

**REPUBLIC OF KENYA**

**COMPETENCY-BASED MODULAR CURRICULUM**

**FOR**

**DAIRY PROCESSING**

**KNQF LEVEL: 4**

**PROGRAMME ISCED CODE: 0721 354A**

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**FOREWORD**

The provision of quality education and training is fundamental to the Government’s overall strategy for social and economic development. Quality education and training contribute to the achievement of Kenya’s development blueprint and sustainable development goals.

Reforms in the education sector are necessary to achieve Kenya Vision 2030 and meet the provisions of the Constitution of Kenya 2010. The education sector had to be aligned to the Constitution, and this resulted in the formulation of the Policy Framework for Reforming Education and Training in Kenya (Sessional Paper No. 14 of 2012). A key feature of this policy is the radical change in the design and delivery of TVET training. This policy document requires that training in TVET be competency-based, curriculum development be industry-led, certification be based on demonstration of competence, and the mode of delivery allow for multiple entry and exit in TVET programmes.

These reforms demand that Industry takes a leading role in curriculum development to ensure the curriculum addresses its competence needs. It is against this background that this curriculum has been developed. For trainees to build their skills on foundational hands-on activities of the occupation, units of learning are grouped in modules. This has eliminated duplication of content and streamlined exemptions based on skills acquired as a trainee progresses in the up-skilling process, while at the same time allowing trainees to be employable in the shortest time possible through the acquisition of part qualifications.

It is my conviction that this curriculum will play a great role in developing competent human resources for the Dairy Sector’s growth and development.

**PRINCIPAL SECRETARY**

**STATE DEPARTMENT FOR TVET**

**MINISTRY OF EDUCATION**

# PREFACE

Kenya Vision 2030 aims to transform Kenya into a newly industrializing middle-income country, providing high-quality life to all its citizens by the year 2030. Kenya intends to create globally competitive and adaptive human resource base to meet the requirements of a rapidly industrializing economy through lifelong education and training. TVET has a responsibility to facilitate the process of inculcating knowledge, skills, and worker behaviour necessary for catapulting the nation to a globally competitive country, hence the paradigm shift to embrace Competency-Based Education and Training (CBET).

TVET Act CAP 210A and Sessional Paper No. 1 of 2019 on Reforming Education and Training in Kenya for Sustainable Development emphasized the need to reform curriculum development, assessment, and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry, as well as increase the global competitiveness of the Kenyan labour force.

This curriculum has been developed in adherence to the Kenya National Qualifications Framework and CBETA standards and guidelines. The curriculum is designed and organized into Units of Learning with Learning Outcomes, suggested delivery methods, learning resources, and methods of assessing the trainee’s achievement. In addition, the units of learning have been grouped in modules to concretize the skills acquisition process and streamline upskilling.

I am grateful to all expert trainers and everyone who played a role in translating the Occupational Standards into this competency-based modular curriculum.

CHAIRMAN OF THE COUNCIL

**ACKNOWLEDGMENT**

This curriculum has been designed for competency-based training and has independent units of learning that allow the trainee flexibility in entry and exit. In developing the curriculum, significant involvement and support were received from expert trainers, institutions and organizations.

I recognize with appreciation the role of the Dairy National Sector Skills Committee (NSSC) in ensuring that competencies required by the industry are addressed in the curriculum. I also thank all stakeholders in the Dairy sector for their valuable input and everyone who participated in developing this curriculum.

I am convinced that this curriculum will go a long way in ensuring that individuals aspiring to work in the Dairy Sector acquire competencies to perform their work more efficiently and effectively.

COUNCIL SECRETARY/CEO

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**KEY TO ISCED UNIT CODE**



# ABBREVIATIONS AND ACRONYMS

|  |  |
| --- | --- |
| CBET | Competence Based Curriculum Training |
| CEO | Chief Executive Officer |
| EAS | East Africa Standard |
| FIFO | First In First Out |
| KCSE | Kenya Certificate of Secondary Education |
| KNQF | Kenya National Qualification Framework. |
| KS | Kenya Standard |
| TVETA | Technical Vocational Education and Training Authority |
| UHT | Ultra-High Temperature |

# COURSE OVERVIEW

Dairy Processing Level 4 qualification consists of competencies that an individual must possess to manage a dairy plant. It involves handling raw milk, raw milk handling, fluid milk processing fermented milk products processing, and fat and based milk products processing.

