

**REPUBLIC OF KENYA**

**COMPETENCY-BASED MODULAR CURRICULUM**

**FOR**

**APPLIED BIOLOGY**

**KNQF LEVEL 6**

**PROGRAMME ISCED CODE:****0511 554A**

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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 Applied Biology 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).

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

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

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

**CHAIRMAN OF THE COUNCIL**

# ACKNOWLEDGMENT

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

I recognize with appreciation the role of the Applied Biology 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 applied biology 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 applied biology sector acquire competencies to perform their work more efficiently and effectively.

**COUNCIL SECRETARY**

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# ACRONYMS

CBET : Competency-Based Education and Training

ICT : Information communication technology

KNQF : Kenya National Qualification Framework

PPEs : Personal Protective Equipment

SOPs : Standard Operating Procedures

TVET : Technical and Vocational Education and Training

TVETA : Technical and Vocational Education and Training Authority

**KEY TO UNIT CODE**

**Sector / Industry**

**Sub Sector**

**Occupational Area**

**Version Control**

**Unit of Competence Number**

**ISCED level, Programme Orientation and Level of Completion**

xx

x

xxx

x

x

x

# COURSE OVERVIEW

Applied Biology Level 6 qualification consists of competencies that an individual must possess to become an Applied Biologist. It involves integrating histological and cytological techniques, plant husbandry, laboratory, animal husbandry, ecological techniques museum, herbarium, aquarium and vivarium techniques, immunological techniques, microbiological techniques, parasitological, entomological techniques, biochemical analysis and pharmacological and toxicological techniques.

**Summary Of Units of Learning**

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **DURATION**  **(Hours)** | **CREDIT FACTOR** |
| **MODULE I** | | | |
| 0031 541 01A | Communication skills | 40 | 4 |
| 0511 551 02A | Laboratory practices principles | 100 | 10 |
| 0541 551 03A | Mathematics for science. | 150 | 15 |
| 0511 551 04A | Histological and cytological techniques | 100 | 12 |
|  | **Sub Total** | **390** | **39** |
| **MODULE II** | | | |
| 0511 551 05A | Anatomy and physiology concepts | 130 | 13 |
| 0511 551 06A | Plant husbandry | 100 | 10 |
| 0511 551 07A | Laboratory animal husbandry | 100 | 10 |
|  | **Sub Total** | **330** | **33** |
| **MODULE III** | | | |
| 051 1551 08A | Taxonomical concepts | 130 | 13 |
| 0511 551 09A | Ecological techniques | 100 | 10 |
| 0511 551 10A | Museum, herbarium, aquarium and vivarium techniques | 130 | 13 |
|  | **Sub Total** | **360** | **36** |
| **MODULE IV** | | | |
| 0611 541 11A | Digital literacy | 40 | 4 |
| 0511 551 12A | Immunological techniques | 130 | 13 |
| 0511 551 13A | Microbiological techniques | 130 | 13 |
|  | **Sub Total** | **300** | **30** |
| **MODULE V** | | | |
| 0417 541 14A | Work ethics and practices | 40 | 4 |
| 0588 551 15A | Scientific research | 150 | 15 |
| 0511 551 16A | Parasitological and entomological techniques | 120 | 12 |
|  | **Sub Total** | **320** | **32** |
| **MODULE IV** | | | |
| 0413 541 17A | Entrepreneurial skills | 40 | 4 |
| 0511 551 18A | Genetics principles | 130 | 13 |
| 0511 551 19A | Biochemical analysis | 150 | 15 |
| 0511 551 20A | Pharmacological and toxicological techniques | 130 | 13 |
|  | **Sub Total** | **450** | **45** |
| **INDUSTRIAL ATTACHMENT** | | **480** | **48** |
| **GRAND TOTAL** | | **2630** | **263** |

**Entry Requirements**

An individual enrolling for this course should have the following minimum requirement:

1. A Kenya Certificate of Secondary Education (KCSE) mean grade C- (minus) or KCE Division III.
2. Any other equivalent qualification as determined by TVETA.

**Trainer Qualification**

1. Must have a minimum of a KNQF level 7 qualification in Applied biology or its equivalent.
2. Be 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 Applied biology a 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 summatively:**

1. During formative assessment all performance criteria shall be assessed based on performance criteria weighting.
2. Number of formative assessments shall minimally be equal to the number of elements in a unit of competency.
3. During summative assessment basic and common units may be integrated in the core units or assessed as discrete units.
4. Theoretical and practical weighting for each unit of learning shall be 40:60 for all units of competence.
5. Formative and summative assessments shall be weighted at 60% and 40% respectively in the overall unit of learning score

**For a candidate to be declared competent in a unit of competency, the candidate must meet the following conditions:**

1. Obtained at least 40% in theory assessment in formative and summative assessments.
2. Obtained at least 60% in practical assessment in formative and summative assessment where applicable.
3. Obtained at least 50% in the weighted results between formative assessment and summative assessment where the former constitutes 60% and the latter 40% of the overall score.
4. Assessment performance rating for each unit of competency shall be as follows:

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

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

**Certification**

A candidate will be issued with a Certificate of Competency upon demonstration of competence in a core Unit of Competency. To be issued with Kenya National TVET Certificate in Applied Biology Technologist Level 6, the candidate must demonstrate competence in all the Units of Competency as given in the qualification pack. A Statement of Attainment certificate may be awarded upon demonstration of competence in certifiable element within a unit.

These certificates will be issued by Qualification Awarding Institution

# MODULE I UNITS OF LEARNING

# MODULE I SUMMARY

This module equips trainees with essential laboratory communication, safety, mathematical, and microscopy skills. Learners gain competence in lab operations, scientific calculations, and cytological and histological techniques—laying a strong foundation for effective support in science laboratories and diagnostic environments.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 0031 541 01A | Communication skills | Apply communication channels. | 10 |
| Apply written communication skills. | 12 |
| Apply non-verbal skills. | 4 |
| Apply oral communication skills. | 4 |
| Apply group communication skills. | 10 |
|  |  | **TOTAL** | **40** |
| 0511 551 02A | Laboratory practices principles | Maintain laboratory safety | 40 |
| Prepare laboratory water | 30 |
| Manage laboratory personnel and material resource | 30 |
| Manage laboratory waste | 30 |
|  |  | **TOTAL** | **100** |
| 0541 551 03A | Mathematics for science | Apply basic arithmetic operation | 10 |
| Apply algebraic equation and expression | 10 |
| Apply linear and non-linear graphs | 10 |
| Apply indices and logarithms | 10 |
| Apply sequences and series | **10** |
| Apply trigonometry | 20 |
| Apply binomial expansions | 20 |
| Apply matrices | 20 |
| Apply statistics methods | 10 |
| Apply vectors | 10 |
| Apply Calculus | 20 |
|  |  | **TOTAL** | **150** |
| 0511 551 04A | Cytological and histological techniques | Carry out care and maintenance of microscope | 40 |
| Perform cytological technique | 30 |
| Perform histological technique | 50 |
|  | **TOTAL** | **100** |
|  | **GRAND TOTAL** | | **390** |

## COMMUNICATION SKILLS

**UNIT CODE:** **0031 541 01A**

**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 * Observation * 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 * Observation * 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 * Observation * 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 * Observation * 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 | * Oral assessemnt * Written assessment * Observation * Portfolio of Evidence * Practical assessment |

**Suggested Methods of Instruction**

* Discussion
* Roleplaying
* Simulation
* Direct instruction
* Demonstration
* Field trips

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| A | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Report writing templates | Trainees | 5 | 1:5 |
| B | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers with OS | Trainees | 25 | 1:1 |
|  | Internet connection | Trainees and Trainers | 1 connection | 1:25 |
|  | Projector | For trainer’s use | 1 | 1:25 |
|  | Whiteboard | For trainer’s use | 1 | 1:25 |
| C | **Consumable materials** | | | |
|  | Printing papers | For trainer and trainee use | Varies | Varies |
|  | Assorted whiteboard markers | For trainer’s use | Varies | Varies |
| D | **Tools and Equipment** | | | |
|  | Printers | For trainer’s use | 2 | 1:12 |
|  | Mobile phones | For trainer’s use | 25 | 1;1 |
|  | External storage media | For trainer and trainee use | Varies | 1:1 or 1:5 depending on need |

## LABORATORY PRACTICE PRINCIPLES

**UNIT CODE: 0511 551 02A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: Apply standard laboratory practices

**Duration of Unit:** 130 hours

**UNIT DESCRIPTION**

This unit of competency provides competencies required by a applied biology technologist to apply laboratory and management practices. The practices include maintaining laboratory safety, preparing laboratory water, managing laboratory personnel and material resources, and managing laboratory waste.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Maintain laboratory safety | 40 |
| 2. | Prepare laboratory water | 30 |
| 3. | Manage laboratory personnel and material resource | 30 |
| 4. | Manage laboratory waste | 30 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| 1. Maintain laboratory safety | 1. Sources of hazards and risks    1. Identification of laboratory hazards and risks 2. Chemical 3. Biological 4. Physical 5. Electrical 6. Fire 7. Radiation    1. Laboratory safety procedures    2. Good house keeping    3. PPEs    4. Storage of laboratory samples    5. Safe handling and storage of laboratory reagents and chemicals    6. Types of injuries and their treatment 8. Cuts 9. Bleeding 10. Bites 11. Burns and scalds 12. Bruises 13. Fractures 14. Wounds     1. First aid procedures | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Prepare laboratory water | * 1. Sources of water   2. Methods of water treatment  1. Distillation 2. Deionization 3. Filtration 4. Sedimentation 5. Reverse osmosis 6. Adsorption | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Manage laboratory personnel and material resource | 1. Definition of management 2. Functions of management 3. Management schools of thought 4. Modern theories of management 5. Maintain laboratory equipment 6. Calibration 7. Validation 8. Preventive maintenance | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Manage laboratory waste | * 1. Types of laboratory wastes  1. Infectious waste 2. General waste 3. Poisonous waste 4. Chemical waste    1. Segregation and disposal of laboratory waste 5. Organic wastes 6. Inorganic waste    1. Methods of waste disposal    2. Decontamination and cleaning of laboratory working areas, benches and equipment. | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |

**Suggested Methods of instruction**

* Practical sessions
* Group discussions
* Demonstration by trainer
* Exercises by trainee

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Lab manuals | Trainees | 25 | 1:1 |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room | Trainer and Trainees | 1 | 1:25 |
|  | Fully equipped laboratory | Trainer and Trainees | 1 | 1:25 |
|  | Computers with internet connection | Trainees | 5 | 1:5 |
|  | Projectors | Trainers | 1 | 1:25 |
|  | Microscopes | Trainees | 5 | 1:5 |
| **C** | **Consumable materials** | | | |
|  | Gloves | Trainees | 25 pairs | 1:1 |
|  | Disposable Masks | Trainees | 25 | 1:1 |
| **D** | **Tools and Equipment** | | | |
|  | Goggles | Trainees | 25 | 1:1 |
|  | Lab coats | Trainees | 25 | 1:1 |

## MATHEMATICS FOR SCIENCE

**UNIT CODE:** **0541 551 03A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: **Apply Mathematics for Science.**

**Duration of Unit**: 150 hours

**Unit Description**

This unit describes the competencies required by an Applied Biology technologist in order to apply mathematics for science. It involves applying: basic arithmetic operation; algebraic equation and expression; linear and non-linear graphs; indices and logarithm and sequences and series, apply trigonometry, apply binomial expansions apply matrices, apply statistics methods apply vectors and apply Calculus

