



2ND SEM. 2010

PAGE 1 OF 3

**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

**PROGRAMMEE : BACHELOR OF SCIENCE IN FOOD
SCIENCE, NUTRITION AND
TECHNOLOGY YEAR II**

COURSE CODE : FSNT 205

TITLE OF PAPER : PRINCIPLES OF FOOD ENGINEERING

TIME ALLOWED : TWO (2) HOURS

**INSTRUCTIONS : ANSWER QUESTION ONE (1)
AND ANY OTHER TWO (2) QUESTIONS**

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BY THE CHIEF INVIGILATOR**

QUESTION 1

- a. Write and discuss the following heat transfer (movement) equations:-
- i. Fourier's law of heat conduction
 - ii. Convection heat transfer-Newton's law of cooling
 - iii. Radiation heat transfer equation
 - iv. Fick's law of diffusion
- [12 marks]
- b. Explain the primary and secondary purposes of pasteurization of different foods (fruit juice, beer, milk, liquid egg and ice cream) and show the optimum temperature and time conditions.
- [10 marks]
- c. Discuss the following basic concepts of thermodynamics in food process engineering:-
- i. System
 - ii. Energy
 - iii. Property
 - iv. Process
- [12 marks]
- d. Discuss different applications of thermodynamics in the various areas of food processing and preservation engineering.
- [6 marks]

[Total = 40 marks]

QUESTION 2

- a. Discuss the three elementary equations of fluid motion:-
- i. Continuity equation
 - ii. Bernoulli equation
 - iii. Momentum equation
- [12 marks]
- b. Discuss the three most important benefits of size reduction unit operation in food processing.
- [6 marks]
- c. Explain three drying rate periods during dehydration of wet foods and discuss three characteristics of air that governs moisture movement at early stage of drying.
- [12 marks]
- [Total = 30 marks]**

QUESTION 3

- a. Discuss the following basic equipments useful in food processing and preservation:-
- i. Heat engines
 - ii. Refrigerator
 - iii. Heat pump
- [12 marks]
- b. Discuss any four effects of sterilization on food.
- [12 marks]
- c. Discuss three important factors that influence the rate of heat transfer and hence determine food processing times and the quality of concentrated products in evaporation.
- [6 marks]
- [Total = 30 marks]**

QUESTION 4

- a. Explain the four main functions of evaporation/concentration of liquid foods by boiling.
- [12 marks]
- b. Discuss the difference between pasteurization and sterilization as the two most important thermal food processing.
- [10 marks]
- c. Using psychrometric chart determine the unknown parameters.

Dry bulb temperature	Wet-bulb temperature	Due-point temperature	Relative humidity
60°C	?	?	50%
75°C	45°C	?	?
55°C	?	?	30%
50°C	39°C	?	?

[8 marks]

[Total = 30 marks]

FSNT 205

42

PSYCHROMETRIC CHART (10-120 °C)

Based on a barometric pressure of 101.325 kPa

Sensible/total heat ratio for
water added at 30 °C

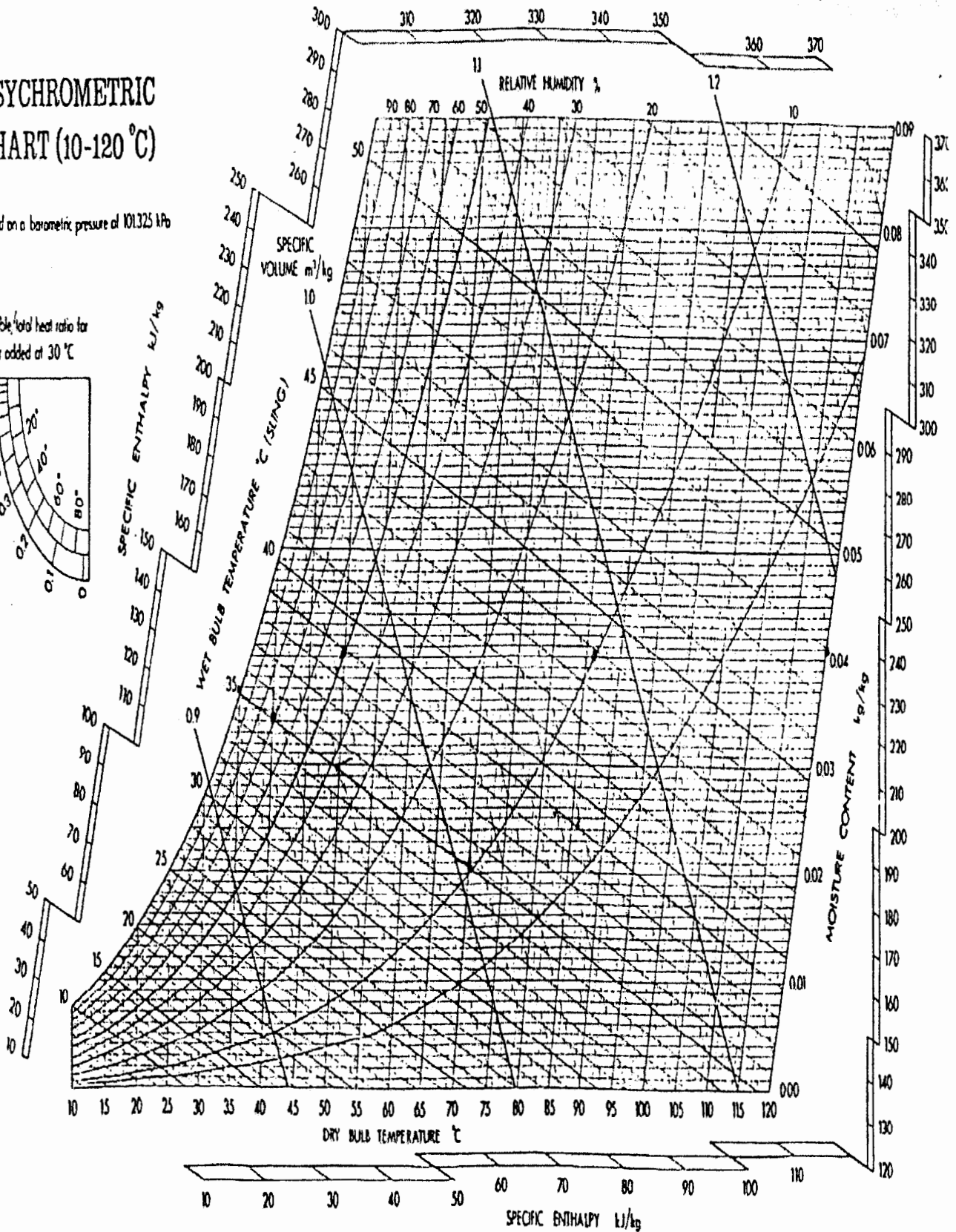
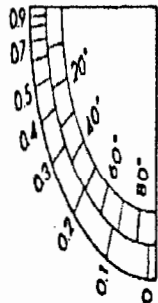


Fig. 14.1 — Psychrometric chart (10-120 °C based on barometric pressure of 101.325 kPa.
(Courtesy of Chartered Institution of Building Services Engineers.)