**Summary of Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **Unit Code** | **Units Title** | **Unit Duration (Hours)** | **Credit Factor** |
| **MODULE I** | | | |
| 0721 351 01A | Raw Milk Handling | 160 | 16 |
| 0721 351 02A | Fluid Milk Processing | 180 | 18 |
| **MODULE II** | | | |
| 0721 351 03A | Fermented Milk Products Processing | 180 | 18 |
| 0721 351 04A | Fat Based Milk Products Processing | 180 | 18 |
| **Sub Total** | | **700** | **70** |
| **Industry Training** | | **320** | **32** |
| **GRAND TOTAL** | | **1020** | **102** |

The total duration of the course is **1020** hours inclusive of **320 hours** of industry training.

**Entry Requirements**

An individual entering this course should have any of the following minimum requirements:

1. Kenya Certificate of Secondary Education (KCSE) Certificate

**Trainer Qualifications**

Qualifications of a trainer for Dairy Plant Management Level 4 include:

1. Possession of a higher qualification than Dairy Processing Level 4 or in related trade area; and

1. Registered by TVETA.

**Industry Training**

An individual enrolled in this course will be required to undergo Industry training for a minimum period of 320 hours in the dairy sector. The industrial training may be taken after completion of all units for those pursuing the full qualification or be distributed equally in each unit for those pursuing part qualification. In the case of dual training model, industrial training shall be as guided by the dual training policy.

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**Assessment**

The course shall be assessed formatively and summative:

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency
3. Assessment of basic and common competencies shall be integrated in the core units
4. Theoretical assessment shall be integrated in practical assessment and conducted orally in both formative and summative assessments.
5. Theoretical and practical weight shall be 10:90 respectively for each unit of learning.
6. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score
7. Assessment performance rating for each unit of competency shall be as follows:

|  |  |
| --- | --- |
| **MARKS** | **COMPETENCE RATING** |
| 80 -100 | Attained Mastery |
| 65 – 79 | Proficient |
| 50 – 64 | Competent |
| 49 and below | Not Yet Competent |
| Y | Assessment Malpractice/irregularities |

1. Assessment for Recognition of Prior Learning (RPL) may lead to award of part and/or full qualification.

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with Kenya **National TVET Certificate** in Dairy Processing Level 4, the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be issued upon demonstration of competence in a certifiable element within a unit.

These certificates will be issued by qualification awarding institution.

# RAW MILK HANDLING

**UNIT CODE: 0721 351 01A**

**UNIT DURATION:** 160Hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Handle Raw Milk**

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician Level 4 to handle raw milk. It involves procuring raw milk, grading raw milk, preserving raw milk and dispatching raw Milk

**Summary of Learning Outcomes**

By the end of this unit, the learner should be able to:

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Procure Raw milk | **40** |
| 2. | Grade Raw milk | **40** |
| 3. | Preserve Raw milk | **40** |
| 4. | Dispatch Raw Milk | **40** |
| **Total** | | **160** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Procure Raw Milk | * 1. Sources of Raw milk      + 1. Dairy Cattle        2. Dairy Goats        3. Dairy Camel   2. Milk –cost determination      + 1. Feasibility study        2. Milk collection sites        3. Milk collection routes        4. Milk collection systems        5. Milk market prices        6. Risk analysis   3. Raw -Milk supply agreement      1. Raw milk supply agreement content         1. Quantity         2. Terms of payment         3. Delivery methods         4. Quality         5. Delivery time         6. Penalties   4. Review period Raw milk delivery      1. Raw Milk storage and transport conditions      2. Hygiene standards in raw -milk delivery | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies |
| 1. Grade Raw Milk | * 1. Raw Milk Sampling      1. Definition of terms      2. Methods of sampling      3. Sampling procedures   2. Grading tools, equipment and materials      1. Alcohol gun      2. Plunger/stirrer      3. Lactometer      4. Thermometer      5. Centrifuge      6. Clarifier      7. Lovi bond Comparator      8. Ethanol      9. Resazurin solution      10. Antibiotic test kit      11. Aflatoxin test kit      12. Phenolphthalein Indicator      13. Sodium hydroxide      14. A.I   3. Raw milk quality Tests      1. Organoleptic      2. Clot On Boiling      3. Compositional test      4. Resazurin test      5. Alcohol test      6. Lactometer test      7. Antibiotic test      8. pH test   4. Receiving Raw milk      1. Raw milk measurement      2. Raw milk Quality inferences   5. Raw Milk Record keeping      1. Factors to consider in record keeping         1. Quantity         2. Quality         3. Supplier         4. Date and time   6. Cleaning and sanitation of Grading tools and Equipment’s      1. Materials and Equipment’s for cleaning      2. Personal Protective Equipment’s      3. Methods of cleaning      4. Cleaning procedures   7. Smart and Sustainable Systems      1. AI application      2. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * Third party report |
| 1. Bulk raw milk | * 1. Concepts of Bulking      1. Definition of terms      2. Bulking Equipment’s         1. Vat         2. Cans         3. Silo tanks      3. Bulking Methods         1. Batch bulking         2. Continuous bulking   2. Bulking Records Documentation      1. Quantity of raw milk received      2. Quality parameters      3. Farmer records   3. Hygiene and sanitation of bulking equipment      1. Cleaning materials, tools and equipment      2. Cleaning process      3. Sanitation methods   4. Smart and Sustainable Systems      1. AI application      2. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studie * Third party report |
| 1. Preserve raw milk | 1. Raw milk cooling parameters 2. Temperature    * 1. Time      2. Temperature-time controls   4.3 Raw milk cooling process  4.3.1 Definition of terms  4.3.2 Chilling methods   * + 1. Refrigeration   4.4 Monitoring of the cooling process   * + 1. Cooling time     2. Agitation     3. Temperatures   4.5 Evaluate chilling process | * Oral questions * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Dispatch Raw Milk | * 1. Raw milk quality analysis      1. Alcohol test      2. Lactometer test   2. Raw milk measurement      1. Raw Milk Record keeping      2. Record keeping   3. Cleaning and sanitation of chilling equipment   4. Raw milk stock | * Oral questions * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |

**Suggested Methods of Instruction**

* Demonstrations
* Group discussion
* Direct instruction
* Role playing

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 1:5 |
|  | Production Manuals |  | 5 | 1;5 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Projector |  | 1 | 1;25 |
|  | Assorted Flash Cards |  | 5 | 1;5 |
|  | Whiteboard |  | 1 | 1;25 |
|  | Rolls flip charts |  | 1 | 1;25 |
|  | Assorted color of whiteboard markers | For trainers Use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 1:25 |
|  | Workshop |  | 1 | 1:25 |
|  | Laboratory |  | 1 | 1:25 |
|  | Site/industry |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Ethanol |  | 1ltr | 1:5 |
|  | Resazurin solution |  | 10mls | 10:5 |
|  | Antibiotic test kit |  | 1 | 1;5 |
|  | Phenolphthalein Indicator |  | 10 mls | 10;5 |
|  | Sodium hydroxide |  | 500ml | 500mls:5 |
|  | Raw milk |  | 500mls | 500;5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Alcohol gun |  | 5 pcs | 1:5 |
|  | Lactometer |  | 5pcs | 1;5 |
|  | Thermometer |  | 1 pcs | 1:5 |
|  | Centrifuge |  | 5 pcs | 1:25 |
|  | Clarifier |  | 5pcs | 5:5 |
|  | Lovi bond Comparator |  | 1 pcs | 1:25 |
|  | Refrigerator/cold room |  | 1 pcs | 1:25 |
|  | Stop watch |  | 5pcs | 1:5 |

# FLUID MILK PROCESSING

**CODE: 0721 351 02A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Process Fluid Milk Products**

**UNIT DURATION:** 180 **Hours**

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician Level 4 to process fluid milk products. It involves processing Pasteurized milk, Ultra Heat-Treated milk and Extended Shelf-Life milk.

