2nd SEM.2009/2010

UNIVERSITY OF SWAZILAND
Article I. 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 CAHART

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY TWO OTHER QUESTIONS.

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QUESTION ONE

a) Give a brief description of agricultural processing and state the advantages of processing agricultural produce **(10 Marks)**

b) Define fineness modulus and outline concisely how it is determined in grain milling. **(10 Marks).**

c) Ambient air at 4 °C (Tdb) and 80% RH is heated to 16 °C (Tdb) before it is circulated through a hay drying barn. The heated air is mixed with warm moist air already in the barn. The air picks up moisture and heat as it passes through the barn and is exhausted at the other end of the barn at 24 °C (Tdb) and 70 % RH. Use the psychrometric chart provided to find the missing parameters of the airs (ambient, heated and exhaust) and present them in a tabular format as suggested below: **(15 Marks)**

Air description	**Dry bulb temperature (°C)**	**Wet bulb temperature (°C)**	**Dew point temperature (°C)**	**Relative humidity (%)**	**Absolute humidity (kg/kg)**	**Enthalpy (J/kg)**	**Specific volume (m^3/kg)**
Ambient air							
Heated air							
Exhaust air							

d) A farmer delivers 80 tonnes of maize grain, to Arrow Feeds in Matsapha, at 25% moisture content. The recommended maize producer price is E 1850 per tonne at 13 % moisture content (wet basis). How much should the farmer be paid considering that his maize consignment is well above the recommended moisture content? **(5 Marks).**

QUESTION TWO

a) Modern crop production techniques such as use of hybrid seeds, application of chemical fertilisers, use of herbicides, improved tillage methods, irrigation technology, pest and disease control etc, have contributed tremendously to higher crop yields. Whilst this is an acceptable development in terms of food security, these modern cropping systems have brought with them a lot of challenges. Outline post-harvest related challenges that are faced by farmers who have adopted the new technologies. **(10 Marks)**

b) Grain moisture content is expressed on a wet basis (mc_{wb}) or dry basis (mc_{db}) as indicated in the equations (I) and (II) below:

% moisture content (wet basis)	$= \frac{\text{weight of water}}{\text{weight of water + dry weight}} \times 100$	---------- *(I)*
% moisture content (dry basis)	$= \frac{\text{weight of water}}{\text{Dry weight}} \times 100$	---------- *(II)*

Develop equations in which;
(i) Moisture content wet basis (mc_{wb}) is the subject expressed as a function of moisture content dry basis (mc_{db}) **only.** **(10 Marks)**

(ii) Moisture content dry basis (mc_{db}) is the subject expressed as a function of moisture content wet basis (mc_{wb}) **only.** **(10 Marks)**

QUESTION THREE

a) Differentiate the following crop processing terminologies:
   i. Drying and dehydration
   ii. Absolute humidity and relative humidity
   iii. Direct food loss and indirect food loss
   iv. Food and feed
   v. Dehulling and threshing **(10 Marks)**

b) Briefly discuss the post-harvest pipeline for a cereal of your choice. **(10 Marks).**

