SET A

UNIVERSITI KUALA LUMPUR

MALAYSIA FRANCE INSTITUTE

FINAL EXAMINATION

SEPTEMBER 2014 SEMESTER

SUBJECT CODE	:	**FCB31103**
SUBJECT TITLE	:	**INTRODUCTION TO CONDITIOING OF AIR**
LEVEL	:	**BACHELOR**
TIME / DURATION	:	**9.00 AM – 12.00 PM** **(3 HOURS)**
DATE	:	**11 JANUARY 2015**

INSTRUCTIONS TO CANDIDATES

1.   Please read the instructions given in the question paper CAREFULLY.

2.   This question paper is printed on both sides of the paper.

3.   Please write your answers on the answer booklet provided.

4.   Answer should be written in blue or black ink except for sketching, graphic and illustration.

5.   Open book exam

6.   Answer all questions in English.

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

a) What is meant by Thermal Comfort? Using selected indices as examples, discuss
    how this may be assessed?

                                                                                  (10 marks)

b) Calculate the insulation value of the clothing level for the activities listed below.
    i)   Sport.
    ii) Office work.

                                                                                  (8 marks)

c) Define term PMV and using the graph below, determine the required PMV so that
    the PPD would not exceed 10% of the occupants of a building.

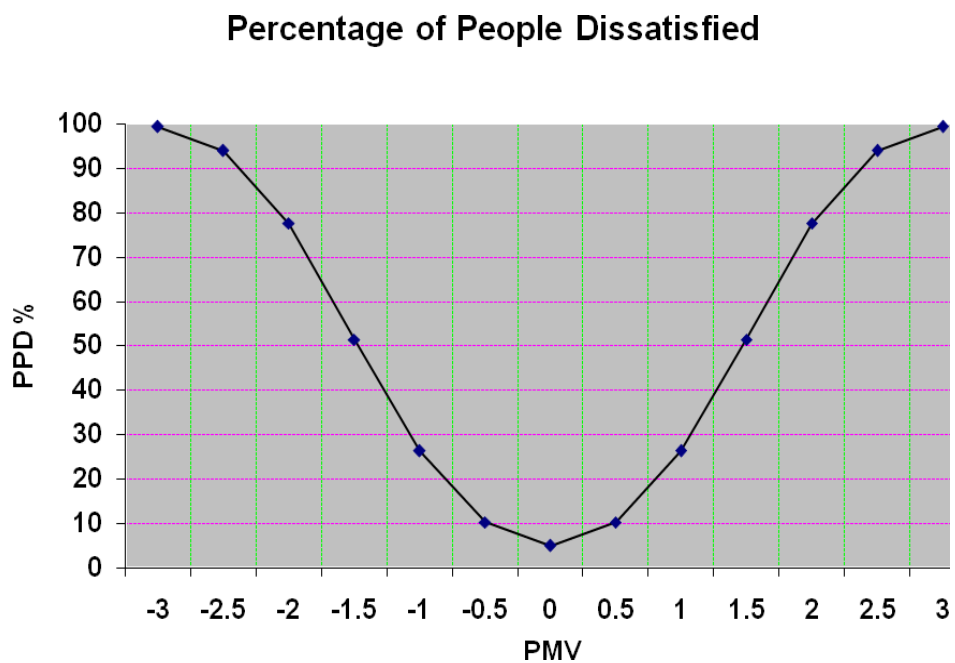   (7 marks)

Percentage of People Dissatisfied

Figure Q1: 1 PMV and PPD

Question 2

Following presentation of your initial evaluation your client wishes you to evaluate the performance of different ventilation strategies on thermal comfort within the space. This exercise is ideally suited to the investigation using a CFD package but you need to convince the client of the necessity of using CFD. Write brief notes for your client to justify the use of CFD. In doing this you need to specifically explain

a) Why CFD is necessary, the advantages and disadvantages of CFD

(10 marks)

b) The purpose of the meshing explain how the software iteratively uses these to produce a solution

(5 marks)

c) The terms convergence and divergence.

(5 marks)

d) The reliability and accuracy of CFD as a tool and measures you can adopt to minimize the error. (5 marks)

Question 3

A counter flow chilled water coils is to cool 3.0 kg/s of air from entering condition of $28^{o}C$ DB and $20^{o}C$ WB to a final wet bulb temperature $12^{o}C$. Chilled water enters the coil at $7^{o}C$ and leaves at $13^{o}C$. The ratio of outside and inside surface area is 16, $h_c = 60$ W/m^2.K, $h_r = 2,500$ W/m^2.K, $Cp = 1.02$ kJ/kg. Calculate:

(a) the required surface area?

