

2913/105  
FOOD ENGINEERING I  
Oct./Nov. 2022  
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN FOOD SCIENCE AND PROCESSING TECHNOLOGY

MODULE I

FOOD ENGINEERING I

3 hours

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination:*

*Answer booklet;*

*Non-programmable scientific calculator.*

*This paper consists of TWO sections; A and B.*

*Answer ALL the questions in section A and any TWO questions from section B in the answer booklet provided.*

*Each question in section A carries 15 marks while each question in section B carries 20 marks.*

*Maximum marks for each part of a question are as shown.*

*Candidates should answer the questions in English.*

**This paper consists of 3 printed pages.**

**Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**

**SECTION A (60 marks)**

*Answer ALL the questions in this section.*

1. (a) State four reasons for sorting raw materials for food processing. (4 marks)
- (b) Explain each of the following methods for cleaning food raw materials:
- (i) magnetic cleaning; (5 marks)
- (ii) spray washing. (6 marks)
2. (a) State four qualities of aluminium favouring its use in construction of food contact surfaces. (4 marks)
- (b) Describe the hygienic installation of equipment in a food processing plant. (6 marks)
- (c) Explain the use of surface active agents in plant cleaning. (5 marks)
3. (a) Define each of the following terms:
- (i) chute; (2 marks)
- (ii) unit load. (2 marks)
- (b) State five factors which affect the design and operation of bucket elevators. (5 marks)
- (c) Explain the use of belt conveyors in the food industry. (6 marks)
4. (a) State four desirable qualities of process water in the food industry. (4 marks)
- (b) Explain wastewater treatment using oxidation ponds. (11 marks)

**SECTION B (40 marks)**

*Answer any TWO questions from this section.*

5. (a) With the aid of sketch diagrams, describe the following modes of operation of size reduction plant:
- (i) choke feeding; (5 marks)
  - (ii) closed circuit grinding. (7 marks)
- (b) Sugar crystals were ground from an average diameter of 0.5 to 0.1 mm particles. The energy required was 0.8 kWh per ton. Calculate the energy consumption if the sugar crystals were to be reduced to 0.05 mm, assuming the following laws apply:
- (i) Rittinger's law; (4 marks)
  - (ii) Kick's law. (4 marks)
6. (a) State five uses of steam in the food processing industry. (5 marks)
- (b) Explain three requirements of water for steam generation. (6 marks)
- (c) State four advantages of water tube boilers over fire tube boilers. (4 marks)
- (d) (i) Define boiler efficiency. (2 marks)
- (ii) Explain the use of superheaters in steam generation. (3 marks)
7. (a) State five properties of a good refrigerant. (5 marks)
- (b) Explain each of the following terms as used in cooling:
- (i) hydrocooling; (5 marks)
  - (ii) cryogenic cooling; (5 marks)
  - (iii) blast freezing. (5 marks)
8. (a) Explain how each of the following properties affect the suitability of materials for processing food products:
- (i) colour; (5 marks)
  - (ii) defects. (5 marks)
- (b) Explain pneumatic conveying of materials in the food processing industry. (10 marks)

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