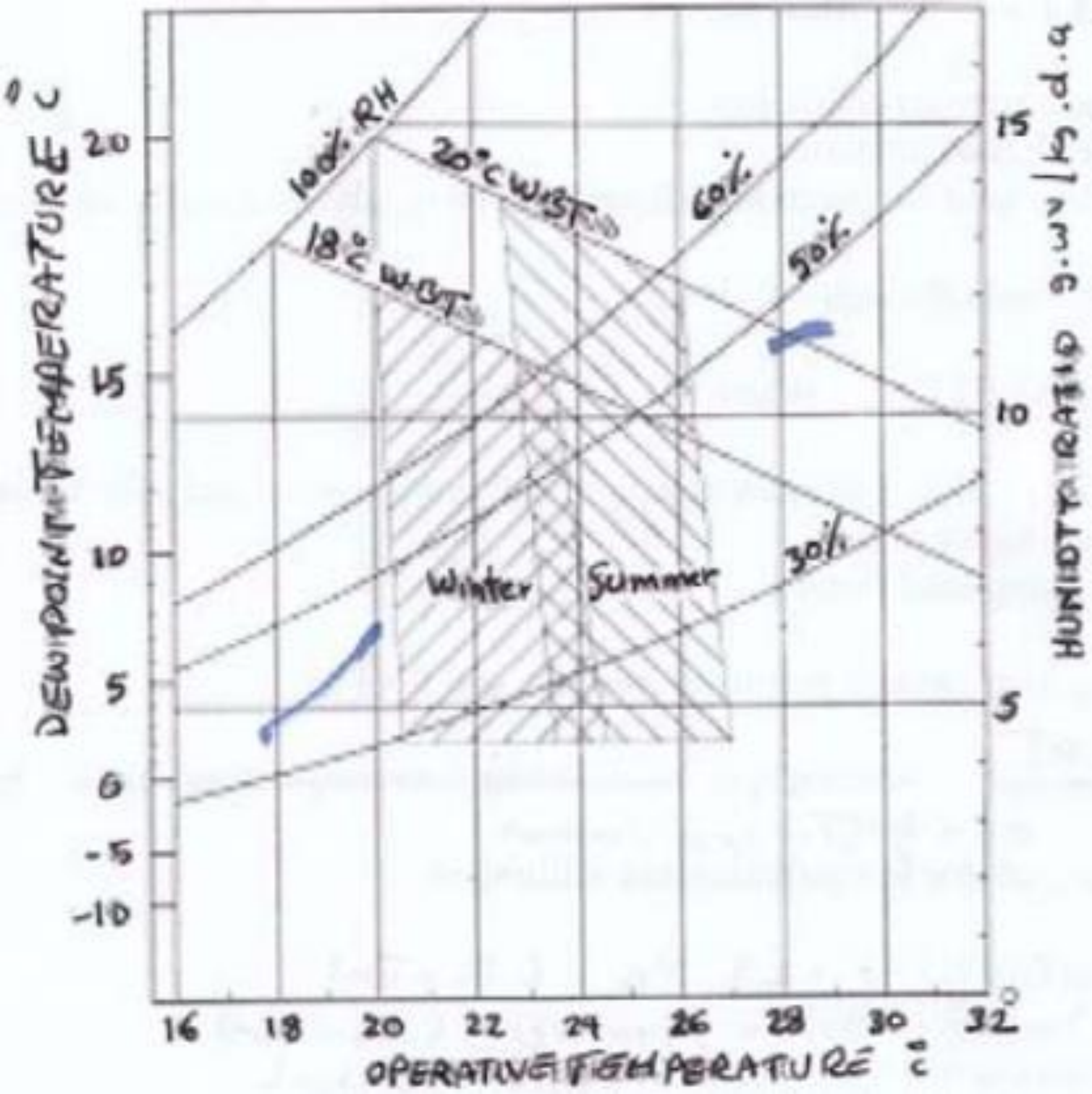
During winter the body gets acclimatized to with stand lower temperatures . Consequently the following Winter design conditions is quite comfortable :

DBT = 21 °C at RH = 50 % and air velocity of (0.15 – 0.2) m/s .

