REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

APPLIED STATISTICS TECHNICIAN

LEVEL 6

TVET CDACC
P.O. BOX 15745-00100
NAIROBI

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FOREWORD

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

Reforms in the education sector are necessary for the achievement of Kenya Vision 2030 and meeting 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 (Sessional Paper No. 4 of 2016). A key feature of this policy is the radical change in the design and delivery of the 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 mode of delivery allows 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 these Occupational Standards were developed for developing a Competency-Based Curriculum for Applied Statistics level 6. These Occupational Standards will also be the basis for assessment of an individual for competence certification.

It is my conviction that these Occupational Standards will play a great role towards development of competent human resource for the Mathematics and Statistics sector's growth and sustainable development.

PRINCIPAL SECRETARY, VOCATIONAL AND TECHNICAL TRAINING
MINISTRY OF EDUCATION

PREFACE

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

The Technical and Vocational Education and Training Act No. 29 of 2013 and the Sessional Paper No. 14 of 2012 on Reforming Education and Training in Kenya, emphasized the need to reform Curriculum development, assessment and certification. This called for 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 Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with Applied Statistics Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for an applied statistician. These Occupational Standards will be the basis for development of competency-based Curriculum for Applied Statistics Level 6. These Standards will also be the basis for assessment of an individual for competence certification.

The Occupational Standards are designed and organized with clear performance criteria for each element of a unit of competency. These standards also outline the required knowledge and skills as well as evidence guide.

I am grateful to the Council Members, Council Secretariat, Applied Statistics SSAC, expert workers and all those who participated in the development of these Occupational Standards.

CHAIRMAN, TVET CDACC

ACKNOWLEDGMENT

These Occupational Standards were developed through combined effort of various stakeholders from private and public organizations. I am sincerely thankful to the management of these organizations for allowing their staff to participate in this course. I wish to acknowledge the invaluable contribution of industry players who provided inputs towards the development of these Standards.

I thank TVET Curriculum Development, Assessment and Certification Council (TVET CDACC) for providing guidance on the development of these Standards. My gratitude goes to the Applied Statistics Sector Skills Advisory Committee (SSAC) members for their contribution to the development of these Standards. I thank all the individuals and organizations who participated in the validation of these Standards.

I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

CHAIRPERSON
APPLIED STATISTICS SECTOR SKILLS ADVISORY COMMITTEE

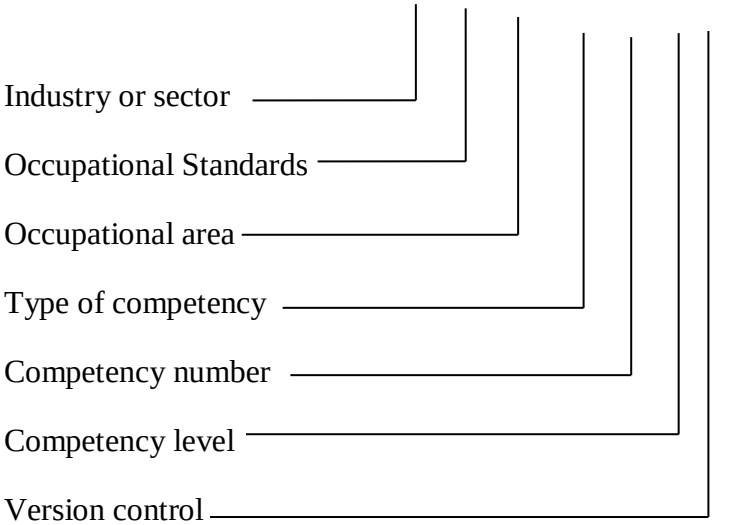
Table of Contents

ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
BC	Basic Competency
CC	Common Competency
CDACC	Curriculum Development, Assessment and Certification Council
CR	Core Competency
CU	Curriculum
2D	Two Dimensional
HIV	Human Immuno-Deficiency Virus
ICT	Information Communication Technology
LCD	Liquid Crystal Display
NEMA	National Environmental Management Authority
OSHA	Occupation Safety and Health Act
OSHS	Occupation Safety and Health Standards
PESTEL	Political Economic Social Technological Environmental and Legal
PPE	Personal Protective Equipment
SSAC	Sector Skills Advisory Committee
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE