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply basic arithmetic operation | 10 |
| 2. | Apply algebraic equation and expression | 10 |
| 3. | Apply linear and non-linear graphs | 10 |
| 4. | Apply indices and logarithms | 10 |
|  | Apply sequences and series | **10** |
|  | Apply trigonometry | 20 |
|  | Apply binomial expansions | 20 |
|  | Apply matrices | 20 |
|  | Apply statistics methods | 10 |
|  | Apply vectors | 10 |
|  | Apply Calculus | 20 |
|  | **TOTAL** | 150 |

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Apply basic arithmetic operation | 1. Addition and subtraction on; 2. Natural numbers 3. Integers 4. Fractions 5. Decimals 6. Multiplication and division on; 7. Natural numbers 8. Integers 9. Fractions 10. Decimals 11. Rational and irrational numbers 12. Ratios, proportions and percentages 13. Direct proportion 14. Inverse proportion | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 1. Apply algebraic equation and expression | 1. Solution of linear equations 2. Solution of simultaneous 3. Elimination method 4. Substitution method 5. Graphical method    1. Transposition of formula    2. Solution of quadratic equations 6. Factorization 7. Completing square method 8. Quadratic formula | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 1. Apply linear and non-linear graphs | 1. Linear and nonlinear graphs 2. Reduction of non-linear to linear graphs 3. Interpretation of graphs | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 1. Apply indices and logarithms | 1. Indices 2. Bases 3. Laws of indices 4. Indicial equations 5. Logarithms 6. Laws of logarithms 7. Logarithmic operations 8. Conversion of base of logarithms 9. Graphs of Logarithmic and exponential functions | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 1. Apply sequences and series | * 1. Arithmetic sequence  1. arithmetic mean 2. nth term of arithmetic sequence    1. Sum of terms of arithmetic series (Arithmetic progression)    2. Geometric sequence 3. Finite geometric sequence 4. Geometric means and nth terms of a geometric sequence 5. Sum of finite and infinite geometric sequence | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 6. Apply trigonometry | 1. Pythagoras theorem 2. Trigonometric ratios   6.2.1 Trigonometry identities  6.2.2 Trigonometric equations | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 7. Apply binomial expansions | * 1. Roots of numbers using binomial theorem      1. Pascals triangle   2. *Errors* of small changes using binomial theorem      1. Absolute Error      2. Relative Error      3. Percentage Error   7.3 Permutation and combination | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence |
| 8. Apply matrices | * 1. Introduction to matrices   2. Types of matrices      1. Singular      2. non-singular      3. identity      4. echelon   3. Order of matrices   4. Matrix operation      1. addition and subtraction      2. multiplication by scaler      3. compatibility      4. matrix multiplication   5. Determinant and inverse of 2x2 matrix | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence |
| 9. Apply statistics methods | * 1. Collection of raw data      1. Ungrouped data      2. Grouped data   2. Data presentation      1. Pictograms      2. Histograms      3. Pie charts      4. Bar charts      5. Frequency polygon   3. Processing of raw data      1. Measures of central tendency         1. Mean         2. Mode         3. Median   4. Measures of dispersion      1. Range      2. Quartile      3. Variance      4. Standard deviation   5. Interpretation of processed data | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence |
| 10. Apply vectors | * 1. Vectors and scalar quantities in two dimensions   2. Definitions of vector and scalar quantities\   3. Drawing a vector   4. Vectors operations      1. Addition      2. Subtraction      3. Scalar multiplication   5. Position of vectors   6. Modulus of a vector   7. Resolution of a vector | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |
| 11. Apply Calculus | **Differential Calculus**  * + 1. **Functional notation**     2. **Differentiation by first principle**     3. **Standard differentiation**   1. **Methods of differentiation**      1. **Product rule**      2. **Quotient rule**      3. **Chain rule**   2. **Rates of change**      1. **Small changes**   3. **Differential equations**   4. **Integral Calculus**      1. **Integral notation**      2. **Standard integration**      3. **Constant of integration**      4. **Definite and indefinite integration**      5. **Methods of integration**      6. **Algebraic substitution** | * Observation * Third party report * Written tests * Oral questioning * Portfolio of evidence * Interviews |

**Suggested Delivery Methods**

* Group discussions
* Demonstration by trainer
* Practical exercises by trainees

**Recommended Resources for 25 trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| **B** | **Learning Facilities & infrastructure** | | | |
| **2.** | Lecture/theory room | For training | 1 | 1:25 |
| **3.** |  |  |  |  |
| **C** | **Tools and Equipment** | | | |
| 4. | Computer | For trainer’s use | 1 | 1:25 |
| 5. | Scientific calculator | For trainee’s use | 25 | 1:1 |
| 6. | Projector | For trainer’s use | 1 | 1:25 |
| 7 | SMP Mathematical table | For trainee’s use | 25 | 1:1 |
| 8 | White board ruler | For trainer’s use | 1 | 1:25 |
| 9 | White board compass | For trainer’s use | 1 | 1:25 |
| 10. | White board protractor | For trainer’s use | 1 | 1:25 |
| 11. | Geometrical set | For trainee’s use | 25 | 1:1 |
|  | Graph book | For trainee’s use | 25 | 1:1 |

## CYTOLOGICAL AND HISTOLOGICAL TECHNIQUES

**UNIT CODE:** **0511 551 04A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out cytological and histological techniques

**Duration of Unit:** 120 Hours

**UNIT DESCRIPTION:** This unit describes the competencies required by an applied biology technologist to conduct cytological and histological techniques. It involves carrying out care and maintenance of microscope, performing cytological and Histological techniques.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Carry out care and maintenance of microscope | 40 |
| 2. | Perform cytological technique | 30 |
| 3. | Perform histological technique | 50 |
|  | **TOTAL** | 120 |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **suggested methods of assessment** |
| 1. 1. Carry out care and maintenance of the microscope | 1. Terminologies used in microscopy 2. Microscopy 3. Microscope 4. Field of view 5. Resolution 6. Magnification 7. Micrometry 8. Parts of a microscope 9. Types of microscopes 10. Light microscope 11. Compound microscope 12. Dark field microscope 13. Fluorescent microscope 14. Phase contrast microscopes 15. Dissecting microscopes 16. Confocal microscopes 17. Electron microscope 18. TEM and SEM 19. How to operate a microscope 20. Uses of the microscope 21. Micrometry 22. Routine care and maintenance | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Perform cytological technique | * 1. Eukaryotic and prokaryotic cells   2. Plant and animal cell structure   3. Cell organelles   4. Cell physiology   5. Cytological specimens  1. Blood 2. Stool 3. Urine 4. Milk 5. Tissues 6. Saliva & Sputum 7. CSF 8. Pus    1. Preparation of temporary slides    2. Cell division       1. Mitosis       2. Meiosis       3. Binary Fission       4. Amitosis | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report Written tests |
| 1. Perform Histological technique | * 1. Types of histological specimens      1. Live specimens      2. Dead specimens   2. Labelling of specimens   3. Storage of specimens   4. Fresh tissue preparations   5. Preparation of histological specimens   6. Microtomy      1. Fixation      2. Dehydration      3. Clearing      4. Embedding      5. Sectioning      6. Mounting      7. Staining      8. Cover slipping   7. Types of smears e.g touch/ apposition smears, thin, thick, e.t.c   8. Examination of histological specimens.   9. Using microscopes | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration by trainer
* Field trips/site visits
* Practice by the trainee
* Exercises
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  (Item: Trainee) |
| **A** | **Learning Materials** | | | |
| 1. 11 | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Computers | For trainees use | 5 | 1:5 |
|  | * Standard manuals/SOPs | For trainees use | 25 | 1:1 |
| **B** | **Learning Facilities & infrastructure** | | | |
|  | Lecture/theory room | For trainer and Trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 5 | 1:5 |
|  | Projectors | For trainee’s use | 2 | 1:12 or 1:13 |
|  | Whiteboard | For trainee’s use | 1 | 1:25 |
| **C** | **Consumable materials** | | | |
|  | Sets of slide preparation | For trainee’s use | 25 | 1:25 |
|  | Embedding media | For trainee’s use | Varies | Varies |
|  | Gloves | For trainee’s use | 25 pairs | 1:1 |
|  | Masks | For trainee’s use | 25 | 1:1 |
|  | Goggles |  | 25 | 1:1 |
|  | Lab coat | For trainee’s use | 25 | 1:1 |
| **D** | **Tools and Equipment** | | | |
|  | Microscopes | For trainee’s use | 5 | 1:5 |
|  | Microtomes | For trainee’s use | 2 | 1:12 or 1:13 |
|  | Cryostat | For trainee’s use | 1 | 1:25 |
|  | Centrifuges | For trainee’s use | 2 | 1:12 or 1:13 |
|  | Refrigerator | For trainee’s use | 1 | 1:25 |
|  | Histological specimens | For trainee’s use | 10 | 1:2 or 1:3 |
|  | Plant specimens | For trainee’s use | 10 | 1:2 or 1:3 |
|  | Histological equipment | For trainee’s use | Varies | Varies |

# MODULE II UNITS OF LEARNING.

# MODULE II SUMMARY

This module advances trainee proficiency in scientific mathematics, biological systems, and laboratory-based husbandry. Learners explore applied plant and animal anatomy, physiology, and care. Through hands-on experience, they gain skills in statistical analysis, plant propagation, hydroponics, and laboratory animal management—essential for supporting research and experimental procedures in biological sciences.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 0511 551 06A | Anatomy and physiology studies | Analyse communication in plants and animals | 30 |
| Apply nutrition in plants and animals | 15 |
| Apply transport in plants and animals | 15 |
| Analyse support and locomotion in animals | 20 |
| Analyse reproduction in plants and animal | 20 |
| Apply excretion in plants and animals | 15 |
| Apply gaseous exchange concept in plants and animals | 15 |
| **TOTAL** | **130** |
| 0511 551 07A | Plant husbandry | Perform plant propagation technique | 30 |
| Manage a greenhouse facility | 15 |
| Manage plant diseases | 35 |
| Perform hydroponic technique | 20 |
| **TOTAL** | **100** |
| 0511 551 08A | Laboratory  animal  husbandry | Construct laboratory animal cages | 30 |
| Manage laboratory animals | 40 |
| Carry out euthanasia | 30 |
| **TOTAL** | **100** |
|  | **GRAND TOTAL** | | **330** |

