UNIVERSITY OF SWAZILAND
FINAL EXAMINATION PAPER

PROGRAMME: BSC Land and Water Management Year 4.

COURSE CODE: 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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SECTION ONE: COMPULSORY

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.

                                                                  (10 Marks)

(c)   Ambient air at 4 °C (Tdb) and 80% RH is heated to 16 °C before it is distributed throughout 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 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	Wet bulb temperature	Dew point temperature	Relative humidity	Absolute humidity	Enthalpy	Specific volume
Ambient air							
Heated air							
Exhaust air							

(d)   An 80- tonne consignment of maize grain, delivered to Arrow Feeds in Matsapha, at 25 % moisture content, is accidentally mixed with 50 tonnes of dry maize at 13.5 % moisture content. Calculate the resultant moisture content of the grain mixture.

                                                                 (5 Marks)

SECTION II: ANSWER ANY TWO QUESTIONS

QUESTION TWO

(a)   Modern crop production techniques such as use of hybrid seeds, application of chemical fertilisers, herbicides, improved tillage techniques, 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 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 either on wet basis (Mc_{wb}) or dry basis (Mc_{db}) as shown in equations (I) and (II) below:

$$\% \text{ moisture content, wet basis} (Mc_{wb}) = \frac{\text{Mass of water} (M_w)}{\text{Mass of water} (M_w) + \text{Dry mass of grain} (M_d)} \times 100 \text{--------(I)}$$

$$\% \text{ moisture content, wet basis} (Mc_{wb}) = \frac{\text{Mass of water} (M_w)}{\text{Dry mass of grain} (M_d)} \times 100 \text{-------------------------(II)}$$

Develop equations in which;

(i) Mc_{wb} is the subject expressed as a function of Mc_{db} **only**   **(10 Marks)**

(ii) Mc_{db} is the subject expressed as a function of 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 unit operations for a cereal of your choice.
                                                                            (10 Marks)
(c)   Explain the advantages of agglomeration of fine powdered agricultural products in relation to the food and livestock industry.   **(10 Marks)**

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

(b)   Figure 1, below, shows a simplified schematic diagram of the vapour –
compression refrigeration cycle. Name the components indicated and describe
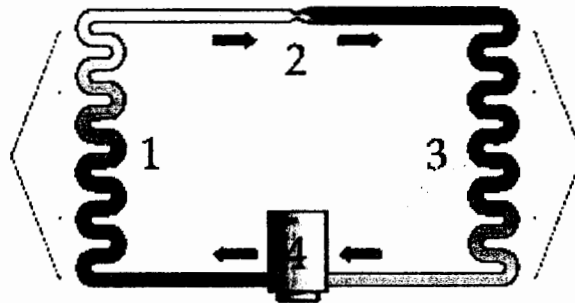their functions.   **(20 Marks)**

Figure 1. Vapour-compression refrigeration cycle:

Psychrometric chart based on a barometric pressure of 101·325 kPa.