

2nd SEM.2013/2014



**UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER**

PROGRAMME: BSC LWM (4)/BSC ABE (4)

COURSE CODE: ABE/LUM 406

TITLE OF PAPER: CROP PROCESSING AND STORAGE

TIME ALLOWED: TWO (2) HOURS

**SPECIAL MATERIAL REQUIRED: CALCULATOR &
PSYCHROMETRIC CHART**

**INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER
QUESTIONS.**

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GRANTED BY THE CHIEF INVIGILATOR**

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SECTION ONE: COMPULSORY

QUESTION ONE

- (a) Discuss psychrometry indicating the parameters of interest in this subject matter
(10 Marks).
- (b) The air leaving the surface of a mass of grain during drying has a temperature of 18 °C and RH of 80%. The air makes contact with an un-insulated roof above the grain.
- (i) With the aid of a sketch diagram of a psychrometric chart indicate with arrows the thermodynamic changes that occur before the air condenses on the roof.
(5 Marks)
- (ii) Using the psychrometric chart provided to you, determine the level the roof temperature must fall before condensation occurs on it? **(5 Marks)**
- (c) Describe the factors that cause grain produce deterioration from the time the crop reaches physiological maturity to storage. Use the following sub-headings to guide your presentation:
- (i) Biochemical factors,
 - (ii) Physical factors,
 - (iii) Biological factors and
 - (iv) Technical factors
- (20 Marks)**

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SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

(a) In a practical session, you were asked to estimate maize yield at the University farm using the following procedure:

- i) Demarcate a 10 m x 10 m (100 m²) area within the maize field,
- ii) Count the number of cobs in the demarcated area,
- iii) Randomly harvest 10 cobs from the demarcated area,
- iv) Count the number of kernel rows on each of the harvested cobs and record the average,
- v) Count the number of kernels in each row and record the average,
- vi) Shell the harvested cobs and obtain the average 1000 grain mass and,
- vii) Record your findings in tabular form as shown below.

Study the table and complete the blank spaces.

Number of cobs per 100 m ²	440	
Number of rows per cob	12	
Number of kernels per row	50	
Number of kernels per cob		(2½ Marks)
Mass of 1000 kernels	235.35 g	
Mass of grain per cob		(2½ Marks)
Mass of grain per 100 m ²		(2½ Marks)
Estimated grain yield (kg/ha)		(2½ Marks)

(b) If the maize in (a) is at 22 % moisture content, what will be the grain yield at 12.5 % moisture content? (5 Marks)

(c) Differentiate between the operating principles of hammer, Burr and Roller Mills and state their advantages and disadvantages. (15 marks)

QUESTION THREE

(a) Define the following terms and indicate their importance in grain handling and storage.

- a. Bulk density of grain (5 Marks)
- b. Repose angle of grain (5 Marks)
- c. Grain porosity (5 Marks)