MATH/OS/AS/BC/01/6/A



OVERVIEW

Applied statistics Level 6 qualification consists of competencies that an individual must achieve to enable him/her to apply statistics in a work place. it entails preparation of research concept, design and data collection tools, collection and management of research data, descriptive data analysis, inferential data analysis, experimental research designs, improvement of industrial process quality

BASIC UNITS OF COMPETENCY

Unit Code	Unit Title
MATH/OS/AS/BC/01/6/A	Demonstrate Communication Skills
MATH/OS/AS/BC/02/6/A	Demonstrate Numeracy Skills
MATH/OS/AS/BC/03/6/A	Demonstrate Digital Literacy
MATH/OS/AS/BC/04/6/A	Demonstrate Entrepreneurial Skills
MATH/OS/AS/BC/05/6/A	Demonstrate Employability Skills
MATH/OS/AS/BC/06/6/A	Demonstrate Environmental Literacy
MATH/OS/AS/BC/07/6/A	Demonstrate Occupational Safety And Health Practices

COMMON UNITS OF COMPETENCY

Unit Code	Unit Title
MATH/OS/AS/CC/01/6/A	Apply Mathematics For Statistics
MATH/OS/AS/CC/02/6/A	Apply Statistical Techniques
MATH/OS/AS/CC/03/6/A	Apply Research Methods
MATH/OS/AS/CC/04/6/A	Develop Database Management Systems
MATH/OS/AS/CC/05/6/A	Manage Statistical Data

CORE UNITS OF COMPENTENCY

Unit of Competency Code	Unit of Competency Title
MATH/CU/AS/CR/01/6/A	Develop Research Concepts
MATH/CU/AS/CR/02/6/A	Collect And Manage Research Data
MATH/CU/AS/CR/03/6/A	Perform Descriptive Data Analysis
MATH/CU/AS/CR/04/6/A	Perform Inferential Data Analysis
MATH/CU/AS/CR/05/6/A	Design Research Experiments
MATH/CU/AS/CR/06/6/A	Improve Process Quality
	Industrial Attachment
	Project/Term Paper

BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: MATH/OS/AS/BC/01/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate communication skills. It involves meeting communication needs of clients and colleagues, developing communication strategies, establishing and maintaining communication pathways, conducting interviews, facilitating group discussion and representing the organization.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Meet communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met based on workplace requirements 1.2 Different communication approaches are identified and applied according to clients' needs 1.3 Conflict is identified and addressed as per the standards of the organization
2. Develop communication strategies	2.1 Strategies for effective internal and external dissemination of information are developed as per organization's requirements 2.2 Special communication needs are considered in developing strategies according workplace procedures 2.3 ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs
3. Establish and maintain communication pathways	3.1 Pathways of communication are established as per organization policy 3.2 Pathways are maintained and reviewed according to organization procedures
4. Promote use of communication strategies	4.1 Information is provided to all areas of the organization as per strategy requirements 4.2 Effective communication techniques are articulated and modeled according work requirements

	4.3 Personnel are given guidance about adapting communication strategies as per organization procedures
5. Conduct interview	5.1 A range of appropriate communication strategies are employed in ***interview situations*** based on the workplace requirements 5.2 Records of interviews are made and maintained in accordance with organizational procedures 5.3 Effective questioning, listening and nonverbal communication techniques are used as per needs
6. Facilitate group discussion	6.1 Mechanisms to enhance ***effective group interaction*** are identified and implemented according to workplace requirements 6.2 Strategies to encourage group participation are identified and used as per organizations' procedures 6.3 Meetings objectives and agenda are set and followed based on workplace requirements 6.4 Relevant information is provided and feedback obtained according to set protocols 6.5 Evaluation of group communication strategies is undertaken in accordance with workplace guidelines 6.6 Specific communication needs of individuals are identified and addressed as per individual needs
7. Represent the organization	5.1 7Relevant presentation are researched and presented based on internal or external communication forums requirements 5.2 Presentation is delivered in a clear and sequential manner as per the predetermined time 5.3 Presentation is made as per appropriate media 5.4 Difference views are respected based on workplace procedures 5.5 Written communication is done as per organizational standards 5.6 Inquiries are responded according to organizational standard

