

**REPUBLIC OF KENYA**

**COMPETENCY-BASED MODULAR CURRICULUM**

**FOR**

**DAIRY PLANT TECHNOLOGY**

**KNQF LEVEL: 5**

**PROGRAMME ISCED CODE: 0721 454A**

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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).

The 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.

CHAIR OF 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**



# ACRONYMS

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

# COURSE OVERVIEW

Dairy Plant technology Level 5 qualification consists of competencies that an individual must possess to manage a dairy plant. It involves handling raw milk, processing fluid, fermented, and fat-based milk products for Dairy Processing, fundamentals of dairy technology, dairy production principles processing, apply dairy microbiology principles, apply dairy chemistry principles, dairy products quality control,

**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 |
| **MODULE III** | | | |
| 0417 441 05A | Work Ethics and Practices | 40 | 4 |
| 0721 551 06A | Fundamentals of Dairy Technology | 120 | 12 |
| 0721 451 07A | Dairy Production Principles | 120 | 12 |
| 0721 451 08A | Cheese Product Processing | 200 | 20 |
| **MODULE IV** | | | |
| 0031 441 09A | Communication Skills | 40 | 4 |
| 0721 551 10A | Principles of Dairy Microbiology | 120 | 12 |
| 0721 551 11A | Principles of Dairy Chemistry | 120 | 12 |
| 0721 551 12A | Dairy Products Quality Control | 120 | 12 |
| **Sub Total** | |  |  |
| **Industry Training** | | **480** | **48** |
| **GRAND TOTAL** | | **2060** | **206** |

The total duration of the course is **2060** hours inclusive of **480 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) mean grade D (D-Plain)

**Or**

1. Certificate in Dairy Processing Level 4

**Or**

1. Equivalent qualifications as determined by TVETA.

**Trainer Qualifications**

Qualifications of a trainer for Dairy Plant Management Level 5 include:

1. Possession of a higher qualification than Dairy Plant Management Level 5 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 480 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.

.

**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. During summative assessment basic and common units shall be integrated in the core units.
3. Summative assessment shall involve practical assessment focusing more on critical aspects of the respective unit of competency.
4. Theoretical and practical weighting for each unit of learning shall be as follows:
5. 10:90 for module 1 and module 2.
6. 30:70 for module 3 and module 4.
7. Theoretical (written/oral) assessment shall have formative and summative assessments weighted at 60% and 40% respectively in the overall unit of learning score
8. Assessment performance rating for each unit of competency shall be as follows:

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

g) 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 Plant Technology Level 5, 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 5 to handle raw milk. It involves procuring, grading, bulking preserving 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 | **30** |
| 3. | Bulk raw milk | **30** |
| 4. | Preserve Raw milk | **30** |
| 5. | Dispatch of Milk | **30** |
| **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         1. Milk collection sites         2. Milk collection routes         3. Milk collection systems         4. Milk market prices         5. 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 5 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** | **Time (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** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Process pasteurized milk. | **Theory**   * 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

**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 5 to 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** | | **180** |

|  |  |  |
| --- | --- | --- |
| **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 5 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 |

**WORK ETHICS AND PRACTICES**

**UNIT CODE:** 0417 441 05A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply work ethics and practices.**

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers competencies required to demonstrate work ethics and practices. It involves the ability to: conduct self-management, promote ethical work practices and values, promote teamwork, manage workplace conflicts, maintain professional and personal development, apply problem-solving, and promote customer care.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply Self-Management Skills | **10** |
| 2. | Promote Ethical Practices and Values | **4** |
|  | Promote Teamwork | **10** |
| 3. | Maintain Professional and Personal Development | **10** |
| 4. | Apply Problem-Solving Skills | **4** |
|  | Promote Customer Care. | **2** |
| **Total** | | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply Self-Management Skills | 1. Self-awareness 2. Formulating personal vision, mission, and goals 3. Healthy lifestyle practices 4. Strategies for overcoming work challenges 5. Emotional intelligence 6. Coping with Work Stress. 7. Assertiveness versus aggressiveness and passiveness 8. Developing and maintaining high self-esteem 9. Developing and maintaining positive self-image 10. Time management 11. Setting performance targets 12. Monitoring and evaluating performance targets | * Written assessment * Third party reports * Portfolio of evidence * Project * Practical * Oral assessment |
| 1. Promote Ethical Work Practices And Values | 1. Integrity 2. Core Values, ethics and beliefs 3. Patriotism 4. Professionalism 5. Organizational codes of conduct 6. Industry policies and procedures | * Written assessment * Third party reports * Portfolio of evidence * Project * Practical * Oral assessment |
| 1. Promote Teamwork | 1. Types of teams 2. Team building 3. Individual responsibilities in a team 4. Determination of team roles and objectives 5. Team parameters and relationships 6. Benefits of teamwork 7. Qualities of a team player 8. Leading a team 9. Team performance and evaluation 10. Conflicts and conflict resolution 11. Gender and diversity mainstreaming 12. Developing Healthy workplace relationships 13. Adaptability and flexibility 14. Coaching and mentoring skills | * Written assessment * Third party reports * Portfolio of evidence * Project * Practical * Oral assessment |
| 1. Maintain Professional and Personal Development | 1. Personal vs professional development and growth 2. Avenues for professional growth 3. Recognizing career advancement 4. Training and career opportunities 5. Assessing training needs 6. Mobilizing training resources 7. Licenses and certifications for professional growth and development 8. Pursuing personal and organizational goals 9. Managing work priorities and commitments 10. Dynamism and on-the-job learning | * Project * Practical * Written assessment * Third party reports * Portfolio of evidence * Oral assessment |
| 1. Apply Problem-Solving Skills | 1. Causes of problems 2. Methods of solving problems 3. Problem-solving process 4. Decision making 5. Creative thinking and critical thinking process in development of innovative and practical solutions | * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |
| 1. Promote Customer Care | 1. Identifying customer needs 2. Qualities of good customer service 3. Customer feedback methods 4. Resolving customer concerns 5. Customer outreach programs 6. Customer retention | * Written assessment * Oral assessment * Third party reports * Portfolio of evidence * Project * Practical |

