Menoufiya University
Faculty of Engineering
Shebin El-Kom
1st Semester, 2014-2015
Higher Diploma Exam

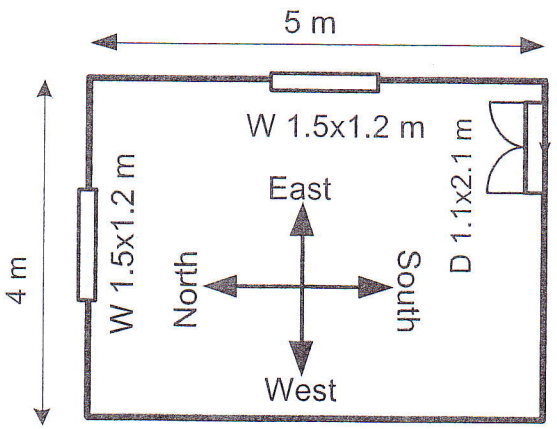
Minufiya University

Mechanical Power Engineering Department
Subject: MPE505
Using computers in R & Air Conditioning
Date: 17/1/2015
Time Allowed: 3 hours

Personal Laptop and all Refrigeration and Air Conditioning Software, tables and charts, and handwrite list of equations belong the students are allowed.

Answer the following Questions كل خصائص الهواء وحسابات أحمال التبريد والتدفئة باستخدام برامج الحاسب الآلى فقط

1. Outdoor air enters an air conditioning system at 10 ^{o}C dbt and 40 % relative humidity at steady rate of 25 m^3/min and it leaves at 26 ^{o}C dbt and 60 % relative humidity. The outdoor air is first heated to 21 ^{o}C dbt in heating section and then humidified by injection of hot steam in the humidifying section. Assume the entire process takes place at a pressure of 101 kPa, draw the process on Psychrometric chart and find; (a) the rate of heat supply in the heating section, (b) the total heat added to the air flow, and (c) the mass flow rate of steam required in the heating section.
2. A wet cooling tower is to cool 60 kg/s of water from 40 ^{o}C dbt to 26 ^{o}C dbt. Atmospheric air enters the tower at 101 kPa with 22 ^{o}C dbt and 16 ^{o}C wbt, respectively, and leaves at 34 ^{o}C dbt with 90 % relative humidity. Represent the process on Psychrometric chart, and determine (a) the volume flow rate of air into the cooling tower and (b) the mass flow rate of the required makeup water.
3. An air conditioning room is maintained at 24 ^{o}C dbt and RH 50 %. The ambient conditions are 36 ^{o}C dbt and 26 ^{o}C wbt . The room has sensible heat gain of 80 kW and latent heat gain of 20 kW. The re-circulated air contains 25 % by weight fresh air. The re-circulated air is supplied to the room at 14 ^{o}C. Calculate, the sensible heat factor, the total amount of conditioned air, the cooling coil dew point, the cooling coil capacity in TR, the cooling coil efficiency, and the rate of water removed from the air.
4. In an air conditioning system of $5\times4\times3$ m, the number of person are 8, and the hall at latitude of 30 °N. The condition space is maintained at 24 ^{o}C dbt and 50 % RH, and the ambient conditions is 39 ^{o}C dbt and 25 ^{o}C wbt. The roof is from thermally insulated light concrete with overall heat transfer coefficient of $U=1.25$ $W/m^2.K$, walls from compost materials with $U=1.85$ $W/m^2.K$, floor is from wooden slabs over unconditioned space with $U=1.15$ $W/m^2.K$, metallic door with $U=3.25$ $W/m^2.K$, glass window with $U=3.17$ $W/m^2.K$ and solar heat gain of 600 W/m^2. The light intensity is 25 W/m^2 of floor area for fluorescent lamps. The appliances load is 5 kW. Take air density as 1.18 kg/m^3, air specific heat of 1.005 $kJ/kg.K$ and water evaporation heat is 2545 kJ/kg. Calculate the cooling load of this system in kW.



With my best wishes