



**UNIVERSITI KUALA LUMPUR
MALAYSIA FRANCE INSTITUTE**

**FINAL EXAMINATION
JANUARY 2014 SEMESTER**

SUBJECT CODE : FCB 31103
SUBJECT TITLE : INTRODUCTION TO CONDITIONING OF AIR
LEVEL : BACHELOR
TIME / DURATION : 9 a.m – 12 p.m
(3 HOURS)
DATE : 5 JUNE 2014

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 4 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.**Please use the answer booklet provided.****Question 1**

- a) Explain briefly how ISO 7730 defines thermal comfort, stating the physical variables used for this purpose. Explain also the meaning: predicted mean vote, percentage people dissatisfied and the lowest possible percentage people dissatisfied

(10 marks)

- b) Computational Fluid Dynamics (CFD) software can be used to analyze the thermal comfort, air flow and air temperature inside the space. Explain briefly the advantages and disadvantages of CFD in the HVAC system design.

(5 marks)

- c) How does the body attempt to compensate for a cool and a warm environment to maintain the internal temperature of 37.2°C?

(5 marks)

- d) Explain briefly what are the important parameters to consider in selecting the inside design conditions?

(5 marks)

Question 2

An office in Kuala Lumpur is maintained at 25°C and 55% RH. The average occupancy is 7 people and there will be some smoking. Calculate the cooling load imposed by the ventilation requirements with supply air condition at 14°C and 95% RH. Refer to Table Q2 for the outdoor air requirement for ventilation and MS 1525 or ASHRAE standard for outdoor design condition.

Function	Estimated occupancy per 100 m ² area	Outdoor air requirement per person , L/s	
		Smoking	Nonsmoking
Offices	7	10	2.5
Meeting and waiting spaces	60	17.5	3.5
Lobbies	30	7.5	2.5

Table Q2: Outdoor air requirement for ventilation

- (a) The recommended rate of outside ventilation air is used. (10 marks)
- (b) If a filtration device of efficiency of contamination removal (E) 80% is used. (10 marks)
- (c) Comments on the result Q2 (a) and Q2 (b). (5 marks)

Question 3

A counter flow chilled water coils is to cool 3.5 kg/s of air from entering condition of 31°C DB and 23°C WB to a final wet bulb temperature 10°C. Chilled water enters the coil at 6°C and leaves at 12°C. The ratio of outside and inside surface area is 14, $h_c = 60 \text{ W/m}^2\cdot\text{K}$, $h_r = 2 \text{ kW/m}^2\cdot\text{K}$, $C_p = 1.02 \text{ kJ/kg}$. Calculate the:

(a) the required surface area?

(15 marks)

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

(10 marks)

Question 4

A variable air volume air conditioning system attempts to maintain a zone in a building at 24°C and 50% RH. The VAV has a turn down ratio of 2:1 and a minimum fresh air is 0.744 m³/s. The air leaves the cooling coil at 10 °C then undergoes 2 K temperature across the fan. Details the design heat gain are as follows in Table Q4.

Zone	Sensible gain (kW)	Latent heat (kW)
Office	40	10

Table Q4: Sensible and latent heat gain

The outside air design conditions are 32°C db and 24°C wb, calculate:

- a) The re-circulation ratio. (10 marks)
- b) The cooling coil capacity. (5 marks)
- c) The minimum sensible heat gain required to maintain the room temperature. (5 marks)
- d) New room ratio line. (5 marks)

