

**2<sup>nd</sup> SEM.2011/2012**



**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) Define agricultural processing **(4 Marks)**
- (b) State four (4) advantages of processing agricultural produce. **(6 Marks)**
- (c) A bin of grain is chilled with air at 100% RH, dry bulb temperature of 4.4° C and airflow rate of 1 699 m<sup>3</sup>/hr. The ambient air conditions are 29.4° C (Tdb) and 21.1° C (Twb).
  - (i) With the help of a sketch psychrometric diagram, describe how you would determine the amount of heat energy and moisture in the ambient air and the air chilling the grain **(10 Marks).**
  - (ii) Using the psychrometric chart provided, determine the amount of heat and moisture that is removed per hour from the inlet air by a grain chilling unit. **(10 Marks)**
- (d) Table 1 below is an extract from the records made by a student during a grain moisture determination practical.

**Table 1: Grain moisture determination practical records**

Mass of empty heat resistant Petri dish + lid	M1	5.60 g
Mass of Petri dish + lid + wet grain	M2	65.78 g
Mass of Petri dish + lid + dry grain	M3	55.85 g

- (i) Show the formula (using the mass symbols M1, M2 and M3) that you would use to determine the grain moisture content (wet basis). **(2½ Marks)**
- (ii) Calculate the grain (wet basis) moisture content using the figures provided. Express your answer to 1 decimal place. **(2½ Marks)**
- (iii) Show the formula (using the mass symbols M1, M2 and M3) that you would use to determine the grain moisture content (dry basis). **(2½ Marks)**
- (iv) Calculate the grain (dry basis) moisture content using the figures provided. Express your answer to 1 decimal place. **(2 ½ Marks)**

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**SECTION II: ANSWER ANY TWO QUESTIONS**

**QUESTION TWO**

(a) What do you understand by the following air-water vapour terms?

- (i) Dew point temperature
- (ii) Absolute humidity
- (iii) Specific volume
- (iv) Enthalpy
- (v) Relative humidity

**(10 Marks)**

(b) Describe the scientific concepts involved in solar drying of food using box dryers.

**(10 Marks)**

(c) A 500 gram sample of maize grain, at 35% moisture content, is accidentally mixed with 800 grams of maize grain at 25% moisture content. Calculate the resultant moisture content of the mixed grain.

**(10 Marks).**

**QUESTION THREE**

(a) Discuss the post-harvest challenges brought about by adopting modern crop production technologies such as use of hybrid seed, chemical fertilisers, irrigation etc.

**(20 Marks)**

(b) Discuss the significance of the following properties in grain handling and storage.

- (i) Bulk density of grain
- (ii) Repose angle of grain

**(5 Marks)**

**(5 Marks)**

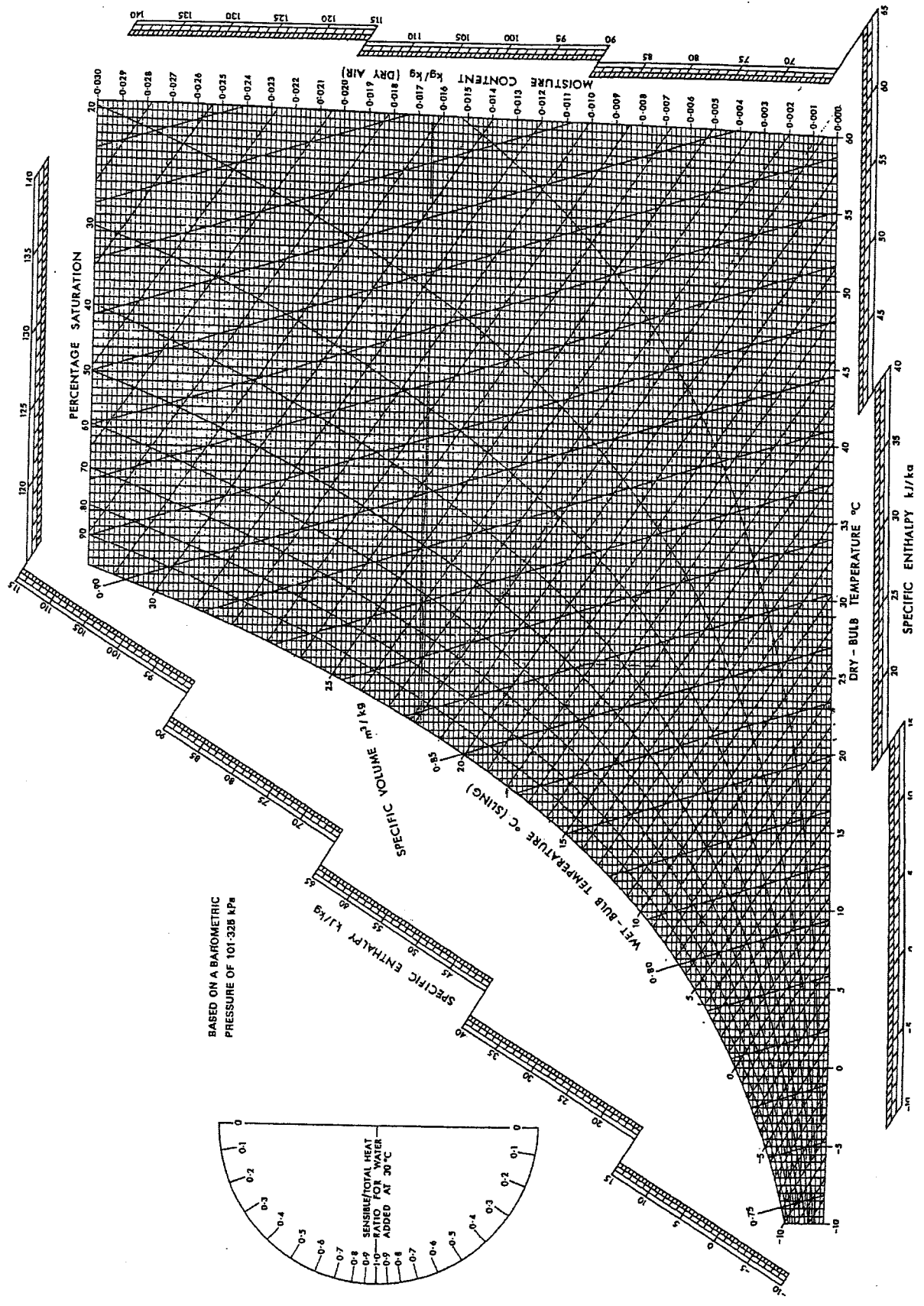
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**QUESTION FOUR**

- (a) Discuss the material and architectural design characteristics of an improved maize storage structure for smallholder farmers. **(15 Marks)**
- (b) Define Fineness Modulus **(3 Marks)**
- (c) In an attempt to classify a batch of milled grain, the following result was obtained in a sieve analysis.

Sieve Number	Weight of material retained above sieve (g)
2	0.0
4	22.8
8	26.8
14	94.0
28	33.6
48	141.2
100	26.0
Pan	55.6
<b>Total</b>	400

- Determine the (i) Percent retention for each sieve  
(ii) Fineness modulus  
(ii) Average grain size **(12 Marks)**



BASED ON A BAROMETRIC PRESSURE OF 101.328 kPa

SENSIBLE/TOTAL HEAT RATIO FOR WATER ADDED AT 30°C