(15 marks)

(b) the dry bulb temperature of the leaving air?

(10 marks)

Question 4

For a coil whose performance and condition of entering air shown in table Q4, when air flow rate of 2.2 m^3/s, the face velocity is 3 m/s and the refrigerant temperature is 4.4^{o}C.

(a) Plot the process on the psychrometric chart.

(10 marks)

(b) Calculate the cooling capacity of the coil.

(8 marks)

(c) Calculate the average cooling capacity of the first two and the last two rows in kW/m^2 of face area.

(7 marks)

Air enters at 30°C dry bulb and 21.7^{o}C wet bulb temperature.

2 m/s			3 m/s		
Row of tubes	Final DBT ^{o}C	Final WBT ^{o}C	Row of tubes	Final DBT ^{o}C	Final WBT ^{o}C
4.4^{o}C refrigerant temperature					
2	18.2	17.1	2	19.7	18.0
3	16.1	15.3	3	17.5	16.5
4	14.3	13.8	4	15.9	15.2
6	11.8	11.5	6	13.5	13.1
8	10.2	9.9	8	11.7	11.4

Table Q4: Performance of direct expansion refrigerant R22.

END OF QUESTION
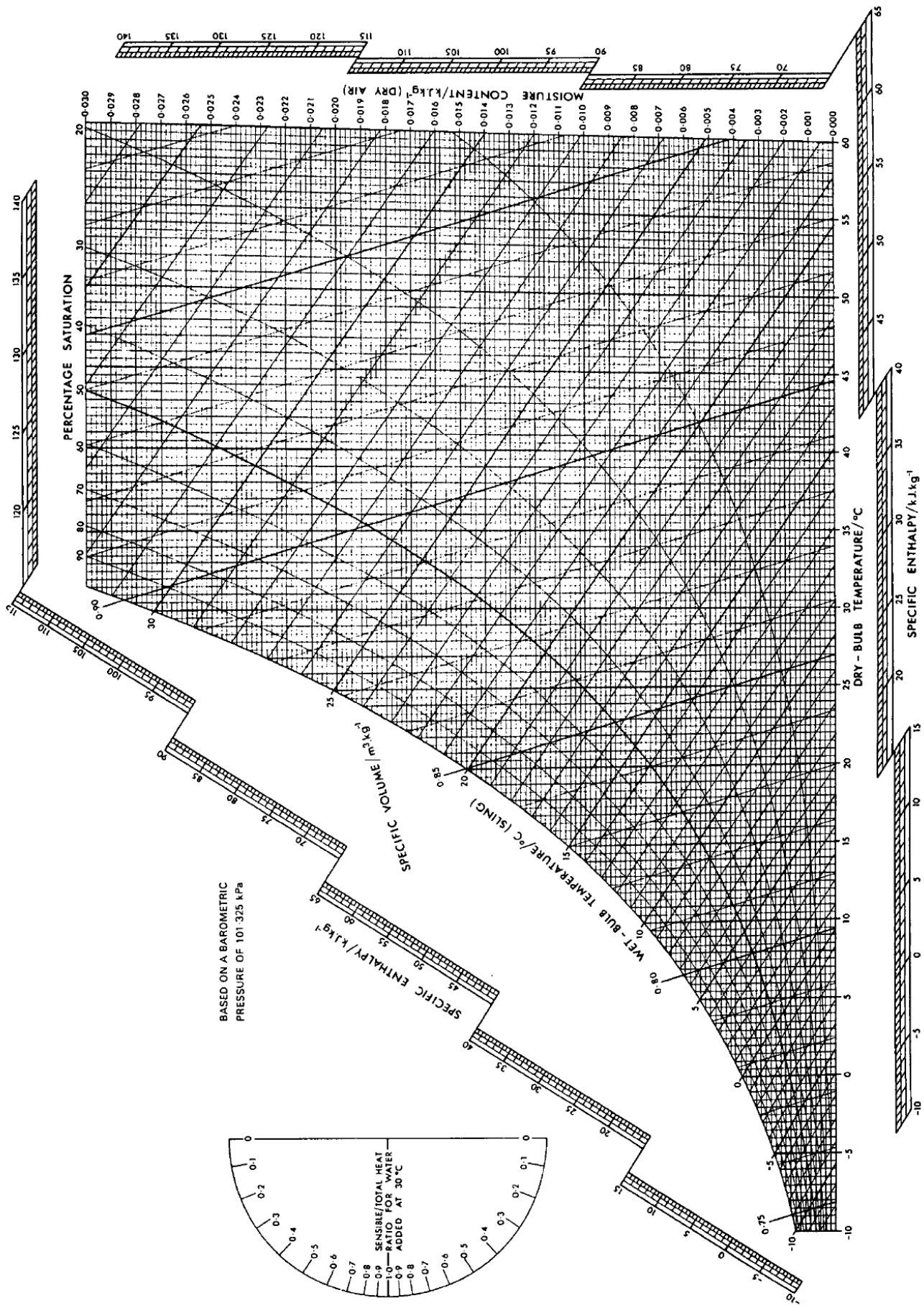
Figure 1.2 CIBSE Psychrometric chart (−10 to +60°C)
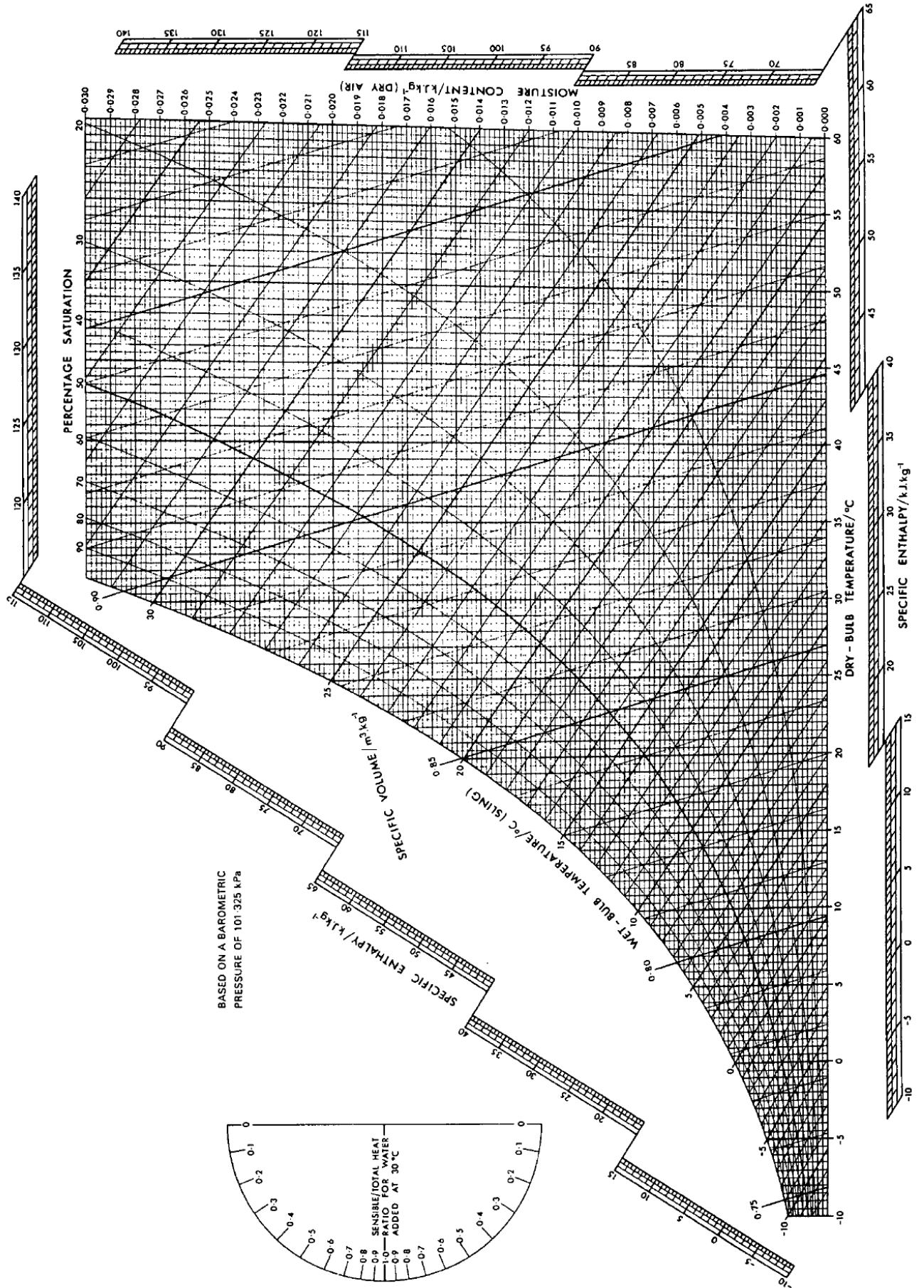
Psychrometric chart based on a barometric pressure of 101·325 kPa.