3.2: Out side air design conditions :

See the air conditioning tables or weather data for Iraqi Cities .

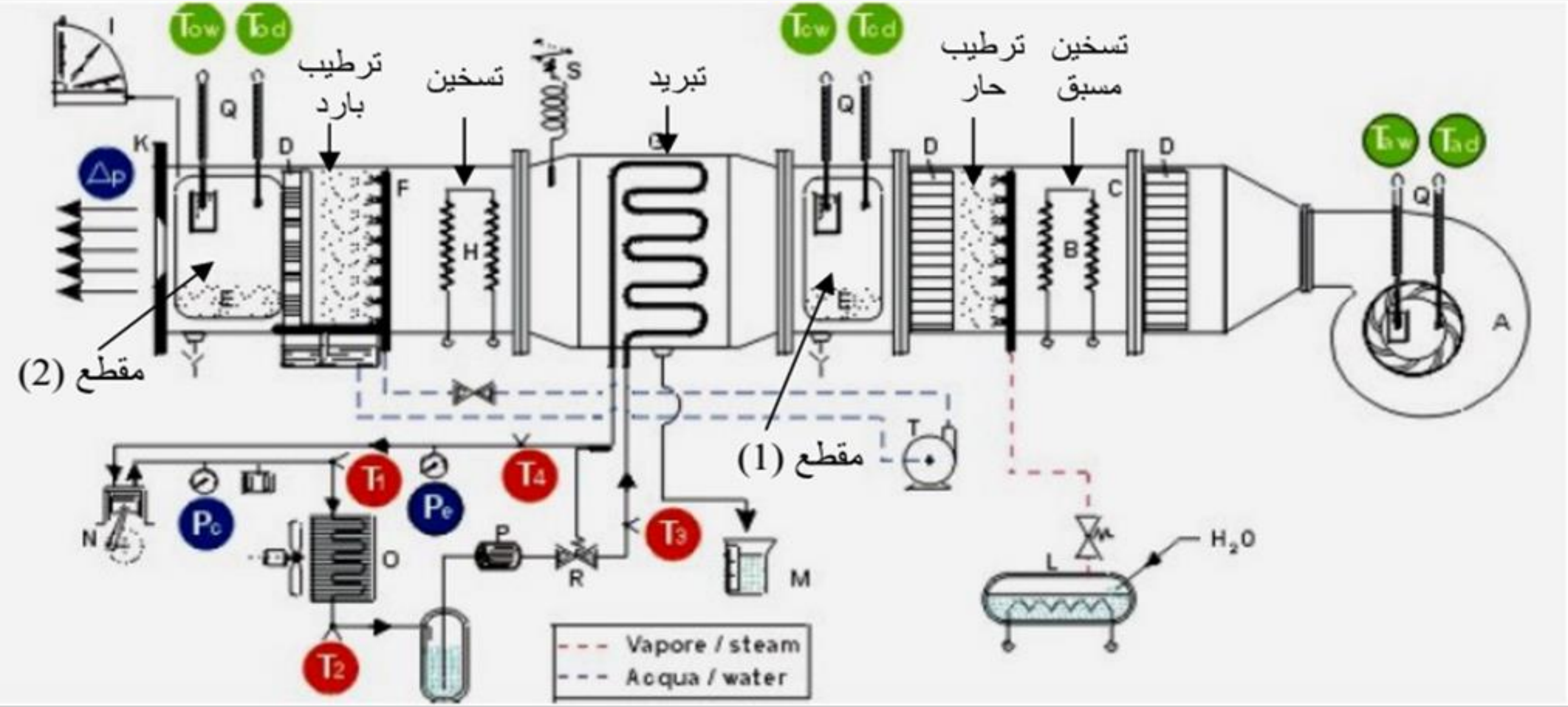
3.3: Comfort zone for Summer and Winter :

