



UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2023/2024

- COURSE NAME : POST HARVEST TECHNOLOGY
- COURSE CODE : BWD 21402
- PROGRAMME CODE : BWD
- EXAMINATION DATE : JULY 2024
- DURATION : 2 HOURS
- INSTRUCTIONS :
1. ANSWER ALL QUESTIONS
 2. THIS FINAL EXAMINATION IS CONDUCTED VIA
 - Open book
 - Closed book
 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **SIXTEENTH** (16) PAGES

PART A (MCQ Question)

Please answer all the following question in the booklet provided.

Q1 All of the followings are world coffee producers **EXCEPT**:

- (a) South America
- (b) Oceania
- (c) Greece
- (d) Africa

(1 mark)

Q2 Which aspect of postharvest technology would be most relevant to ensure the fresh produce reaches the market in the best possible condition?

- (a) Postharvest technology focuses solely on the harvesting process of agricultural produce.
- (b) Postharvest technology encompasses various stages from harvest to consumption, including production, conservation, processing, packaging, distribution, marketing, and utilization.
- (c) Postharvest technology primarily deals with the transportation of agricultural produce from farms to markets.
- (d) Postharvest technology is limited to the packaging and marketing of agricultural produce.

(1 mark)

Q3 There are 5 development stages in coffee tree. Pin head is the initial development stage. Explain the correct phenomenon that occur in this stage.

- (I) Occur during the the sixth to the 17th week of development.
- (II) Fruit growth is negligible.
- (III) Fruit has high respiration rate.
- (IV) Growth of the pericarp and seeds is mostly by cell division instead of by cell expansion.

- (a) I, II, III
- (b) II, III, IV
- (c) I, II, IV
- (d) I and III

(1 mark)

Q4 Identify the biggest commercialised coffee species in beverage industry.

- (a) *Coffea canephora*
- (b) *Coffea arabica*
- (c) *Coffea excelsa*
- (d) *Coffea liberica*

(1 mark)

Q5 A team of researchers is conducting a study on coffee tree development. They aim to measure various characteristics to understand the fruit growth, such as fruit length, diameter, volume, fresh weight and dry mass. Describe the accurate settings of the experiment?

- (a) Sampling frequency and statistical models, irrespective of coffee species or variety.
- (b) Coffee species, variety, or clones, regardless of sampling frequency or statistical models.
- (c) Fruit component parts (whole fruit, seed, or embryos), without considering sampling frequency or statistical models.
- (d) Coffee species, variety, or clones, along with sampling frequency and statistical models.

(1 mark)

Q6 The phase of maturation is believed to facilitate the end quality of coffee. Explain the physiological process of coffee which can lead to high-quality coffee cherry.

- (a) Faster maturation processes are preferred as they lead to quicker harvesting and higher yield, disregarding the impact on beverage quality.
- (b) Slower maturation allows for the full expression of biochemical steps crucial for beverage quality, contributing to the superior taste and aroma of coffee.
- (c) Maturation speed has no bearing on coffee quality; other factors such as processing methods and roasting techniques are solely responsible for beverage quality.
- (d) Quality in coffee production is solely determined by genetic factors and environmental conditions; maturation speed is inconsequential.

(1 mark)

Q7 Which of the following statements are best described about “dry process” of coffee.

- (I) Cherry bean is normally dried by sun or mechanical drying.
 - (II) The coffee cherry is passed through the animal intestine.
 - (III) Dry processing has a high risk of secondary fermentation because of the mucilage, which is very hygroscopic remains with the coffee cherry.
 - (IV) Right after harvesting, the coffee cherries are washed and then de-pulped using a machine before drying is initiated.
- (a) I, II, III
 - (b) II, III, IV
 - (c) I, II, IV
 - (d) I and III

(1 mark)

Q8 Identify the type of non-conventional tea

- (a) Black tea
- (b) Decaffeinated tea
- (c) Oolong tea
- (d) Green tea

(1 mark)

Q9 Identify main composition of tea.

- (I) Caffein
 - (II) Volatile oil
 - (III) Tannins
 - (IV) Vitamin E
- (a) I, II, III
 - (b) II, III, IV
 - (c) I, II, IV
 - (d) I and III

(1 mark)

Q10 Whole leaf, broken leaves and fannings are different grades of tea product. Choose the correct grades separation of the black tea product.

- (I) Whole leaf teas are considered as the most premium grades.
- (II) Broken leaves are normally packed in a bag.
- (III) Fannings are usually small particles of tea leftover from the production of larger tea varieties.
- (IV) Fanning have darker colour but milder flavour when brewed.

