ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2024
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR FOOD SCIENCE

Date	: October 5, 2024
Total Marks	**:**100
Writing Time	:150 minutes (2.5 hours)
Reading Time	:15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided 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 - 5 Short Answer Questions

      All questions under SECTION A are COMPULSORY.
    - **SECTION B** consists of case I and Case II. Choose **ONE CASE** and answer the questions.
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 correct 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. What is the name of water that is trapped in a crystal?
   a) Absorbed water
   b) Adsorbed water
   c) Free water
   d) Bound water

2. After slaughtering the stored glycogen in animal is converted into:
   a) Glucose
   b) Lactic acid
   c) Citric acid
   d) Acetic acid

3. Which of the following is an example for hermetic packaging?
   a) Cans
   b) Wood baskets
   c) Nets
   d) Polyethylene cover

4. The process of separation of suspended particle from fluid by passing it through a porous medium is:
   a) Centrifugation
   b) Filtration
   c) Sedimentation
   d) Extraction

5. Development of unstable fat crystal on the surface of chocolate is called:
   a) Fat blush
   b) Fat crack
   c) Fat bloom
   d) Fat dot

6. Which from the following is a primary additive used in whole egg mayonnaise.
   a) Humectant
   b) Antioxidant
   c) Emulsifier
   d) Acidulant

7. _____ is the major component of meat muscle
   a) Myoglobin
   b) Hemoglobin
   c) Xanthophyl
   d) Collagen

8. The yellow coloration of milk fat is due to the presence of:
   a) Curcumin
   b) Chlorophyl
   c) Anthocyanin
   d) Carotenoid

9. Two different type of fermentation is involved in the production of:
   a) Yoghurt
   b) Pickle
   c) Vinegar
   d) Wine

10. What is the third HACCP step?
   a) Conduct hazard analysis
   b) Determine Critical Control Points
   c) Set critical limit
   d) Establish a monitoring system

11. The membrane pore diameter in ultrafiltration to filter solute of molecular weight 4000-10,000 is
   a) 0.05-5 micrometre
   b) 0.005-0.1 micrometre
   c) 0.0005-0.01 micrometre
   d) 0.0001-0.001 micrometre

12. In Controlled Atmosphere storage for apples, the recommended oxygen content in the cold storage room should be:
   a) 3%
   b) 4%
   c) 5%
   d) 6%

13. Food heats up in a microwave oven primarily due to vibration of:
   a) Water
   b) Fat
   c) Protein
   d) Carbohydrate

14. A food that contains 3 grams of fat, 4 grams of protein and 5 grams of carbohydrate would have calories equal to:
   a) 48
   b) 63
   b) 83
   c) 68

15. What happens to the boiling point of water when it is heated at high altitudes?
   a) It increases
   b) It decreases
   c) It stays the same
   d) Water doesn’t boil at high altitude

16. Degumming is an initial purification stage of refining process in oil to remove:
    a) Water
    b) Dirt
    c) Free fatty acid
    d) Phosphatides

17. Adulteration of wheat flour with sand and stones can be inferred by:
    a) Total Ash
    b) Acid Insoluble Ash
    c) Crude fibre
    d) Total Solids

18. A toxin commonly found in corn and peanuts is:
    a) Solanine
    b) Protease
    c) Goitrogens
    d) Aflatoxins

19. Which of the following pertains to the misuse of additives:
    a) To deceive the consumers into a false sense of assurance on the sensory attributes
    b) To disguise the use of faulty processing and handling techniques
    c) To disguise the use of inferior quality of raw materials
    d) All of the above

20. Which among the following is NOT a change that take place during baking?
    a) Gas vaporization with increase in temperature
    b) Dough-crumb transition
    c) Starch gelatinization
    d) Moisture adsorption

21. _____interaction between muscle protein is responsible for muscle contraction.
    a) Globulin
    b) Actomyosin
    c) Collagen
    d) Elastin

22. Which is stated by the First Law of Thermodynamics?
    a) Energy can be created or destroyed by physical processes
    b) Entropy always increases
    c) Energy cannot be created or destroyed
    d) The organization of the universe is steadily increasing

23. Which of the following food ingredient can be used for both emulsification and aeration:
    a) Flour
    b) Egg
    c) Corn flour
    d) Vinegar

24. Fibre is a type of
    a) Sugar
    b) Protein
    c) Carbohydrate
    d) Fat

25. As per the Bhutan Mandatory Standard for Labelling of Prepackaged Food (BMS-12:2017), exemption from mandatory labeling requirement relating to ingredient declaration applies when:
    a) Irradiated food
    b) Functional food
    c) Small units where the package surface area is less than $10cm^2$
    d) Quantity of food is less than 250gm/ml.