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	Range
1. Communication strategies may include but not limited to:	• Language switch • Comprehension check • Repetition • Asking confirmation • Paraphrase • Clarification request • Translation • Restructuring • Approximation • Generalization
2. Effective group interaction may include but not limited to:	• Identifying and evaluating what is occurring within an interaction in a nonjudgmental way • Using active listening • Making decision about appropriate words, behavior • Putting together response which is culturally appropriate • Expressing an individual perspective • Expressing own philosophy, ideology and background and exploring impact with relevance to communication
3. Situations may include but not limited to:	• Establishing rapport • Eliciting facts and information • Facilitating resolution of issues • Developing action plans • Diffusing potentially difficult situations

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Active listening
- Interpretation
- Negotiation

- Writing

Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process
- Dynamics of groups
- Styles of group leadership
- Key elements of communications strategy

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Developed communication strategies to meet the organization requirements and applied in the workplace 1.2 Established and maintained communication pathways for effective communication in the workplace 1.3 Used communication strategies involving exchanges of complex oral information
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Direct observation 3.2 Oral questioning 3.3 Written texts
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE NUMERACY SKILLS

UNIT CODE: MATH/OS/AS/BC/02/6/A

UNIT DESCRIPTION

This unit describes the competencies required to demonstrate numeracy skills. It involves; applying a wide range of mathematical calculations for work; applying ratios, rates and proportions to solve problems; estimating, measuring and calculating measurement for work; using detailed maps to plan travel routes for work; using geometry to draw and construct 2D and 3D shapes for work; collecting, organizing and interpreting statistical data; using routine formula and algebraic expressions for work and using common functions of a scientific calculator.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Apply a wide range of mathematical calculations for work	1.1 Mathematical information embedded in a range of workplace tasks and texts is extracted as per workplace procedures. 1.2 Mathematical information is interpreted and comprehended as per job specifications 1.3 A range of mathematical and problem solving processes are selected and used as per job specification 1.4 Different forms of fractions, decimals and percentages are flexibly used as per SOPs 1.5 Calculation performed with positive and negative numbers as per SOPs 1.6 Numbers are expressed as powers and roots and are used in calculations as per SOPs 1.7 Calculations done using routine formulas as per SOPs 1.8 Estimation and assessment processes are used to check outcome as per workplace procedures 1.9 Mathematical language is used to discuss and explain the processes, results and implications of the task as per workplace procedures

2. Use and apply ratios, rates and proportions for work	2.1 Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts as per SOPs 2.2 Mathematical information related to ratios, rate and proportions is analysed as per SOPs 2.3 Problem solving processes are used to undertake the task as per workplace procedures 2.4 Equivalent ratios and rates are simplified as per SOPs 2.5 Quantities are calculated using ratios, rates and proportions as per SOPS 2.6 Graphs, charts or tables are constructed to represent ratios, rates and proportions as per SOPs 2.7 The outcomes reviewed and checked as per job specifications 2.8 Information is record using mathematical language and symbols as per workplace procedures
3. Estimate, measure and calculate measurement for work	3.1 Measurement information embedded in workplace texts and tasks are extracted and interpreted as per job specifications 3.2 Appropriate workplace measuring equipment are identified and selected as per job specifications 3.3 Accurate measurements are estimated and made as per SOPs 3.4 The area of ***2D shapes*** including compound shapes are calculated as per SOPs 3.5 The volume of 3D shapes is calculated using relevant formulas as per SOPs 3.6 Sides of right angled triangles are calculated using Pythagoras' theorem as per SOPs 3.7 conversions are perform between units of measurement as per job specification 3.8 Problem solving processes are used to undertake the task as per workplace Procedures 3.9 The measurement outcomes are reviewed and checked as per workplace procedures 3.10 Information is recorded using mathematical language and symbols appropriate for the task as per workplace procedures

