

PAPER III: SUBJECT SPECIALISATION PAPER FOR DAIRY TECHNOLOGY

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2023
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER DAIRY TECHNOLOGY

Date	: October 7, 2023
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer Questions

All questions under SECTION A are COMPULSORY.

 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **8 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I: Multiple Choice Questions [30 marks]

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Which of the following culture is used in the manufacture of yogurt?
 - a) *Lactobacillus bulgaricus*
 - b) *Streptococcus thermophilus*
 - c) *Lactobacillus acidophilus*
 - d) *Lactobacillus bulgaricus* & *Streptococcus thermophilus*

2. Butter milk is a by-product from the manufacture of:
 - a) Cheese
 - b) Butter
 - c) Yogurt
 - d) Ice cream

3. Which of the following is the major protein found in milk?
 - a) β – lactoglobulin
 - b) α – lactalbumin
 - c) Casein
 - d) Albumin

4. The increase of volume caused by whipping air into the ice cream mix is known as:
 - a) Runoff
 - b) Hardening
 - c) Aging
 - d) Overrun

5. The average specific gravity of milk as measured by a lactometer at 16°C is:
 - a) 0.900
 - b) 1.020
 - c) 1.032
 - d) 1.300

6. The energy value of foods is measured in terms of:
 - a) Carbohydrates
 - b) Proteins
 - c) Fats
 - d) Calories

7. Which of the following is an emulsifying agent used in manufacture of processed cheese?
 - a) Pectin
 - b) Glycerides
 - c) Whey protein
 - d) Lactose

8. Which of the following is the most variable component of milk?

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- a) Fat
 - b) Protein
 - c) Lactose
 - d) Minerals
9. What is the standard requirement of fat percentage in butter?
- a) 70%
 - b) 80%
 - c) 90%
 - d) 95%
10. Non-bacterial ropiness or sliminess in milk and milk products can be caused due to
- a) the presence of fibrin and leucocytes from mastitis in milk.
 - b) thickness of cream.
 - c) films of casein and lactalbumin.
 - d) all of the above
11. What is the sequence for the addition of reagents and milk during the Gerber butter fat test?
- a) Sulphuric acid, amyl alcohol and milk
 - b) Amyl alcohol, milk and sulphuric acid
 - c) Sulphuric acid, milk and amyl alcohol
 - d) Milk, sulphuric acid and amyl alcohol
12. The heat treatment process for about 20 seconds at 72° is defined as:
- a) Thermalisation
 - b) Batch pasteurization
 - c) HTST pasteurization
 - d) UHT treatment
13. A nozzle atomizer is used in a/an
- a) Evaporator
 - b) Roller dryer
 - c) Spray dryer
 - d) None of the above
14. Which of the following milk component undergoes maillards reaction that results in the burnt color of milk
- a) Proteins
 - b) Vitamins
 - c) Fat
 - d) Minerals
15. Which bacteria is responsible for the formation of the “eyes” in certain cheese varieties?

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- a) Lactic acid bacteria
 - b) Brevibacterium linens
 - c) Clostridium tyrobutyricum
 - d) Propionibacterium
16. The ripening of cheese occurs through the action of the starter bacteria and in some varieties with the additional action of either surface or internal moulds. Which of the following cheese varieties is **NOT** a mould ripened cheese?
- a) Camembert
 - b) Brie
 - c) Cheddar
 - d) Roquefort
17. The cheese made through precipitating the globulins and albumin proteins remaining in the whey after the manufacture of other cheeses is
- a) Camembert
 - b) Gouda
 - c) Ricotta
 - d) Cheddar
18. Milk is an emulsion of:
- a) Oil in water
 - b) Water in oil
 - c) Oil in oil
 - d) Water in water
19. The physical removal of bacteria and their spores from milk is achieved by:
- a) Concentration
 - b) Bactofugation
 - c) Homogenization
 - d) Evaporation
20. A virus that can infect and kill a bacterial cell is known as:
- a) mRNA
 - b) Bacteriocins
 - c) Bacteriophages
 - d) Bacteriofuge
21. Dissolving whole milk powder in potable water to obtain a liquid similar in composition to whole milk is known as:
- a) Reconstituted milk
 - b) Recombined milk
 - c) Toned milk
 - d) Filled milk