- (a) I, II, III
- (b) II, III, IV
- (c) I, II, IV
- (d) I and III

(1 mark)

Q11 Yellow tea is a unique type of tea that occupies an intermediate position between black and green tea, leaning closer to green tea in terms of characteristics. It is made from the same plant species, *Camellia sinensis*, but undergoes a distinct processing method. How processing method affect the final quality of tea?

- (a) Yellow tea is made from fully matured tea leaves, resulting in a more intense flavor profile compared to green tea.
- (b) Yellow tea is fermented for a longer duration than black tea, leading to its characteristic bright color.
- (c) Yellow tea is produced using multiple leaves and buds, contributing to its complex flavor profile similar to black tea.
- (d) Yellow tea is made using only one bud or one bud with 1-2 leaves, resulting in brighter colour infusion than that of green tea.

(1 mark)

Q12 Red tea, also known as rooibos tea, is a popular beverage renowned for its distinct flavor and health benefits. The production of red tea involves a unique fermentation process that sets it apart from other types of tea. Explain why its fermentation process gives special identity to “red tea” characteristics?

- (a) The fermentation process in red tea is faster than that in black tea manufacture, resulting in a stronger and more robust flavor profile.
- (b) Red tea undergoes minimal fermentation, with the primary emphasis on thermochemical processes to enhance its natural flavors
- (c) The fermentation process in red tea is similar to that of green tea, relying solely on enzymatic processes to develop its unique characteristics.
- (d) Red tea fermentation involves a controlled combination of enzymatic and thermochemical processes, with the enzymic process being slower than in black tea manufacture.

(1 mark)

Q13 Green brick tea is a unique product popular in Mongolia, China, and Russia, valued both for its flavor and its versatility as a foodstuff. Explain the correct statement about green brick tea.

- (a) Green brick tea is primarily consumed as as a soup served hot or cold, and is made from the youngest leaves of the tea plant.
- (b) Green brick tea is exclusively consumed in its dry form, without any additional ingredients, and is made from the freshest leaves of the tea plant.
- (c) Green brick tea is consumed as a soup is made from the older leaves of the tea plant.
- (d) Green brick tea is used primarily in traditional ceremonies and rituals, and its production involves a meticulous fermentation process.

(1 mark)

Q14 The duration of fermentation process of tea typically ranges from 45 minutes to 3 hours, influenced by factors such as leaf nature, maceration techniques, ambient temperatures, and desired tea quality. During fermentation process, the color of the tea leaves transitions from green to coppery red, accompanied by the development of a pleasant characteristic aroma. Which of the following **DOES NOT** influence the duration of fermentation in black tea processing?

- (a) The microbe inoculated in the fermentation process
- (b) The nature of the tea leaf being processed.
- (c) The techniques used for maceration.
- (d) The ambient temperature during fermentation

(1 mark)

Q15 Firing is one of crucial technique involved in making black tea. Explain why firing process is conserved as key treatment for tea production?

- (a) Firing enhances the color and aroma of the tea leaves.
- (b) Firing introduces additional moisture to the leaves for better flavor development.
- (c) Firing accelerates the oxidation process in tea leaves.
- (d) Firing halts oxidation and removes excess moisture to prevent mold or rotting.

(1 mark)

Q16 Green tea is reputed to have a substantially higher concentration of antioxidant activity compared to black tea. Explain the difference between green tea and black tea that result to antioxidant activity?

- (a) Black tea contains more caffeine than green tea.
- (b) Green tea has a higher concentration of theanine compared to black tea.
- (c) Black tea contains higher levels of proline than green tea.
- (d) Green tea contains over four times the concentration of catechins compared to black tea.

(1 mark)

Q17 A farmer has harvested a large batch of lettuce from his field. However, he notices that some of the leaves are discolored and slightly damaged due to pests. He wants to trim the lettuce for sale in the market while ensuring its quality. Why trimming can be applied to address these issues?

- (a) By regularly harvesting outer leaves, growers can encourage the plant to produce fresh foliage, extending the harvesting period and maximizing yield.
- (b) Trimming is performed to increase the flavor of lettuce even some of it got damages.
- (c) Trimming improves visual quality and reduce deteriorated parts that later impacting the fresh quality lettuce during handling, packaging, and transportation
- (d) Trimming involves adding chemicals to the undamaged lettuce to improve its appearance and preventing against spoilage.