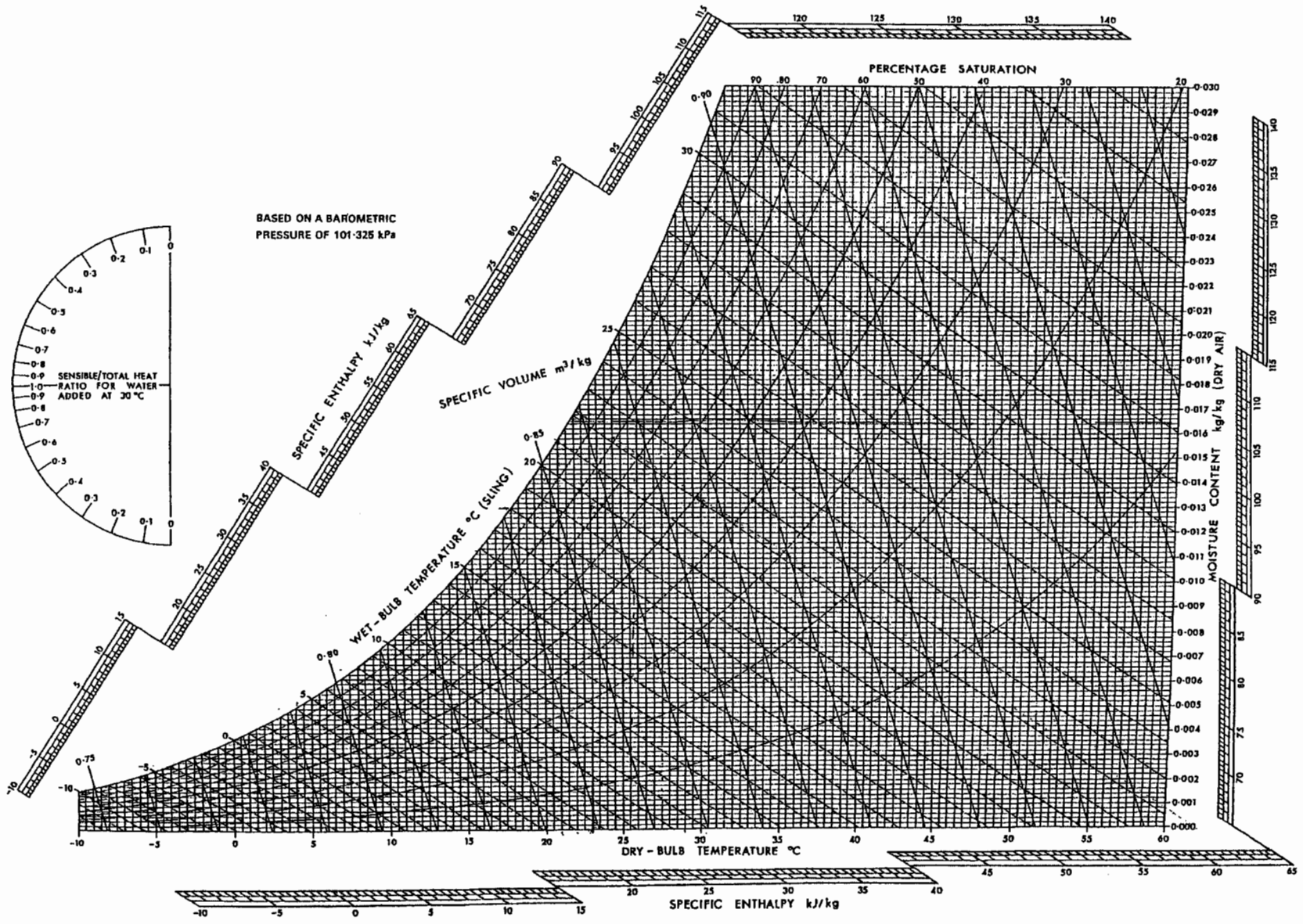
c) With the aid of a sketch diagram of a psychrometric chart, describe the changes in thermodynamic properties of air during the drying processes. **(10 Marks)**