**Suggested Methods of Instruction**

* Practical
* Demonstrations
* Project
* Group discussion
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/no.** | **Category/item** | **Description/specification** | **Quantity** | **Recommended ratio(item: trainee)** |
| 1. **Learning materials** | | | | |
|  | Video clips | Digital types | 25 | 1:25 |
|  | Audio tapes and CDs | Digital types | 25 | 1:25 |
|  | Flashcards | Educational flash cards | 5 | 1:5 |
|  | Flip charts | Educational flip charts | 5 | 1:5 |
| 1. **Learning facilities and infrastructure** | | | | |
|  | Lecture/theory room | 72m2 | 1 | 1:25 |
|  | Whiteboard | 4 feet by 8 feet | 1 | 1:25 |
|  | Projector | LCD High resolution | 1 | 1:25 |
|  | Computers | RAM: 8GB | 25 | 1:25 |
|  | Printers | Ink Jet | 2 | 1:13 |
|  | Smart TV | LCD | 1 | 1:25 |
| 1. **Consumable materials** | | | | |
|  | Stationary materials | Pens, pencils, papers | Enough for 25 | 1:25 |
|  | Assorted whiteboard markers | Non-permanent | Enough for 25 | 1:25 |

# FUNDAMENTALS OF DAIRY TECHNOLOGY

**UNIT CODE**: **0721 441 06A**

**UNIT DURATION:** 120Hours

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Fundamentals of Dairy Technology**

**Unit Description**

This unit specifies the competencies required by a Dairy Processing technician level 5 to apply fundamentals of dairy technology. It involves application milk composition and dairy microbiology knowledge and also dairy equipment operations principles

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | **30** | **30** |
| 2. | **40** | **40** |
| 3. | **50** | **50** |
| **Total** | | **120** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Apply Milk Composition Knowledge | * 1. Milk Composition      1. Definition of terms      2. Milk Composition      3. Factors affecting milk composition         1. Management Factors         2. Biological Factors         3. Milk Adulteration   2. Physical Properties of milk      1. Colour      2. Taste      3. Density      4. Viscosity      5. Freezing point   3. Chemical Properties      1. pH      2. Enzymes      3. Emulsions      4. Heat sensitivity   4. Smart and Sustainable Systems      1. AI application      2. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Individual/group assignments |
| 1. Apply dairy microbiology knowledge | 1. Introduction to Microbiology    * 1. Definition of terms      2. Role of microbiology in dairy processing         1. Milk Preservation         2. Milk safety         3. Fermentation         4. Waste management      3. Classification of Micro organism         1. Bacteria         2. Moulds         3. Yeast    1. Microbiological apparatus       1. Microscope       2. Incubators       3. Autoclave    2. Microscopy Procedures       1. Sampling       2. Slide Preparation       3. Staining       4. Culturing       5. enumeration       6. Observation       7. Documentation    3. Hygiene and sanitation       1. Sanitation procedures    4. Waste Management       1. Definition of terms       2. Waste segregation       3. Handling of bio hazards       4. Methods of waste management       5. Importance of waste management    5. Smart and Sustainable Systems       1. AI application       2. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies |
| 1. Apply Dairy equipment operational Principles | * 1. Dairy Equipment and Machinery      1. Definition of terms      2. Operational parameters      3. Operational Processes      4. Maintenance      5. Operations principles and maintenance of dairy processing equipment and machinery      6. Types of Dairy Equipment’s and Machinery         1. Milk separator         2. Milk homogenizer         3. Heat exchanger         4. Vats         5. Milk coolers         6. Milk Pumps         7. Milk filters         8. Butter churn         9. Ice cream freezer   2. Packaging equipment Operations and maintenance of Dairy Utilities and services      1. Steam boiler      2. Electricity      3. Water      4. Waste water system      5. Refrigeration equipment   3. Smart and Sustainable Systems      1. AI application      2. Sustainable waste disposal      3. Eco friendly dairy plant utilities | * Written tests * Practical * Interviews/ Oral questions * Individual/group assignments * Case Studies |

**Suggested Methods of Instruction**

* Demonstrations
* Role playing
* Group discussion
* Direct instruction
* Question and Answer
* Snow balling

**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 colour 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 |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Iodine |  |  | 1:5 |
|  | Crystal violet |  | 25 pcs | 1:1 |
|  | Safranin |  |  |  |
|  | Ethanol/acetone |  |  |  |
|  | Iodine |  |  |  |
|  | Milk /product samples |  | 500ml | 500mls:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Microscope |  | 5 pcs | 1:5 |
|  | Microscope slides |  | 50 pcs | 2:1 |
|  | Heat exchanger |  | 1 pcs | 1:25 |
|  | Vats |  | 5 pcs | 1:5 |
|  | Refrigeration Equipment’s |  | 1 pcs | 1:25 |
|  | Milk separator |  | 1 pcs | 1:25 |
|  | Milk homogenizer |  | 1 pcs | 1:25 |
|  | Heat exchanger |  | 1 pcs | 1:25 |
|  | Vats |  | 1 pcs | 1:25 |
|  | Milk coolers |  | 1 pcs | 1:25 |
|  | Milk Pumps |  | 1 pcs | 1:25 |
|  | Milk filters |  | 1 pcs | 1:25 |
|  | Butter churn |  | 1 pcs | 1:25 |
|  | Ice cream freezer |  | 1 pcs | 1:25 |
|  | Packaging equipment |  | 1 pcs | 1:25 |