PSYCHROMETRIC CHART
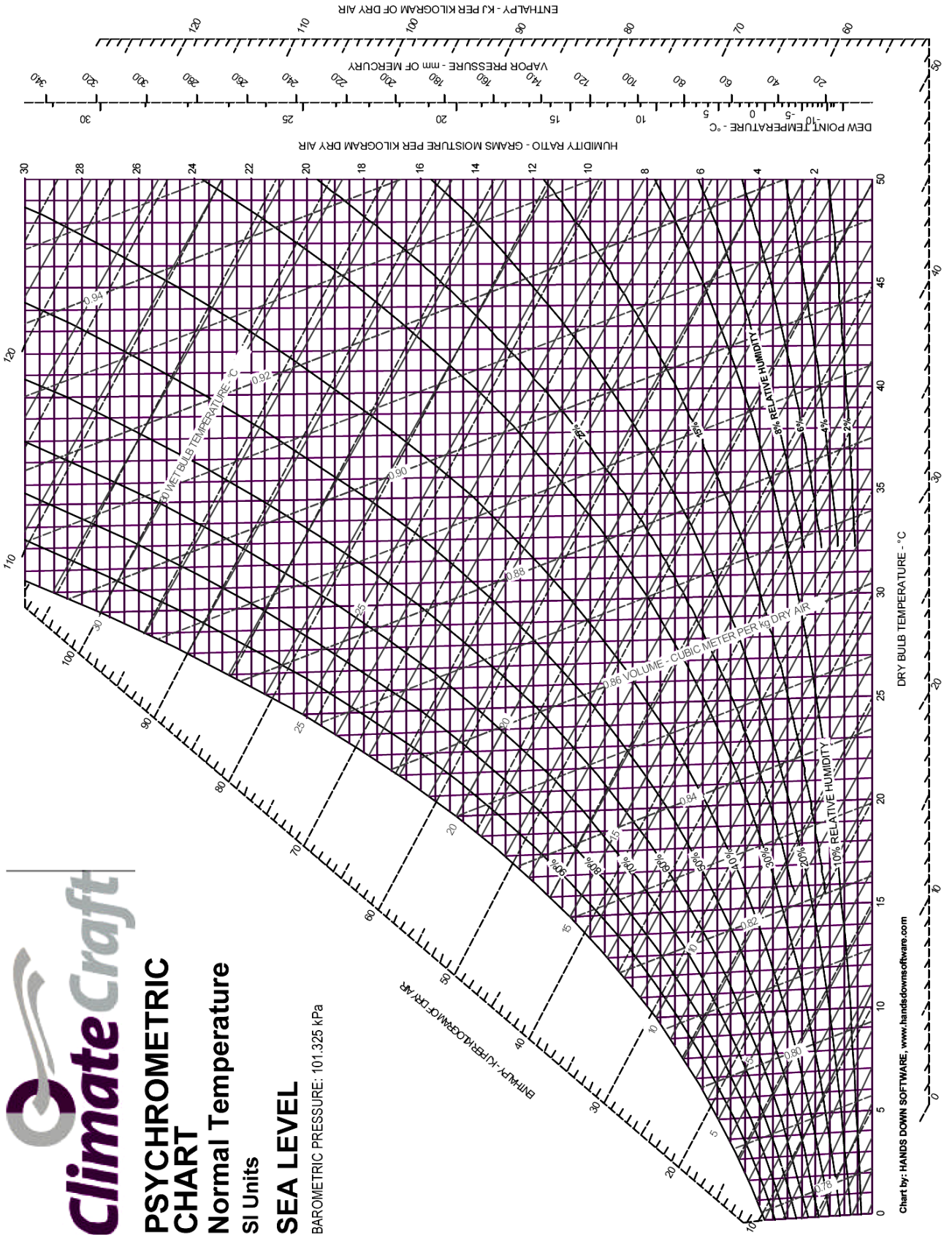Normal Temperature
SI Units