**Summary of Learning Outcomes**

By the end of this unit, the learner should be able to:

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Process pasteurized milk | **45** |
| 2. | Process ultra-high temperature milk | **45** |
| 3. | Process lactose free milk | **45** |
| 4. | Process milk substitutes products | **45** |
| **Total** | | **180** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Process pasteurized milk. | * 1. Pasteurized milk processing      1. Definition of pasteurization      2. Importance of pasteurization      3. Milk biosynthesis         1. Duct and milk secretory systems.         2. Hormonal control in milk synthesis and let-down      4. Anti-microbial systems in raw milk   2. Raw milk Sampling      1. Definition of term         1. Sample         2. Sampling         3. population      2. Sampling methods      3. Sampling procedures   3. Raw milk quality Analysis      1. Raw milk quality tests         1. Organoleptic         2. Clot On Boiling         3. Compositional test         4. Resazurin test         5. Alcohol test         6. Lactometer test         7. Antibiotic test         8. pH test   4. Pasteurization equipment and materials      1. Pasteurization Materials         1. Raw milk         2. Milk powder         3. Anhydrous fat         4. Packaging material      2. Pasteurization tools and equipment         1. Blender         2. Cream separator         3. Homogenizer         4. Pasteurizer         5. Milk silo tank         6. Packaging machine         7. A.I   5. Milk standardization      1. Definition of standardization      2. Determination of milk composition         1. Gerber fat test      3. Standardization methods         1. Pearson’s square method         2. Mass Balance method      4. Importance of standardization   6. Milk homogenization      1. Definition of homogenization      2. Homogenization equipment      3. Homogenization principles      4. Factors influencing homogenization      5. Homogenisation efficiency      6. Importance of Homogenization   7. Pasteurization process      1. Pasteurization equipment      2. Principles of milk pasteurization      3. Types of Pasteurization      4. Pasteurization methods   8. Evaluation of pasteurization efficiency      1. Phosphatase test      2. Coliform test   9. Shelf life of pasteurised milk      1. Factors influencing Shelf life   10. Packaging of Fluid milk products       1. Packaging machines       2. Packaging materials       3. Packaging methods          1. Aseptic packaging          2. Hermetic packaging       4. Importance of Packaging   11. Storage of fluid milk products       1. Storage requirements       2. Storage principles       3. Storage equipment   12. Hygiene and sanitation of pasteurization equipment       1. Cleaning procedures       2. Sanitization methods   13. Waste disposal       1. Methods of waste disposal       2. Importance of waste disposal   14. Record-keeping       1. Types of records       2. Importance   15. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Produce UHT milk | * 1. UHT Milk Processing      1. Terminologies used in thermal processing         1. Decimal reduction time (D-value)         2. The Z-value         3. Thermal Death Time (TDT)      2. Heating methods         1. Sterilization         2. UHT   2. Sterilization equipment and materials      1. Sterilization Materials         1. Raw milk         2. Milk powder         3. Anhydrous fat         4. Packaging material      2. Tool and equipment         1. Blender         2. Cream separator         3. Homogenizer         4. Pasteurizer         5. Milk silo tank         6. Packaging machine         7. A.I   3. Heat Sterilization process      1. Definition of terms      2. Sterilization conditions      3. Sterilization process      4. Importance /advantages      5. Effect of sterilization on milk quality   4. Evaluation of sterilization efficiency      1. Peroxidase      2. Catalase test   5. Packaging of UHT milk products      1. Definition of terms      2. Packaging machines      3. Packaging materials      4. Packaging methods         1. Aseptic packaging         2. Hermetic packaging      5. Importance of Packaging   6. Storage of UHT milk products      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   7. Hygiene and sanitation of pasteurization equipment      1. Cleaning procedures      2. Sanitization methods   8. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   9. Record keeping      1. Types of records      2. Importance   10. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Process lactose free milk | * 1. Lactose Free milk production      1. Definition of terms         1. Enzyme treatment         2. Enzyme   2. Lactose free milk processing equipment and materials      1. Materials         1. Pasteurized milk         2. Milk powder         3. Lactase enzyme         4. Packaging material      2. Tool and Equipment         1. Blender         2. Cream separator         3. Homogenizer         4. Pasteurizer         5. Milk silo tank         6. Packaging machine         7. A.I   3. Lactase –enzyme treatment      1. Concept of enzyme treatment      2. Process of enzyme treatment      3. Importance   4. Packaging of lactose free milk products      1. Definition of terms      2. Packaging machines      3. Packaging materials      4. Packaging methods         1. Aseptic packaging         2. Hermetic packaging      5. Importance of Packaging   5. Storage of lactose free milk products      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   6. Hygiene and sanitation of pasteurization equipment      1. Cleaning procedures      2. Sanitization methods   7. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   8. Record keeping      1. Types of records      2. Importance Record -keeping   9. Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Third party report * Individual/group assignments * Case Studies |
| 1. Process milk substitutes products | * 1. Types of milk substitute products      1. Soy Milk      2. Almond Milk      3. Coconut Milk      4. Oat Milk      5. Rice Milk      6. Cashew Milk   2. Milk substitute processing materials      1. Base ingredients   3. Milk substitute processing      1. Heat treatment   4. Packaging of milk substitute products      1. Definition of terms      2. Packaging machines      3. Packaging materials      4. Packaging methods         1. Aseptic packaging         2. Hermetic packaging         3. Importance of Packaging   5. Storage of milk substitute products      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   6. Hygiene and sanitation of processing equipment      1. Cleaning procedures      2. Sanitization methods   7. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   8. Record keeping      1. Types of records      2. Importance Record -keeping   9. Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal      4. Sustainable packaging options      5. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Third party report * Individual/group assignments * Case Studies |

