Prince of Songkla University
Faculty of Engineering

Mid-Term Examination   **Semester 1/2548**

6 August 2005   **Time 9:00-12:00**

215-663 Energy Management in Buildings   **Room: R300**

Directions

- This is an open book examination.
- All types of calculator and dictionary are permitted.
- Attempt all 5 questions.
- Students may not borrow books and note, nor talk to each other.

Juntakan Taweekun
Instructor

Problem	Marks	
1	20	
2	20	
3	20	
4	15	
5	25	
Total	100	

Name _____

ID _____

Name _____ ID _____

Question 1 (20 points)

An air stream flowing at 1 kg/s, with dry-bulb temperature of 30 °C and relative humidity 50%, is cooled down to 20 °C and relative humidity 90%.

    1.1 What is the cooling load to the air-conditioner and what are the values of sensible and latent loads?

    1.2 How much water is condensed per hour (in unit of kg/hr)?

Question 2 (20 points)

A sedentary person generates CO_2 at a rate of 0.009 g/s. If the ventilation rate for a room in which the person resides is 9 l/s, and if the ventilation air contains:

- 0.6 g/m^3 of CO_2,
- 10 mg/m^3 of CO and
- 350 $\mu g/m^3$ of SO_2

What would be the concentration of CO_2, CO and SO_2 in the room? Assume 1 m^3 of air weighs 0.9 kg.

Name _____ ID _____

Question 3 (20 points)

3.1 Explain all the factors affect thermal comfort in details. In your opinion, what additional factors should be considered for thermal comfort and why?

3.2 Based on ASHRAE standard 55-1992, find the alternative values for a given pair of physical or personal variable when others are assumed to take reference values:

a) clo = 0.4, T_o = 24.4 °C
Find   clo = 1.2, T_o = ?

b) met = 1.2, clo = 0.5, T_o = 24.5 °C
Find   met = 2, clo = 0.9, T_o = ?

Name _____ ID _____

Name _____ ID _____

Question 4 (15 points)

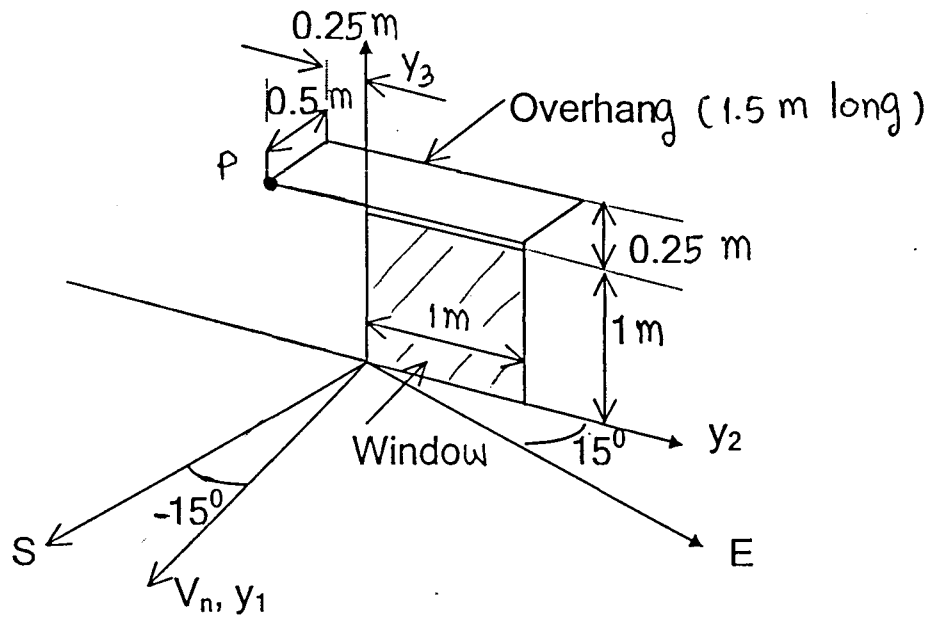Calculate sunrise and sunset times on 21 March 2000 for Beijing.
Given: Latitude of Beijing = 40°

Question 5 (25 points)

Calculate the position of the shade for point "P" and draw the shade of an overhang (1.5 m long and extend 0.5 m) in the following figure of a window (1 m x 1 m) facing a direction 15° from the South towards East at 14:30 on 1 December (Julian date = 335) in Bangkok. The shading device is perpendicular to the plane of the window.