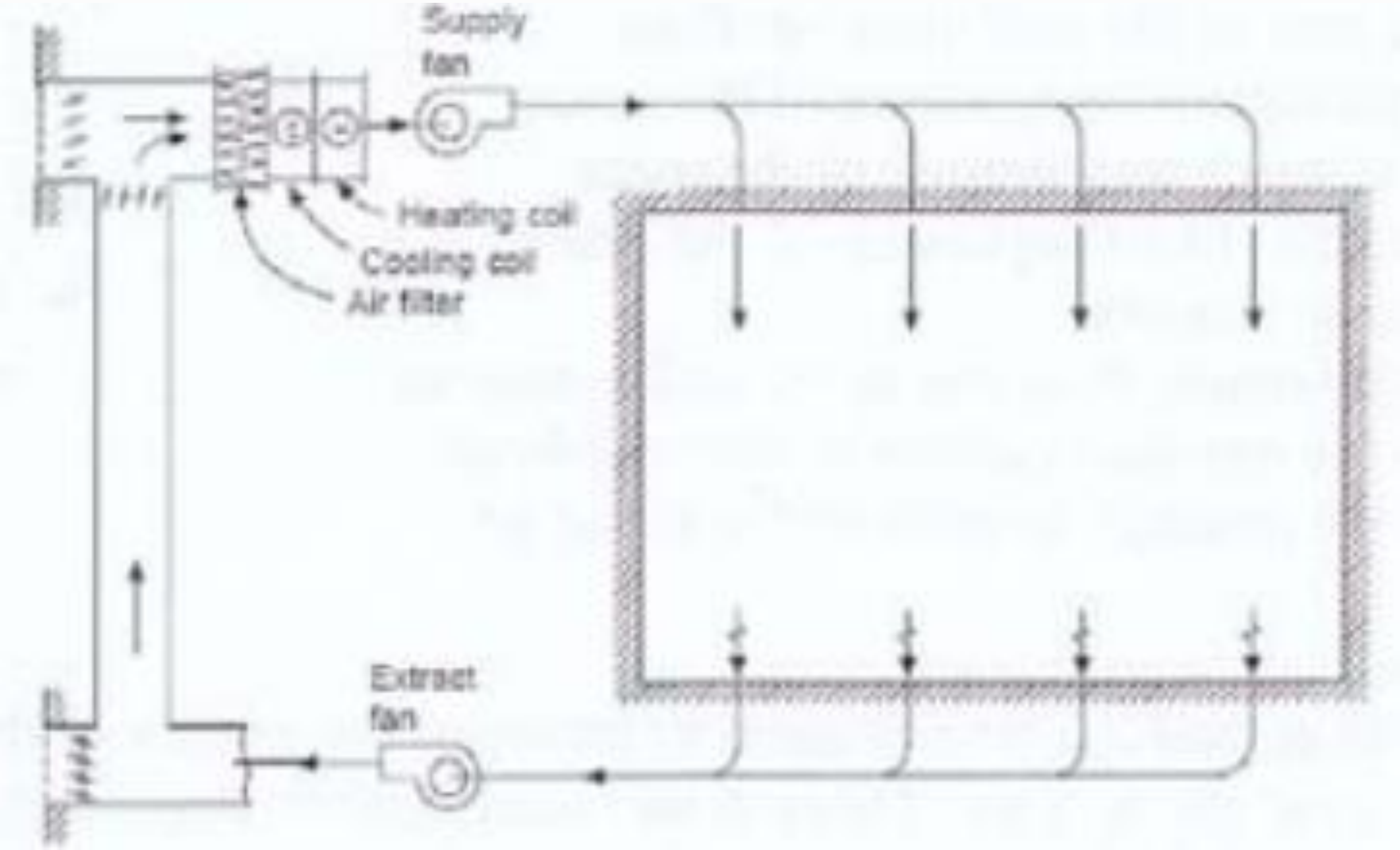

100% RH
20°C WBT
18°C WBT
60%
50%
30%
Winter
Summer
DEWPOINT TEMPERATURE °C
HUMIDITY RATIO g.w / kg.d.a
OPERATIVE TEMPERATURE °C
16
18
20
22
24
26
28
30
32
20
15
10
5
0
-5
-10

Chapter six: Air conditioning systems

6.1: All air systems: It is consist of the following systems :

a- Constant air volume systems
b- Variable air volume systems
c- Reheat systems
d- dual duct systems
e- Air side economizer