**Suggested Methods of Instruction**

* Demonstrations
* Group discussion
* Direct instruction
* Role Play

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 1:5 |
|  | Production Manuals |  | 5 | 1;5 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Projector |  | 1 | 1;25 |
|  | Assorted Flash Cards |  | 5 | 1;5 |
|  | Whiteboard |  | 1 | 1;25 |
|  | Rolls flip charts |  | 1 | 1;25 |
|  | Assorted color of whiteboard markers | For trainers Use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 1:25 |
|  | Workshop |  | 1 | 1:25 |
|  | Laboratory |  | 1 | 1:25 |
|  | Site/industry |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Raw milk |  | 1ltr | 1:5 |
|  | Pasteurized milk |  | 10mls | 10:5 |
|  | Lactase enzyme |  | 1 | 1;5 |
|  | Flavour |  | 10 mls | 10;5 |
|  | Skimmed milk powder |  | 500ml | 500mls:5 |
|  | Live culture |  | - | - |
| **D** | **Tools and Equipment** |  |  |  |
|  | Alcohol gun |  | 5 pcs | 1:5 |
|  | Lactometer |  | 5pcs | 1;5 |
|  | Thermometer |  | 1 pcs | 1:5 |
|  | Centrifuge |  | 5 pcs | 1:25 |
|  | Clarifier |  | 5pcs | 5:5 |
|  | Lovi bond Comparator |  | 1 pcs | 1:25 |
|  | Refrigerator/cold room |  | 1 pcs | 1:25 |
|  | Stop watch |  | 5pcs | 1:5 |

# FERMENTED MILK PRODUCTS PROCESSING

**ISCED UNIT CODE: 0721 351 03A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Process Fermented Milk Products**

**UNIT DURATION:** 180 Hours

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician Level 6to process fermented milk products. It involves producing Yoghurt, Cultured and Kefir milk products.

**Summary of Learning Outcomes**

By the end of this unit, the learner should be able to:

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Produce yoghurt | **80** |
| 2. | Produce cultured milk | **50** |
| 3. | Produce kefir milk | **50** |
| **Total** | |  |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Produce Yoghurt. | * 1. Yoghurt Production concepts      1. Definition of terms         1. Inoculation         2. Fermentation         3. Incubation   2. Dairy Culture      1. Qualities/characteristics      2. Storage conditions      3. Factors that affect starter culture viability   3. Types of fermentation      1. Aerobic, anaerobic, Uncontrolled, Controlled, Homo fermentation, Hetero fermentation, Lactic acid fermentation, Propionic acid fermentation, Alcohol fermentation, Citric acid fermentation, Coliform gassy fermentation, Butyric acid fermentation   4. Types of yoghurt      1. Set yoghurt      2. Stirred Yoghurt   5. Raw milk Sampling      1. Definition of terms      2. Sampling methods      3. Sampling procedures   6. Raw milk quality Analysis      1. Raw milk quality tests      2. Organoleptic      3. Clot On Boiling      4. Compositional test      5. Resazurin test      6. Alcohol test      7. Lactometer test      8. Antibiotic test      9. pH test   7. Milk additives      1. Types (Sugar or sweetener; Stabilisers; Milk powder, Flavour, Colour)      2. Role of milk additives   8. Yoghurt making tools, equipment and materials      1. Pasteurization Materials         1. Raw milk         2. Milk powder         3. Sugar         4. Thermophilic live culture         5. Packaging material         6. Flavour         7. Food colour      2. Yoghurt making equipment         1. Clarifier         2. Homogenizer         3. Pasteurizer         4. Incubator/fermentation tank         5. Packaging machine         6. A.I   9. Yoghurt making process      1. Pre-warming      2. Milk standardization      3. Homogenization      4. Pasteurization      5. Cooling      6. Inoculation      7. Incubation      8. Breaking the coagulum      9. Addition of flavour and colour      10. Heat treatment of yoghurt   10. Quality evaluation of yoghurt       1. Sensory evaluation          1. Principles of sensory evaluation          2. Judging and grading       2. Shelf life       3. Yield   11. Packaging of Finished yoghurt product       1. Packaging machines       2. Packaging materials       3. Packaging methods          1. Aseptic packaging          2. Hermetic packaging       4. Importance of Packaging   12. Storage of yoghurt       1. Definition of terms       2. Storage conditions       3. Storage principles; FIFO       4. Storage equipment   13. Hygiene and sanitation of yoghurt processing equipment       1. Cleaning procedures       2. Sanitization methods   14. Waste disposal       1. Methods of waste disposal       2. Importance of waste disposal   15. Record-keeping       1. Types of records       2. Importance   16. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Produce cultured milk | * 1. Production of Cultured Milk      1. Definition of terms         1. Mesophilic Culture         2. Cultured Milk   2. Cultured milk processing equipment and materials      1. Cultured milk Materials         1. Raw milk         2. Milk powder         3. Mesophilic live culture         4. Packaging material      2. Cultured Milk equipment         1. Blender         2. Cream separator         3. Homogenizer         4. Pasteurizer         5. Milk silo tank         6. Packaging machine   3. Cultured milk processing      1. Raw milk standardization      2. Pasteurization      3. Cooling      4. Inoculation      5. Incubation      6. Breaking coagulum   4. Milk homogenization      1. Definition of terms      2. Homogenization equipment      3. Homogenization principles      4. Factors influencing homogenization   5. Quality evaluation of cultured milk product      1. Sensory Evaluation         1. Principles of sensory evaluation         2. Judging and grading      2. Yield      3. Shelf life   6. Packaging of cultured milk products      1. Packaging machines      2. Packaging materials      3. Packaging methods         1. Aseptic packaging         2. Hermetic packaging      4. Importance of Packaging      5. Sustainable packaging options   7. Storage of Cultured milk product      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   8. Hygiene and sanitation of cultured milk processing equipment      1. Cleaning procedures      2. Sanitization methods   9. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   10. Record keeping       1. Types of records       2. Importance   11. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Produce kefir | * 1. Kefir Production      1. Definition of Kefir      2. Characteristics of kefir   2. Kefir processing equipment and materials      1. Kefir Processing Materials         1. Raw milk         2. Kefir grains         3. Packaging material      2. Kefir Processing equipment         1. Homogenizer         2. Clarifier         3. Pasteurizer         4. Milk silo tank         5. Packaging machine   3. Kefir processing      1. Standardization      2. Pasteurization      3. Cooling      4. Inoculation      5. Incubation      6. Separation   4. Packaging of kefir milk product      1. Packaging machines      2. Packaging materials      3. Packaging methods         1. Aseptic packaging         2. Hermetic packaging   5. Importance of Packaging Storage of kefir milk product      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   6. Hygiene and sanitation of kefir processing equipment      1. Cleaning procedures      2. Sanitization methods   7. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   8. Record keeping      1. Types of records      2. Importance Record -keeping   9. 1.1 Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal   10. Apply smart and sustainable systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | •Written tests  •Interviews/ Oral questions  •Practical reports  •Individual/group assignments  Third party report  •Case Studies |

