MEBS6006 Environmental Services I

http://me.hku.hk/msc-courses/MEBS6006/index.html

Exercises on Psychrometry and Thermal Comfort

1. Moist air exists at 40°C dry-bulb temperature, 20°C thermodynamic wet-bulb temperature, and 101.325 kPa pressure. Determine the humidity ratio, enthalpy, dew-point temperature, relative humidity, and specific volume.

2. Moist air, saturated at 2°C, enters a heating coil at a rate of 10 m^3/s. Air leaves the coil at 40°C. Find the required rate of heat addition.

3. Moist air at 30°C dry-bulb temperature and 50% rh enters a cooling coil at 5 m^3/s and is processed to a final saturation condition at 10°C. Find the kW of refrigeration required.
(Given data: specific enthalpy of water at 10°C under standard atm. pressure is 42.11 kJ/kg)

4. A stream of 2 m^3/s of outdoor air at 4°C dry-bulb temperature and 2°C thermodynamic wet-bulb temperature is adiabatically mixed with 6.25 m^3/s of recirculated air at 25°C dry-bulb temperature and 50% rh. Find the dry-bulb temperature and thermodynamic wet-bulb temperature of the resulting mixture.

5. Moist air at 20°C dry-bulb and 8°C thermodynamic wet-bulb temperature is to be processed to a final dew-point temperature of 13°C by adiabatic injection of saturated steam at 110°C. The rate of dry airflow is 2 kg/s (dry air). Find the final dry-bulb temperature of the moist air and the rate of steam flow.

6. Which mechanism in thermal comfort study is each of the following referring to?

   (a) A warm body transferring heat across space to surrounding surface.
   (b) The heat flow through a substance by physical contact.
   (c) Cooler air warmed by the body rise, drawing in more cool air to the body.
   (d) Moisture exits the body through pores in the skin and changes to a vapour causing the skin to cool.

7. The mean radiant temperature (MRT) is defined as:

   (a) The weighted average of the temperature of each surface and the distance to that surface.
   (b) The weighted average of temperature of each surface and the angle of exposure of your body to the surface.
   (c) The weighted average of temperature, height, width and length of each surface in the space.
   (d) The weighted average of the temperature of each surface and the temperature of the air.

8. What are the two important conditions for achieving thermal comfort?