# PRINCIPLES OF DAIRY PRODUCTION

**UNIT CODE: 0721 451 07A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Dairy Production Principles**

**Duration of Unit:** 120Hours

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician Level 5 to apply dairy production principles. It involves breeding dairy cattle, applying principles of animal nutrition, applying hygienic milk production practices and performing dairy practices

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply breeding principles | **20** |
| 2 | Apply dairy animal structures principles | **30** |
| 3. | Apply animal nutrition principles | **30** |
| 4. | Apply hygienic milk production practices | **20** |
| 5. | Perform dairy routine practices | **20** |
| **Total** | | **120** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Breed dairy cattle | **Theory**   * 1. Dairy Animal Breeds      1. Definition of terms  1. Breeding    * + 1. Inbreeding        2. Cross breeding        3. Out crossing        4. Insemination      1. Importance of dairy breeding      2. Types of animal breeds         1. Friesian         2. Ayrshire         3. Guernsey         4. Jersey         5. Red poll         6. Sahiwal         7. Fleckvieh      3. Characteristics of animal breeds         1. Colour         2. Shape         3. Productivity         4. lactation period         5. vigour    1. Breeding management tools, equipment and materials       1. Types of dairy breeding tools equipment and materials          1. Animal identification methods          2. Animal pregnancy testing kits          3. Semen collection kits          4. Artificial insemination kit       2. Uses of dairy tools, equipment and Materials       3. Maintenance of tools, equipment and machinery          1. Regular Cleaning          2. Routine Maintenance    2. Breeding       1. Types of breeding       2. Breeding procedures    3. Record keeping       1. Breeding records    4. Artificial Intelligence       1. Internet of things | * Written tests * Third party report * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies |
| 1. Apply Principles of Animal Nutrition | 1. Principles of Animal Nutrition    * 1. Definition of terms         1. Nutrients         2. Nutrition         3. Feedstuff         4. Fodder         5. Concentrates         6. Roughage         7. Feed additives      2. Carbohydrates      3. Proteins      4. Lipids      5. Vitamins      6. Minerals      7. Water 2. Feed formulation tools, equipment and Materials    * 1. PPES      2. Feed mixers      3. Calculators      4. Computers      5. Grinders      6. Pelleting machines      7. Feed analysis equipment      8. Molasses      9. Pollard      10. Maize bran      11. Cotton seed cake      12. Sunflower seed cake      13. Dairy premix      14. Dicalcium phosphate (DCP)      15. Artificial Intelligent 3. Dairy Animal Rations    * 1. Maintenance rations      2. Production rations      3. Weaning rations      4. Balanced rations 4. Animal feed conservation    * 1. Silage      2. Hay      3. Standing hay 5. Feed waste management    * 1. Bio- gas      2. Composting      3. Waste water treatment      4. Recycling    1. Smart and Sustainable Systems       1. AI application       2. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Apply Hygienic Milk Production Practices | 1. Tools and Equipment and Materials    * 1. Milking churn      2. Milking bucket      3. Lactometer test      4. Udder towel      5. Milking salve      6. California Mastitis test      7. Weighing scale      8. Teat dip      9. Milk strainer      10. Milking Parlour      11. A.I 2. HygienePractices    * 1. Handwashing      2. Cleaning and drying of the udder      3. Cleaning and sanitization of equipment      4. Environmental hygiene         1. Clean beddings 3. Milking    * 1. Milking procedure      2. Milking techniques      3. Hand milking      4. Machine milking      5. Milk tests         1. Organoleptic         2. Lactometer         3. Alcohol         4. Clot on boiling 4. Milk storage    * 1. Storage conditions      2. Storage equipment 5. Record keeping    * 1. Health records      2. Production records    1. Smart and Sustainable Systems       1. AI application       2. Sustainable waste disposal | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party reports |
| 1. Perform Dairy Practices | 1. Dairy Animal identification    * 1. Ear tags      2. Ear notching      3. Tattooing      4. Collar      5. Branding 2. Routine practices    * 1. Culling      2. Dehorning and disbudding      3. Hooves trimming      4. Feeding      5. Cleaning 3. Disease Control    * 1. Quarantine and isolation      2. Embargo      3. Vaccination      4. Spraying      5. Deworming      6. Fencing      7. Disinfection      8. Clean water      9. Footbath 4. Smart and Sustainable Systems    * 1. AI application      2. Sustainable waste disposal | * Written tests * Reflection papers * Interviews/ Oral questions * Practical * Individual/group assignments * Third party reports * Case Studies |
| 5. Apply dairy animal structures principles | 1. Types of farm structures    * 1. Milking parlour      2. Cattle sheds      3. Zero grazing unit      4. Calf pens      5. Hay barn      6. Silos      7. Holding crush      8. Spray race      9. Plunge dip      10. Stores      11. Watering troughs      12. Feeding troughs      13. Fences 2. Factors considered in siting farm structure 3. Factors considered in selection of tools &equipment 4. Factors considered in selection of construction material & supplies 5. Maintenance of Dairy animal structures 6. Waste is management 7. Documentation 8. Farm records |  |