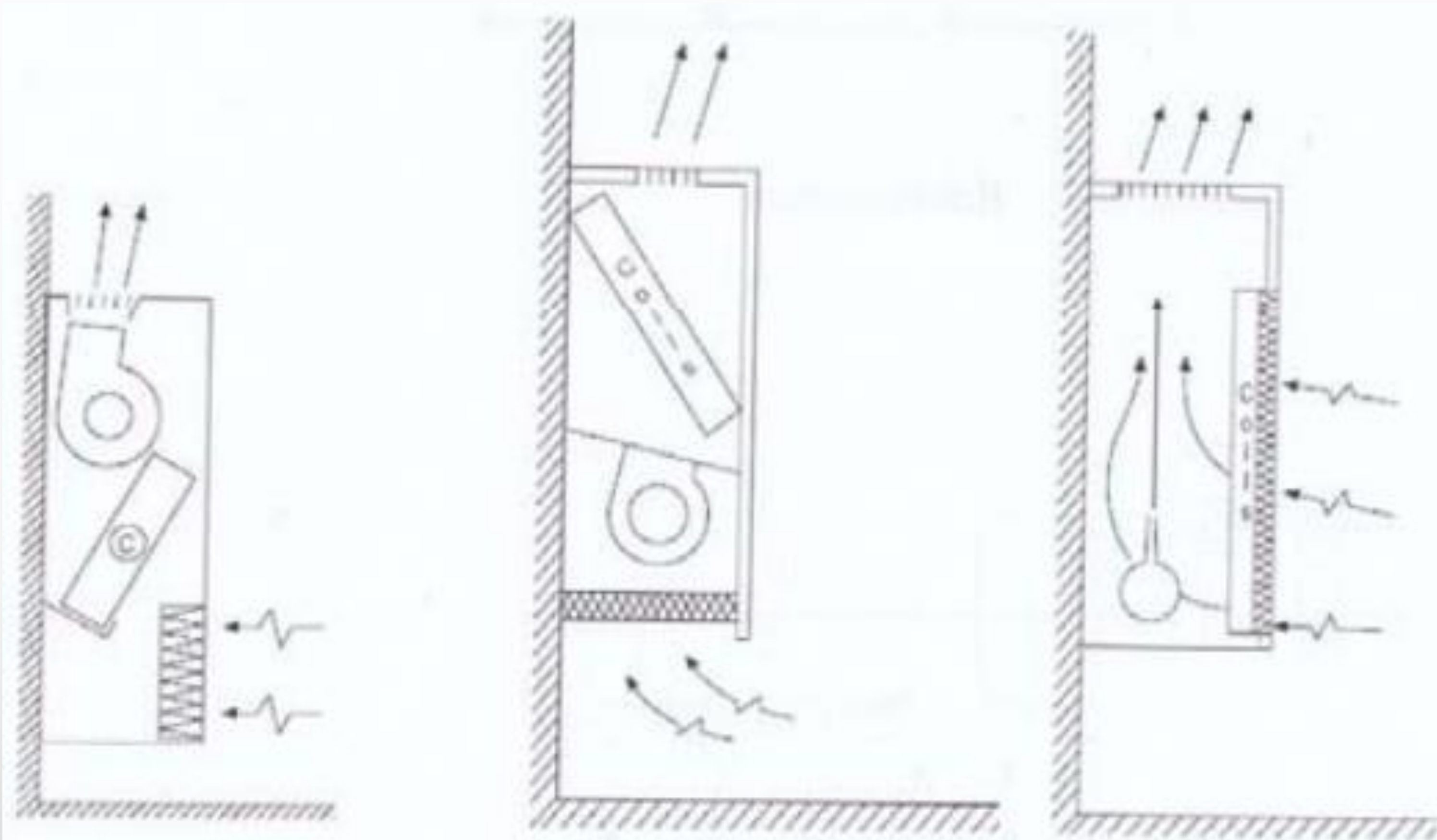


Constant air volume system

6.3: Air water systems : It is consist of the following systems :