## ANATOMY AND PHYSIOLOGY CONCEPTS

**UNIT CODE: 0511 551 06A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform anatomy and physiology studies

**Duration of Unit: 130 Hours**

**Unit Description**

This unit outlines the competencies required to perform anatomy and physiology studies. It covers the ability to analyse communication, support and locomotion, and reproduction in plants and animals. It also includes applying concepts of nutrition, transport, excretion, and gaseous exchange in both plants and animals.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Analyze communication in plants and animals | 30 |
| 2. | Apply nutrition in plants and animals | 15 |
| 3. | Apply transport in plants and animals | 15 |
| 4. | Analyze support and locomotion in animals | 20 |
| 5. | Analyze reproduction in plants and animal | 20 |
| 6. | Apply excretion in plants and animals | 15 |
| 7. | Apply gaseous exchange concept in plants and animals | 15 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| 1. Analyze communication in plants and animals | 1. Nervous System 2. Structure of the Nervous System 3. Central Nervous System (CNS) 4. Peripheral Nervous System (PNS) 5. Transmission of Nervous Impulse 6. Nervous System Diseases and Disorders 7. Sensory Organs 8. Structure and Functions of Sensory Organs 9. Endocrine System 10. Overview of the Endocrine System 11. Major Endocrine Glands 12. Pituitary Gland 13. Hypothalamus 14. Adrenal Gland 15. Pineal Gland 16. Thyroid Gland 17. Parathyroid Gland 18. Pancreas 19. Thymus 20. Plant Responses and Growth 21. Plant Growth Curves 22. Primary and Secondary Growth 23. Tropic and Tactic Growth Responses | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 2. Apply nutrition in plants and animal’s concepts | 1. Plant Nutrition 2. Structure and Functions of the Leaf 3. Photosynthesis   2.1.2.1 Light and Dark Stages  2.1.2.2 Calvin Cycle   1. Animal Nutrition 2. The Digestive System and Enzymes 3. Process of Digestion and Absorption 4. Dissection 5. Nutritional Deficiency Diseases 6. Marasmus 7. Kwashiorkor 8. Scurvy 9. Beri-Beri Disease | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 3. Apply transport in plants and animals | 1. Mammalian Circulatory Systems   3.1.1 Types of Circulatory Systems  3.1.1.1 Open Circulatory System  3.1.1.2 Closed Circulatory System  3.1.2 The Cardiovascular System  3.1.2.1 Blood and Its Components  3.1.2.2 Blood Vessels  3.1.2.3 The Heart  3.1.3 Overview of the Lymphatic System  3.2 Plant Transport Systems  3.2.1 Plant Structure and Functions  3.2.1.1 Internal Structures of the Root and Shoot  3.2.2 Water and Mineral Uptake in Plants  3.2.2.1 Forces Involved  3.2.2.2 Transpiration  3.2.2.3 Translocation | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 4. Analyze support and locomotion in animals | **4.1 Types of Skeletons**  **4.1.1 Bone Formation 4.1.2 Bones of Axial Skeleton 4.1.3 Bones of Endoskeleton**  **4.2 Joints 4.3 Cartilages and Tendons**  **4.4 Types of Muscles 4.5 Mechanism of Muscle Action**  **4.6 Skeletal Diseases and Disorders 4.7 Muscular Diseases and Disorders** | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 5. Analyze reproduction in animals and plants | 5.1 Reproductive System in Mammals  5.1.1 Testes  5.1.2 Ovaries  5.2 Gametogenesis  5.3 Menstrual Cycle  5.4 Pregnancy  5.5 Birth Control Methods  5.2 Reproductive System in Plants  5.2.1 Flower Structure and Functions  5.2.2 Pollination  5.2.3 Fertilization  5.2.4 Seeds and Fruits  5.3 Asexual Reproduction  5.4 Vegetative Propagation  5.3 Reproductive System Diseases and Disorders | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report   Written tests |
| 6. Apply excretion in plants and animals concepts | 6.1 Excretory Products and Systems  6.1.1 Plants Excretory Products  6.2 Excretory System in Mammals  6.2.1 Kidney Structure and Functions  6.2.2 Process of Urine Formation  6.2.3 Osmoregulation and Homeostasis  6.2.4 Roles of Renin, Vasopressin (Antidiuretic Hormone), and Aldosterone Hormones  6.3 Animal Excretory Products  6.4 Excretory System Diseases and Disorders | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 7. Apply gaseous exchange concept in plants and animals | 7.1 Respiratory Surfaces and Gaseous Exchange  7.1.1 Types and Characteristics of Respiratory Surfaces  7.2 Gaseous Exchange in Mammals  7.3 Mechanisms of Breathing in Mammals  7.4 Gaseous Exchange in Fish  7.5 Gaseous Exchange in Plants  7.5.1 Opening and Closing of Stomata  7.6 Respiratory System Diseases and Disorders | * Practical assessment * Portfolio of evidence * Oral assessment * Third party report * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainees and trainer’s use | Varies | Varies |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainers and Trainee’ s use | 1 | 1:25 |
|  | Well-equipped laboratory facility | For trainer and Trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 5 | 1:5 |
|  | Whiteboard | For trainer’s use | 1 | 1:25 |

## PLANT HUSBANDRY

**UNIT CODE: 0511 551 07A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out plant husbandry.

**Duration of Unit: 100 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to carry out plant husbandry. It involves performing plant propagation techniques, managing greenhouse facility, managing plant diseases and performing hydroponic techniques.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Perform plant propagation technique | 30 |
| 2. | Manage a greenhouse facility | 15 |
| 3. | Manage plant diseases | 35 |
| 4. | Perform hydroponic technique | 20 |
|  | **TOTAL** | 100 |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| 1. Perform plant propagation technique | 1.1 Planting Propagation Materials  1.1.1 Seeds  1.1.2 Cuttings  1.1.3 Suckers  1.1.4 Buds  1.1.5 Tubers  1.1.6 Bulbs  1.1.7 Splits  1.2 Screening of Propagation Materials  1.3 Seed Dormancy  1.4 Seed Germination  1.2 Propagation Methods  1.3 Field Management Practices  1.3.1 Weeding  1.3.2 Soil Management  1.3.3 Water Management  1.3.4 Pruning  1.3.5 Pests and Disease Control  1.3.6 Thinning  1.3.7 Fertilizer Application  1.3.8 Harvesting  1.3.9 Gapping  1.3.10 Germination | * Observation * Oral questions * Written tests * Practical tests |
| 1. Manage a greenhouse facility | 2.1 Greenhouse Management  2.1.1 Meaning of Greenhouse  2.1.2 Functions of Greenhouse  2.1.3 Types of Greenhouses  2.1.4 Construction of Greenhouse  2.1.5 Management of Greenhouse | * Written tests * Observation * Oral questioning * Practical tests |
| 1. Manage plant diseases | 3.1 Plant Diseases  3.1.1 Meaning of Terms  3.1.2 Collection and Testing of Infected Plant Specimens  3.1.3 Classification of Plant Diseases  3.1.3.1 Bacterial Diseases  3.1.3.2 Fungal Diseases  3.1.3.3 Viral Diseases  3.1.3.4 Nematode Infections  3.1.3.5 Diseases Caused by Abiotic Factors | * Written tests * Oral questions * Observation * Practical tests |
| 1. Perform hydroponic technique | 4.1 Hydroponics  4.1.1 Hydroponic Procedures  4.1.2 Plant Materials and Nutrients  4.1.3 Hydroponic Growing Media  4.1.4 Maintaining Hydroponic Plants | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainer’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Well-equipped laboratory facility | For Trainer/trainee’s use | 1 | 1:25 |
|  | White board | For Trainer’s use | 1 | 1:25 |
|  | Computers with internet | For Trainee’s use | 5 | 1:5 |
| C | Consumable materials | | | |
|  | White board marker | For Trainer’s use | 1 | 1:25 |
| D | Tools and Equipment | | | |
|  | Rulers, pencils and erasers | For Trainee’s use | 25 | 1:1 |
|  | Drawing sheets | For Trainee’s use | 25 | 1:1 |

## LABORATORY ANIMAL HUSBANDRY

**UNIT CODE: 0511 551 08A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out animal husbandry.

**Duration of Unit: 100 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to carry out laboratory animal husbandry. It involves constructing laboratory animal cages, managing laboratory animals, and carrying out euthanasia.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Construct laboratory animal cages | 30 |
| 2. | Manage laboratory animals | 40 |
| 3. | Carry out euthanasia | 30 |
|  | **TOTAL** | **100** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **suggested methods of assessment** |
| 1. Construct laboratory animal cages | 1.1 Introduction to Animal Husbandry  1.1.1 Laboratory Animals  1.1.2 Animal House Design  1.1.2.1 Partitions  1.1.2.2 Construction Materials  1.1.2.3 Animal Cages  1.1.3 Disinfection and Cleaning of Animal House | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| 2. Manage laboratory animals | 2.1 Animal Sourcing, Breeding, and Care  2.1.1 Sourcing and Handling of Animals  2.1.1.1 Laboratory Rats  2.1.1.2 Rabbits  2.1.1.3 Mice  2.1.1.4 Guinea Pig  2.1.1.5 Hamster  2.1.2 Sexing  2.1.3 Characteristics of Breeding Animals  2.1.4 Oestrous Cycle  2.1.5 Gestation Period  2.1.6 Litter Size  2.1.7 Population Control Methods  2.1.8 Animal Inoculation  2.1.9 Animal Diseases  2.1.9.1 Fungal Diseases  2.1.9.2 Viral Diseases  2.1.9.3 Bacterial Diseases  2.1.9.4 Parasites  2.1.10 Animal Laws | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| 3. Carry out euthanasia | 3.1 Laboratory Animal Procedures and Ethics  3.1.1 Anesthetic Agents  3.1.1.1 Local Anesthetics  3.1.1.2 General Anesthetics  3.1.2 Routes of Drug Administration  3.1.3 Dissection  3.1.4 Euthanasia/Humane Killing  3.1.4.1 Chemical Methods  3.1.4.2 Physical Methods  3.1.5 Carcass Disposal  3.1.5.1 Burying  3.1.5.2 Incineration | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Third party report * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For Trainer’s use | 1 | 1:25 |
|  | Flip charts | For Trainer’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Well – equipped laboratory | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers | For Trainee’s use | 5 | 1:5 |
|  | Projector | For Trainer’s use | 1 | 1:25 |
|  | White board | For Trainer’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Mice | For Trainee’s use | 5 | 1:5 |
|  | White board marker | For Trainer’s use | 1 | 1:25 |
| D | Tools and Equipment | | | |
|  | Animal cages | For Trainee’s use | 5 | 1:5 |
|  | Dissecting kits | For Trainee’s use | 10 | 1:2 |

# **MODULE III UNITS OF LEARNING**.MODULE III SUMMARY

This module equips learners with essential skills in biological classification, ecological data collection, and specimen preservation. Trainees explore taxonomical surveys across all kingdoms, apply ecological field techniques, and gain hands-on experience in museum, herbarium, vivarium, and aquarium operations—preparing them for careers in conservation, biodiversity studies, and educational research institutions.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 051 155 09A | Taxonomical concepts | Apply principles of classification | 20 |
| Carry out kingdom Monera survey | 20 |
| Carry out kingdom Protoctista survey | 20 |
| Carry out kingdom Fungi survey | 20 |
| Carry out kingdom Plantae survey | 20 |
| Carry out kingdom Animalia survey | 20 |
| Construct dichotomous key | 10 |
|  |  | **TOTAL** | **130** |
| 0511 551 10A | Ecological techniques | Collect ecological samples | 20 |
| Determine ecological species distribution | 20 |
| Perform soil analysis | 40 |
| Measure ecological abiotic parameters | 20 |
| **TOTAL** | **100** |
| 0511 551 11A | Museum, Herbarium, Aquarium and Vivarium techniques | Perform museum technique | 20 |
| Perform herbarium techniques | 30 |
| Perform vivarium techniques | 20 |
| Perform aquarium techniques | 25 |
| Perform aquaculture techniques | 35 |
| **TOTAL** | **130** |
|  | **GRAND TOTAL** | | **360** |

## TAXONOMICAL CONCEPTS

**UNIT CODE: 0511 551 09A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out taxonomical concepts.

**Duration of Unit: 130 Hours**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to apply taxonomical concepts. It involves applying principles of classification, carrying out kingdom Monera survey, carrying out kingdom Protoctista survey, carrying out kingdom fungi survey, carrying out kingdom plantae survey, carrying out kingdom Animalia survey, and constructing dichotomous key