END OF QUESTION

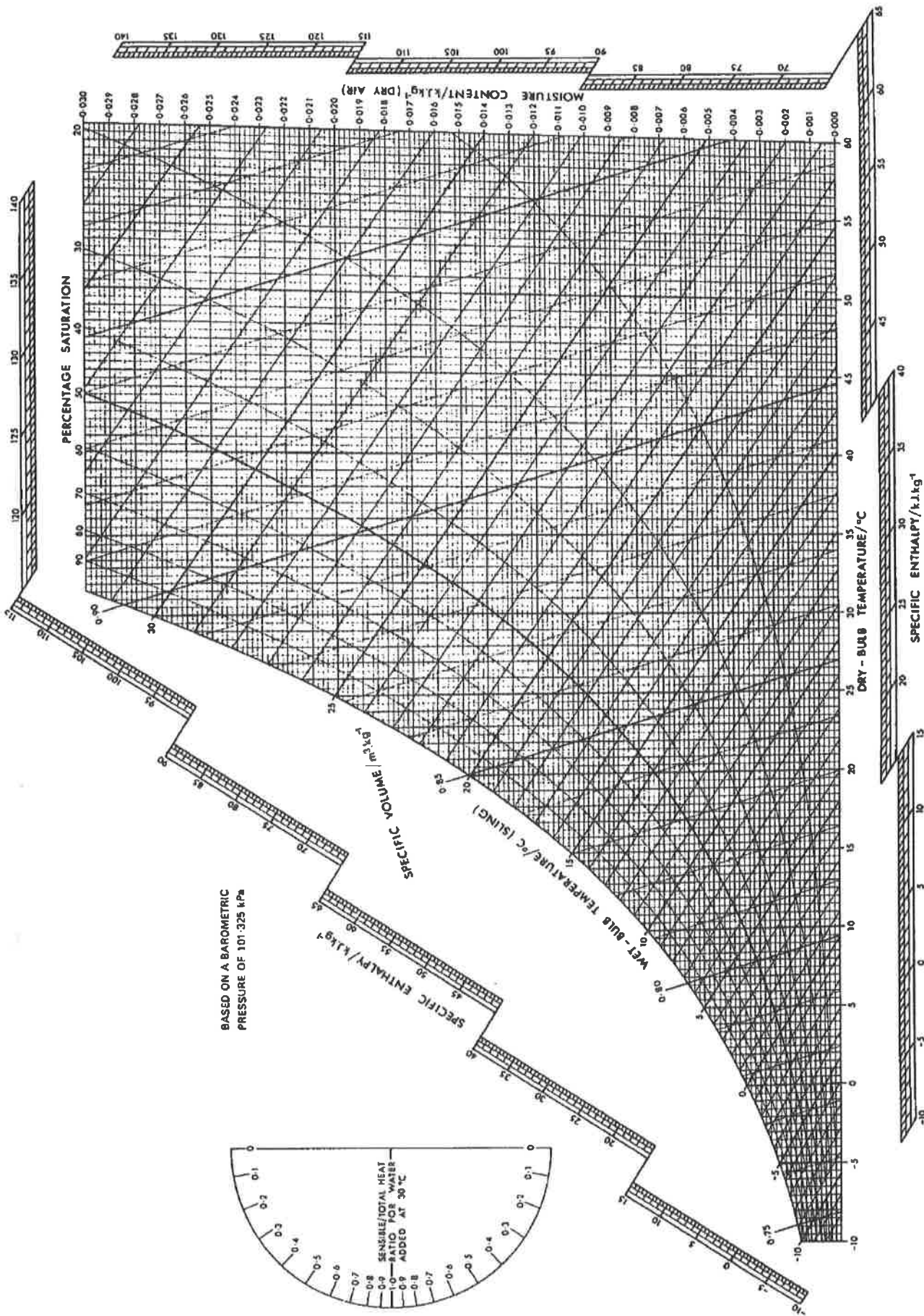


Figure 1.2 CIBSE Psychrometric chart (-10 to +60°C)