a- Air water induction systems

b- fan coil systems : two pipe ,three pipe or four pipe systems



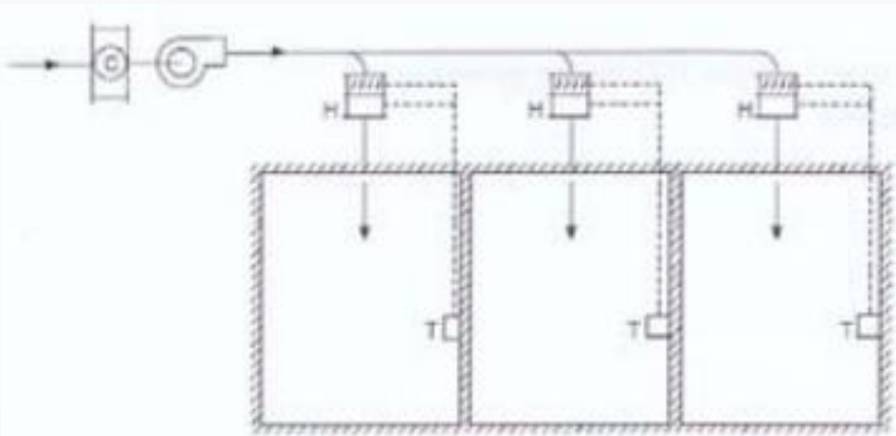
Fan coil unit | Fan coil unit | Induction systems

6.4: Unitry and hybrid systems : It is consist of the following systems:

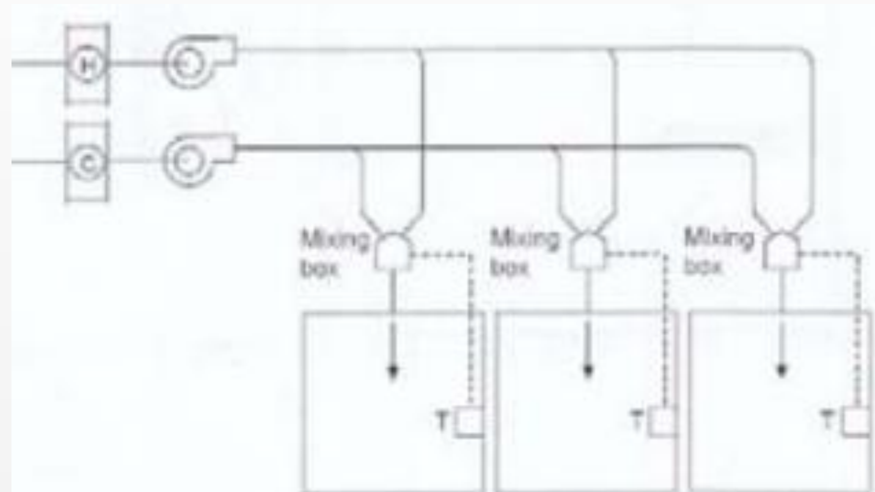
a- Incremental units ,examples motel units and large single zone units .

b- Heat pumps , air to air heat pumps , water to air heat pumps .

c- Heat recover system , air to air heat exchanger, heat wheel and heat pipe.