4. Use detailed maps to plan travel routes for work	4.1 Different types of maps are identified and interpreted as per job requirements 4.2 Key features of maps are identified as per job requirements 4.3 Scales are identified and interpreted as per job requirements 4.4 Scales are applied to calculate actual distances 4.5 Positions or locations are determined using directional information as per job requirements 4.6 Routes are planned by determining directions and calculating distances, speeds and times as per job requirements 4.7 Information is gathered and identified and relevant factors related to planning a route checked as per job requirements 4.8 Relevant equipment is select and checked for accuracy and operational effectiveness as per job requirements 4.9 Task is planned and recorded using specialized mathematical language and symbols appropriate for the task as per job requirements
5. Use geometry to draw 2D shapes and construct 3D shapes for work	5.1 A range of 2D shapes and 3D shapes and their uses in work contexts is identified as per job specifications 5.2 Features of 2D and 3D shapes are named and described as per job specifications 5.3 Types of angles in 2D and 3D shapes are identified as per job specifications 5.4 Angles are drawn, estimated and measured using geometric instruments as per job requirements 5.5 Angle properties of 2D shapes are named and identified as per SOPs 5.6 Angle properties are used to evaluate unknown angles in shapes as per SOPs 5.7 Properties of perpendicular and parallel lines are applied to shapes as per SOPs 5.8 Understanding and use of symmetry is demonstrated as per SOPs

	5.9 Understanding and use of similarity is demonstrated as per SOPs 5.10 The workplace tasks and mathematical processes required are identified as per workplace procedures 5.11 2D shapes is drawn for work as per job specification 5.12 3D shapes is constructed for work as per job specification 5.13 The outcomes are reviewed and checked as per workplace procedures 5.14 Specialized mathematical language and symbols appropriate for the task are used as per SOPs
6. Collect, organize, and interpret statistical data for work	6.1 Workplace issue requiring investigation are identified as per workplace procedures 6.2 Audience / population / sample unit is determined as per workplace procedures as per workplace procedures 6.3 Data to be collected is identified as per workplace procedures 6.4 Data collection method is selected as per workplace procedures 6.5 Appropriate statistical data is collected and organized as per SOPs 6.6 Data is illustrated in appropriate formats as per SOPs 6.7 The effectiveness of different types of graphs are compared as per SOPs 6.8 The summary statistics for collected data is calculated as per SOPs 6.9 The results / findings are interpreted as per SOPs 6.10 Data is checked to ensure that it meets the expected results and content as per workplace procedures 6.11 Information from the results including tables, graphs and summary statistics is extracted and interpreted as per workplace procedure 6.12 Mathematical language and symbols are used to report results of investigation as per workplace procedure

7. Use routine formula and algebraic expressions for work	7.1 Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated as per SOPs 7.2 Simple algebraic expressions and equations are developed as per job specification 7.3 Operate on algebraic expressions as per job requirement 7.4 Algebraic expressions are simplified as per job requirement 7.5 Substitution into simple routine equations is done as per SOPs 7.6 Routine formulas used for work tasks are identified and comprehended as per SOPs 7.7 Routine formulas are evaluate by substitution as per SOPs 7.8 Routine formulas transposed as per SOPs 7.9 Appropriate formulas are identified and used for work related tasks as per workplace procedures 7.10 Outcomes are checked and result of calculation used as per workplace procedures
8. Use common functions of a scientific calculator for work	8.1 Required numerical information to perform tasks is located as per job specification 8.2 The order of operations and function keys necessary to solve mathematical calculation are determined as per job specification 8.3 Function keys on a scientific calculator are identified and used as per SOPs 8.4 Estimations are referred to check reasonableness of problem solving process as per workplace procedures 8.5 Appropriate mathematical language, symbols and conventions are used to report results as per workplace procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. 2D shapes may include but not limited may include but not limited to:	• Triangles • Square • Rectangle • Triangle

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Measuring
- Logical thinking
- Computing
- Drawing of graphs
- Applying mathematical formulas
- Analytical

Required knowledge

The individual needs to demonstrate knowledge of:

- Types of common shapes
- Differentiation between two dimensional shapes / objects
- Formulae for calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Fundamental operations (addition, subtraction, division, multiplication)
- Rounding techniques
- Types of fractions
- Different types of tables and graphs
- Meaning of graphs, such as increasing, decreasing, and constant value
- Preparation of basic data, tables & graphs

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1. 1Developed communication strategies to meet the organization requirements and applied in the workplace 1. 2Established and maintained communication pathways for effective communication in the workplace 1. 3 Used communication strategies involving exchanges of complex oral information
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace or appropriately simulated environment where assessment can take place 2.2 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DIGITAL LITERACY