**Suggested Methods of Instruction**

* Demonstrations
* Group discussion
* Direct instruction
* Role play

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 1:5 |
|  | Production Manuals |  | 5 | 1;5 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Projector |  | 1 | 1;25 |
|  | Assorted Flash Cards |  | 5 | 1;5 |
|  | Whiteboard |  | 1 | 1;25 |
|  | Rolls flip charts |  | 1 | 1;25 |
|  | Assorted color of whiteboard markers | For trainers Use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 1:25 |
|  | Workshop |  | 1 | 1:25 |
|  | Laboratory |  | 1 | 1:25 |
|  | Site/industry |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Raw milk |  | 1ltr | 1:5 |
|  | Pasteurized Milk |  | 1ltr | 1:5 |
|  | Mesophilic culture |  |  |  |
|  | Thermophilic culture |  |  |  |
|  | Kefir |  |  |  |
|  | Ethanol |  | 10 ml | 10:5 |
|  | Resazurin solution |  | - | - |
|  | Antibiotic test kit |  | - | - |
| **D** | **Tools and Equipment** |  |  |  |
|  | Alcohol gun |  | 5 pcs | 1:5 |
|  | Lactometer |  | 5pcs | 1;5 |
|  | Thermometer |  | 5 pcs | 1:5 |
|  | Centrifuge |  | 1 pcs | 1:25 |
|  | Clarifier |  | 1pcs | 1:25 |
|  | Pasteurizer |  | 1 pcs | 1:25 |
|  | Homogenizer |  | 1 pcs | 1:25 |
|  | Lovi bond Comparator |  | 1pcs | 1:25 |

# FAT BASED MILK PRODUCTS PROCESSING

**UNIT CODE: 0721 351 04**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Process Fat Based Milk Products**

**UNIT DURATION:** 180Hours

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technologist level 4 to process fat-based milk products. It involves producing dairy cream, dairy Butter, dairy Ghee and dairy Ice Cream.

**Summary of Learning Outcomes**

By the end of this unit, the learner should be able to:

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Produce dairy cream | **45** |
| 2. | Produce dairy butter | **45** |
| 3. | Produce dairy ghee | **45** |
| 4. | Produce dairy ice cream | **45** |
| **Total** | | **180** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Produce Dairy Cream | **Theory**   * 1. Dairy Cream manufacturing      1. Definition of dairy cream      2. Characteristics of dairy cream      3. Types of cream   2. Dairy Cream equipment and materials      1. Materials         1. Raw milk         2. Milk powder         3. Cream         4. live culture         5. Packaging material         6. Stabilizer         7. emulsifier      2. Equipment         1. Clarifier         2. Centrifuge         3. Homogenizer         4. Pasteurizer         5. Incubator/fermentation tank         6. Packaging machine   3. Dairy Cream processing      1. Pre-warming      2. Separation      3. Neutralization      4. Cream standardization      5. Homogenization      6. Pasteurization      7. Ripening      8. Cooling      9. Ageing   4. Quality evaluation of Dairy cream      1. Sensory evaluation      2. Defects      3. Overrun      4. Shelf-life determination   5. Packaging of Finished Dairy Cream product      1. Packaging machines      2. Packaging materials      3. Importance of Packaging   6. Storage of Dairy Cream      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   7. Hygiene and sanitation of Dairy Cream processing equipment      1. Cleaning procedures      2. Sanitization methods   8. Waste disposal      1. Methods of waste disposal      2. Importance of waste disposal   9. Record-keeping      1. Types of records      2. Importance   10. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Practical * Written tests * Interviews/ Oral questions * Individual/group assignments * Case Studies * Third Party report |
| 1. Produce butter | * 1. Butter Production      1. Definition of terms         1. butter         2. butter churning      2. Types of butter   2. Butter processing equipment and materials      1. Materials         1. Cream         2. Salt         3. Live culture         4. Cold room/refrigerator         5. Packaging material      2. Cultured Milk equipment         1. Vat         2. Butter churner         3. Continuous butter maker   3. Butter processing      1. Methods of butter processing         1. Batch method         2. Continuous method      2. Butter processing         1. Loading         2. Churning         3. Draining         4. Washing         5. Salting         6. working   4. Quality evaluation in butter      1. Sensory Evaluation      2. Yield      3. Shelf –life determination   5. Packaging of Butter      1. Packaging machines      2. Packaging materials; eco-friendly packaging      3. Importance of Packaging   6. Storage of Butter      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   7. Hygiene and sanitation of butter processing equipment      1. Cleaning procedures      2. Sanitization methods   8. Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Practical * Interviews/ Oral questions * Written assessments * Practical reports * Individual/group assignments * Case Studies * Third party report |
| 1. Produce Anhydrous Milk Fats | * 1. Ghee processing      1. Definition of ghee      2. Characteristics f anhydrous milk fat   2. Anhydrous milk Fat processing equipment and materials      1. Materials         1. Cream         2. Butter         3. Packaging material      2. Anhydrous Milk fat equipment         1. Vat   3. Ghee processing      1. Methods of ghee processing         1. Direct method         2. Indirect method   4. Quality evaluation of ghee      1. Sensory Evaluation      2. Yield   5. Packaging of Anhydrous milk fat products      1. Packaging machines      2. Packaging materials      3. Importance of Packaging   6. AI in ghee making      1. Roboting      2. Sustainable packaging options   7. Storage of Anhydrous milk fat product      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   8. Hygiene and sanitation of ghee processing equipment      1. Cleaning procedures      2. Sanitization methods   9. Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Practical * Written tests * Interviews/ Oral questions * Individual/group assignments * Case Studies * Third party report |
| 1. Produce Ice Cream | * 1. Ice cream production      1. Definition of terms         1. ice cream         2. ice cream overrun         3. Hardening      2. Characteristics of ice cream      3. Classification of ice cream   2. Ice cream processing equipment and materials      1. Ice-cream Processing Materials         1. Dairy ingredients         2. Non- dairy ingredients         3. Packaging material      2. Ice-cream Processing equipment         1. Homogenizer         2. Clarifier         3. Pasteurizer         4. Ice Cream Freezer         5. Ageing Tank         6. Blender         7. Refrigerator         8. Packaging machine         9. A.I   3. Classification of Ice Cream   4. Ice Cream Processing      1. Selection of Ingredients      2. Formulation of Ice cream mix      3. Blending      4. Pasteurization      5. Homogenization      6. Cooling      7. Ageing      8. Freezing      9. Hardening   5. Quality evaluation of ice cream      1. Sensory Evaluation      2. Yield      3. Overrun      4. Shelf-life determination   6. Packaging of ice cream      1. Packaging machines      2. Packaging materials; eco –friendly packaging      3. Importance of Packaging   7. Storage of Ice cream milk product      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   8. Apply Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Practical * Written tests * Interviews/ Oral questions * Individual/group assignments * Case Studies * Third party report |