**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** |  |  |  |
|  | Molasses |  | 1ltr | 1:5 |
|  | Pollard |  | 2kgs | 2:5 |
|  | Maize bran |  | 2kgs | 2;5 |
|  | Cotton seed cake |  | 2kgs | 2;5 |
|  | Sunflower seed cake |  | 2kgs | 2;5 |
|  | Milk /product samples |  | 500ml | 500mls:5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Source of heat |  | 5 pcs | 1:5 |
|  | PPES |  | 1pcs | 1:1 |
|  | Feed mixers |  | 1 pcs | 1:25 |
|  | Calculators |  | 1 pcs | 1:25 |
|  | Computers |  | 5 pcs | 1:5 |
|  | Grinders |  | 1pcs | 1:25 |
|  | Pelleting machines |  | 1 pcs | 1:25 |
|  | Feed analysis equipment |  | 1pcs | 1:25 |
|  | Lactometer |  | 5pcs | 1:5 |
|  | Alcohol |  |  |  |
|  | Test tubes |  | 10 | 10;5 |
|  | Animal pregnancy testing kits |  | 1 | 1:5 |
|  | Semen collection kits |  | 1 | 1:5 |
|  | Milking churn |  | 1 | 1:5 |
|  | Milking bucket |  | 1 | 1:5 |
|  | Udder towel |  | 2 | 1:5 |
|  | Milking salve |  | 10g | 10g:5 |
|  | California Mastitis test |  | 1 | 1:5 |
|  | Hammer |  | 1 | 1:5 |
|  | Nails |  | 1 | 1:5 |
|  | Saw |  | 1 | 1:5 |
|  | Poles |  | 1 | 1:5 |
|  | Slasher |  | 1 | 1:5 |

