

EGERTON



UNIVERSITY

UNIVERSITY EXAMINATIONS  
NJORO CAMPUS

FIRST SEMESTER 2012/2013

FIFTH YEAR EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN  
AGRICULTURAL ENGINEERING

AGEN 543: PROPERTIES OF AGRICULTURAL MATERIALS

STREAM: 2008 (Y5) B. SC. AGEN

TIME: 2 hours

DAY/TIME: Friday, 12.00 – 02.00 pm

DATE: 11/01/2013

INSTRUCTIONS:

1. The paper contains **FOUR (4)** questions.
2. Attempt **QUESTION 1** and **any other TWO** questions
3. All questions carry equal marks.
4. Shown in parenthesis are marks for each question.
5. **EACH QUESTION SHOULD BE STARTED ON A NEW PAGE.**

**QUESTION ONE (COMPULSORY)**

(a) Briefly discuss the following terms that relate to agricultural materials:

(i) Rheology

(ii) creep

(4 marks)

(b) Discuss the importance of the study of the properties of agricultural materials.

(3 marks)

(c) With the help of a well-labelled graph, show and discuss the various loading stages of a cylindrical potato sample that is subjected to axial compression.

(6 marks)

(d) Discuss thermal approaches towards quality control during the manufacture of food materials.

(3 marks)

(e) Frozen chicken is thawed in a microwave set at 70 °C. The chicken mass is at 300 g with the enthalpy of frozen chicken being 1125 kJ/kg and that of cooked meat being 2310 kJ/kg.

Calculate the specific heat of the frozen chicken.

(4 marks)

**QUESTION TWO**

- (a) Briefly discuss the importance, applications and means of assessment of the following electrical parameters with respect to agricultural materials:
- (i) Impedance
  - (ii) Conductivity
  - (iii) capacitance (9 marks)
- (b) With the aid of a well labelled diagram, briefly describe the operation of an electrically charged hazelnut grader. (7 marks)
- (c) Briefly discuss the importance of bio-yield point during fruit harvesting, transportation and handling as well as key considerations made with respect to the same to ensure that these operations yield best results. (4 marks)

**QUESTION THREE**

- (a) Briefly explain the following terms:
- (i) Roundness ratio
  - (ii) Sphericity (2 marks)
- (b) Discuss how shape and size affect processing and handling of agricultural materials. (6 marks)
- (c) Discuss how the ripening and senescence processes of vegetable products can be managed based on the changes in colour. (4 marks)
- (d) The Red, Blue and Yellow coordinates for a two potato samples are checked in an effort to check a toxic compounds formed when they are exposed to light which is indicated by green colouration.

Sample	X'	Y'	Z'
1	0.24	0.2	0.3
2	0.5	0.4	0.1

If Red is at a  $\lambda$  of 600, Blue at 450 and Yellow at 500 m $\mu$ , respectively, check if any of these samples have the compound. (8 marks)

**QUESTION FOUR**

- (a) The behaviour of biological materials greatly differs from mechanical materials such as steel. Discuss. (4 marks)
- (b) From fundamental laws, derive the Maxwell model, stating its limitations. (8 marks)

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(c) Briefly explain the importance of terminal velocity of a grain material due for pneumatic conveyance and illustrate how this can be measured. **(4 marks)**

(d) Calculate the terminal velocity of a wheat sample conveyed in air with a density of  $1.23 \text{ g/cm}^3$  and a dropping tube of 9.4 m. The time difference recorded in the timer was 15.36 mS.

**(4 marks)**

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