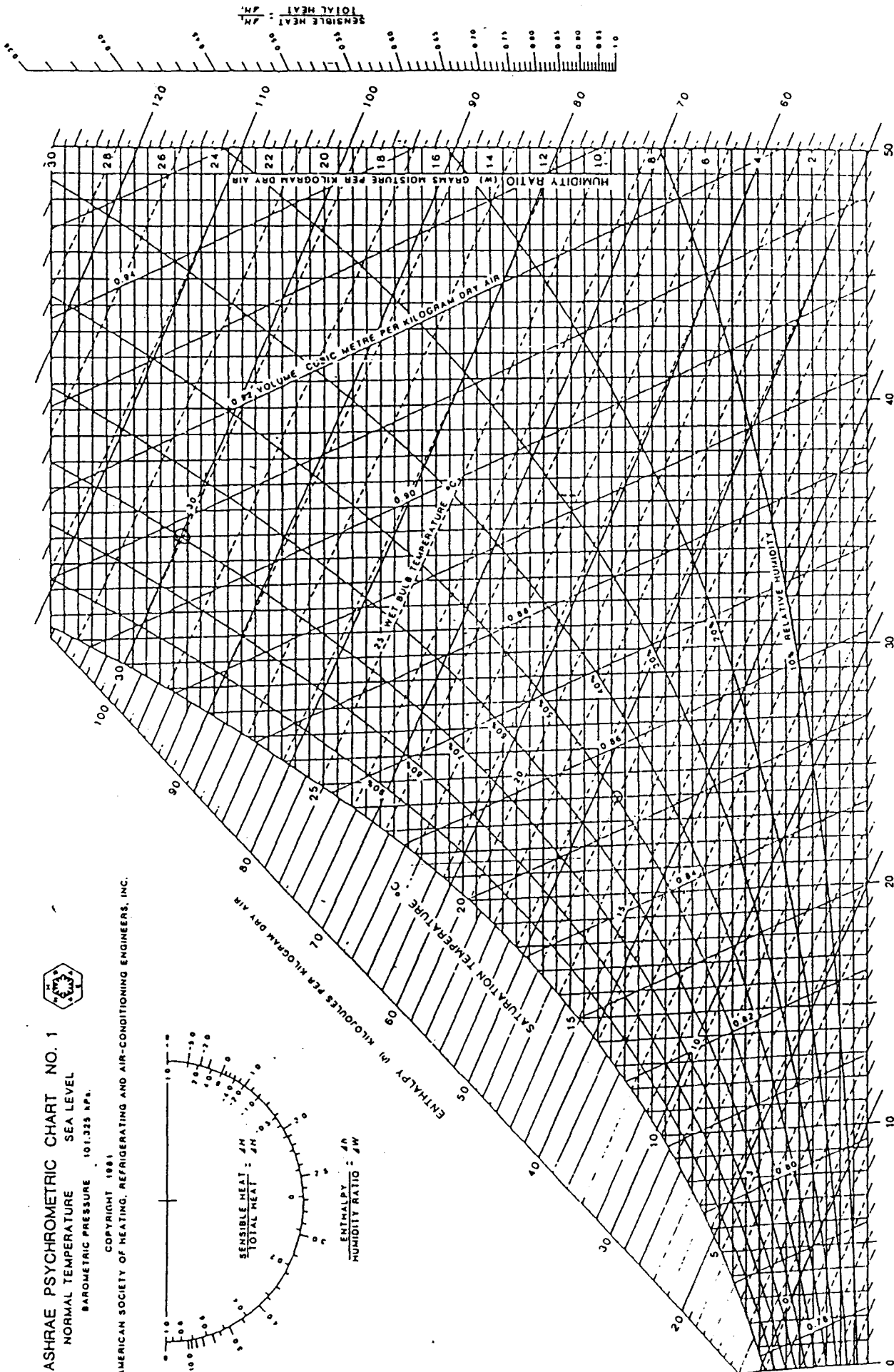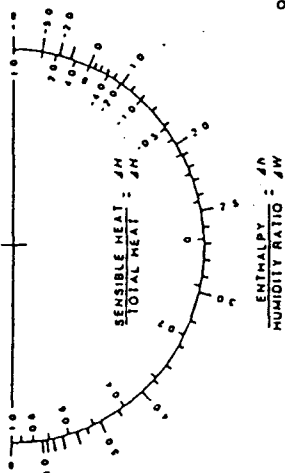**Given:** Latitude of Bangkok = 13.7°

Longitude of Bangkok = 100.5 °E

Name _____ ID _____

Fig. 4   ASHRAE Psychrometric Chart

ANSI/ASHRAE 41.6-1982