UNIT CODE: MATH/OS/AS/BC/03/6/A

UNIT DESCRIPTION

This unit describes competencies required to demonstrate digital literacy. It involves, identifying computer software and hardware, applying security measures to data, hardware, and software in automated environment, applying computer software in solving task, applying internet and email in communication at workplace, applying desktop publishing in official assignments and preparing presentation packages.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify appropriate computer software and hardware	1.1 Concepts of ICT are determined in accordance with computer equipment 1.2 Classifications of computers are determined in accordance with manufacturers specification 1.3 Appropriate computer software is identified according to manufacturer's specification 1.4 Appropriate computer hardware is identified according to manufacturer's specification 1.5 Functions and commands of operating system are determined in accordance with manufacturer's specification
2. Apply security measures to data, hardware, software in automated environment	2.1 ***Data security and privacy are classified*** in accordance with the prevailing technology 2.2 ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected in accordance to Information Management security guidelines

	2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
3. Apply computer software in solving tasks	3.1 ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements 3.2 ***Word processing utilities*** are applied in accordance with workplace procedures 3.3 Worksheet layout is prepared in accordance with work procedures 3.4 Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures 3.5 Continuous data manipulated on worksheet is undertaken in accordance with work requirements 3.6 Database design and manipulation is undertaken in accordance with office procedures 3.7 Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures
4. Apply internet and email in communication at workplace	4.1 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy 4.2 Office internet functions are defined and executed in accordance with office procedures 4.3 ***Network configuration*** is determined in accordance with office operations procedures 4.4 Official World Wide Web is installed and managed according to workplace procedures
5. Apply Desktop publishing in official assignments	5.1 Desktop publishing functions and tools are identified in accordance with manufactures specifications 5.2 Desktop publishing tools are developed in accordance with work requirements 5.3 Desktop publishing tools are applied in accordance with workplace requirements 5.4 Typeset work is enhanced in accordance with workplace standards
6. Prepare presentation packages	6.1 Types of presentation packages are identified in accordance with office requirements 6.2 Slides are created and formulated in accordance with workplace procedures

	6.3 Slides are edited and run-in accordance with work procedures 6.4 Slides and handouts are printed according to work requirements

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Appropriate computer hardware may include but not limited to:	Collection of physical parts of a computer system such as: • Computer case, monitor, keyboard, and mouse • All the parts inside the computer case, such as the hard disk drive, motherboard and video card
2. Data security and privacy may include but not limited to:	• Confidentiality of data • Cloud computing • Integrity -but-curious data surfing
3. Security and control measures may include but not limited to:	• Counter measures against cyber terrorism • Risk reduction • Cyber threat issues • Risk management • Pass-wording
4. Security threats may include but not limited to:	• Cyber terrorism • Hacking

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Analytical skills

- Interpretation
- Typing
- Communication
- Computing (applying fundamental operations such as addition, subtraction, division and multiplication)
- Using calculator
- Basic ICT skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Software concept
- Functions of computer software and hardware
- Data security and privacy
- Computer security threats and control measures
- Technology underlying cyber-attacks and networks
- Cyber terrorism
- Computer crimes
- Detection and protection of computer crimes
- Laws governing protection of ICT
- Word processing;
    - Functions and concepts of word processing.
    - Documents and tables creation and manipulations
    - Mail merging
    - Word processing utilities
- Spread sheets;
    - Meaning, formulae, function and charts, uses and layout
    - Data formulation, manipulation and application to cells
    -
- Database;
    - Database design, data manipulation, sorting, indexing, storage retrieval and security
- Desktop publishing;
    - Designing and developing desktop publishing tools
    - Manipulation of desktop publishing tools
    - Enhancement of typeset work and printing documents
- Presentation Packages;

- Types of presentation Packages
- Creating, formulating, running, editing, printing and presenting slides and handouts

- Networking and Internet;
  - Computer networking and internet.
  - Electronic mail and world wide web
- Emerging trends and issues in ICT;
  - Identify and integrate emerging trends and issues in ICT
  - Challenges posed by emerging trends and issues

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified and controlled security threats 1.2 Detected and protected computer crimes 1.3 Applied word processing in office tasks 1.4 Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures 1.5 Opened electronic mail for office communication as per workplace procedure 1.6 Installed internet and World Wide Web for office tasks in accordance with office procedures 1.7 Integrated emerging issues in computer ICT applications 1.8 Applied laws governing protection of ICT
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview

	3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENTREPRENEURIAL SKILLS

UNIT CODE : MATH/OS/AS/BC/04/6/A
UNIT DESCRIPTION

This unit covers the competencies required to demonstrate understanding of entrepreneurship. It involves demonstrating understanding of an entrepreneur, entrepreneurship, and self-employment, identifying entrepreneurship opportunities, creating entrepreneurial awareness, applying entrepreneurial motivation, developing business innovative strategies and developing business plan.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA
1. Demonstrate understanding of an Entrepreneur	1. 1 Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 1. 2 ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 1. 3 Ways of becoming an Entrepreneur are identified as per principles of Entrepreneurship 1. 4 ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 1. 5 Factors affecting Entrepreneurship development are explored as per principles of Entrepreneurship
2. Demonstrate understanding of Entrepreneurship and self-employment	2. 1 Entrepreneurship and self-employment are distinguished as per principles of entrepreneurship 2. 2 Importance of self-employment is analysed based on business procedures and strategies 2. 3 ***Requirements for entry into self-employment*** are identified according to business procedures and strategies 2. 4 Role of an Entrepreneur in business is determined according to business procedures and strategies

	2. 5 Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 2. 6 Entrepreneurship culture in Kenya is explored as per business procedures and strategies 2. 7 Born or made Entrepreneurs are distinguished as per entrepreneurial traits
3. Identify Entrepreneurship opportunities	3.1 Sources of business ideas are identified as per business procedures and strategies 3.2 Business ideas and opportunities are generated as per business procedures and strategies 3.3 Business life cycle is analysed as per business procedures and strategies 3.4 Legal aspects of business are identified as per procedures and strategies 3.5 Product demand is assessed as per market strategies 3.6 Types of ***business environment*** are identified and evaluated as per business procedures 3.7 Factors to consider when evaluating business environment are explored based on business procedure and strategies 3.8 Technology in business is incorporated as per best practice
4. Create entrepreneurial awareness	4.1 ***Forms of businesses*** are explored as per business procedures and strategies 4.2 Sources of business finance are identified as per business procedures and strategies 4.3 Factors in selecting source of business finance are identified as per business procedures and strategies 4.4 ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies

	4.5 Problems of starting and operating SSEs are explored as per business procedures and strategies
5. Apply entrepreneurial motivation	5.1 ***Internal and external motivation*** factors are determined in accordance with motivational theories 5.2 Self-assessment is carried out as per entrepreneurial orientation 5.3 Effective communications are carried out in accordance with communication principles 5.4 Entrepreneurial motivation is applied as per motivational theories
6. Develop innovative business strategies	6.1 Business innovation strategies are determined in accordance with the organization strategies 6.2 Creativity in business development is demonstrated in accordance with business strategies 6.3 ***Innovative business strategies*** are developed as per business principles 6.4 Linkages with other entrepreneurs are created as per best practice 6.5 ICT is incorporated in business growth and development as per best practice
7. Develop Business Plan	7.1 Identified Business is described as per business procedures and strategies 7.2 Marketing plan is developed as per business plan format 7.3 Organizational/Management plan is prepared in accordance with business plan format 7.4 Production/operation plan in accordance with business plan format 7.5 Financial plan is prepared in accordance with the business plan format 7.6 Executive summary is prepared in accordance with business plan format 7.7 Business plan is presented as per best practice

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	Range
1. Types of entrepreneurs may include but not limited to:	• Innovators • Imitators • Craft • Opportunistic • Speculators
2. Characteristics of Entrepreneurs may include but not limited to:	• Creative • Innovative • Planner • Risk taker • Networker • Confident • Flexible • Persistent • Patient • Independent • Future oriented • Goal oriented
3. Requirements for entry into self-employment may include but not limited to	• Technical skills • Management skills • Entrepreneurial skills • Resources • Infrastructure
4. Internal and external motivation may include but not limited to:	• Interest • Passion • Freedom • Prestige • Rewards • Punishment • Enabling environment • Government policies

5. Business environment may include but not limited to:	• External • Internal • Intermediate
6. Forms of businesses may include but not limited to:	• Sole proprietorship • Partnership • Limited companies • Cooperatives
7. Governing policies may include but not limited to:	• Increasing scope for finance • Promoting cooperation between entrepreneurs and private sector • Reducing regulatory burden on entrepreneurs • Developing IT tools for entrepreneurs
8. Innovative business strategies may include but not limited to:	• New products • New methods of production • New markets • New sources of supplies • Change in industrialization