**Suggested Methods of Instruction**

* Practical
* Demonstrations
* Group discussion
* Direct instruction
* Role playing

**Recommended Resources for 25 Trainees Tools and Equipment**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** |  |  |  |
|  | Textbooks |  | 5 pcs | 1:5 |
|  | Production Manuals |  | 5 | 1;5 |
|  | PowerPoint presentations | For trainer’s use |  |  |
|  | Projector |  | 1 | 1;25 |
|  | Assorted Flash Cards |  | 5 | 1;5 |
|  | Whiteboard |  | 1 | 1;25 |
|  | Rolls flip charts |  | 1 | 1;25 |
|  | Assorted color of whiteboard markers | For trainers Use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
|  | Lecture/theory room |  | 1 | 1:25 |
|  | Workshop |  | 1 | 1:25 |
|  | Laboratory |  | 1 | 1:25 |
|  | Site/industry |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Stabilizers |  | 1ltr | 1:5 |
|  | Emulsifier |  | 10mls | 10:5 |
|  | Sweeteners |  | 1 | 1;5 |
|  | Cream |  | - | - |
|  | Butter |  | 1ltr | 1:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Alcohol gun |  | 5 pcs | 1:5 |
|  | Lactometer |  | 5pcs | 1;5 |
|  | Thermometer |  | 5 pcs | 1:5 |
|  | Centrifuge |  | 1 pcs | 1:25 |
|  | Clarifier |  | 1pcs | 5:25 |
|  | Pasteurizer |  | 1 pcs | 1:25 |
|  | Homogenizer |  | 1 pcs | 1:25 |
|  | Lovi bond Comparator |  | 1pcs | 1:25 |
|  | Ageing tank |  | 1pcs | 1:25 |
|  | Ice Cream Freezer |  | 1pcs | 1:25 |