(1 mark)

- Q18** Which of the following accurately describes the composition of rice grain?
- (a) Rice grain is composed of approximately 75%-80% starch, along with water and a small percentage of protein.
 - (b) Rice grain contains primarily protein with a small amount of starch.
 - (c) Rice grain is composed mainly of water, with minimal starch content.
 - (d) Rice grain consists primarily of amylopectin, with only trace amounts of amylose.

(1 mark)

- Q19** What is the recommended moisture content for the specified storage durations for rice grain?

- (a) 20% for a maximum of 1 week
- (b) 15% or less if it's to be stored for 6 months
- (c) 12% for long-term storage exceeding 1 year
- (d) 9% or less for long-term storage

(1 mark)

- Q20** Parboiled rice, also known as converted rice or easy-cook rice. What distinguishes parboiled rice from other types of rice?

- (a) It is dried under direct sunlight before milling.
- (b) It is soaked in water for an extended period before cooking.
- (c) It undergoes partial boiling in the husk during processing.
- (d) It is enriched with additional vitamins and minerals during production.

(1 mark)

Q21 Milling is commonly referred to as "whitening." How can milling improve the nutritional quality of rice?

- (a) Milling removes the outer layers that have lower protein content and retains the inner endosperm, which is relatively higher in protein, the protein content per unit weight of rice producing a complete diet for human nutrition.
- (b) The outer layers of the rice grain, including the bran and germ, contain higher concentrations of lipids (fats) compared to the starchy endosperm found at the core of the grain. During milling, these outer layers are removed to produce polished white rice. Since the bran and germ layers are where most of the lipids are concentrated, their removal significantly reduces the overall lipid content of the rice lead to healthier food choice.
- (c) Milling preserves the outer bran layer, thus enhancing the nutritional value of rice. These outer layers contain a significant portion of the rice's nutrients, including fiber, vitamins (such as B vitamins), minerals (like magnesium and phosphorus), and antioxidants.
- (d) When rice is milled, the outer bran layer, which contains fiber and other nutrients, is removed, leaving behind the starchy endosperm, which is primarily composed of carbohydrates. Carbohydrates are a crucial macronutrient that provides energy to the body.

(1 mark)

Q22 Brown rice is known for its abundance of antioxidants, vitamins, and minerals, contributing to its nutritional value. Explain the specialty of nutritional composition of brown rice as compared to white rice.

- (a) Brown rice is primarily composed of carbohydrates.
- (b) Brown rice contains high levels of vitamin C and vitamin E.
- (c) Brown rice provides essential minerals such as calcium, iron, and magnesium.
- (d) Brown rice is a significant source of saturated fats and cholesterol.

(1 mark)

Q23 Temperature fluctuations during rice storage can significantly impact the composition of rice grains. Describe the effect of higher temperature on rice grain composition?

- (a) Higher temperatures lead to an increase in water content, enhancing protein, lipid, and ash contents.
- (b) Higher temperatures have significant effect water content of rice grains solely.
- (c) Higher temperatures cause a decrease in water content, which negatively impacts protein, lipid, and ash contents.
- (d) Higher temperatures result in an increase in protein content but a decrease in lipid and ash contents in rice grains.

(1 mark)

Q24 The drying process in food production relies on heat and mass transfer between grains and drying air. This process is to ensure optimal moisture levels can be achieved during storage. Describe condition that should be met during drying process of grain?

- (a) The water vapor pressure of the grains should be lower than that of the drying air.
- (b) The drying air should have a lower temperature than the grains to facilitate drying.
- (c) Hygroscopic equilibrium occurs when the water vapor pressure of the grains equals that of the drying air.
- (d) The drying process relies solely on the natural evaporation of moisture from the grains.

(1 mark)

Q25 Understanding the characteristics of herbs and spices is crucial for effective culinary usage. Differentiates between herbs and spices based on their botanical sources and forms?

- (a) Herbs are primarily derived from seeds, bark, roots, or fruits, while spices are predominantly the leaves of plants.
- (b) Herbs are typically used in smaller quantities than spices due to their potent flavor profile.
- (c) Spices are commonly fresh and used in larger quantities, while herbs are often dried for culinary applications.
- (d) Herbs are generally the leaves of plants and can be used fresh or dried, whereas spices are obtained from various plant parts such as seeds, bark, roots, or fruits.

(1 mark)

Q26 Determine the plant organ of black pepper.

- (a) Arils
- (b) Bark
- (c) Berry
- (d) Pistil

(1 mark)

Q27 Understanding the global spice industry and its key players is essential for stakeholders in the culinary and agricultural sectors. Which statement accurately reflects the distribution of spice production among the top countries worldwide?