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply principles of classification | 20 |
| 2. | Carry out kingdom Monera survey | 20 |
| 3. | Carry out kingdom Protoctista survey | 20 |
| 4 | Carry out kingdom Fungi survey | 20 |
| 5 | Carry out kingdom Plantae survey | 20 |
| 6 | Carry out kingdom Animalia survey | 20 |
| 7 | Construct dichotomous key | 10 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| Learning Outcome | Content | Suggested methods of assessment |
| 1. Apply principles of classification | 1. Collection instruments 2. Collection of specimens 3. General Classification of specimens | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 2. Carry out kingdom Monera   survey | 1. Characteristics of Kingdom Monera 2. Classification in Kingdom Monera 3. Samples of Kingdom Monera 4. Economic importance of Kingdom Monera 5. Diseases 6. Ecological relationships    1. Food    2. Industrial | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 3. Carry out kingdom Protoctista   survey | 1. Characteristics of Kingdom Protoctista 2. Classification in Kingdom Protoctista 3. Samples of Kingdom Protoctista 4. Economic importance of Kingdom Protoctista 5. Diseases 6. Ecological relationships 7. Food 8. Industrial | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 4. Carry out kingdom Fungi   survey | 1. Characteristics of Kingdom Fungi 2. Classification in Kingdom Fungi 3. Samples of Kingdom Fungi 4. Economic importance of Kingdom Fungi 5. Diseases 6. Ecological relationships 7. Food 8. Industrial | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 5. Carry out kingdom Plantae   survey | 1. Characteristics of Kingdom Plantae 2. Classification in Kingdom Plantae 3. Samples of Kingdom Plantae 4. Economic importance of Kingdom Plantae 5. Diseases 6. Ecological relationships 7. Food 8. Industrial | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 6. Carry out kingdom Animalia survey | 1. Characteristics of Kingdom Animalia 2. Classification in Kingdom Animalia 3. Samples/specimens of Kingdom Animalia 4. Economic importance of Kingdom Animalia 5. Diseases 6. Ecological relationships 7. Food 8. Industrial | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| 7. Construct dichotomous key | 1. Characteristics of organisms 2. Dichotomous key 3. Use of dichotomous key in identification. | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |

Suggested Methods of instruction

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Field guides | For trainee’s | 1 | 1:25 |
|  | Charts and diagrams illustrating taxonomic hierarchies and classifications | For trainees and trainer’s use | 10 | 1:3 |
|  | Rulers, Pencils and erasers | For trainee’s use | Varies | Varies |
|  | Drawing sheets | For trainee’s use | Varies | Varies |
|  | Relevant videos | For trainees and trainer’s use | Varies | Varies |
| B | Learning Facilities & Infrastructure | | | |
|  | Lecture/theory room | For trainers and Trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 5 | 1:5 |
|  | Well-equipped laboratory facility | For trainers and Trainee’s use | 1 | 1:25 |
|  | Whiteboard | For trainer’s use | 1 | 1:25 |
|  | Internet | For trainers and Trainee’s use | 1 connection | 1:25 |
| 1. C | Consumable materials | | | |
|  | Collecting vials | For trainee’s use | 50 | 2:1 |
|  | Calculator | For trainee’s use | 25 | 1:1 |
| D | Tools and Equipment | | | |
|  | Insect nets | For trainee’s use | 10 | 1:3 |
|  | GPS | For trainee’s use | 5 | 1:5 |
|  | Projector | For trainer’s use | 1 | 1:25 |

## ECOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 10A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out ecological and soil studies

**Duration of Unit: 100 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to perform ecological techniques. It involves collecting ecological samples, determining ecological species distribution, performing soil analysis, measuring ecological abiotic parameters

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Collect ecological samples | 20 |
| 2. | Determine ecological species distribution | 20 |
| 3. | Perform soil analysis | 40 |
| 4 | Measure ecological abiotic parameters | 20 |
| 5 | **TOTAL** | **100** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| 1. Collect ecological samples | 1. Concepts in ecology 2. Ecology 3. Biome 4. Biosphere 5. Community 6. Population 7. Ecosystem 8. Biodiversity 9. Habitat 10. Food chain 11. Food web 12. Predation 13. Symbiosis 14. Ecological niche 15. Principles of ecology 16. Types of ecology 17. Abiotic and biotic factors 18. Sample collection and handling | * Observation * Oral questions * Written tests * Practical tests |
| 1. Determine ecological species distribution | 1. Population estimation methods 2. Population dynamics 3. Succession 4. Recording of findings | * Practical tests * Observation * Project based assessment * Written tests * Oral questioning |
| 1. Perform soil analysis | 1. Soil structure and texture 2. Soil air and water relations 3. Soil temperature 4. Soil mineral composition 5. Clay minerals 6. Ion exchange 7. pH and buffering capacity of the soil 8. Soil organisms 9. Isolation and identification of soil organisms | * Practical tests * Observation * Project based assessment * Written tests * Oral questioning |
| 1. Measure ecological abiotic parameters | 1. Abiotic factors and parameters 2. Soil 3. Water 4. Wind 5. Temperature 6. Humidity 7. Air pressure    1. Equipment for measuring abiotic factors    2. Recording of measurement parameters | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainer’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers and internet connection | For trainee’s use | 5 | 1:5 |
|  | Well-equipped laboratory facility | For trainee/trainer’s use | 1 | 1:25 |
|  | White board | For trainee/trainer’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Field note books | For trainee’s use | 25 | 1:25 |
|  | Rulers, pencils, erasers | For trainee’s use | 25 | 1:25 |
|  | Drawing sheets | For trainee’s use | 25 | 1:25 |
| D | Tools and Equipment | | | |
|  | Soil test kits | For trainee’s use | 5 | 1:5 |
|  | Insect nets | For trainee’s use | 10 | 1:3 |
|  | GPS units | For trainee’s use | 5 | 1:5 |
|  | Projectors | For trainer’s use | 1 | 1:25 |
|  | Glassware | For trainee’s use | 25 sets | 1:1 |

## MUSEUM, HERBARIUM, AQUARIUM AND VIVARIUM TECHNIQUES

**UNIT CODE: 0511 551 11A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply herbarium, museum, aquarium and vivarium techniques

**Duration of Unit: 130 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to perform museum, herbarium, aquarium, and vivarium techniques. It involves performing Museum technique, performing herbarium technique, performing Aquarium techniques, performing vivarium techniques and performing aquaculture techniques.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Perform museum technique | 20 |
| 2. | Perform herbarium techniques | 30 |
| 3. | Perform vivarium techniques | 20 |
| 4 | Perform aquarium techniques | 25 |
| 5 | Perform aquaculture techniques | 35 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| * + - 1. Perform Museum technique | 1. Introduction to Museum techniques 2. Classification of museum specimens 3. Specimen collection 4. Specimen preparation 5. Specimen preservation 6. Zoological 7. Botanical 8. Pathological | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform herbarium technique | 1. Classification of plant specimens 2. Collection of specimens 3. Drying of specimens 4. Preservation of specimens 5. Mounting of specimens 6. Labeling of specimens 7. Filing of plant specimens | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform Aquarium techniques | 1. Components of an aquarium 2. Filter 3. Pump 4. Thermometer 5. Aquatic plants and animals 6. Decoration    1. Setting up an aquarium 7. Introducing aquarium organisms 8. Managing an aquarium | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform vivarium techniques | 1. Components of a vivarium 2. Setting up a vivarium 3. Introducing vivarium organisms 4. Managing a vivarium 5. Construction of vivarium 6. Vivarium diseases | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform aquaculture techniques | 1. Fish farming structures 2. Cages 3. Hatcheries 4. Fish ponds 5. Fish feeding 6. Fish breeding 7. Fish harvesting 8. Fish diseases and management | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | PowerPoint presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainer’s use | 1 | 1:25 |
| B | Learning Facilities & Infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Well-equipped laboratory | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers with internet | For Trainee’s use | 5 | 1:5 |
|  | Fish pond |  |  |  |
| C | Consumable materials | | | |
|  | Fish | For Trainee’s use | 10 | 1:3 |
| D | Tools and Equipment | | | |
|  | Plant press | For Trainee’s use | 5 | 1:5 |
|  | Herbarium and museum specimens | For Trainee’s use | 10 | 1:3 |
|  | Projector | For Trainer’s use | 1 | 1:25 |
|  | Aquarium | For Trainee’s use | 1 | 1:25 |

# MODULE IV UNITS OF COMPETENCY

# MODULE IV SUMMARY

This module develops digital proficiency and essential laboratory competencies. Learners gain hands-on skills in using computer tools, managing data, and exploring online work. It also builds capacity in immunological and microbiological techniques including sample handling, diagnostic testing, vaccine development, and microbial applications in health, food safety, and industrial processes.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOMES** | **DURATION (HOURS)** |
| 0611 541 12 | Digital literacy | Operate computer devices | 10 |
| Solve tasks using office suite | 5 |
| Manage data and information | 5 |
| Perform online communication and collaboration | 5 |
| Apply cybersecurity skills | 5 |
| Perform online jobs | 5 |
| Apply job entry techniques | 5 |
|  |  | **TOTAL** | **40** |
| 0511 551 13 | Immunological techniques | Collect immunological test sample | 50 |
| Carry out immunodiagnostic tests | 40 |
| Develop simple vaccines | 40 |
|  |  | **TOTAL** | **130** |
| 0511 551 14 | Microbiological techniques | Collect microbiological samples | 30 |
| Culture microbiological specimen | 30 |
| Carry out antimicrobial sensitivity testing | 30 |
| Test microbial organisms in food and water | 20 |
| Perform industrial microbial processes | 20 |
|  |  | **TOTAL** | **130** |
|  | **GRAND TOTAL** | | **300** |

