



MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF AGRICULTURE, ENVIRONMENT AND HEALTH SCIENCES

DEPARTMENT OF AGRICULTURAL SCIENCES

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN AGRICULTURAL EDUCATION AND EXTENSION

BACHELOR OF EDUCATION (SCIENCE)

BACHELOR OF EDUCATION (SPECIAL NEEDS EDUCATION)

AGR 412: POSTHARVEST TECHNOLOGY

TIME:

DATE:

INSTRUCTIONS: Answer question ONE (COMPULSORY) and any other TWO

QUESTION ONE (COMPULSORY - 30 MARKS)

- a) With the aid of a well-labelled diagram explain the growth and developmental phases observed in a typical climacteric fruit from initiation to senescence (6 marks).
- b) Maturity establishment and harvesting are key steps in the agricultural production and value chain for compliance with postharvest management practices.
 - i) Define the two classes of maturities encountered in perishable agricultural commodities (2 marks).
 - ii) Explain five requirements of a maturity index (5 marks).
 - iii) Explain four guiding principles that have to be followed while harvesting horticultural commodities (4 marks).
- c) Determination of sugar and total titratable acidity contents is important in the postharvest management practices of fruits. Based on this statement:
 - i) Explain the importance of determining sugar and acid contents in fruits (3 marks).

- ii) Describe the method used in the determination of total titratable acidity content in an agricultural food commodity (3 marks).
- iii) Describe the method used to approximate the total sugar content in a fruit (3 marks).
- d) A consignment of 4500 tonnes of wheat was dried from an initial moisture content of 25% down to 12%. Calculate the final weight of the dried wheat (4 marks).

QUESTION TWO (20 MARKS)

- a) The UN Sustainable Development Goals (SDGs) and in particular Goal 12: Ensure sustainable consumption and production patterns, Sub-section 12.3 states as follows: ***By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including postharvest losses.*** From a postharvest food loss and waste perspectives, discuss how failure to achieve Sub-section 12.3 of Goal 12 will impact environmental sustainability and climate change (10 marks).
- b) With respect to respiration of harvested agricultural commodities, explain:
 - i) Five effects of respiration in the harvested agricultural commodities (5 marks).
 - ii) Five technical importance of measuring the rate of respiration in harvested agricultural commodities (5 marks).

QUESTION THREE (20 MARKS)

- a) Assume that a vegetable with a water content of 97% is brought into a store with a relative humidity of 89%. From this information, answer the following questions:
 - i) Define the term equilibrium relative humidity (1 mark).
 - ii) Calculate the vapour pressure deficit in the store room (2 mark).
 - iii) Calculate the percentage amount of water that the vegetable has to lose in order attain the equilibrium relative humidity (2 marks).
- b) Describe five methods used to control water loss from harvested perishable commodities (10 marks).
- c) Explain five factors that influence the adoption of controlled atmosphere and/or modified atmosphere storage systems as alternative methods for storage of harvested horticultural commodities (5 marks).

QUESTION FOUR (20 MARKS)

- a) Explain five justifications for the need for rapid cooling of harvested perishable commodities as a tool in postharvest management (5 marks).
- b) Assume that a student conducted an experiment on the determination of total titratable acidity content using the titration method and total soluble solids content in an orange fruit. The student extracted 16 ml of juice and used 1 ml to determine the total soluble solids content and the rest to carry out the titration. The following data were obtained:
- Total soluble solids content = 11° Brix
- Volume of 0.1N NaOH used to reach end point = 14.2 ml
- Given that the conversion factor of the predominant organic acid in orange fruit is 0.0064, prove that the sugar:acid ratio is 18:1 (5 marks).
- c) Explain the hypotheses/theories that have been advanced to explain the physical and chemical alterations that take place during ripening of fleshy fruits and lead to the associated quality attributes (6 marks).
- d) Explain four reasons for the establishment of quality standards in the postharvest management practices of agricultural commodities (4 marks).

QUESTION FIVE (20 MARKS)

- a) From respiratory and ethylene metabolisms view point explain the implications of storing climacteric fruits in an anaerobic condition on:
- i) Physiological processes of the fruit (2 marks).
- ii) The quality of the fruit (2 marks).
- iii) The postharvest shelf-life of the fruit (2 marks).
- b) Global-GAP is key in the survival of the fresh agricultural produce export trade in any economy:
- i) Explain the term 'Global-GAP' (2 marks).
- ii) Explain any eight principles on which Global-GAP is based (8 marks).
- iii) Explain any four benefits that may be accrued from Global-GAP certification in the context of the fresh produce sub-sector in Kenya (4 marks).