- (a) China leads in spice production, followed by India, Bangladesh, and Pakistan.
- (b) India is the largest producer, consumer, and exporter of spices globally, followed by Turkey, Nepal, and China.
- (c) Turkey ranks second in spice production, with India, China, and Pakistan following closely behind.
- (d) India dominates the global spice industry wholly, followed by China, Bangladesh, and Pakistan.

(1 mark)

Q28 Understanding the growth and harvesting process of anise is crucial for agricultural practitioners and enthusiasts. Describes the maturation and harvesting of anise?

- (a) Anise crops mature within 60-80 days, and harvesting begins when the fruit turns dark purple.
- (b) Anise crops mature within 180-200 days, and harvesting occurs when the fruiting umbels turn bright red.
- (c) Anise crops mature within 120-140 days, and harvesting starts when the tips of the fruit turn greyish green.
- (d) Anise crops mature within 90-110 days, and harvesting is initiated when the leaves of the plant start wilting.

(1 mark)

Q29 Understanding the preparation of coriander leaves for marketing is essential for agricultural producers and distributor. Describes the preparation of coriander leaves for marketing?

- (a) Coriander leaves are sold individually, with stems trimmed to enhance freshness.
- (b) Coriander leaves are bundled together with roots intact to prolong shelf life.
- (c) Coriander compound leaves with stems are prepared in small bunches of desirable size for marketing.
- (d) Coriander leaves are processed into powder form before being packaged for sale.

(1 mark)

Q30 Choose the most accurate statement regarding sun drying for herbs?

- (a) Sun drying is the preferred method for preserving herbs, as it enhances their flavor and color.
- (b) Sun drying should be avoided for herbs, as it can lead to loss of flavor and color.
- (c) Sun drying is suitable for herbs with robust flavors, as it intensifies their taste and appearance.
- (d) Sun drying is necessary for certain herbs to enhance their medicinal properties and aroma.

(1 mark)

Q31 Which of the following list are identified as tender-leaf herbs?

- (a) Basil, thyme, rosemary, and sage
- (b) Oregano, parsley, cilantro, and dill
- (c) Tarragon, mint, cilantro, and sage
- (d) Basil, oregano, tarragon, and lemon balm

(1 mark)

- Q32** Understanding the drying process for herbs is essential for maintaining their quality and flavor. Describes the drying times for a tender herbs in a dehydrator?
- (a) Drying times typically range from 6 to 8 hours for dehydrator drying of herbs.
 - (b) Drying times may vary from 1 to 4 days for dehydrator drying of herbs.
 - (c) Drying times may vary from 1 to 4 hours for dehydrator drying of herbs.
 - (d) Drying times are consistent and fixed at 12 hours for dehydrator drying of herbs.

(1 mark)

- Q33** Identify the primary growing regions of cocoa?

- (a) Europe, Australia, and North America
- (b) South America, Antarctica, and Africa
- (c) Africa, Asia, and Latin America
- (d) Europe, Asia, and Oceania

(1 mark)

- Q34** For stakeholders in the food and beverage industry, it is crucial to grasp the wide-ranging uses of cocoa in food products and its potential health advantages. Why cocoa is considered as multifunction food ingredients?

- (a) Cocoa primarily contributes to scent and hue in products and exhibits calming effects to food product.
- (b) Cocoa enriches flavor, consistency, and colour in food and pharmaceutical products while possessing anti-inflammatory, antidepressant, and antioxidant attributes.
- (c) Cocoa imparts both sweetness and bitterness to products lead to artificial sweeteners in food products.
- (d) Cocoa is predominantly utilized as a preservative in products and demonstrates stimulant and diuretic characteristics in cosmetic product.

(1 mark)

- Q35 Describe the importance of cocoa fermentation on its cocoa powder quality?
- (a) During fermentation, naturally occurring microorganisms on the cocoa beans metabolize sugars and other compounds, leading to the development of complex flavor compounds. This fermentation process is essential for unlocking the characteristic flavor profile of cocoa, including notes of chocolate, fruitiness, and floral aromas. Proper fermentation is necessary to achieve the desired flavor balance and richness in cocoa powder.
 - (b) Raw cocoa beans contain high levels of bitter and astringent compounds, such as polyphenols and alkaloids. Fermentation helps to induce these undesirable flavors by breaking down and transforming these compounds into milder, more palatable forms. The high bitterness and astringency contributes to the overall smoothness and palatability of cocoa powder.
 - (c) Fermentation leads to the development of desirable yellow coloration in cocoa beans, indicating the formation of flavor-rich precursors such as melanoidins. This color development enhances the visual appeal of cocoa powder and is indicative of its quality.
 - (d) Fermentation helps to increase the moisture content of cocoa beans and creates a natural pH environment that inhibits the growth of harmful microorganisms. This microbial activity plays a critical role in ensuring the safety and stability of cocoa beans during storage and subsequent processing into cocoa powder.

