

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Agricultural and Plantation Engineering



0007

Study Programme : Bachelor of Science Honours in Engineering
Name of the Examination : Final Examination
Course Code and Title : AGX7418 Food Engineering
Academic Year : 2024/25
Date : 16th February 2026
Time : 1330-1630h
Duration : 3 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. Answers should be in clear hand writing.
3. Do not use red colour pen.
4. This question paper consists of **two (02) sections**.

Section 1

- Consists of 15 questions in four **(04)** pages.
- Answer all questions.
- All questions carry equal marks.
- Write answers only in the space provided.
- Please do not remove the question paper from the examination hall.
- You may spend **one (01)** hour to answer this section.

Section 11

- Contain **six (06)** questions.
- Answer any **four (04)** questions.
- You may spend **two (02)** hour to answer this section.
- All questions carry equal marks.
- Answer for each question should commence from a new page.

Index number

Section 1

1. State **one (01)** advantage and one disadvantage of solar drying over hot air drying

i.

ii.

2. State **one (01)** advantage and one disadvantage of freeze drying over hot air drying

Advantage:

Disadvantage:

3. State **two (02)** novel thermal drying methods which are used in the food industry in Sri Lanka.

i.

ii.

4. Write the main reason why we cannot recommend temperatures greater than 70°C for drying of starch containing food commodities, specifically; fruits and vegetables.

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5. Mention the main reason for not using the digital moisture analyzer to measure the moisture content in black pepper powder.

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6. List **two (02)** thermal processing technologies and two non-thermal processing technologies which are in commercial operations in food industries.

i.

ii.

7. Mention **two (02)** products which are processed using Ultra High Temperature (UHT) in food industry.

- i.
 - ii.
8. What is the major social concern on irradiated foods?
- i.
9. List **two (02)** parameters which affect the drying rate of a ripened mango slice.
- i.
 - ii.
10. Name **two (02)** chemical treatments which we can use to reduce the browning effect during drying.
- i.
 - ii.
11. What are the **three (03)** regions of ultraviolet light within the electromagnetic spectrum?
- i.
 - ii.
 - iii.
12. What are the **three (03)** ranges of wavelengths in the three regions of ultraviolet light within the electromagnetic spectrum?
- i.
 - ii.
 - iii.
13. What is the main limitation of applying ultraviolet light as the microbial decontamination of a food powder.
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14. State the major disadvantage of fumigation in processing cinnamon for the export industry.

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15. What is the water activity level which we should maintain in dried fruits to prevent spoilage?

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End of Section 1



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Section 2

Question 01

- a. Mention three advantages and three limitations of non-thermal processing technologies compared to thermal processing in microbial decontamination of foods. (6 marks)
- b. Describe the working principles of below non thermal processes. Draw diagrams where appropriate. (12 marks)
 1. Fumigation
 2. Ultra Violet Treatment
 3. Cold Plasma Treatment
 4. Gamma Irradiation
- c. Briefly describe the key membrane technologies; the pressure- driven membrane processes in the food industry with suitable diagrams. (7 marks)

Question 02

- a. Fresh tomatoes containing 94% moisture (wet basis) are dried in a hot air dryer to a final moisture content of 12% (wet basis)
If 500 kg of fresh tomatoes are fed into the dryer:
 1. Calculate the mass of dried tomatoes produced.

2. Determine the amount of water removed during drying.

Assume no loss of dry solids during the drying process (10 marks)

- b. Fresh tomatoes (500 kg) containing 94% moisture (wet basis) are dried in a hot-air dryer to a final moisture content of 12% (wet basis).

Hot air enters the dryer at 70°C and leaves at 40°C.

The mass flow rate of dry air supplied is 1,200 kg of dry air.

Assume:

- Specific heat of dry air, $C_{p,a} = 1.0 \text{ kJ/kg}^\circ\text{C}$
- Latent heat of vaporization of water at drying conditions, $\lambda = 2,400 \text{ kJ/kg}$
- Initial temperature of tomatoes = 25°C
- Specific heat of tomatoes (wet material) = $3.8 \text{ kJ/kg}^\circ\text{C}$
- Heat losses are negligible

Calculate:

1. The total heat supplied by the hot air
2. The heat required to evaporate moisture
3. Comment on whether the supplied heat is sufficient for drying (15 marks)

Question 03

- a. Tomato juice with a density of $1,050 \text{ kg/m}^3$ and a viscosity of $3.0 \times 10^{-3} \text{ Pa}\cdot\text{s}$ flows steadily through a horizontal stainless-steel pipe of internal diameter 25 mm at an average velocity of 1.2 m/s.

Calculate:

1. The Reynolds number of the flow
 2. State whether the flow is laminar or turbulent (10 marks)
- b. Explain the importance of measuring the “moisture content” and “water activity” of dried tomatoes. (7 marks)

- c. Mention two organic pre-treatments and two non-organic pre-treatments which can be practiced in drying of green banana slices. (8 marks)

Question 04

- a. What are the main intrinsic and extrinsic parameters of mangoes which should be considered in selecting for manufacturing canned mango pulp. (6 marks)
- b. What are the properties of the food contact surfaces of the machinery which should be selected to establish the canned mango pulp production facility. (5 marks)
- c. Make a list of machinery which are required to purchase to establish a medium scale mango pulp processing facility. Start from receiving of fresh mango to the facility. (14 marks)

Question 05

- a. State the two advantages and two disadvantages of vacuum drying compared to hot air drying in fruits and vegetable dehydration. (6 marks)
- b. Explain the working principle of spray drying and state two industrial applications (9 marks)
- c. Discuss the limitations of investing for a freeze dryer in Sri Lanka for dehydrating fruits and vegetables. (10 marks)

Question 06

- a. Briefly describe the pH-based classification for thermal processing of foods. (5 marks)
- b. What are the essential machinery required for conventional thermal processing (eg: canned fish, canned coconut milk) (10 marks).

- c. What are the essential machinery required for aseptic thermal processing (eg: milo in tetra pack, coconut milk in tetra pack) (10 marks)

End of Section 2

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