26. To control crystal size when making candy, an interfering agent such as_____is added.
    a) Salt
    b) Sugar
    c) Water
    d) Cream of tartar

27. Non-essential amino acids are:
    a) Not essential for the body
    b) Naturally produced in animals and can be found in meant
    c) Naturally produced by the human body
    d) All of the above

28. Viscoelastic nature of wheat dough is due to
    a) Gliadin
    b) Glutenin
    c) Both
    d) None

29. The main advantage of MAP in case of bakery products is
    a) Lowered respiration
    b) Mold growth inhibition
    c) Inhibition of ripening
    d) All of above

30. Which of the following is the correct pairing of essential fatty acids?
    a) Linolenic acid and Oleic acid
    b) Lenoleic acid and Linolenic acid
    c) Linolenic acid and Laurie acid
    d) Oleic acids and Lenoleic acid

PART II – Short Answer Questions [20 marks]

Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. Explain hydrogenation of fat and give a practical application of this process in the food industry? Despite being bad for human health give 2 reasons why hydrogenated fats are so popular in the food industry. **(2+1+2=5 marks)**

2. What is the isoelectric point for protein and what factor is responsible for isoelectric point? What is its significance in food processing? Give an example of a processed product resulting from this phenomenon. **(2+1+1+1=5 marks)**

3. What does rheometer and viscometer specifically measure. State one important difference between Newtonian and Non Newtonian fluid. **(3+2=5 marks)**

4. Define Thermal Death Time, D and Z values? **(1+2+2=5 marks)**

SECTION B: Case Study [50 marks]

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

CASE I

1. Explain/define the following with 1 example each and their implication on the quality of a food product. **(4X3=12 marks)**
   1.1 Dextrinisation
   1.2 Gelatinization
   1.3 Use of shortening in baked product

2. Write 2 differences between the following: **(6X3=18 marks)**
   2.1 High density Lipoprotein and Low density lipoprotein
   2.2 High density Polyethylene and Low density polyethylene
   2.3 Density and grammage of packaging material
   2.4 Plate heat exchanger and Tubular heat exchanger
   2.5 Flavouring substances and flavour enhancer
   2.6 Climateric and non-climacteric fruit

3. Tetra Pak cartoons are an example of composite packaging material. The multiple layers ensure that the food inside remain shelf stable for month at ambient condition without the need for refrigeration. Given in the picture below are the different layers of the packaging material.

   3.1 Four different type of packaging materials are used. Explain their functional role depending on their properties and how the materials are arranged in 6 layers? **(1.5X6 =9 marks)**
   3.2 Give 2 advantages and 2 disadvantages of using Tetra Pak cartoons for packing milk instead of glass bottles. **(1.5X2=3 marks)**

4 Organic farming and products are gaining momentum due to consumer awareness towards the benefit of consuming products free from chemical. As per Bhutan Food and Drug Authority enlist 4 labelling requirements for ingredients, origin and declaration on the label. **(4x2=8 marks)**

CASE II

1. Extrusion processing of food material has gained widespread application in the food industry for snack food processing to cereal and pasta and many more.
   1.1 Define extrusion processing and explain hot extrusion principle **(1+3=4 marks)**
   1.2 Food extruders are composed of 5 main parts as given below, elaborate on each part with its function during the process. **(5*2=10 marks)**
      i. Pre-conditioning
      ii. Feeding system
      iii. Screw
      iv. Barrel or sleeves
      v. Die and cutting mechanism

   1.3 List 4 important factors of the feed materials that have an important influence on the texture and color of the product **(4 marks)**
   1.4 What are the four most important operating parameters in an extruder **(4 marks)**

2. Sensory evaluation is an important aspect of food product development. There are different methodologies designed to assess the organoleptic acceptance of food product by consumer.
   2.1 Write down 4 objectives for conduction sensory evaluation **(4 marks)**
   2.2 Discuss on how Duo Trio Test and Triangle test are conducted? **(2+2=4 marks)**
   2.3 Which test method is superior and why? **(1+1=2 marks)**

3. Fried food products are widely consumed worldwide and are popular snacking item. Owing to the fact that the fried products are heated in oil at high temperature, they are not particularly a healthy snacking option.

3.1 Discuss on 2 adverse effects of fried food on human health? **(2 marks)**
3.2 List and discuss on 5 factors that control the quality of fried food. **(5 marks)**
3.3 Define the following values and their significance **(3X2=6 marks)**
i. Anisidine value
ii. Peroxide Value
iii. Acid value

4 Given in the table below are some of changes in the physical parameters during frying in oil and their causes. Fill in as in the format of the example given in the first row **(5 marks)**

Sl. no	**Physical Parameters**	**Changes during deep fat frying**	**Causes**
1	Refractive index/UV	Increases	Accumulation of conjugated fatty acids
2	Density		Polymerized Triacylglycerols
3		Becomes more intensive & darker	(Maillard) reaction products
4	Smoke point		volatile oxidized decomposition products
5	Specific Heat	Increases	
6	Viscosity	Increases	

TASHI DELEK