SEA LEVEL
BAROMETRIC PRESSURE: 101.325 kPa
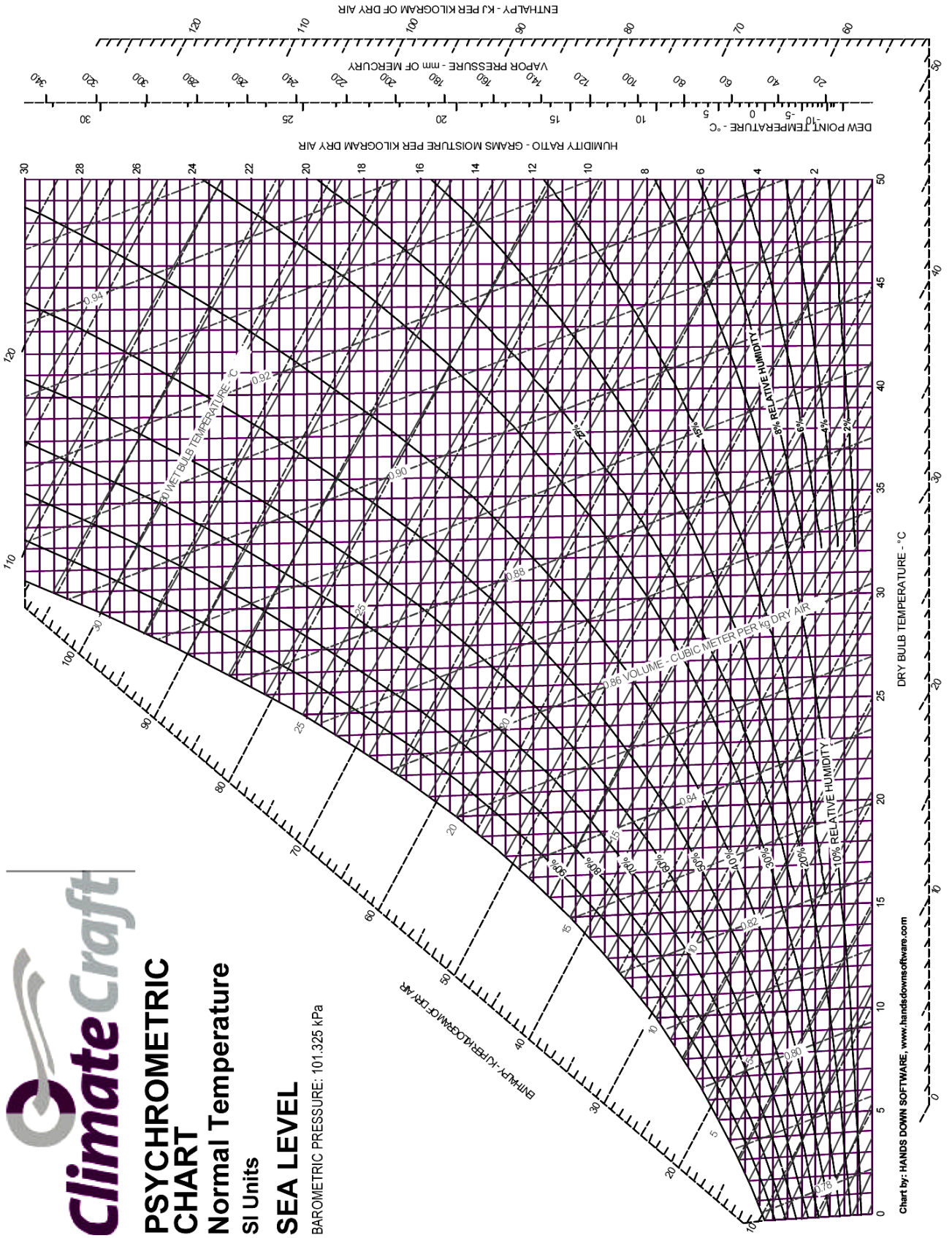
Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com

ENTHALPY - KJ PER KILOGRAM OF DRY AIR

VAPOR PRESSURE - mm OF MERCURY

DEW POINT TEMPERATURE - °C

HUMIDITY RATIO - GRAMS MOISTURE PER KILOGRAM DRY AIR

DRY BULB TEMPERATURE - °C

WET BULB TEMPERATURE - °C

RELATIVE HUMIDITY

VOLUME - CUBIC METER PER kg DRY AIR

PSYCHROMETRIC
CHART
Normal Temperature
SI Units

SEA LEVEL
BAROMETRIC PRESSURE: 101.325 kPa