# CHEESE PRODUCTS PROCESSING

**UNIT CODE: 0721 451 08A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Process Cheese Products**

**UNIT DURATION:** 200 Hours

**Unit Description**

This unit specifies the competencies required by Dairy Plant Technician Level 5 to process cheese products. It involves producing Cheddar, Gouda Paneer, Mozzarella cheese, Processed and Cream cheese.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Produce cheddar cheese | **40** |
| 2. | Produce gouda cheese | **30** |
| 3. | Produce paneer cheese | **30** |
| 4. | Produce mozzarella cheese | **30** |
|  | Produce processed cheese | **20** |
|  | Produce cream cheese | **20** |
|  | Produce Feta Cheese | **30** |
| **Total** | | **200** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Produce cheddar cheese | * 1. Cheddar cheese processing concepts      1. Definition of terms         1. Cheddar cheese         2. Ripening         3. Acidification         4. Ageing         5. Syneresis         6. Coagulation      2. Cheese Classification      3. Cheese milk quality requirements      4. Cheese milk pre-treatments      5. Cheese additives and ingredients      6. General cheese making operations principles      7. Characteristics of cheddar cheese   2. Raw milk Sampling      1. Definition of terms      2. Sampling methods      3. Sampling procedures   3. 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   4. Cheddar cheese making equipment and materials      1. Materials         1. Raw milk         2. Milk powder         3. Renin         4. lactic live culture         5. Packaging material         6. salt      2. Equipment         1. Pre-warming Cheese vat         2. Cheese press         3. Cheese mould         4. Knives         5. Cheese cloth         6. Miller         7. pH meter         8. Thermometer         9. Packaging machine   5. Cheddar Cheese making process      1. Milk standardization      2. Pasteurization      3. Innoculation of cheese milk      4. Acidification         1. Objectives of acidification         2. Use of rennet enzyme         3. Factors affecting rennet activity         4. Use of dilute acids      5. Coagulation      6. Cooking/scalding the Curd      7. Cutting the Curd      8. Draining Whey      9. Texturizing      10. Salting      11. Pressing and moulding of Curds   6. Ripening      1. Ripening conditions      2. Physical and chemical changes      3. Effect of Ripening on quality   7. Quality evaluation of Cheddar cheese      1. Sensory evaluation      2. Yield      3. Shelf-life   8. Packaging of Finished Cheddar Cheese product      1. Packaging machines      2. Packaging materials      3. Packaging methods         1. Aseptic packaging         2. Hermetic packaging      4. Importance of Packaging   9. Storage of cheddar cheese      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   10. Hygiene and sanitation of cheddar cheese processing equipment       1. Cleaning procedures       2. Sanitization methods   11. Waste disposal       1. Methods of waste disposal       2. Importance of waste disposal   12. Record-keeping       1. Types of records       2. Importance   13. 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 reports |
| 1. Produce Gouda cheese | 2.1 Gouda Cheese processing   * + 1. Definition of terms     2. Characteristics of gouda cheese   1. Gouda cheese making equipment and materials      1. Materials         1. Raw milk         2. Milk powder         3. Renin         4. lactic live culture         5. Packaging material         6. Flavour         7. Salt      2. Equipment         1. Pre-warming Cheese vat         2. Cheese press         3. Cheese mould         4. Knives         5. Cheese cloth         6. Miller         7. pH meter         8. Thermometer         9. Packaging machine   2. Gouda Cheese making      1. Definition of Terms         1. gouda Cheese         2. Ripening         3. Syneresis         4. Coagulation      2. Characteristics of Gouda cheese      3. Gouda cheese making process         1. Milk standardization         2. Pasteurization         3. Inoculation of cheese milk         4. Renneting and coagulation         5. Cooking the Curd         6. Cutting the Curd         7. Draining Whey and Moulding         8. Salting         9. Pressing of Curds   3. Ripening      1. Definition of terms      2. Ripening conditions      3. Physical and chemical changes      4. Effect of Ripening on quality   4. Quality evaluation of Gouda cheese      1. Sensory evaluation      2. Shelf-life assessment      3. Cheese yield   5. Packaging of Gouda cheese product      1. Packaging machines      2. Packaging materials      3. Packaging methods         1. Aseptic packaging         2. Hermetic packaging         3. Importance of Packaging   6. Storage of gouda cheese      1. Definition of terms      2. Storage conditions      3. Storage principles; FIFO      4. Storage equipment   7. Hygiene and sanitation of Gouda cheese 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 | * Written tests * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * Third party reports |
| 1. Produce Paneer cheese | * 1. Paneer Cheese Production      1. Definition of terms      2. Characteristics of paneer cheese   2. Raw milk Sampling   3. Raw milk quality Analysis   4. Paneer cheese processing equipment and materials      1. Paneer cheese Processing Materials         1. Raw milk         2. Salt         3. Acetic /citric acid         4. Packaging material      2. Paneer cheese Processing equipment         1. Cheese vat         2. Cheese mould         3. Knives         4. Cheese cloth         5. Thermometer         6. pH meter         7. Homogenizer         8. Clarifier         9. Pasteurizer   5. Paneer cheese processing      1. Pasteurization      2. Acidification      3. Homogenization      4. Curding      5. Wheying off      6. Salting      7. cooling   6. Quality Evaluation of paneer cheese      1. sensory evaluation      2. shelf-life evaluation      3. cheese yield   7. Packaging of paneer cheese      1. Packaging machines      2. Packaging materials      3. Packaging methods   8. Importance of Packaging   9. Storage of Paneer Cheese      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   10. Hygiene and sanitation of paneer cheese processing equipment       1. Cleaning procedures       2. Sanitization methods       3. Waste disposal   11. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies |
| 1. Produce Mozzarella Cheese | * 1. Mozzarella cheese production      1. Definition of mozzarella cheese      2. Characteristics of mozzarella cheese   2. Raw milk Sampling   3. Raw milk quality Analysis   4. Mozzarella cheese processing equipment and materials      1. Mozzarella cheese Processing Materials         1. Raw milk         2. Salt         3. Live culture         4. Rennet enzyme         5. Packaging material      2. Mozzarella cheese Processing equipment         1. Cheese vat         2. Cheese mould         3. Knives         4. Cheese cloth         5. Thermometer         6. Pasteurizer         7. Cold room/refrigerator   5. Mozzarella cheese processing      1. Pre-treatment      2. Pasteurization      3. Inoculation      4. Ripening      5. Renneting and coagulation      6. Scalding      7. Moulding      8. Cooling      9. Salting   6. Quality evaluation of Mozzarella cheese      1. sensory evaluation      2. shelf-life evaluation   7. Packaging of Mozzarella cheese      1. Packaging machines      2. Packaging materials      3. Importance of Packaging   8. Storage of Mozzarella Cheese      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   9. Hygiene and sanitation of Mozzarella cheese processing equipment      1. Cleaning procedures      2. Sanitization methods   10. Waste disposal       1. Methods of waste disposal       2. Importance of waste disposal   11. Record keeping   12. Smart and Sustainable Systems       1. AI application       2. Sustainable packaging options       3. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies |
| 1. Processed Cheese | * 1. 5Processed Cheese Production      1. Definition of processed cheese      2. Characteristics of processed cheese      3. Processed cheese processing equipment and material      4. Processed cheese Processing Materials      5. Base Cheese      6. Salt      7. Live culture      8. Emulsifiers      9. Cream      10. Pasteurised Milk      11. Flavour      12. Packaging material Cheese      13. Food Colour      14. Emulsifier      15. Stabilizer      16. Permitted preservative      17. Skim milk power      18. Portable water      19. Processed cheese Processing equipment      20. Cheese vat      21. Cheese mould      22. Knives      23. Cheese cloth      24. Thermometer      25. Pasteurizer      26. Blender      27. Cold room/refrigerator      28. Processed cheese processing      29. Selection of Base cheese      30. Blending      31. Melting and cooking      32. Cooling      33. Quality evaluation of processed cheese      34. sensory evaluation      35. shelf-life evaluation      36. Packaging of processed cheese      37. Packaging machines      38. Packaging materials      39. Importance of Packaging      40. Storage of Processed Cheese      41. Storage conditions      42. Storage principles; FIFO      43. Storage equipment      44. Smart and Sustainable Systems      45. AI application      46. Sustainable packaging options      47. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * Third party reports |
| 1. Cream Cheese | * 1. Cream Cheese Production      1. Definition of Cream Cheese      2. Characteristics of Cream cheese  1. Cream cheese processing equipment and materials    * 1. Cream cheese Processing Materials         1. Cream         2. Salt         3. Mesophilic culture         4. Emulsifiers         5. Pasteurised Milk         6. Flavour         7. Packaging material      2. Cream cheese Processing equipment         1. Cheese vat         2. Cheese mould         3. Knives         4. Cheese cloth         5. Thermometer         6. Pasteurizer         7. Blender         8. Cold room/refrigerator 2. Cream cheese processing    * 1. Standardization      2. Homogenization      3. Pasteurization      4. Cooling      5. Inoculation      6. Incubation      7. Coagulation      8. Draining      9. Salting 3. Quality evaluation of cream cheese    * 1. Sensory evaluation      2. Shelf-life evaluation 4. Packaging of cream cheese    * 1. Packaging machines      2. Packaging materials      3. Importance of Packaging 5. Storage of cream Cheese    * 1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment 6. Smart and Sustainable Systems    * 1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * Third party reports |
| 1. Produce Feta Cheese | * 1. Feta Cheese Production      1. Definition of Feta Cheese      2. Characteristics of Feta cheese      3. Feta cheese processing equipment and materials      4. Feta cheese Processing Materials         1. Milk         2. Salt         3. Mesophilic culture         4. Packaging material      5. Feta cheese Processing equipment         1. Cheese vat         2. Cheese mould         3. Knives         4. Cheese cloth         5. Thermometer         6. Pasteurizer         7. Blender         8. Cold room/refrigerator   2. Feta cheese processing      1. Cheese milk Standardization      2. Cheese milk pasteurization      3. Cheese milk inoculation      4. Cheese milk renneting      5. Cut coagulum treatment      6. Cheese curd handling      7. Cheese ripening      8. Cheese packaging and distribution   3. Quality evaluation of Feta cheese      1. Sensory evaluation      2. Shelf-life evaluation   4. Packaging of Feta cheese      1. Packaging machines      2. Packaging materials      3. Importance of Packaging   5. Storage of Feta Cheese      1. Storage conditions      2. Storage principles; FIFO      3. Storage equipment   6. Smart and Sustainable Systems      1. AI application      2. Sustainable packaging options      3. Sustainable waste disposal | * Written tests * Practical * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * Third party reports |