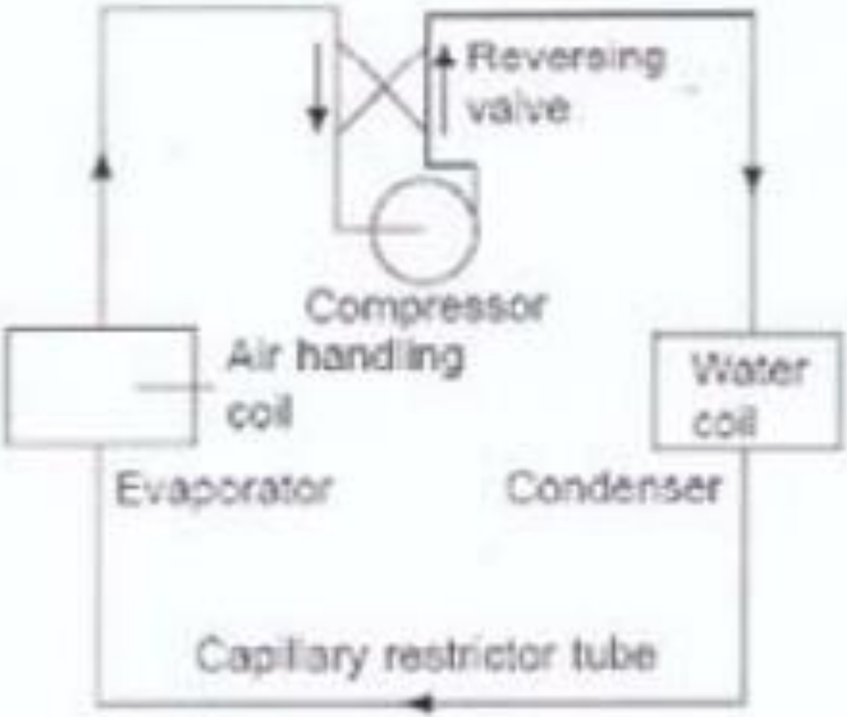
Reheat system



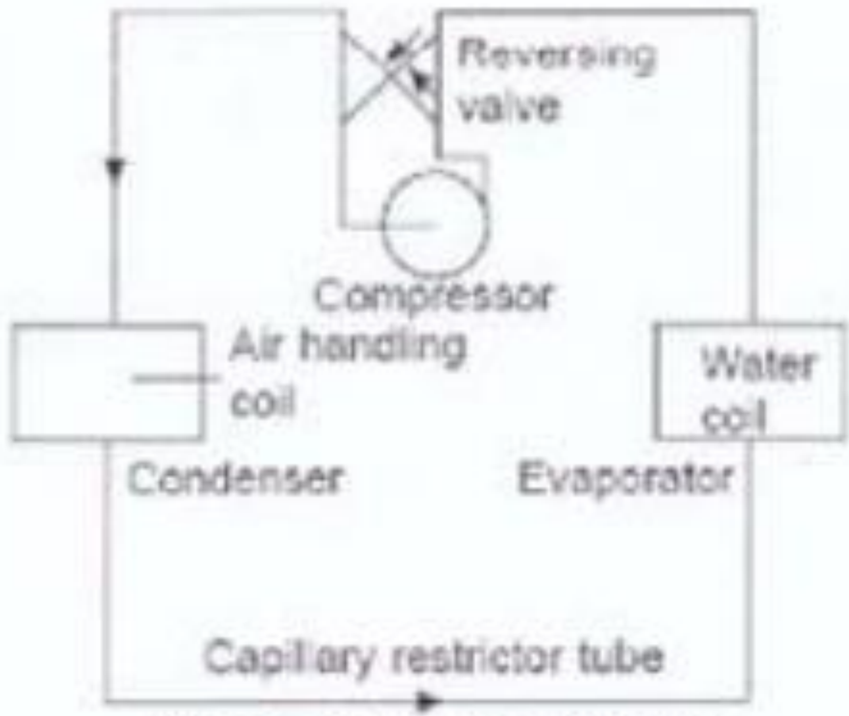
Dual duct system

6.2: All water systems : It is consist of the following systems :