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Analytical
- Management
- Problem-solving
- Root-cause analysis
- Communication

Required Knowledge

The individual needs to demonstrate knowledge of:

- Decision making
- Business communication
- Change management

- Competition
- Risk
- Net working
- Time management
- Leadership
- Factors affecting entrepreneurship development
- Principles of Entrepreneurship
- Features and benefits of common operational practices, e. g., continuous improvement (kaizen), waste elimination,
- Conflict resolution
- Health, safety and environment (HSE) principles and requirements
- Customer care strategies
- Basic financial management
- Business strategic planning
- Impact of change on individuals, groups and industries
- Government and regulatory processes
- Local and international market trends
- Product promotion strategies
- Market and feasibility studies
- Government and regulatory processes
- Local and international business environment
- Relevant developments in other industries
- Regional/ County business expansion strategies

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	1. 1 Assessment requires evidence that the candidate: 1. 2 Distinguished entrepreneurs and businesspersons correctly 1. 3 Identified ways of becoming an entrepreneur appropriately 1. 4 Explored factors affecting entrepreneurship development appropriately 1. 5 Analysed importance of self-employment accurately

	1. 6 Identified requirements for entry into self-employment correctly 1. 7 Identified sources of business ideas correctly 1. 8 Generated Business ideas and opportunities correctly 1. 9 Analysed business life cycle accurately 1. 10 Identified legal aspects of business correctly 1. 11 Assessed product demand accurately 1. 12 Determined Internal and external motivation factors appropriately 1. 13 Carried out communications effectively 1. 14 Identified sources of business finance correctly 1. 15 Determined Governing policy on small scale enterprise appropriately 1. 16 Explored problems of starting and operating SSEs effectively 1. 17 Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 1. 18 Prepared executive summary correctly 1. 19 Determined business innovative strategies appropriately 1. 20 Presented business plan effectively
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	3.1 Written tests 3.2 Oral questions 3.3 Third party report 3.4 Interviews 3.5 Portfolio of Evidence
4. Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment

5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE EMPLOYABILITY SKILLS

UNIT CODE: MATH/OS/AS/BC/05/6/A

UNIT DESCRIPTON

This unit covers competencies required to demonstrate employability skills. It involves conducting self-management, demonstrating interpersonal communication, critical safe work habits, leading a workplace team, planning and organizing work, maintaining professional growth and development, demonstrating workplace learning, problem solving skills and managing ethical performance.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Conduct self-management	1.1 Personal vision, mission and goals are formulated based on potential and in relation to organization objectives 1.2 Emotional intelligence is demonstrated as per workplace requirements. 1.3 Individual performance is evaluated and monitored according to the agreed targets. 1.4 Assertiveness is developed and maintained based on the requirements of the job. 1.5 Accountability and responsibility for own actions are demonstrated based on workplace instructions. 1.6 Self-esteem and a positive self-image are developed and maintained based on values. 1.7 Time management, attendance and punctuality are observed as per the organization policy. 1.8 Goals are managed as per the organization's objective 1.9 Self-strengths and weaknesses are identified based on personal objectives

2. Demonstrate interpersonal communication	2.1 Writing skills are demonstrated as per communication policy 2.2 Negotiation and persuasion skills are demonstrated as per communication policy 2.3 Internal and external stakeholders' needs are identified and interpreted as per the communication policy 2.4 Communication networks are established based on workplace policy 2.5 Information is shared as per communication policy
3. Demonstrate critical safe work habits	3.1 Stress is managed in accordance with workplace policy. 3.2 Punctuality and time consciousness is demonstrated in line with workplace policy. 3.3 Personal objectives are integrated with organization goals based on organization's strategic plan. 3.4 ***Resources*** are utilized in accordance with workplace policy. 3.5 Work priorities are set in accordance to workplace goals and objectives. 3.6 Leisure time is recognized and utilized in line with personal objectives. 3.7 ***Drugs and substances of abuse*** are identified and avoided based on workplace policy. 3.8 HIV and AIDS prevention awareness is demonstrated in line with workplace policy. 3.9 Safety consciousness is demonstrated in the workplace based on organization safety policy. 3.10 ***Emerging issues*** are identified and dealt with in accordance with organization policy.
4. Lead a workplace team	4.1 Performance targets for the ***team*** are set based on organization's objectives 4.2 Duties are assigned in accordance with the organization policy. 4.3 ***Forms of communication*** in a team are established according to organization's policy. 4.4 Team performance is evaluated based on set targets as per workplace policy. 4.5 Conflicts are resolved between team members in line with organization policy.