**Suggested Methods of Instruction**

* Demonstrations
* Role playing
* Group discussion
* Direct instruction

**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 |  | 10ml | 10:5 |
|  | Sodium hydroxide |  | - | - |
|  | Raw milk |  | 1ltr | 1:5 |
|  | Rennet enzyme |  | - | - |
|  | Salt |  | - | - |
|  | Live culture |  | - | - |
| **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 |

**COMMUNICATION SKILLS**

**UNIT CODE:** 0031 441 09A

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Communication Skills**

**Duration of Unit:** 40 hours

**Unit Description**

This unit covers the competencies required to apply communication skills. It involves applying communication channels, written, non-verbal, oral, and group communication skills.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply communication channels. | **10** |
| 2. | Apply written communication skills. | **12** |
| 3. | Apply non-verbal skills. | **4** |
| 4. | Apply oral communication skills. | **4** |
|  | Apply group communication skills. | **10** |
| **Total** | | **40** |

**Learning Outcomes, Content, and Suggested Assessment Methods**

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply communication channels | 1. Communication process 2. Principles of effective communication 3. Channels/medium/modes of communication 4. Factors to consider when selecting a channel of communication 5. Barriers to effective communication 6. Flow/patterns of communication 7. Sources of information 8. Organizational policies | * Oral questions * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply written communication skills | 1. Types of written communication 2. Elements of communication 3. Organization requirements for written communication | * Oral assessment * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply non-verbal communication skills | * 1. Utilize body language and   2. Gestures   3. Apply body posture   4. Apply workplace dressing code | * Oral assessment * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply oral communication skills | * 1. Types of oral communication pathways   2. Effective questioning techniques   3. Workplace etiquette   4. Active listening | * Oral assessment * Written assessment * Portfolio of Evidence * Practical assessment * Third party report |
| 1. Apply group discussion skills | 1. Establishing rapport 2. Facilitating resolution of issues 3. Developing action plans 4. Group organization techniques 5. Turn-taking techniques 6. Conflict resolution techniques 7. Team-work | * Practical * Portfolio of Evidence * Oral assessment * Written assessment |

**Suggested Methods of Instruction**

* Practical
* Demonstrations
* Project
* Group discussion
* Direct instruction

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/no.** | **Category/item** | **Description/specification** | **Quantity** | **Recommended ratio(item: trainee)** |
| 1. **Learning materials** | | | | |
|  | Report writing templates | Digital report template | 5 | 1:5 |
|  | Flashcards | Educational flash cards | 5 | 1:5 |
|  | Flip charts | Educational flip charts | 5 | 1:5 |
| 1. **Learning facilities and infrastructure** | | | | |
|  | Lecture/theory room | 72m2 | 1 | 1:25 |
|  | Whiteboard | 4 feet by 8 feet | 1 | 1:25 |
|  | Projector | LCD High resolution | 1 | 1:25 |
|  | Computers | RAM: 8GB | 25 | 1:25 |
|  | Printers | Ink Jet | 2 | 1:13 |
| 1. **Consumable materials** | | | | |
|  | Printing Papers | A4 | Enough for 25 | 1:25 |
|  | Assorted whiteboard markers | Non-permanent | Enough for 25 | 1:25 |
| 1. **Tools and equipment** | | | | |
|  | Mobile phones | Functioning smart phone | Enough for 25 | 1:25 |

# PRINCIPLES OF DAIRY MICROBIOLOGY

**UNIT CODE: 0721 451 10A**

**UNIT DURATION: 80 hours**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Dairy Microbiology Principles**

UNIT DESCRITION

This unit specifies the competencies required by a Dairy Plant Technologist level 5 to apply dairy microbiology principles. It involves utilizing dairy microorganism, applying dairy hygiene practices, and controlling dairy microorganisms.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Utilize dairy microorganism | **50** |
| 2. | Apply dairy hygiene practices | **20** |
| 3. | Control dairy microorganisms | **50** |
| 4. | Dispatch of Milk | **30** |
| **Total** | | **120** |