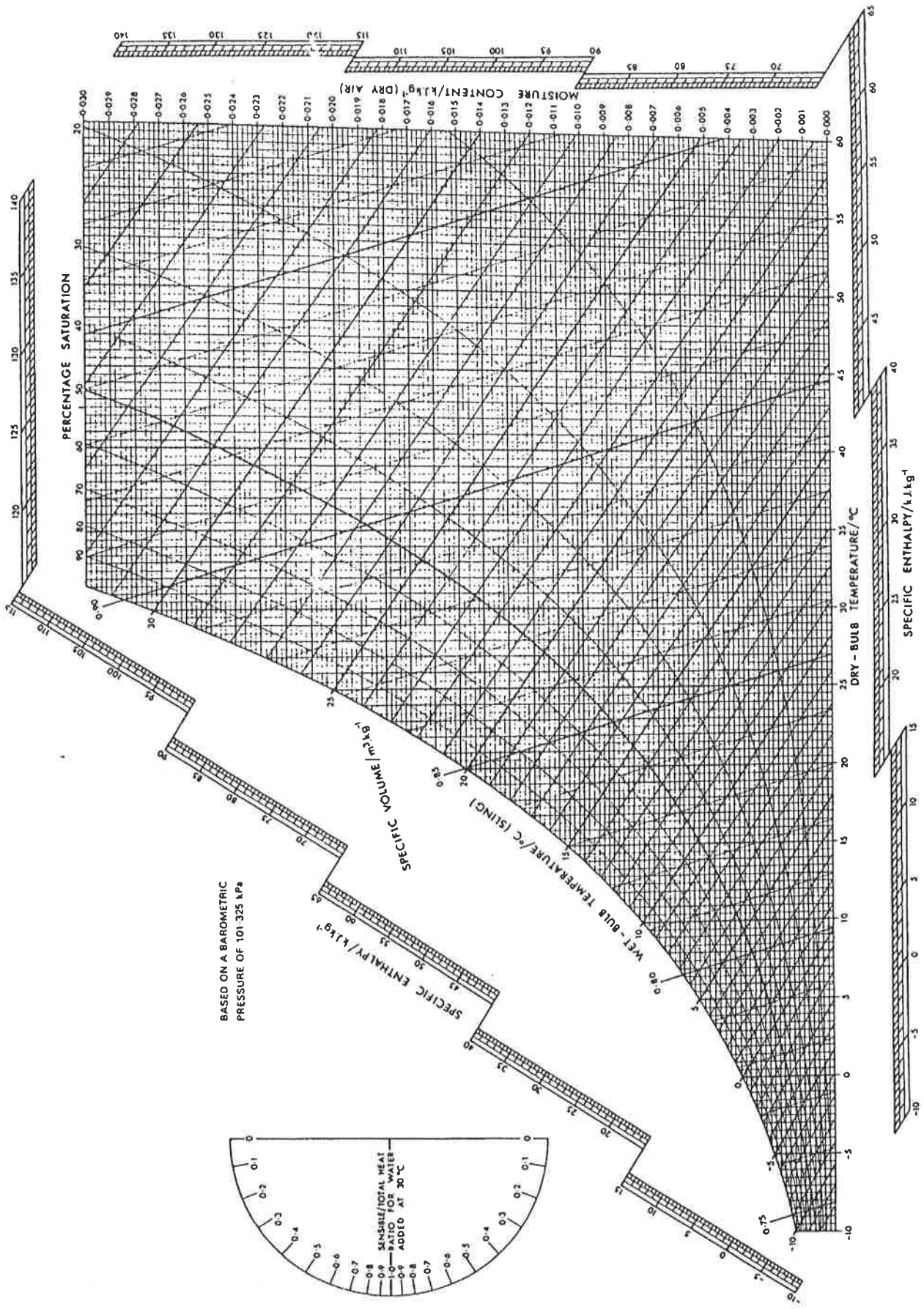


Figure 1.2 CIBSE Psychrometric chart (-10 to +60°C)



