

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**FIRST YEAR EXAMINATION FOR THE AWARD OF DEGREE
OF BACHELOR OF SCIENCE IN FOOD SCIENCE AND TECHNOLOGY**

FOST 131: FOOD PROCESSING ENGINEERING I

STREAMS: FOST

TIME: 2 HOURS

DAY/DATE: THURSDAY 25/03/2021

11.30 A.M. – 1.30 P.M.

INSTRUCTIONS

- *Answer ALL questions in Section A and any TWO in Section B*
- *Show your workings clearly*
- *No borrowing of calculators while in the exam room*
- *Do not write anything on the question paper. All rough work to be done on the answer booklet and crossed through.*

SECTION A: ANSWER ALL QUESTIONS (30 MARKS)

Question One

Differentiate between the following terms as applied in food engineering

- Specific heat and latent heat **(5 Marks)**
- pasteurization and sterilization of food **(5 Marks)**

Question Two

A sausage formulation is to be made from the following ingredients:

Lean beef: 14% fat, 67% water, 19% protein.

Pork fat: 89% fat, 8% water, 3% protein.

Soy protein isolate: 90% protein, 8% water.

Water needs to be added (usually in the form of ice) to achieve the desired moisture content. The protein isolate added is 3% of the total weight of the

mixture. How much lean beef, porkfat, water, and soy isolate must be used to obtain 100 kg of a formulation having the following composition:

Protein, 15%; moisture, 65%; fat, 20% **(10 Marks)**

Question Three

A mango juice concentrate is made by concentrating single strength juice of 15% solids to 70% solids followed by dilution of the concentrate using 1/4 of the single strength juice. Starting with 1000 kg of the fresh juice, calculate the quantities of each component **(10 Marks)**

SECTION B: ANSWER ANY TWO QUESTIONS (40 MARKS)

Question Four

- a) Discuss the applications of psychrometrics in food processing and explain how knowledge of psychrometric chart is used to solve complex air-conditioning processes **(8 Marks)**
- b) In efforts to conserve energy, a food dryer is being modified to reuse part of the exhaust air along with ambient air. The exhaust airflow of 10 m³/s at 68°C and 25% relative humidity is mixed with 20 m³/s of ambient air at 35°C and 60% relative humidity. Using the psychrometric chart, determine the properties of the mixed air. **(12 Marks)**

Question Five

A juice processor is to produce 8000 ½ kg cans of juice concentrate with 45% solids. At the reception, fruits yield 30% of their weight of juice with 15% solids. In the process line, the raw juice is divided into two portions. One portion is over-concentrated to 60% solids and the over-concentrated juice is mixed with the other portion to obtain a product with 45% solids before canning.

- a) Assuming no losses, calculate the ;
- i) Amount of juice required for this process **(2 Marks)**
 - ii) Amount of juice portions for overconcentration and blending **(5 Marks)**
 - iii) Amount of water to be evaporated **(3 Marks)**
 - iv) Amount of fruits required **(2 Marks)**
- b) Assuming a product loss of 2% is incurred during canning, calculate, the quantities in (a) above **(8 Marks)**

Question Six

- a) Show your understanding of D-value and z-value as used in thermal food processing

(8 Marks)

- b) In a laboratory experiment it was found that heating a suspension of spores at 115°C for 90 seconds results in a 6-log killing of the spores. To achieve the same reduction at 120°C, 30 seconds are needed. Calculate the decimal reduction time at the two temperatures and the z value

(6 Marks)

- c) A suspension of bacterial spores containing 101200 spores per ml is heated at 120°C. The number of survivors is determined in samples that are withdrawn every 10 minutes. The results are as shown in the table below. Use the data provided to determine the decimal reduction time

(6 Marks)

Heating time, t	N, survivors per ml
0	101200
10	31650
20	10000
30	1600
40	400
50	100

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