(1 mark)

- Q36 The optimal roasting temperature for cocoa beans is crucial for achieving desired flavor profiles in chocolate production. Recommend the range of roasting temperatures that is optimal for cocoa beans for chocolate production?
- (a) The roasting temperature for cocoa beans typically between 50 to 80°C.
 - (b) The roasting temperature for cocoa beans typically between 150 to 180°C
 - (c) The roasting temperature for cocoa beans typically between 95 to 145°C.
 - (d) Cocoa beans are roasted at temperatures exceeding 200°C to enhance their fragrance and texture.

(1 mark)

Q37 Kibbling process is vital for ensuring efficient cocoa bean processing in the chocolate industry. Describes about the kibbling process.

- (a) Kibbling involves sorting cocoa beans based on size and color before roasting.
- (b) Kibbling is a process of roasting cocoa beans to enhance their flavor and aroma.
- (c) Kibbling refers to the cracking of roasted or partially dried cocoa beans to facilitate shell removal.
- (d) Kibbling involves grinding cocoa beans into a fine paste to create cocoa liquor for chocolate production.

(1 mark)

Q38 Dutching affects the solubility of cocoa powder and enhance its properties for various applications in the food industry, such as in the production of chocolate, cocoa drinks, and baking mixes. Additionally, dutching can impart a smoother, milder flavor to cocoa products. Describes the dutching process.

- (a) Dutching is the treatment of cocoa liquor with an alkali solution to reduce acidity and improve flavor.
- (b) Dutching involves fermenting cocoa beans to enhance their flavor profile before grinding.
- (c) Dutching refers to the addition of sugar and milk solids to cocoa liquor to create milk chocolate.
- (d) Dutching involves roasting cocoa beans at high temperatures to develop rich chocolatey notes before processing.

(1 mark)

Q39 Cocoa butter is extracted from cocoa beans and utilized as an edible vegetable fat in chocolate production. Describes the fatty acid composition of cocoa butter.

- (a) Cocoa butter primarily consists of linoleic acid, alpha-linolenic acid, and arachidonic acid.
- (b) Cocoa butter is predominantly composed of myristic acid, linolenic acid, and eicosenoic acid.
- (c) The main fatty acids found in cocoa butter are palmitic, oleic, and stearic acid.
- (d) Cocoa butter contains primarily lauric acid, linoleic acid, and linolenic acid.

(1 mark)

Q40 Cocoa liquor, also known as cocoa mass or cocoa paste, is a key intermediate product in chocolate manufacturing. Describes about cocoa liquor.

- (a) Cocoa liquor is a mixture of cocoa powder and cocoa butter, used as a flavoring agent in desserts.
- (b) Cocoa liquor is a pure cocoa mass in liquid form, consisting of cocoa solids and cocoa butter.
- (c) Cocoa liquor is a liquid beverage made from ground cocoa beans and water, similar to hot chocolate.
- (d) Cocoa liquor is a type of alcoholic beverage made from fermented cocoa beans, popular in some regions.

(1 mark)

PART B: Please answer all the questions in the booklet provided.

Q41 Tea producers pay close attention to every detail of the production process, from the selection of tea bushes to the timing of plucking, the method of processing, and even the packaging of the final product. This attention to detail is akin to that of an artist striving for perfection in their work.

- (a) The tea production requires a combination of skill, knowledge, and craftsmanship. Outline **EIGHT (8)** important steps with brief explanation required generally to produce wide range of tea.

(16 marks)

- (b) Explain how the taste and flavor of teas are influenced by their key chemical component.

(4 marks)

Q42 Encik Abu is a fruit vendor at a local market. His business operates an open stall at Pasar Malam, Pagoh. His business starts from 3 pm until 10 pm. In recent time, he noticed a significant increase in the number of customers complaining about the poor quality of the bananas they purchased from his stall. Upon closer inspection, he realizes that many of the bananas are ripening too quickly and developing brown spots, making them unsuitable for sale. Concerned about the decline in sales and reputation of his stall, he decides to investigate the issue further.

- (a) Explain **FOUR (4)** factors that making the banana ripen so fast.

(12 marks)

- (b) Illustrates the stages of banana ripening that lead to a browning effect when displayed at the stall.

(8 marks)

-END OF QUESTIONS-