(The University of choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR
(Main examination)

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR THE DEGREE OF:

BACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY

COURSE CODE: APT 202

COURSE TITLE: PROPERTIES OF BIOLOGICAL MATERIALS

DATE: 26ᵀᴴ APRIL 2022   **TIME:3.00-5.00PM**

Instructions: This paper consists of 5 questions
Answer question 1 and any other 3 questions
Ensure your answers are clearly and logically written
All line diagrams drawn should be clear and clearly labelled

MMUST observes ZERO tolerance to examination cheating

This paper consists of FOUR printed pages. Please Turn Over

SECTION A
Question One (25 marks)

(a) Describe how a hydrometer can be calibrated to measure liquid density and hence state the equation used for liquid density calculation during the calibration process **(3 marks)**

(b) Differentiate between differential and cumulative and analysis methods of analysis of size of granular materials **(2 marks)**

(c) Giving liquid food examples, describe
   i.   Shear thickening
   ii. Pseudoplasticity **(2 marks)**

(d) Distinguish between the steady and unsteady methods used in the determination of thermal conductivity of food products **(2 marks)**

(e) State the significance of sphericity, hence with equations give two different approaches used in the determination of sphericity **(3 marks)**

(f) Define the following thermal properties of foods, hence state their importance in food processing
   i.   Latent heat
   ii.   Enthalpy
   iii. Thermal diffusivity **(3 marks)**

(g) Describe the phenomenon of hysteresis during sorption and desorption of a food product, hence state its significance **(4 marks)**

(h) With the aid of diagrams define the following shape criteria used in describing the shapes of fruits
   i.Obovate
   ii.Elliptical
   iii.Oblate
   iv.Truncate **(4 marks)**

(i) Differentiate between frictional drag and terminal velocity properties of an agricultural product **(2 marks)**

SECTION B
Question Two (15 marks)

(a)   The pressure drop versus volumetric flow rate data is obtained for chocolate melt using a capillary viscometer with a pipe diameter of 1 cm and a length of 60 cm
   i.   Show that chocolate melt is not a Newtonian fluid.

ii. Determine the rheological model constants of the power law, Herschel-Bulkley, and Casson models for the given data.
(5 marks)

Pressure Drop (Pa)	Flow Rate (cm³/s)
3840	0.01
4646	0.06
5762	0.13
6742	0.24
7798	0.37
10,454	0.72
11,760	0.94

(b) Outline the principle of the following colour order systems
i. Munsell colour system
ii. CIE lab colour space
iii. Lovibond system
iv. CIE colour system
v. Hunter Lab Colour Space
(10 marks)

Question Three (15 marks)
(a) Briefly outline the principle behind the prediction of specific heat of food products
(4 marks)

(b) Determine the penetration depth of a chicken meat during processing in home type microwave oven. Chicken meat has a dielectric constant of 53.2 and dielectric loss factor of 18.1. Assume that dielectric properties are constant during heating.
(5 marks)

(c) Describe the water activity phenomenon and hence state the three approaches used in the determination of water activity.
(6 marks)

Question Four (15 marks)
(a) State and define the different density types used in food evaluation
(6 marks)

(b)Describe the following food colloidal systems
i. Foam
ii. Gel
iii. Sol
iv. Emulsion
(4 marks)

(c) Using diagrams, state the elements of the following viscoelastic models

i. Maxwell
ii. Kelvin-Voight
iii. Burgers

Question Five (15 marks)

(a) With the aid of a Textural Profile Analysis (TPA) diagram, define he following textural indices
    i. Springiness
    ii. Adhesiveness
    iii. Hardness
    iv. Fracturabilty   **(4 marks)**

(b) Discuss concisely citing examples, how size and shape of agricultural and food products are of importance in the food processing industry
        (11 marks)