## DIGITAL LITERACY

**UNIT CODE: 0611 551 12A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Apply Digital Literacy

**Duration of Unit: 80 Hours**

**Unit Description**

This unit covers the competencies required to demonstrate digital literacy. It involves operating computer devices, solving tasks using the Office suite, accessing online/offline data and information, performing online communication and collaboration, applying cybersecurity skills and performing jobs online. It also involves applying job entry techniques.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Operate computer devices | 10 |
| 2. | Solve tasks using office suite | 10 |
| 3. | Manage data and information | 20 |
| 4 | Perform online communication and collaboration | 10 |
| 5 | Apply cybersecurity skills | 10 |
| 6 | Perform online jobs | 10 |
| 7 | Apply job entry techniques | 10 |
|  | **TOTAL** | **80** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Operate computer devices | 1. Introduction to Digital Literacy    * 1. Meaning and Importance of Digital Literacy      2. Functions and Uses of Computers      3. Classification of Computers 2. Components of a Computer System 3. Computer Hardware 4. The System Unit (e.g. Motherboard, CPU, Casing) 5. Input Devices (e.g. Pointing, Keying, Scanning, Voice/Speech Recognition, Direct Data Capture Devices) 6. Output Devices (e.g. Hardcopy Output and Softcopy Output) 7. Storage Devices    1.2.1.4.1 Main Memory (e.g. RAM)   1.2.1.4.2 Secondary Storage (Solid State Devices, Hard Drives, CDs & DVDs, Memory Cards, Flash Drives)  1.2.1.5 Computer Ports (e.g. HDMI, DVI, VGA, USB Type-C)   1. Classification of Computer Software 2. Operating System Functions 3. Procedure for Turning On/Off a computer 4. Computer Operation Techniques 5. Mouse Use Techniques 6. Keyboard Parts and Use Techniques 7. Desktop Customization 8. File and Files Management Using an Operating System 9. Internet Connectivity Options 10. Computer Internet Connection Options 11. Mobile Networks/Data Plans 12. Wireless Hotspots 13. Cabled (Ethernet/Fiber) 14. Dial-Up 15. Satellite 16. Computer External Devices Management 17. Device Connections 18. Device Controls (Volume Controls and Display Properties) | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| 1. Solve tasks using Office suite | 2.1 Word Processing  2.1.1 Meaning and Importance of Word Processing  2.1.2 Examples of Word Processors  2.1.3 Working with Word Documents  2.1.3.1 Open and Close Word Processor  2.1.3.2 Create a New Document  2.1.3.3 Save a Document  2.1.3.4 Switch Between Open Documents  2.1.4 Enhancing Productivity  2.1.4.1 Set Basic Options/Preferences  2.1.4.2 Help Resources  2.1.4.3 Use Magnification/Zoom Tools  2.1.4.4 Display, Hide Built-in Toolbar  2.1.4.5 Using Navigation Tools  2.1.4.6 Typing Text  2.1.5 Document Editing  2.1.5.1 Copy, Cut, Paste Commands  2.1.5.2 Spelling and Grammar Check  2.1.6 Document Formatting  2.1.6.1 Formatting Text  2.1.6.2 Formatting Paragraph  2.1.6.3 Formatting Styles  2.1.6.4 Alignment  2.1.7 Creating and Formatting Tables  2.1.7.1 Creating Tables  2.1.7.2 Formatting Tables  2.1.8 Graphical Objects  2.1.8.1 Insert Object (Picture, Drawn Object)  2.1.8.2 Select an Object  2.1.8.3 Edit an Object  2.1.8.4 Format an Object  2.1.9 Document Print Setup  2.1.9.1 Page Layout  2.1.9.2 Margins Setup  2.1.9.3 Orientation  2.1.10 Word Document Printing  2.2 Spreadsheets  2.2.1 Meaning and Importance of Electronic Spreadsheets  2.2.2 Components of Spreadsheets  2.2.3 Application Areas of Spreadsheets  2.2.4 Using Spreadsheet Applications  2.2.4.1 Parts of Excel Screen: Ribbon, Formula Bar, Active Cell, Name Box, Column Letter, Row Number, Quick Access Toolbar  2.2.4.2 Cell Data Types  2.2.4.3 Block Operations  2.2.4.4 Arithmetic Operators (Formula Bar: -, +, etc.)  2.2.4.5 Cell Referencing  2.2.5 Data Manipulation  2.2.5.1 Using Functions (Sum, Average, SumIF, Count, Max, Min, IF, Rank, Product, Mode, etc.)  2.2.5.2 Using Formulae  2.2.5.3 Sorting Data  2.2.5.4 Filtering Data  2.2.5.5 Visual Representation Using Charts  2.2.6 Worksheet Printing  2.3 Electronic Presentations  2.3.1 Meaning and Importance of Electronic Presentations  2.3.2 Examples of Presentation Software  2.3.3 Using the Electronic Presentation Application  2.3.3.1 Parts of the PowerPoint Screen (Slide Navigation Pane, Slide Pane, Notes, the Ribbon, Quick Access Toolbar, Scroll Bars)  2.3.3.2 Open and Close Presentations  2.3.3.3 Creating Slides (Insert New Slides, Duplicate, or Reuse Slides)  2.3.3.4 Text Management (Insert, Delete, Copy, Cut and Paste, Drag and Drop, Format, Spell Check)  2.3.3.5 Use Magnification/Zoom Tools  2.3.3.6 Apply or Change a Theme  2.3.3.7 Save a Presentation  2.3.3.8 Switch Between Open Presentations  2.3.4 Developing a Presentation  2.3.4.1 Presentation Views  2.3.4.2 Slides  2.3.4.3 Master Slide  2.3.4.4 Text  2.3.4.5 Editing Text  2.3.4.6 Formatting  2.3.4.7 Tables  2.3.4.8 Charts  2.3.4.9 Using Charts  2.3.4.10 Organization Charts  2.3.4.11 Graphical Objects  2.3.4.12 Insert, Manipulate  2.3.4.13 Drawings  2.3.5 Prepare Outputs  2.3.5.1 Applying Slide Effects and Transitions  2.3.5.2 Check and Deliver  2.3.5.3 Spell Check a Presentation  2.3.5.4 Slide Orientation  2.3.5.5 Slide Shows, Navigation  2.3.5.6 Print Presentations (Slides and Handouts) | * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| 1. Manage data and information | 3.1 Data, Information, and Internet Use  3.1.1 Meaning of Data and Information  3.1.2 Importance and Uses of Data and Information  3.1.3 Types of Internet Services  3.1.3.1 Communication Services  3.1.3.2 Information Retrieval Services  3.1.3.3 File Transfer  3.1.3.4 World Wide Web Services  3.1.3.5 Web Services  3.1.3.6 Automatic Network Address Configuration  3.1.3.7 News Group  3.1.3.8 E-commerce  3.1.4 Types of Internet Access Applications  3.1.5 Web Browsing Concepts  3.1.5.1 Key Concepts  3.1.5.2 Security and Safety  3.1.5.3 Web Browsing  3.1.5.4 Using the Web Browser  3.1.5.5 Tools and Settings  3.1.5.6 Clearing Cache and Cookies  3.1.5.7 URIs  3.1.5.8 Bookmarks  3.1.6 Web Outputs  3.1.6.1 Web-based Information  3.1.6.2 Search  3.1.6.3 Critical Evaluation of Information  3.1.6.4 Copyright and Data Protection  3.1.6.5 Downloads Management  3.1.7 Performing Digital Data Backup  3.1.7.1 Online Backup  3.1.7.2 Offline Backup  3.1.8 Emerging Issues in Internet | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| 1. Perform online communication and collaboration | 4.1 Netiquette and Online Communication  4.1.1 Netiquette Principles  4.1.2 Communication Concepts  4.1.3 Online Communities  4.1.3.1 Communication Tools  4.1.4 Email Concepts  4.1.4.1 Using Email  4.1.4.2 Sending Email  4.1.4.3 Receiving Email  4.1.4.4 Tools and Settings  4.1.4.5 Organizing Email  4.1.5 Digital Content Copyright and Licenses  4.1.6 Online Collaboration Tools  4.1.7 Online Storage  4.1.7.1 Google Drive  4.1.8 Online Productivity Applications  4.1.8.1 Google Docs & Forms  4.1.9 Online Meetings  4.1.9.1 Google Meet/Zoom  4.1.10 Online Learning Environments  4.1.11 Online Calendars  4.1.11.1 Google Calendars  4.1.12 Social Networks  4.1.12.1 Facebook/Twitter - Settings & Privacy  4.1.13 Preparation for Online Collaboration  4.1.13.1 Common Setup Features  4.1.13.2 Setup  4.1.13.3 Mobile Collaboration  4.1.14 Key Concepts of Mobile Collaboration  4.1.14.1 Using Mobile Devices  4.1.14.2 Applications  4.1.14.3 Synchronization | * Observation * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| 1. Apply cybersecurity skills | 5.1 Data Protection, Privacy, and Security  5.1.1 Data Protection and Privacy  5.1.1.1 Confidentiality of Data/Information  5.1.1.2 Integrity of Data/Information  5.1.1.3 Availability of Data/Information  5.1.2 Internet Security Threats  5.1.2.1 Malware Attacks  5.1.2.2 Social Engineering Attacks  5.1.2.3 Distributed Denial of Service (DDoS)  5.1.2.4 Man-in-the-Middle Attack (MitM)  5.1.2.5 Password Attacks  5.1.2.6 IoT Attacks  5.1.2.7 Phishing Attacks  5.1.2.8 Ransomware  5.1.3 Computer Threats and Crimes  5.1.4 Cybersecurity Control Measures  5.1.4.1 Physical Controls  5.1.4.2 Technical/Logical Controls (Passwords, PINs, Biometrics)  5.1.4.3 Operational Controls  5.1.5 Laws Governing Protection of ICT in Kenya  5.1.5.1 The Computer Misuse and Cybercrimes Act No. 5 of 2018  5.1.5.2 The Data Protection Act No. 24 of 2019 | * Portfolio of Evidence * Project * Written assessment * Practical assessment * Oral assessment |
| 1. Perform Online Jobs | 6.1 Introduction to Online Working  6.1.1 Types of Online Jobs  6.1.1.1 Online Job Platforms  6.1.2 Online Job Platforms  6.1.2.1 Remotask  6.1.2.2 Data Annotation Tech  6.1.2.3 Cloud Worker  6.1.2.4 Upwork  6.1.2.5 Oneforma  6.1.2.6 Appen  6.1.3 Online Account and Profile Management  6.1.4 Identifying Online Jobs/Job Bidding  6.1.5 Online Digital Identity  6.1.6 Executing Online Tasks  6.1.7 Management of Online Payment Accounts | * Observation * Oral assessment * Portfolio of evidence * Third party report * Written assessment |
| 1. Apply job entry techniques | 7.1 Types of Job Opportunities  7.1.1 Self-Employment  7.1.1.1 Service Provision  7.1.1.2 Product Development  7.1.2 Salaried Employment  7.1.3 Sources of Job Opportunities  7.2 Resume/Curriculum Vitae  7.2.1 What is a CV?  7.2.2 How Long Should a CV Be?  7.2.3 What to Include in a CV  7.2.4 Format of CV  7.2.5 How to Write a Good CV  7.2.6 Don’ts of Writing a CV  7.3 Job Application Letter  7.3.1 What to Include in a Cover Letter  7.3.2 Addressing a Cover Letter  7.3.3 Signing off a Cover Letter  7.4 Portfolio of Evidence  7.4.1 Academic Credentials  7.4.2 Letters of Commendations  7.4.3 Certification of Participations  7.4.4 Awards and Decorations  7.5 Interview Skills  7.5.1 Listening Skills  7.5.2 Grooming  7.5.3 Language Command  7.5.4 Articulation of Issues  7.5.5 Body Language  7.5.6 Time Management  7.5.7 Honesty  7.5.8 General Knowledge in Current Affairs and Technical Area | * Observation * Oral assessment * Portfolio of evidence * Written assessment |

**Suggested Methods Instruction**

* Project
* Practical
* Demonstration
* Viewing of related videos
* Group discussions
* Role play
* Case study

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
| 1. | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Sample CVs | For trainee’s use | 5 | 1:5 |
|  | Sample job applications | For trainee’s use | 5 | 1:5 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers with OS (Windows/Linux/Mac), Microsoft Office, Google Workspace, Antivirus | For trainee’s use | 25 | 1:1 |
|  | Internet connection | For trainees and trainer’s use | 1 connection | 1:25 |
|  | Whiteboard | For trainer’s use | 1 | 1:25 |
|  | Smartboard/Smart TV (Where applicable) | For trainer’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Printing papers | For trainer and trainee use | Varies | Varies |
|  | Assorted whiteboard markers | For trainer’s use | Varies | Varies |
| D | Tools and Equipment | | | |
|  | Printers | For trainer’s use | 2 | 1:12 |
|  | External storage media | For trainer and trainee use | Varies | 1:1 or 1:5 depending on need |
|  | Projector | For trainer’s use | 1 | 1:25 |

## IMMUNOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 13A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: perform immunological techniques.