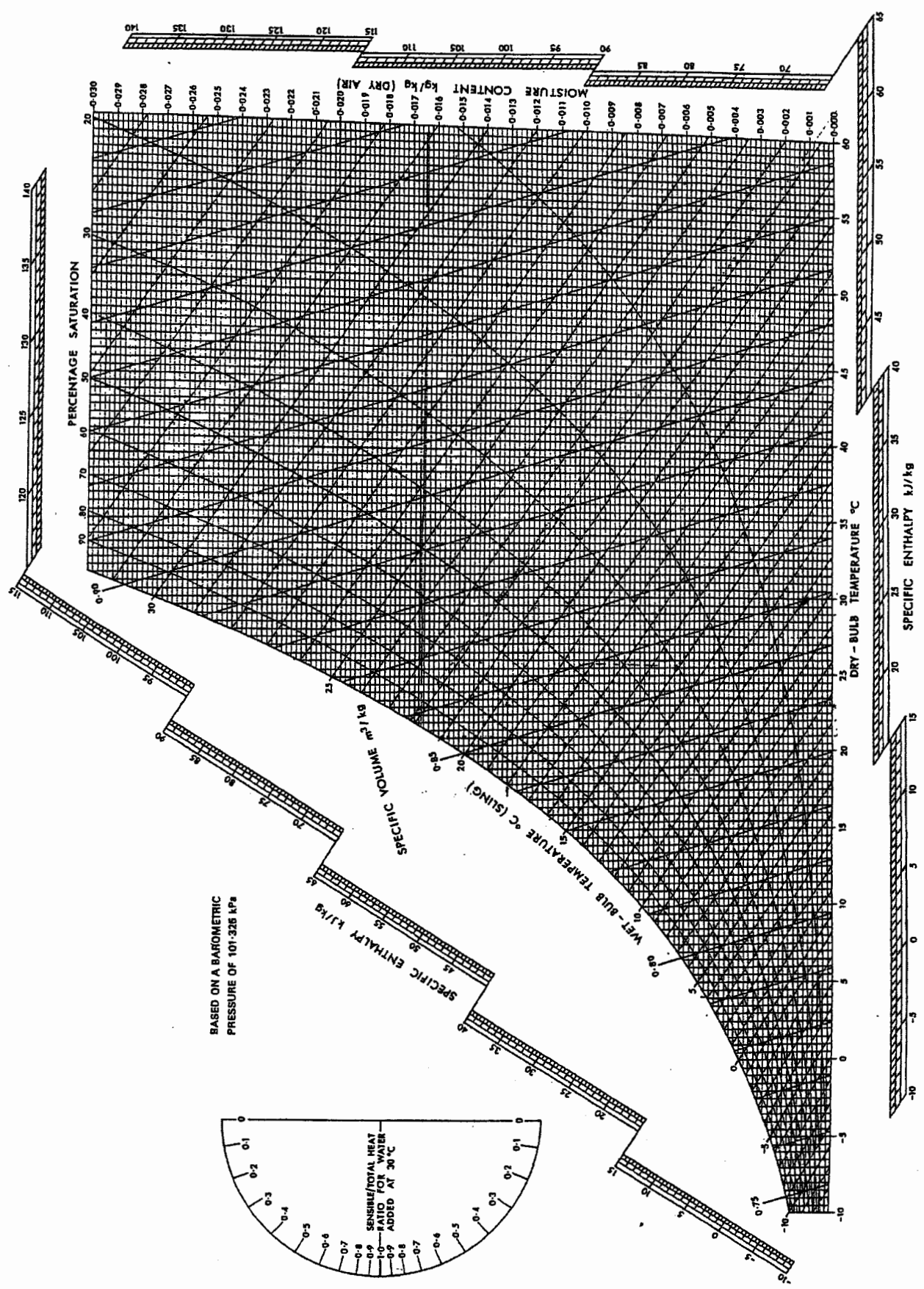
(b) You were part of the team that designed and constructed a maize crib at the departmental experimental plot. Using a sketch diagram where appropriate, indicate the critical design parameters that you observed in the location and construction of the crib.

(15 marks)

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QUESTION FOUR

- (a) Discuss any five (5) techniques that are available for shelling maize. **(10 Marks)**
- (b) Indicate the precautions that the farmers need to take when shelling maize. **(5 Marks)**
- (c) Discuss the nature of moisture in grains indicating the forms it takes **(5 Marks)**
- (d) Moisture content in grain is expressed as a percentage of moisture based on wet basis (MC_{wb}) or dry basis (MC_{db}). Wet basis moisture content is generally used in agriculture. Dry basis is used primarily for research purposes.
 - (i) Show the equations for (MC_{wb}) and dry basis (MC_{db}). Define all symbols you use in your expressions. **(5 Marks)**
 - (ii) If a dealer in grains reports that his maize grain is at a moisture content of 20% (wet basis), what will be the scientific moisture content value of his maize? **(5 Marks)**



BASED ON A BAROMETRIC
PRESSURE OF 101.325 kPa

Psychrometric chart (Courtesy: The Chartered Institution of Building Engineers, from whom parts of A3-size charts may be obtained)