QUESTION FOUR

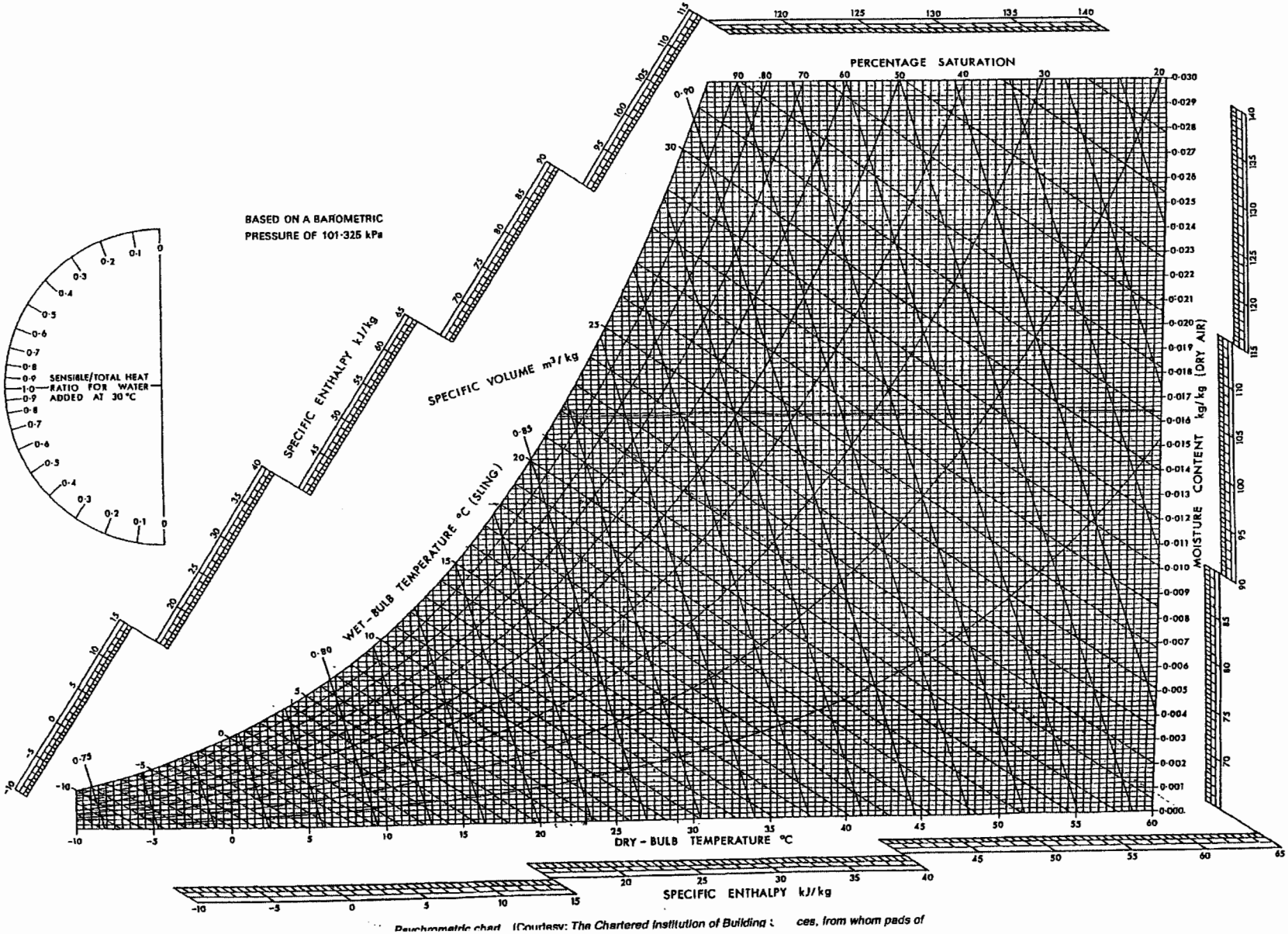
a) Grains are hygroscopic and have low thermal conductivity. What is the implication of these characteristics in grain storage? **(10 Marks)**

b) Giving practical examples, explain the rationale of understanding the following properties of grain:

i. Physical properties **(8 Marks)**
ii. biochemical properties and **(4 Marks)**
iii. mechanical properties **(8 Marks)**



Psychometric chart (Courtesy: The Chartered Institution of Building ; ces, from whom pads of



Psychrometric chart (Courtesy: The Chartered Institution of Building S ces, from whom pads of