**Duration of Unit: 130 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to perform immunological techniques. It involves collecting immunological test sample, carrying out immunodiagnostic tests and developing simple vaccines.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Collect immunological test sample | 50 |
| 2. | Carry out immunodiagnostic tests | 40 |
| 3. | Develop simple vaccines | 40 |
| 4 | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| 1. Collect immunological test sample | 1.1 Introduction to Immunology  1.1.1 Terms Used in Immunology  1.1.1.1 Innate vs Adaptive  1.1.1.2 Active vs Passive  1.1.1.3 Humoral vs Cell-mediated  1.1.2 Antigens, Haptens, and Immunogens  1.1.3 Antibody or Immunoglobulins  1.1.4 Vaccines and Adjuvants  1.1.5 Cytokines, Chemokines  1.1.6 Cells of the Innate and Adaptive Immune System  1.1.7 Lymphoid Tissues and Organs  1.1.8 Inflammation  1.1.9 Complement System  1.1.10 Hypersensitivity Reactions  1.1.11 Autoimmune Disorders  1.2 Tools and Equipment for Collecting Immunological Specimens  1.2.1 Types of Immunological Specimens  1.2.1.1 Serum  1.2.1.2 Virology Swab  1.2.1.3 Biopsy and Necropsy Tissue  1.2.1.4 Cerebrospinal Fluid  1.2.1.5 Whole Blood  1.2.1.6 Urine  1.2.1.7 Sputum  1.3 Processing of Immunological Specimens | * Practical assessment * Projects * Portfolio of evidence * Third party report * Written tests * Oral presentation |
| 1. Carry out immunodiagnostic methods | 2.1 Immunological Tests  2.1.1 Agglutination  2.1.2 Agglutination Inhibition  2.1.3 Precipitation  2.1.4 Enzyme-Linked Immunosorbent Assay (ELISA)  2.1.5 Immunoelectrophoresis  2.1.6 Western Blot  2.1.7 Complement Fixation Tests  2.1.8 Immunofluorescence  2.2 Analysis and Recording of Results | * Practical assessment * Projects * Portfolio of evidence * Written tests * Oral presentation |
| 1. Develop simple vaccines | 3.1 Culturing and Isolation of Microorganisms  3.1.1 Attenuation  3.1.2 Testing Vaccines Using Animal Models  3.1.3 Vaccine Trials | * Practical assessment * Projects * Portfolio of evidence * Third party report * Written tests * Oral presentation |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainer’s use | 1 | 1:25 |
|  | Standard operating procedure manuals | For Trainee’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Well-equipped laboratory | For trainer/trainee’s use | 1 | 1:25 |
|  | White board | For trainer ‘s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Drugs (assorted) | For Trainee’s use | 25 | 1:25 |
|  | Laboratory animals | For Trainee’s use | 5 | 1:5 |
| D | Tools and Equipment | | | |
|  | PCR machine | For Trainee’s use | 1 | 1:25 |
|  | ELISA reader | For Trainee’s use | 1 | 1:25 |
|  | Spectrophotometer | For Trainee’s use | 1 | 1:25 |
|  | Microscopes | For Trainee’s use | 5 | 1:5 |
|  | Centrifuges | For Trainee’s use | 5 | 1:5 |
|  | Autoclaves | For Trainee’s use | 2 | 1:13/1:12 |
|  | Incubators | For Trainee’s use | 2 | 1:13/1:12 |
|  | Specimen bottles | For Trainee’s use | 10 | 1:2 |
|  | Glass ware (assorted) | For Trainee’s use | 10 | 1:2 |
|  | Projector | For trainer’s use | 1 | 1:25 |

## MICROBIOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 14A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Carry out microbiological techniques

**Duration of Unit: 130 Hours**

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Collect microbiological samples | 30 |
| 2. | Culture microbiological specimen | 30 |
| 3. | Carry out antimicrobial sensitivity testing | 30 |
| 4 | Test microbial organisms in food and water | 20 |
| 5 | Perform industrial microbial processes | 20 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| 1. Collect microbiological samples | 1.1 Classification of Laboratories Based on Biosafety Levels  1.1.1 Types of Pathogens Handled in Each Level  1.2 Sterilization and Disinfection  1.2.1 Physical Methods  1.2.2 Chemical Methods  1.3 Sample Collection Materials/Tools  1.4 Types of Specimens  1.4.1 Sputum  1.4.2 Urine  1.4.3 Stool  1.4.4 Blood  1.4.5 Saliva  1.4.6 Pus  1.4.7 Cerebrospinal Fluid (CSF)  1.4.8 Food  1.4.9 Milk  1.4.10 Soil and Water  1.5 Sample Collection Techniques  1.6 Aseptic Techniques of Handling Specimens  1.7 Packaging, Transportation, Processing, and Storage of Microbiological Specimens | * Practical assessment * Projects * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Culture microbiological specimen | 2.1 Culture Media and Reagents  2.1.1 Forms of Culture Media  2.1.1.1 Broth  2.1.1.2 Solid  2.1.1.3 Semi-solid  2.2 Types of Culture Media  2.2.1 Basic Media  2.2.2 Transport Media  2.2.3 Selective Media  2.2.4 Non-selective Media  2.2.5 Enriched Media  2.2.6 Enrichment Media  2.3 Media Preparation  2.4 Inoculation Methods  2.4.1 Pouring  2.4.2 Streaking  2.4.3 Stabbing  2.4.4 Spreading  2.5 Slopes and Deep Culture  2.6 Bacterial Identification  2.6.1 Staining  2.6.1.1 Gram Stain  2.6.1.2 Acid-fast Staining  2.6.2 Biochemical Tests | * Practical assessment * Projects * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| 1. Carry out antimicrobial sensitivity testing | 3.1 Definition of Antibiotics  3.2 Classes and Modes of Action of Antibiotics  3.3 Antimicrobial Samples  3.3.1 Crude Plant Extracts  3.3.2 Commercial Antibiotics  3.3.3 Commercial Antifungals  3.4 Antibiotic Resistance  3.5 Antibiotic Sensitivity Test  3.5.1 Kirby Bauer Disk Diffusion Method  3.5.2 Automated Systems  3.5.3 PCR  3.5.4 Broth Dilution Method  3.6 Microbial Culture Isolation and Enumeration  3.6.1 Plate Count Method  3.6.2 Most Probable Number (MPN)  3.6.3 Direct Count  3.6.4 Use of Flow Cytometry | * Practical assessment * Projects * Portfolio of evidence * Oral assessment * Written tests |
| 1. Test microbial organisms in food and water | 4.1 Sources of Water  4.2 Water and Food Sampling Methods  4.3 Water Pollution  4.4 Water Treatment  4.5 Sewage Treatment  4.6 Analysis of Microorganism in Food  4.7 Methods of Detecting Microorganisms in Food  4.8 Food Preservation Methods  4.9 Recording of Test Results | * Practical assessment * Projects * Portfolio of evidence * Oral assessment * Written tests |
| 1. Perform industrial microbial processes | 5.1 Industrial Microorganisms  5.2 Industrial Processes  5.2.1 Beer Making  5.2.2 Wine Making  5.2.3 Baking  5.2.4 Yoghurt Making  5.2.5 Antibiotic Production  5.2.6 Biodegradation  5.2.7 Biogas Production | * Practical assessment * Projects * Portfolio of evidence * Oral assessment * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
| 1. | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Standard manuals/SOPs | For trainee’s use | 25 | 1:1 |
|  | Flip chart | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For Trainers and Trainee’s use | Varies | Varies |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainers and Trainee’s use | 1 | 1:25 |
|  | Well microbiology laboratory | For Trainers and Trainee’s use | 1 | 1:25 |
|  | Computers with internet connection | Trainee | 5 | 1:5 |
|  | Projectors | For trainer’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Petri dishes | For trainee’s use | 25 | 1:1 |
|  | Culture media (various types) | For trainee’s use | Varies | Varies |
|  | Disinfectants | For trainee’s use | Varies | Varies |
|  | Samples | For trainee’s use | Varies | Varies |
| D | Tools and Equipment | | | |
|  | Incubators | For trainee’s use | 2 | 1:13 |
|  | Inoculating loops | For trainee’s use | 10 | 11:3 |
|  | Autoclaves | For trainee’s use | 2 | 1:13 |
|  | Hot air ovens | For trainee’s use | 2 | 1:13 |
|  | Bio-safety cabinet | For Trainer/Trainee’s use | 1 | 1:25 |
|  | Sets of glass wares (Petri dishes, pipettes, test tubes, measuring cylinders, beakers) | For trainee’s use | 25 | 1:1 |
|  | Analytical balance | For trainer’s use | 1 | 1:25 |
|  | PPEs (Gloves, Masks, Goggles, Lab coats) | For trainee’s use | 25 sets | 1:1 |
|  | Distiller | For trainer’s use | 1 | 1:25 |

# MODULE V UNITS OF COMPETENCY

# MODULE V SUMMARY

This module equips learners with strong professional values, scientific inquiry skills, and practical competencies in parasitology and entomology. Trainees develop ethical work habits, conduct scientific research, and gain hands-on experience in collecting and analyzing parasitic and entomological samples—preparing them for roles in public health, agriculture, and biomedical research.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOME** | **DURATION (HOURS)** |
| 0417 541 15A | Work ethics and practices | Apply self-Management skills | **10** |
| Promote ethical practices and values | **4** |
| Promote teamwork | **10** |
| Maintain professional and Personal development | **10** |
| Maintain professional and Personal development | **4** |
| Promote customer care. | **2** |
|  |  | **TOTAL** | **40** |
| 058 855 16A | Science Laboratory research | Prepare for science laboratory research | 50 |
| Apply scientific research methods | 30 |
| Analyse science laboratory research findings | 70 |
|  |  | **TOTAL** | **150** |
| 0511 551 17A | Parasitological and entomological techniques | Collect parasitological samples | 30 |
| Perform parasitological tests | 20 |
| Manage human and animal parasites | 20 |
| Perform entomological techniques | 30 |
| Manage insect pests and vectors | 20 |
|  |  | **TOTAL** | **120** |
|  | **GRAND TOTAL** | | **320** |

## WORK ETHICS AND PRACTICES

**UNIT CODE: 0417 541 15A**

**Relationship to Occupational Standards**

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

**Duration of Unit: 50 hours**

**Unit Description**

This unit covers competencies required to demonstrate employability skills. 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** |
| 3. | Promote teamwork | **10** |
| 4 | Maintain professional and Personal development | **10** |
| 5 | Maintain professional and Personal development | **4** |
| 6 | 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 | * Observation * Portfolio of evidence * Project * Practical * Written assessment * 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 | * Portfolio of evidence * Project * Practical * Observation * Written assessment * 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   3.7 Qualities of a team player  3.8 Leading a team  3.9 Team performance and evaluation  3.10 Conflicts and conflict resolution  3.11 Gender and diversity mainstreaming  3.12 Developing Healthy workplace relationships  3.13 Adaptability and flexibility  3.14 Coaching and mentoring skills | * Observation * Written assessment * Oral assessment * Portfolio of evidence * Project * Practical |
| 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 * Observation * Written assessment * Oral assessment * Portfolio of evidence |
| 1. Apply problem-s 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 | * Observation * Project * Portfolio of evidence * Practical * Written assessment * Oral assessment |
| 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 | * Observation * Project * Practical * Portfolio of evidence * Written assessment * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Charts | For trainees and Trainer’s use | 6-10 | 1:5 pr 1:10 |
|  | * Video clips | For trainees and Trainer’s use | Varies | Varies |
|  | Audio tapes | For trainees and Trainer’s use | Varies | Varies |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 25 | 1:1 |
|  | Radio sets | For trainee’s use | 3-5 | 1:5 or 1:10 |
|  | TV sets | For trainee’s use | 3-5 | 1:5 or 1:10 |
| C | Consumable materials | | | |
|  | Stationery | For trainees and trainer’s use | Varies | Varies |
| D | Tools and Equipment | | | |
|  | LCD projectors | For trainer’s use | 1 | 1:25 |