**Learning Outcomes, Content and Suggested Assessment Methods**

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Utilize dairy microorganism | * 1. application of microbiology in dairy technology      1. milk fermentation      2. control of milk borne diseases      3. preservation of milk      4. waste management   2. Beneficial microorganisms for milk fermentation      1. Bacteria         1. *Lactobacillus bulgaricus*         2. *Streptococcus thermophilus*         3. *Lactococcus lactis*         4. Bifido bacteria      2. Fungi      3. *Penicillium sp*      4. Mucor      5. *Rhizopus*      6. *Aspergillus*   3. Fermentation process   4. Factors affecting fermentation process   5. Indicators of fermentation process   6. Symbiotic relationship in fermentations   7. Enzymatic activity   8. Factors affecting enzymatic activity   9. Fermentation process records | * Practical * Third party report * Portfolio of evidence * Written tests * Oral questions |
| 1. Apply dairy hygiene practices | * 1. Plant hygiene   2. Definition of terms      1. sanitation      2. Hygiene      3. Sanitiser      4. Cleaning      5. Sterilisation      6. Detergent   3. Dairy plant cleaning      1. Cleaning in place      2. Cleaning out of place   4. Inspection of dairy plant      1. Hygiene and sanitation      2. Facility layout and design      3. Equipment and machinery      4. Raw material handling   5. Microbial tests      1. Standards plate count      2. Total plate count      3. Coliforms plate count      4. Yeast and mould count   6. Dairy plant environment hygiene      1. Processing area      2. Packaging area      3. Dairy laboratory      4. Waste disposal area   7. Worker’s hygiene   8. Dairy hygiene records | * Practical * Third party report * Portfolio of evidence * Written tests * Oral questions |
| 1. Control dairy microorganisms | * 1. Harmful dairy microorganisms      1. *Salmonella*      2. *Escherichia coli*      3. *Listeria monocytogenes*      4. *Staphylococcus aureus*   2. Control of harmful dairy microorganisms      1. Hygienic practices      2. Heat treatment      3. Low temperature storage      4. Packaging   3. Harmful dairy microorganisms Control records | * Practical * Third party report * Portfolio of evidence * Written tests * Oral questions |

**Suggested Methods of Instruction**

* Demonstrations
* Practical
* Group discussion
* Direct instruction
* Project

**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 |
| 3 | Flash Cards | Assorted | 5 | 1:5 |
| 4 | Whiteboard |  | 1 | 1:25 |
| 5 | Flip chart |  | 1 | 1:25 |
| 8 . | Assorted colour of whiteboard markers | For trainers Use |  |  |
| **B** | **Learning Facilities & infrastructure** |  |  |  |
| 9. | Lecture/theory room |  | 1 | 1:25 |
|  | Microbiology Laboratory |  | 1 | 1:25 |
|  | Workshop |  | 1 | 1:25 |
| **C** | **Consumable materials** |  |  |  |
|  | Slides |  | 100 | 4:1 |
|  | Petri dishes |  | 100 | 4:1 |
|  | Cover slips |  | 100 | 4:1 |
|  | Test tubes |  | 200 | 8:1 |
|  | Assorted pipettes |  | 100 | 4:1 |
|  | Inoculating loops |  | 25 | 1:1 |
|  | Swabs |  | 200 | 8:1 |
|  | Culture media | Assorted | 500g each | - |
|  | Lab coat |  | - | - |
|  | Head covers |  | 25 | 1:1 |
|  | Medical gloves |  | 200pcs | - |
|  | Sodium hydroxide |  | 500 gms | - |
|  | Spirit |  | 1 lt | - |
|  | Nitric acid |  | 1 ltr | - |
|  | Antiseptics |  | 1ltr | - |
|  | Brooms |  | 25 | 1:1 |
|  | Squeezers |  | 25 | 1:1 |
|  | Brushes |  | 25 | 1:1 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Source of heat |  | 5 pcs | 1:5 |
|  | Incubator |  | 5 pcs | 1:5 |
|  | Microscope |  | 1pc | 1:25 |
|  | Colony counter |  | 1 pc | 1:25 |
|  | Autoclave |  | 1pc | 1:25 |
|  | Digester |  | 1 | 1:25 |
|  | Grider |  | 1 | 1:25 |
|  | Incinerator |  | 1 | 1:25 |
|  | Test tube racks |  | 5 | 1:5 |
|  | Clean bench for Microbiology |  | 1 | 1:25 |
|  | UV chamber |  | 1 | 1:25 |
|  | Centrifuge |  | 1 | 1:25 |
|  | Refrigerator |  | 1 | 1:25 |
|  | Freezer |  | 1 | 1:25 |
|  | Analytical balance |  | 5 | 1:5 |
|  | Water bath |  | 5 | 1:5 |
|  | CIP unit |  | 1 | 1:25 |
|  | COP unit |  | 1 | 1:25 |

# PRINCIPLES OF DAIRY CHEMISTRY

**UNIT CODE: 0721 451 11A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Apply Dairy Chemistry Principles**

**Duration of Unit:** 120 Hours

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician level 5 to apply dairy chemistry principles. it involves applying physical properties, applying chemical properties, applying functional properties

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply physical properties | **40** |
| 2. | Apply chemical properties | **40** |
| 3. | Apply functional properties | **40** |
| **Total** | | **120** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Apply physical chemistry principles | * 1. Acid and bases      1. Definition of terms      2. Properties of Acids and bases   2. Salts      1. Classification of salts      2. Properties of salts   3. Mole concept      1. Chemical Equations      2. Stoichiometry         1. Definition of Terms         2. Balancing of chemical equations         3. Ionic Equations   4. Reaction Kinetics      1. Order of reaction and molecularity      2. Variation of rates of concentrates      3. Collision theory      4. Catalysts and activation energy      5. Choir reactions   5. Gas Properties      1. Definitions      2. Kinetic theory      3. Gas laws         1. Boyles law         2. Charles Law         3. Avogadro’s law         4. Gay lussacs law | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 1. Apply inorganic chemistry concepts | * 1. Matter      1. Definitions      2. Properties of matter      3. States of matter      4. Separation of mixtures   2. Elements of the periodic table      1. Atomic structure      2. Physical and chemical properties of elements         1. Ions         2. Molecules         3. Compounds      3. Mass Spectroscopy   3. Structure and Bonding      1. Definition of terms      2. Types of Bonds         1. Ionic Bond         2. Ionic bond         3. Covalent bonds         4. Van der Waals bond         5. Hydrogen bond      3. Structure of inorganic Compounds         1. Giant Ionic lattice         2. Molecular Covalent         3. Metallic Lattice         4. Giant Covalent | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies * Third party report |
| 3.Apply organic chemistry principles | * 1. Concepts of organic chemistry      1. Definition of terms      2. Classification of organic compound         1. Hydrocarbons         2. Organic acids         3. Alcohols         4. Esters         5. Ethers         6. Amines   2. Physical Properties of Organic compounds      1. Colour      2. Odour      3. Mass      4. Solubility      5. Density      6. Melting point   3. Chemical properties organic compounds      1. pH      2. Chemical stability      3. Radioactivity      4. Flammability      5. Heat of combustion | * Written tests * Interviews/ Oral questions * Practical * Individual/group assignments * Case Studies Third party report |