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22. During the manufacture of cheese, what substance is added to milk to speed up the clotting process and produce a firmer gel?
- Potassium nitrate
 - Annatto
 - Citric acid
 - Calcium chloride
23. Which enzyme is used as the basis to check for proper pasteurization?
- Lactase
 - Phosphatase
 - Catalase
 - None of the above
24. Which of the following mould is used in the production of an internal mould ripened cheese?
- Penicillium candidum*
 - Geotrichum candidum*
 - Penicillium roqueforti*
 - All of the above
25. The freezing point of milk is
- 0.350°C
 - 0.450°C
 - 0.540°C
 - 0.640°C
26. Lactose is a disaccharide composed of:
- Fructose and glucose
 - Glucose and galactose
 - Galactose and fructose
 - Glucose and xylose
27. Sodium hypochlorite is a
- Sanitizer
 - Detergent
 - Acid
 - None of the above
28. In order for partial coalescence of fat globules and the formation of butter grains, it is necessary that
- part of the milk fat should be crystalline.
 - all of the milk fat should be crystalline.
 - all of the milk fat should be liquid fat.
 - None of the above.

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29. Which of the following is not an indirect heating system?
- Plate
 - Tubular
 - Steam infusion
 - Scraped surface
30. During the manufacture of ice cream, which ingredient is used to prevent the formation of objectionable large ice crystals?
- Sweeteners
 - Stabilizers
 - Emulsifiers
 - Egg yolk

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

- Describe 5 platform milk quality tests.
- What is the Gerber test? Provide the list of equipment and reagent required to perform the test and explain the procedure to conduct the test.
- Assuming negligible loss of fat, and separation of 200kgs milk with 4.5% fat:
 - What weight of cream with 30% fat can we expect?
 - Calculate the % yield of skim milk
 - Calculate the % yield of cream

Use the formula $[F_c = (W_m \times F_m) / W_c]$ where F_c is fat in cream, W_m is weight of milk, F_m is fat in milk and W_c is weight of cream, for your calculations

- Using the Pearson square method, standardize 120kgs of 30% cream to 20% cream using milk testing 3.8% fat.

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SECTION B: Case Study [50 marks]

Choose either CASE I OR CASE II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

Milk production in the country has seen a steady increase over the years with 54,654MT of milk produced in 2021. Most of the milk produced are sold either as raw unpasteurized milk to processors and consumers while some of the milk is used for self-consumption or production of local butter and datshi through traditional means. Product diversification into products such as yogurt and gouda cheese are carried out in processing units across the country. The quality of raw milk however is below international recommendations thereby compromising food safety standards. As an expert in dairy science and technology provide your insight to the following questions:

1. Identify and explain 5 factors that influence the composition of milk. (10 Marks)
2. Provide 5 recommendations for the production of clean and hygienic milk at the farmers' level to ensure supply of clean and safe milk. Outline 5 platform milk tests that can be performed at the milk collection centres or milk processing units to inspect the quality of milk supplied. (10 Marks)
3. What is the Standard Plate Count? Provide the media and reagents required and explain the standard operating procedure in detail required to perform the SPC. (10 Marks)
4. What is the somatic cell count and the acceptable level of SCC in milk? Explain the causes of an elevated level of SCC in milk and its implications on products processing and food safety. Describe 1 rapid diagnostic tool for the quick diagnosis of elevated SCC. (10 Marks)
5. What is the MBRT? Describe the process to perform the MBRT. (10 Marks)

CASE II

The production of traditional datshi follows age old practices passed down from generations through knowledge gained from practical experience. In current times, the demand for cheese has expanded beyond the traditional datshi with many varieties either being imported or produced in country. One such variety produced in country is the Gouda cheese that follows well established practices based on scientific methods. As an expert in dairy science and technology provide your insight to the following questions:

1. Provide a sketch for the plant layout taking into consideration product flow, GMP/GHP and HACCP requirements for a cheese manufacturing plant suitable to our local conditions. The sketch should include all requirements such as milk reception areas, processing area and other associated facilities required for the functioning of the plant. (10 Marks)

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2. Provide a list of processing, laboratory and ancillary equipment required to have a fully functional Gouda cheese manufacturing plant. (10 Marks)
3. Identify 5 GMP/GHP practices to be adopted for the processing plant. Describe CCP and identify 4 CCPs in the cheese manufacturing process. (10 Marks)
4. Detail the production process for the manufacture of Gouda cheese with a flow chart and explain the process. (10 Marks)
5. Identify the starter cultures used and explain the role of starter culture and rennet used for the manufacture of Gouda cheese. Identify and outline manufacturing process (flow chart) for the manufacture of 1 product from the cheese whey. (10 Marks)

TASHI DELEK