# SCIENTIFIC RESEARCH

**UNIT CODE: 0588 551 16A**

**Relationship to Occupational Standards**

This unit addresses the unit of competency: **Conduct Scientific Research**

**Duration of Unit: 150 Hours**

**Unit Description**

This unit specifies the competencies required to conduct science laboratory research. It involves preparing for science laboratory research, carrying out science laboratory research and analyzing the science laboratory research findings. It also includes documenting and disseminating science laboratory research findings.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Prepare for science laboratory research | 50 |
| 2. | Apply scientific research methods | 30 |
| 3. | Analyze science laboratory research findings | 70 |
| 4 | **TOTAL** | **150** |

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

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * 1. Prepare for science laboratory research | 1. Introduction to research methods 2. Ethics in research 3. Research topics and study site 4. Research problem 5. Research objectives 6. Designing research questions 7. Development of conceptual framework 8. Establishment of research theoretical framework 9. Proposal writing procedures | * Practical Assessment * Project-Based Assessment * Portfolio of Evidence * Written Assessment |
| * 1. Carry out science laboratory research | 1. Scientific study design 2. Sampling techniques 3. Sample size 4. Research instruments 5. Piloting of research instruments 6. Data collection | * Practical Assessment * Project-Based Assessment * Portfolio of Evidence * Third Party Reports * Written Assessment |
| * 1. Analyse science laboratory research findings | 1. Standard Data Analysis Methods 2. Validity and Reliability of Analytical Methods 3. Research Ethical Considerations 4. Data Analysis Techniques 5. Data Presentation 6. Statistical Packages (e.g., SPSS, Excel) 7. Documentation of Research Processes 8. Recommendations of Research Study 9. Compiling Research Report 10. Dissemination of Research | * Practical Assessment * Project-Based Assessment * Portfolio of Evidence * Written Assessment |

**Suggested Delivery Methods**

* Practical work
* Demonstration
* Demonstration videos
* Field trips / Excursion
* Trainee group discussions
* Case studies

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Computer | For trainer’s use | 1 | 1:25 |
|  |  |  |  |  |
|  | Standard manuals/SOPs | For trainer’s use | 1 | 1:25 |
|  | Flip charts | For trainer’s use | 1 | 1:25 |
|  | Stationeries | For trainee’s use | 25 | 1:1 |
| **B** | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For trainer and trainee use | 1 | 1:12 |
|  | Fully equipped science laboratory | For trainee’s use | 1 | 1:25 |
|  | Lecture room | For trainee’s use | 1 | 1:25 |
| 1. **C** | Consumable materials | | | |
| 1. **1.** | Disinfectant | For trainee’s use | 25 | 1:1 |
|  | Gloves | For trainee’s use | 25 | 1:1 |
|  | Laboratory coats | For trainee’s use | 25 | 1:1 |
|  | Face Masks | For trainee’s use | 25 | 1:1 |
| **D** | Tools and Equipment | | | |
|  | First aid kit | For trainee’s use | 1 | 1:25 |
|  | Goggles | For trainee’s use | 25 | 1:1 |
|  | Projector | For trainer’s use | 1 | 1:25 |
|  | Safety boots | For trainee’s use | 25 | 1:1 |

## PARASITOLOGICAL AND ENTOMOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 17A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: Perform parasitological and entomological techniques

**Duration of Unit: 120 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to perform parasitological and entomological techniques. It involves collecting parasitological samples, performing parasitological tests, managing human and animal parasites, performing entomological techniques and managing insect pests and vectors.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Collect parasitological samples | 30 |
| 2. | Perform parasitological tests | 20 |
| 3. | Manage human and animal parasites | 20 |
| 4 | Perform entomological techniques | 30 |
| 5 | Manage insect pests and vectors | 20 |
|  | **TOTAL** | **120** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| * + - 1. Collect parasitological samples | 1. Sample collection and handling 2. Faecal 3. Blood 4. Urine 5. Sputum 6. Tissue biopsy 7. Skin scrapings or swabs 8. Sample packaging, transportation, processing and storage | * + Practical assessment   + Project   + Portfolio of evidence   + Oral assessment   + Third party report   + Written tests |
| * + - 1. Perform parasitological tests | 1. Collection and processing of samples 2. Diagnostic techniques 3. Faecal examination 4. Blood smears 5. Urine analysis 6. Sputum examination 7. Examination of the skin scrapings or /and swabs   2.3 Recording of results | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| * + - 1. Manage human and animal parasites | 1. Classification of human and animal parasites 2. Protozoa 3. Metazoan 4. Arthropods 5. Modes of parasite transmission 6. Parasite lifecycle 7. Prevention and control | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| * + - 1. Perform entomological techniques | 1. Branches of entomology 2. Insect collection methods 3. Sweeping 4. Light traps 5. pitfall traps 6. aspirators 7. Insect preservation techniques 8. Ethanol preservation 9. Pinning 10. Freezing 11. Identification and classification 12. Morphological identification 13. Molecular techniques 14. Keys and Guides | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |
| * + - 1. Manage insect pests and vectors | 1. Insect pests, vectors collection and classification 2. Insect pests 3. Storage pests 4. Insect outbreak 5. Control of insect pests and vectors | * + Practical assessment   + Project   + Portfolio of evidence   + Oral assessment   + Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainer’s use |  |  |
| **B** | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers and internet connection | For trainee’s use | 5 | 1:5 |
|  | Projectors | For Trainer /trainee’s use | 1 | 1:25 |
|  | White board | For Trainer/trainee’s use | 1 | 1:25 |
| **C** | Consumable materials | | | |
|  | Drawing sheets | For trainee’s use | 25 | 1:1 |
|  | PPE | For trainee’s use | 25 | 1:1 |
| **D** | Tools and Equipment | | | |
|  | Calculators | For trainee’s use | 25 | 1:1 |
|  | GPS units | For trainee’s use | 5 | 1:5 |
|  | Dissection kits | For trainee’s use | 25 | 1:1 |
|  | Incubators | For trainee’s use | 2 | 1:13/1:12 |
|  | Microscopes | For trainee’s use | 5 | 1:5 |
|  | Magnifying glasses | For trainee’s use | 25 | 1:1 |
|  | Insect nets | For trainee’s use | 25 | 1:1 |

# MODULE VI UNITS OF LEARNING

# MODULE VI SUMMARY

This module blends entrepreneurship, genetics, biochemistry, and pharmacological techniques to prepare trainees for innovative roles in biosciences. Learners develop entrepreneurial thinking, understand genetic inheritance, perform advanced biochemical analyses, and assess drug efficacy and toxicity—empowering them for careers in biotech, healthcare, herbal research, and science-based business ventures.

|  |  |  |  |
| --- | --- | --- | --- |
| **UNIT CODE** | **UNIT NAME** | **LEARNING OUTCOME** | **DURATION (HOURS)** |
| 0413 541 18 | Entrepreneurial skills | Apply financial literacy | **6** |
| Apply the entrepreneurial concept | **4** |
| Identify entrepreneurship opportunities | **10** |
| Apply business legal aspects | **6** |
| Innovate business strategies | **6** |
| Develop a business plan | **12** |
|  |  | **TOTAL** | **40** |
| 051 155 19 | Genetics principles | Apply cell division concepts | 20 |
| Apply knowledge on structure of nucleic acids | 30 |
| Apply mendelian law of inheritance | 30 |
| Apply protein synthesis knowledge | 20 |
| Carry out animal and plant breeding | 30 |
|  |  | **TOTAL** | **130** |
| 0511 551 20 | Biochemical analysis | Carry out biomolecule tests | 50 |
| Perform bio-molecules separation and qualitative analysis | 50 |
| Perform enzyme activity tests | 50 |
|  |  | **TOTAL** | **150** |
| 0511 551 21 | Pharmacological and toxicological techniques | Prepare plant crude extracts | 50 |
| Test herbal drugs’ efficacy | 40 |
| Carry out toxicity testing | 40 |
|  |  | **TOTAL** | **130** |
|  | **GRAND TOTAL** | | **470** |

## ENTREPRENEURIAL SKILLS

**UNIT CODE: 0413 541 18A**

**Relationship to occupational standards**

This unit addresses the unit of competency: Apply Entrepreneurial skills.

**Duration of unit: 40 hours**

**Unit Description:**

This unit covers the competencies required to demonstrate an understanding of entrepreneurship. It involves demonstrating an understanding of financial literacy, applying entrepreneurial concepts identifying entrepreneurship opportunities, applying business legal aspects, and developing business innovative strategies and business plans.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply financial literacy | **10** |
| 2. | Apply the entrepreneurial concept | **5** |
| 3. | Identify entrepreneurship opportunities | **5** |
| 4 | Apply business legal aspects | 5 |
| 5 | Innovate business strategies | 5 |
| 6 | Develop a business plan | 10 |
|  | **TOTAL** | **40** |

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

| **Learning Outcome** | **Content** | **Suggested Assessment Methods** |
| --- | --- | --- |
| 1. Apply financial literacy | 1. Personal finance management 2. Balancing between needs and wants 3. Budget Preparation 4. Saving management 5. Factors to consider when deciding where to save 6. Debt management 7. Factors to consider before taking a loan 8. Investment decisions 9. Types of investments 10. Factors to consider when investing money 11. Insurance services 12. insurance products available in the market 13. Insurable risks | * Observation * Project * Written assessment * Oral assessment * Interviews |
| 2.Apply entrepreneurial concept | 1. Difference between Entrepreneurs and Business persons 2. Types of entrepreneurs 3. Ways of becoming an entrepreneur 4. Characteristics of Entrepreneurs 5. salaried employment and self-employment 6. Requirements for entry into self-employment 7. Roles of an Entrepreneur in an enterprise 8. Contributions of Entrepreneurship | * Observation * Project * Written assessment * Oral assessment |
| 3.Identify entrepreneurship opportunities | 1. Sources of business ideas 2. Factors to consider when evaluating business opportunity 3. Business life cycle | * Observation * Project * Written assessment * Oral assessment |
| 4.Apply business legal aspects | 1. Forms of business ownership 2. Business registration and licensing processing 3. Types of contracts and agreements 4. Employment laws 5. Taxation laws | * Observation * Project * Written assessment * Oral assessment |
| 5.Innovate business strategies | 1. Creativity in business 2. Innovative business strategies 3. Entrepreneurial Linkages 4. ICT in business growth and development | * Observation * Project * Written assessment * Oral assessment |
| 6.Develop business plan | 1. Business description 2. Marketing plan 3. Organizational/Management   plan   1. Production/operation plan 2. Financial plan 3. Executive summary 4. Business plan presentation 5. Business idea incubation | * Observation * Written assessment * Project * Oral assessment |

**Suggested Methods of Instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | **Category/Item** | **Description/ Specifications** | **Quantity** | **Recommended Ratio**  **(Item: Trainee)** |
| **A** | **Learning Materials** | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Case studies | For trainee’s use | 5 | 1:5 |
|  | Business plan templates | For trainee’s use | 5 | 1:5 |
| **B** | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For trainers and trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 10 | 1:2 or 1:3 |
|  |  |  |  |  |
|  | Internet | For Trainers and Trainee’s use | 1 connection | 1:25 |
|  | Video clips | For trainers and Trainee’s use | Varies | Varies |
|  | Newspapers and Handouts | For trainee’s use | 5 | 1:5 |
|  | Business Journals | For trainee’s use | 5 | 1:5 |
| **C** | Consumable materials | | | |
|  | Sets of Writing materials | For trainee’s use | 25 | 1:1 |
| **D** | Tools and Equipment | | | |
|  | Overhead projector | For trainer’s use | 1 | 1:25 |

## GENETICS PRINCIPLES

**UNIT CODE: 0511 551 19A**

**UNIT DESCRIPTION**

This unit describes the competencies required by an applied biology technologist to apply genetics principles. It involves applying cell division concepts, applying knowledge on Structure of nucleic acids, applying Mendelian law of inheritance, applying protein synthesis knowledge and carrying out animal and plant breeding.

