UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMME: BSC Land and Water Management Year 4

COURSE CODE: LUM 406

COURSE TITLE: CROP PROCESSING AND STORAGE

TIME ALLOWED: TWO (2) HOURS

SPECIAL MATERIAL REQUIRED: CALCULATOR &
                               PSYCHROMETRIC CHART

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

DO NOT OPEN THIS PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE CHIEF INVIGILATOR

2nd SEM.2010/2011

SECTION ONE: COMPULSORY

QUESTION ONE

(a) The air leaving the surface of a mass of grain during drying has a temperature of 18°C (Tdb) and relative humidity (RH) of 80%. The air makes contact with an un-insulated galvanized roof above the grain.

      i. Using the psychrometric chart provided, determine the other physical and thermodynamic properties of the air as it leaves the grain mass.

(10 Marks)

      ii. Determine the level to which the roof temperature must fall before condensation occurs on it. **(5 Marks)**

(b) A farmer delivers 80 tonnes of maize grain, to Arrow Feeds in Matsapha, at a moisture content of 25% (wet basis). The recommended maize producer price is E 2,000.00 per tonne, therefore, the farmer expects to receive a cheque for E160, 000.00.

      i. Explain why the farmer should not be paid that much money.

(10 Marks)

      ii. Determine a fair value for this maize consignment   **(5 Marks)**

[Hint: equilibrium moisture content of maize under the prevailing climatic conditions in Matsapha is 13% (wet basis)].

(c)

(i) Define grain porosity and give a basic equation for its calculation.   **(4 Marks)**

(ii) In a practical session, a student fills a 500 ml container with maize grain and carefully transfers the grain into a graduated cylinder partially filled with some liquid to the 300 cm³ mark. The completely immersed maize grain displaces the liquid in the cylinder to the 607 cm³ mark.

Determine:

a) The volume of void spaces   **(2 Marks)**

b) The volume of grain solid particles   **(2 Marks)**

c) Porosity of the maize grain   **(2 Marks)**

2ⁿᵈ SEM.2010/2011

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

(a) In an attempt to classify a batch of harvested sorghum grain, the following result was obtained in a sieve analysis.

Sieve Number	Weight of material retained above sieve (g)
2	0.0
4	100.0
8	96.0
14	79.0
28	54.0
48	26.0
100	11.0
Pan	5.0
Totals	**371**

(i)   Complete the blank columns in the table below: **(12 Marks)**

Sieve Number	Weight of Material Retained above sieve (g)	Cumulative weight Retained in the Sieves	% Material Retained	Cumulative % Retained
2	0.0			
4	100.0			
8	96.0			
14	79.0			
28	54.0			
48	26.0			
100	11.0			
Pan	5.0			
Totals	371			

(ii) Calculate Fineness Modulus   **(5 Marks)**
(ii) Calculate average grain size   **(3 Marks)**

(b)Describe the process involved in solar drying of food using box dryers   **(10 marks)**

2nd SEM.2010/2011

QUESTION THREE

(a) Explain why it is import for grain traders to have knowledge about the following physical properties of grain:
      a. Bulk density
      b. Angle of repose
      c. hygroscopicity
      d. porosity.   **(20 Marks)**

(b) Discuss the merits and demerits of artificial crop drying   **(10 Marks)**

QUESTION FOUR

(a) Describe the drying process of a grain kernel, indicating the changes in rate of drying and the factors that influence rate of drying.   **(15 Marks)**

(b) Discuss the design of a hammer mill and indicate the functions of the major components of the mill. What are the pros and cons of this type of mill?

                                                (15 Marks)
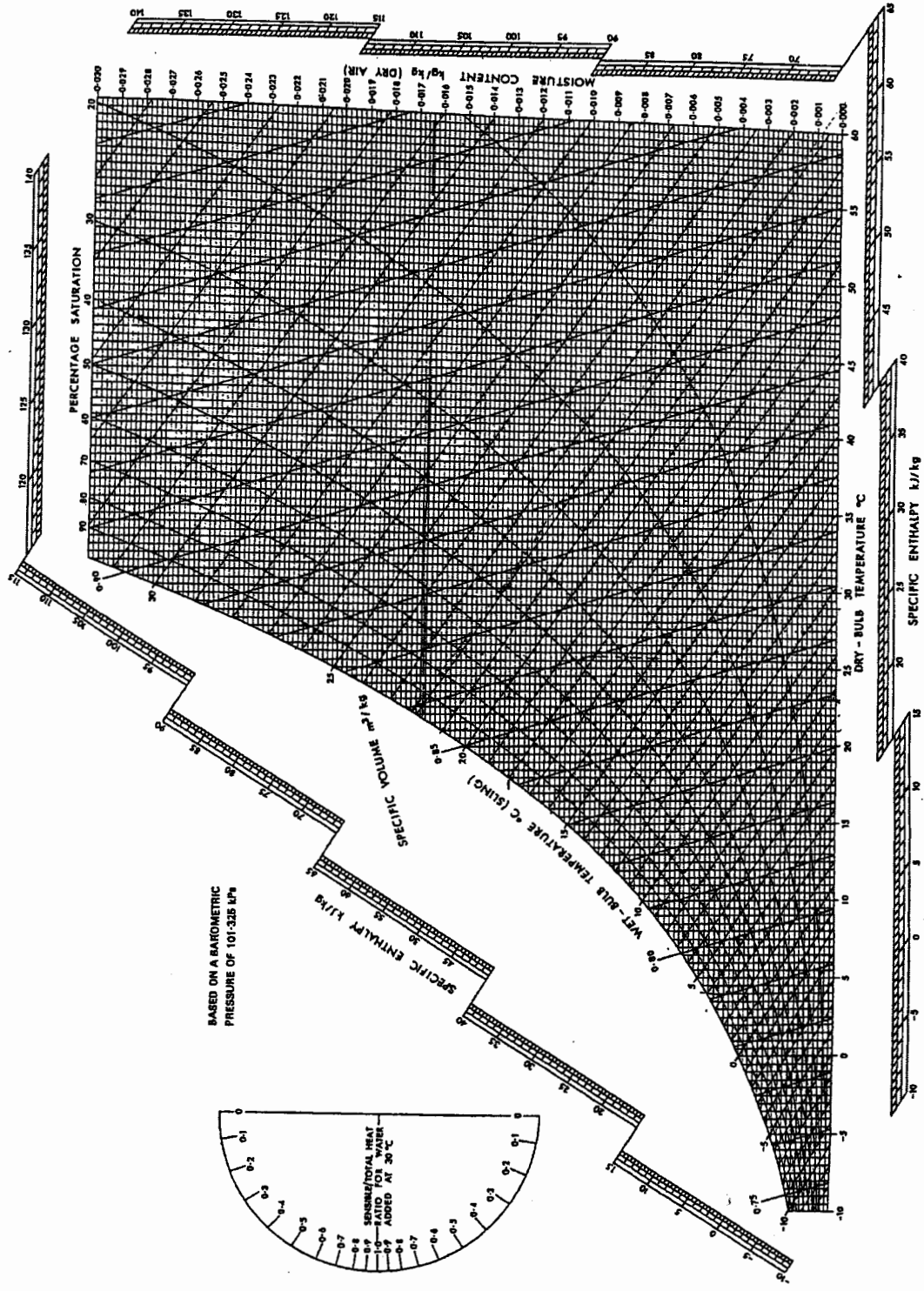
Psychrometric chart (Courtesy: The Chartered Institution of Building … ces, from whom pads of A5-size charts may be obtained)