**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 colour 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** |  |  |  |
|  | Alcohol |  | 1ltr | 1:5 |
|  | Sodium |  | 2gs | 2:5 |
|  | Potassium |  | 2gs | 2;5 |
|  | Bases |  | 15mls | 15;5 |
|  | Iodine |  | 10 mls | 10;5 |
|  | Milk /product samples |  | 500ml | 500mls:5 |
|  | Esters |  | 20mls | 20;5 |
| **D** | **Tools and Equipment** |  |  |  |
|  | Source of heat |  | 5 pcs | 1:5 |
|  | Burettes |  | 1 pcs | 1:25 |
|  | Pipettes |  | 1 pcs | 1:25 |
|  | Conical flask |  | 5 pcs | 1:5 |
|  | Volumetric flasks |  | 5pcs | 5:5 |
|  | Measuring cylinders |  | 1 pcs | 1:25 |
|  | Test tubes |  | 10 pcs | 10:5 |
|  | Test-tube holder |  | 5pcs | 1:5 |
|  | Filter papers |  | 10 |  |

# DAIRY PRODUCT QUALITY CONTROL

**UNIT CODE: 0721 451 12A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: **Conduct Dairy Product Quality Control**

**UNIT DURATION:** 200 Hours

**Unit Description**

This unit specifies the competencies required by a Dairy Plant Technician Level 5 to conduct dairy product quality control. it involves analyzing raw materials and ingredients, monitoring production process, analyzing end product quality and implementing quality control measures

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Analyse raw materials and ingredients | **50** |
| 2. | Monitor production process | **50** |
| 3. | Analyse end product quality | **50** |
| 4. | Analyse product handling condition quality | **50** |
| **Total** | | **200** |

|  |  |  |
| --- | --- | --- |
| **Learning Outcomes** | **Content** | **Suggested Assessment Methods** |
| 1. Analyse raw materials and ingredients | * 1. Concept of Quality Control      1. Definition of terms      2. Quality characteristics of milk      3. Importance of Quality Control      4. Methods of quality assessment         1. Objective methods         2. Subjective methods      5. Statistical Methods  1. Factors affecting quality of Raw Milk    * 1. Genetic factors      2. Production factors    1. Laboratory reagents, tools and equipment       1. Laboratory reagents          1. Types          2. Preparation of laboratory reagents       2. Laboratory tools and equipment       3. Laboratory safety rules    2. Raw milk quality Analysis       1. Raw milk quality tests          1. Organoleptic          2. Physical /chemical tests    3. Record-keeping       1. Definition of terms       2. Types of records       3. Importance of record keeping    4. Smart and Sustainable Systems       1. AI application       2. Sustainable waste disposal    5. Apply 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. Monitor production process | * 1. Process controls      1. Pasteurization temperature      2. Pasteurization time      3. Chilling temperatures      4. Sterilization temperatures      5. Standardization   2. Process Quality Analysis      1. Alkaline phosphatase test      2. Stability test      3. Peroxidase      4. Acidity      5. Salt content      6. Butter fat content      7. pH      8. A.I   3. 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. Analyse End product quality | 1. Sensory evaluation of milk products    * 1. Flavour      2. Colour      3. Taste      4. Consistency      5. Viscosity      6. Appearance 2. End product quality Analysis tests    * 1. Phosphatase      2. Sterility      3. Peroxidase      4. Acidity      5. Salt content      6. Butter fat content      7. pH      8. Total plate count      9. Coliforms plate count      10. Yeast and mould count      11. A.I 3. Shelf-life Evaluation    * 1. Definitions      2. Methods of determining shelf-life      3. Factors affecting shelf-life of milk products      4. Importance of shelf-life evaluation 4. Packaging and labelling evaluation    * 1. Labelling      2. Packaging 5. 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. Analyse product handling condition quality | 1. Storage Conditions for dairy Products    * 1. Temperature      2. Duration      3. Humidity      4. Lighting      5. A.I 2. Evaluation of Personnel hygiene    * 1. Personnel Hygiene measures      2. Personnel swab      3. Personnel Protective Equipment      4. Food handler’s health compliance 3. Evaluation of Dairy premises and Equipment    * 1. Premises      2. Lighting      3. Ventilation      4. Design and plant layout      5. Hygiene and sanitation 4. Equipment    * 1. Food contact Materials      2. Hygiene, sanitation and waste management 5. Smart and Sustainable Systems    * 1. AI application      2. Sustainable waste disposal | * I Written tests * Interviews/ Oral questions * Practical reports * Individual/group assignments * Case Studies * 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** |  |  |  |
|  | Raw milk |  | 1ltr | 1:5 |
|  | Cream |  | 10mls | 10:5 |
|  | Yoghurt |  | 1 | 1;5 |
|  | Butter |  | - | - |
|  | Ghee |  | 1ltr | 1:5 |
|  | Ethanol |  | 100mls | 100;5 |
|  | Sodium Hydroxide |  | 500mls | 500;5 |
|  | Resazurin solution |  | 10mls | 10:5 |
|  | Iodine |  | - | - |
|  | Phenolphthalein indicator |  | - | - |
| **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 |
|  | Source of heat |  | 1 | 1:25 |
|  | Refractometer |  | 5 | 1;25 |

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