**Duration of Unit: 130hours**

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Apply cell division concepts | 20 |
| 2. | Apply knowledge on structure of nucleic acids | 30 |
| 3. | Apply mendelian law of inheritance | 30 |
| 4 | Apply protein synthesis knowledge | 20 |
| 5 | Carry out animal and plant breeding | 30 |
|  | **TOTAL** | **130** |

**Leaning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| * 1. Apply Cell division concepts | 1. Cell cycle 2. Cell division 3. Mitosis 4. Meiosis    1. Genetic crossing. | * Practical assessment * Project * Portfolio of evidence * Third party report * Written tests |
| * 1. Apply knowledge on Structure of nucleic acids | 1. Structure of the chromosome 2. DNA structure and function 3. RNA structure and function 4. Mutation    1. Chromosomal mutations    2. Gene mutations    3. Advantageous and deleterious mutations    4. Causes of mutations    5. Mutation disorders | * Practical assessment * Project * Portfolio of evidence * Third party report * Written tests |
| * 1. Apply Mendelian law of inheritance | 1. Mendelian principle of inheritance and deviations from the laws. 2. Punnet squares 3. Monohybrid and dihybrid crosses    1. Genes, DNA and Chromosomes    2. Gene interactions    3. Types of dominance    4. Genetic disorders 4. Sickle cell anaemia 5. Muscular dystrophy 6. Cystic fibrosis 7. Albinism 8. Huntington’s disease 9. Down’s syndrome 10. Klinefelter’s syndrome 11. Turner’s Syndrome 12. Erythroblastis fetalis 13. Haemophilia | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| * 1. Apply Protein synthesis knowledge | 1. DNA replication 2. DNA transcription 3. DNA translation | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |
| * 1. Carry out Animal and plant breeding | * 1. Animal and plant breeding materials  1. Sex determination    1. Types of breeding 2. Natural and artificial breeding 3. Selective breeding 4. Inbreeding 5. Crossbreeding 6. Outbreeding/outcrossing 7. Hybridization breeding 8. Line breeding 9. Cloning 10. Captive breeding   5.3 Sexual reproduction   1. Pollination 2. Fertilization    1. Results of breeding    2. Effects of breeding | * Practical assessment * Project * Portfolio of evidence * Written tests * Oral assessment |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/No.** | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| **A** | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Relevant videos | For trainees and trainer’s use | Varies | Varies |
| **B** | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For trainees and trainer’s use | 1 | 1:25 |
|  | Well-equipped Biology laboratory | For trainees and trainer’s use | 1 facility | 1:25 |
|  | Computers | For trainee’s | 5 | 1:5 |
|  | Whiteboard | For trainer’s use | 1 | 1:15 |
|  | Internet | For trainees and trainer’s use | 1 connection | 1:25 |
| **C** | Consumable materials | | | |
|  | Printing papers | For trainees use |  |  |
|  | White board makers | For trainees and trainer’s use |  |  |
| **D** | Tools and Equipment | | | |
|  | Microscopes | For trainee’s use | 5 | 1:5 |
|  | Centrifuges | For trainee’s use | 2 | 1:13 |
|  | Refrigerator | For trainer’s use | 1 | 1:25 |
|  | Spectrophotometer | For trainee’s use | 1 | 1:25 |
|  | Incubator | For trainee’s use | 1 | 1:25 |
|  | PCR thermocycler | For trainee’s use | 1 | 1:25 |
|  | Gel Electrophoresis equipment | For trainee’s use | 1 | 1:25 |
|  | Assorted molecular biology equipment and reagents | For trainers and trainee’s use | Varies | Varies |
|  | Gel Doc system | For trainee’s use | 1 | 1:25 |
|  | Assorted laboratory animals | For trainee’s use | 5 | 1:5 |
|  | Projector | For trainer’s use | 1 | 1:25 |

## BIOCHEMICAL ANALYSIS

**UNIT CODE: 0511 551 20A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: apply biochemical techniques. It involves carrying out biomolecule tests, performing bio-molecules separation and qualitative analysis and performing enzyme activity tests.

**Duration of Unit: 150 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to conduct biochemical analysis. It involves carrying out biomolecule tests, performing bio-molecules separation and qualitative analysis and performing enzyme activity tests.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Carry out biomolecule tests | 50 |
| 2. | Perform bio-molecules separation and qualitative analysis | 50 |
| 3. | Perform enzyme activity tests | 50 |
|  | **TOTAL** | **150** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **Suggested methods of assessment** |
| * + - 1. Carry out biomolecule tests | 1. Definition of biomolecules 2. Classification, structure, properties, and metabolism of biomolecules: 3. Water 4. Carbohydrates 5. Proteins 6. Lipids 7. Enzymes 8. Nucleic acids 9. Vitamins and minerals 10. Acids, bases, buffers and pH   1.3 Testing of biomolecules  1.4 Recording of results | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform bio-molecules separation and qualitative analysis | 1. Biomolecule separation procedures 2. Iodine/iodide test (starch test) 3. Reducing sugar test (benedicts test) 4. Translucent test (lipids) 5. Biuret test (proteins) 6. DCPIP test (ascorbic acid test) 7. Chromatography 8. Electrophoresis | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |
| * + - 1. Perform enzyme activity tests | 1. Classifications of enzymes 2. Properties of enzymes 3. Factors influencing enzyme activity 4. Temperature 5. pH 6. Substrate concentration 7. Enzyme concentration 8. Co-factors and co- enzymes 9. Mechanisms of action 10. Regulation of enzyme activity | * Practical assessment * Projects * Oral assessment * Portfolio of evidence * Written tests |

**Suggested Methods of instruction**

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

**Recommended Resources for 25 Trainees**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainee/trainer use | 1 | 1:25 |
|  | Well-equipped laboratory | For Trainer/trainee use | 1 | 1:25 |
|  | Computers with internet | For Trainee’s use | 5 | 1:5 |
|  | White board | For Trainer’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | Paper chromatograms | For Trainee’s use | 25 | 1:25 |
|  | Reagents(assorted) | For Trainee’s use | 10 | 1:3 |
|  | Biomolecules | For Trainee’s use | 10 | 1:3 |
|  | Enzymes | For Trainee’s use | 10 | 1:3 |
| D | Tools and Equipment | | | |
|  | Calculator | For Trainee’s use | 25 | 1:25 |
|  | Water baths | For Trainer’s use | 2 | 1:13 |
|  | Glass ware (assorted) | For Trainee’s use | 10 | 1:3 |
|  | UV light | For Trainee’s use | 1 | 1:25 |
|  | Projector | For Trainer’s use | 1 | 1:25 |

## PHARMACOLOGICAL AND TOXICOLOGICAL TECHNIQUES

**UNIT CODE: 0511 551 21A**

**Relationship to Occupational Standards**

This unit addresses the Unit of Competency: perform pharmacological and toxicological techniques. It involves Prepare plant crude extracts, carrying out toxicity testing.

**Duration of Unit: 130 Hours**

**Unit Description**

This unit describes the competencies required by an applied biology technologist to perform pharmacological and toxicological techniques. It involves preparing plant crude extracts, testing herbal drugs’ efficacy and carrying out toxicity testing.

**Summary of Learning Outcomes**

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

|  |  |  |
| --- | --- | --- |
| **S/No** | **Learning Outcomes** | **Duration (Hours)** |
| 1. | Prepare plant crude extracts | 50 |
| 2. | Test herbal drugs’ efficacy | 40 |
| 3. | Carry out toxicity testing | 40 |
|  | **TOTAL** | **130** |

**Learning Outcomes, Content and suggested methods of assessment**

|  |  |  |
| --- | --- | --- |
| **Learning Outcome** | **Content** | **suggested methods of assessment** |
| 1. Prepare plant crude extracts | 1. Introduction 2. Pharmacology, 3. Phytochemistry 4. Toxicology 5. Pharmacokinetics 6. Pharmacodynamics 7. Alkaloids 8. terpenes 9. Tannins 10. Flavonoids 11. Saponins 12. Collection of plant samples 13. Extraction and separation techniques, screening/ detection and purification 14. Storage | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Written tests |
| 1. Test herbal drugs’ efficacy | 1. Identification of herbal plants. 2. Extraction of active ingredient 3. Classification of herbal medicine 4. Routes of drug administration 5. Dosage 6. Drug efficacy test 7. In-vivo, In-vitro, clinical trials, 8. Crude extracts serial dilution 9. Drug sensitivity test 10. Disc diffusion 11. Broth dilution 12. Time kill assay | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Written tests |
| 1. Carry out toxicity testing | 1. Toxicity testing tools and materials 2. Drug sample administration 3. Effective dose determination 4. Half-life of toxic substances 5. Factors contributing to toxicity of a drug. 6. Recording of toxicity test findings | * Practical assessment * Project * Portfolio of evidence * Oral assessment * Third party report * Written tests |

Suggested Methods of instruction

* Practical
* Projects
* Group discussions
* Demonstration
* Field trips/site visits
* Direct instruction

Recommended Resources for 25 Trainees

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/No. | Category/Item | Description/ Specifications | Quantity | Recommended Ratio  (Item: Trainee) |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For trainer/trainee use | 1 | 1:25 |
|  | Computers with internet | For trainee’s use | 5 | 1:5 |
|  | White board | For trainer/trainee’s use | 1 | 1:25 |
| C | Consumable materials | | | |
|  | PPE | For Trainee’s use | 25 | 1:1 |
|  | Drugs (assorted) | For Trainee’s use | 25 | 1:1 |
|  | Laboratory animals | For Trainee’s use | 25 | 1:1 |
|  | White board markers | For Trainee’s use | 1 | 1:25 |
| D | Tools and Equipment | | | |
|  | Fume hood | For Trainee’s use | 1 | 1:1 |
|  | Spectrophotometer | For Trainee’s use | 1 | 1:25 |
|  | HPLC | For Trainee’s use | 1 | 1:25 |
|  | Centrifuges | For Trainee’s use | 3 | 1:8 |
|  | Biosafety cabinet | For Trainee’s use | 1 | 1:25 |
|  | Refrigerator | For Trainee’s use | 1 | 1:25 |
|  | Glassware (assorted) | For Trainee’s use | 25 | 1:1 |
|  | Projectors | For trainee/trainer’s use | 2 | 1:13 |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | Learning Materials | | | |
|  | Power point presentations | For trainer’s use | 1 | 1:25 |
|  | Charts | For trainees and Trainer’s use | 6-10 | 1:5 pr 1:10 |
|  | Video clips | For trainees and Trainer’s use | Varies | Varies |
|  | Audio tapes | For trainees and Trainer’s use | Varies | Varies |
| B | Learning Facilities & infrastructure | | | |
|  | Lecture/theory room | For Trainer/trainee’s use | 1 | 1:25 |
|  | Computers | For trainee’s use | 25 | 1:1 |
|  | Radio sets | For trainee’s use | 3-5 | 1:5 or 1:10 |
|  | TV sets | For trainee’s use | 3-5 | 1:5 or 1:10 |
| C | Consumable materials | | | |
|  | Stationery | For trainees and trainer’s use | Varies | Varies |
| D | Tools and Equipment | | | |
|  | LCD projectors | For trainer’s use | 1 | 1:25 |