PSYCHROMETRIC CHART

Normal Temperature
SI Units

SEA LEVEL

BAROMETRIC PRESSURE: 101.325 kPa

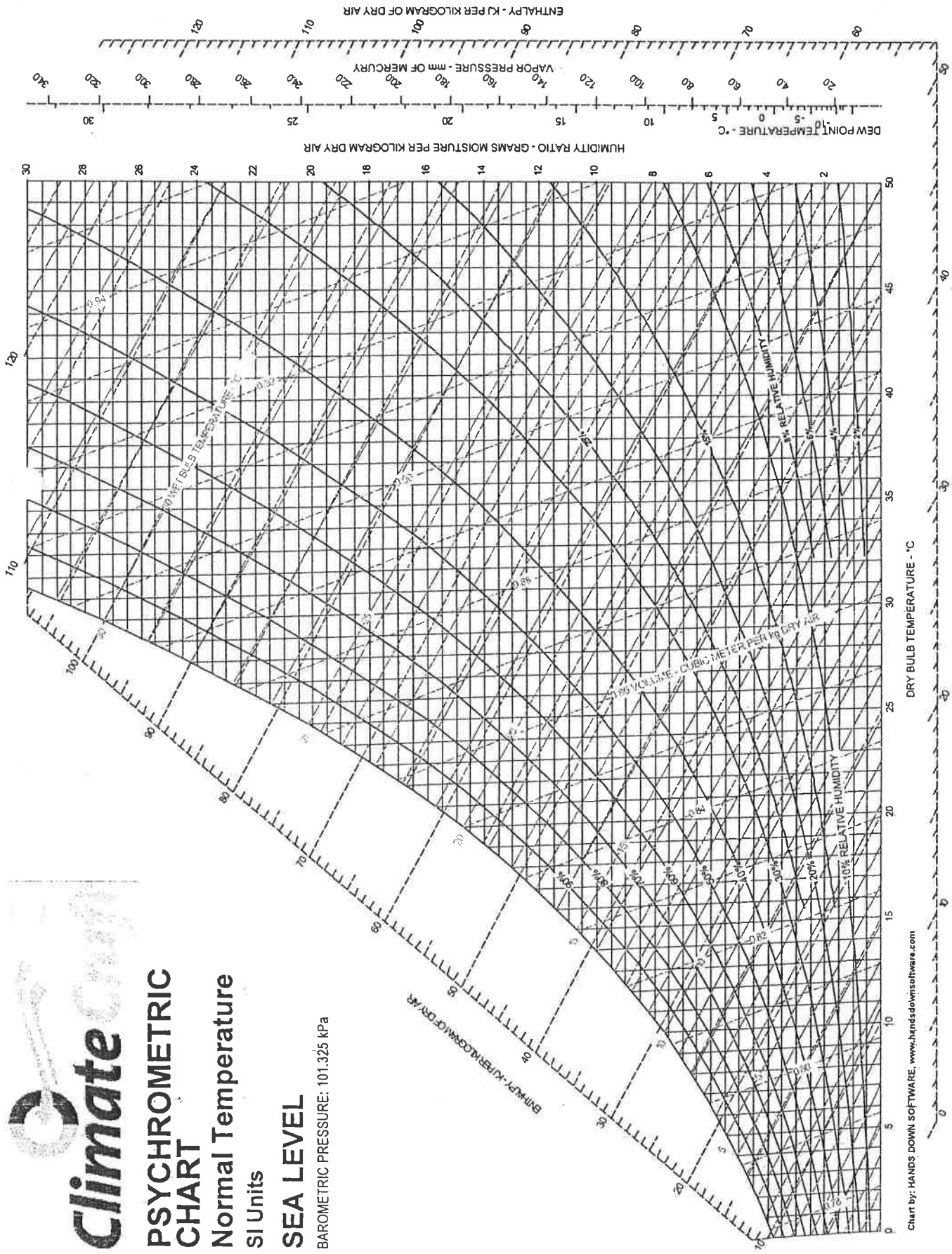


Chart by: HANDS DOWN SOFTWARE, www.handsdownsoftware.com



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