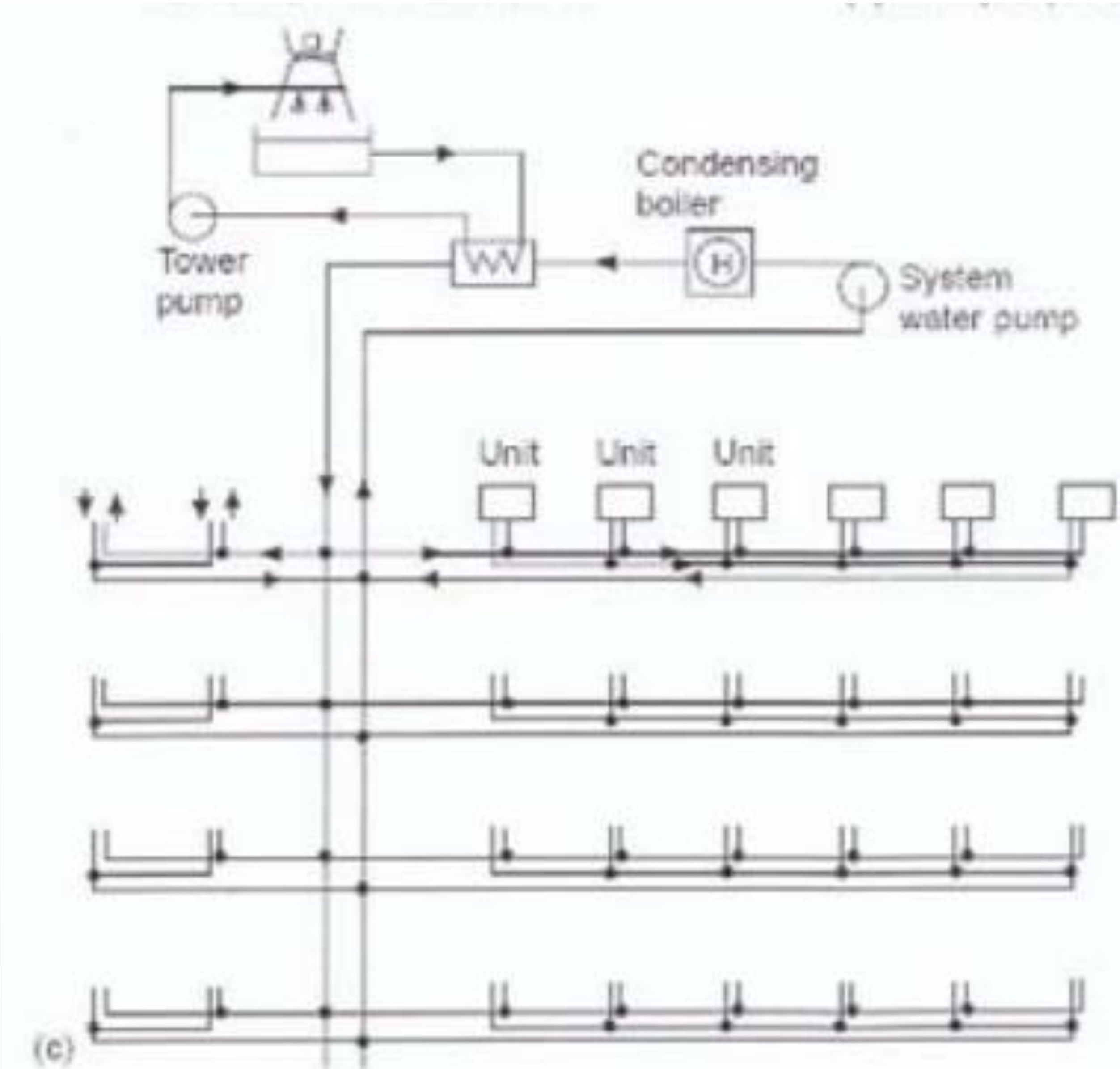
a- Fan coil
b- Unite ventilator
c- Radiant panels



(a) Heat pump cooling cycle



(b) Heat pump cooling cycle



(c) Heat recovery system

2. Use the following equations to calculate the required variables:-

$Q_s = 1.22\ V_s (T_r - T_s)$, this can be used to find V_s . or $Q_s = m_{supply}\ c_p\ (T_r - T_s)$

$Q_{coil} = 1.2\ V_s (h_m - h_s)$, if there is mixing

$c_p = 1.005$ kJ/kg. K

$Q_{coil} = 1.2\ V_s (h_o - h_s)$, for all outside air

$V_s = V_{supply} = m_{supply} / \rho$

$Q_{coil} = 1.2\ V_s (h_r - h_s)$, for all return air

$Q_s = V_{supply}\ c_p * \rho (T_r - T_s)$

$m_{vap} = m_s \Delta g$ and the condition as in Q_{coil}

$Q_s = 1.22\ V_{supply} (T_r - T_s)$

$Q_{water} = m_{water}\ c_p\ \Delta T_{water}$ where $c_p = 4.2$ kJ/kg. K

$Q_L = m_{supply} \Delta g\ h_{fg}$