	4.6 Gender related issues are identified and mainstreamed in accordance workplace policy. 4.7 Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010. 4.8 Healthy relationships are developed and maintained in line with workplace.
5. Plan and organize work	5.1 Work plans are prepared based on activities and budget. 5.2 Assigned tasks are interpreted and expectations identified as per the workplace instructions. 5.3 Task occupational safety and health requirements are identified and observed regulations. 5.4 Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5.5 Work activities are monitored and evaluated in line with work plans and workplace policy. 5.6 Work plans are reviewed based on target and available resources.
6. Maintain professional growth and development	6.1 Personal training needs are identified and assessed in line with the requirements of the job. 6.2 ***Training and career opportunities*** are identified and utilized based on job requirements. 6.3 Resources for training are mobilized and allocated based organizations and individual skills needs. 6.4 Licensees and certifications relevant to job and career are obtained and renewed as per policy. 6.5 Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives. 6.6 Recognitions are sought as proof of career advancement in line with professional requirements.
7. Demonstrate workplace learning	7.1 Learning opportunities are sought and managed based on job requirement and organization policy. 7.2 Improvement in performance is demonstrated based on courses attended. 7.3 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job

	7.4 Time and effort is invested in learning new skills based on job requirements 7.5 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 7.6 New systems are developed and maintained in accordance with the requirements of the job. 7.7 Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job.
8. Demonstrate problem solving skills	8.1 Creative, innovative and practical solutions are developed based on the problem 8.2 Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job. 8.3 Team problems are solved as per the workplace guidelines 8.4 Problem solving strategies are applied as per the workplace guidelines 8.5 Problems are analyzed and assumptions tested as per the context of data and circumstances
9. Manage ethical performance	9.1 Policies and guidelines are observed as per the workplace requirements 9.2 Self-worth and professionalism is exercised in line with personal goals and organizational policies 9.3 Code of conduct is observed as per the workplace requirements 9.4 Integrity is demonstrated as per legal requirement

RANGE

This section provides work environment and conditions to which the performance criteria apply. It allows for different work environment and situations that will affect performance.

Variable	**Range**
1. Drug and substance abuse may include but not limited to:	Commonly abused • Alcohol • Tobacco • Miraa • Over-the-counter drugs

	• Cocaine • Bhang • Glue
2. Feedback may include but not limited to:	• Verbal • Written • Informal • Formal
3. Relationships may include but not limited to:	• Man/Woman • Trainer/trainee • Employee/employer • Client/service provider • Husband/wife • Boy/girl • Parent/child • Sibling relationships
4. Forms of communication may include but not limited to:	• Written • Visual • Verbal • Non verbal • Formal and informal
5. Team may include but not limited to:	• Small work group • Staff in a section/department • Inter-agency group
6. Personal growth may include but not limited to:	• Growth in the job • Career mobility • Gains and exposure the job gives • Net workings • Benefits that accrue to the individual as a result of noteworthy performance
7. Personal objectives may include but not limited to:	• Long term • Short term • Broad • Specific
8. Trainings and career opportunities may includes but not limited to	• Participation in training programs • Serving as Resource Persons in conferences and workshops

9. Resource may include may but not limited to:	• Human • Financial • Technology
10. Innovation may include but not limited to:	• New ideas • Original ideas • Different ideas • Methods/procedures • Processes • New tools
11. Emerging issues may include but not limited to:	• Terrorism • Social media • National cohesion • Open offices
12. Range of media for learning may include but not limited to:	• Mentoring • peer support and networking • IT and courses

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Interpersonal
- Communication
- Critical thinking
- Organizational
- Negotiation
- Monitoring
- Evaluation
- Record keeping
- Problem solving
- Decision Making
- Resource utilization
- Resource mobilization

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies
- Company operations, procedures and standards
- Occupational Health and safety procedures
- Fundamental rights at work
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning
- Organizing work
- Monitoring and evaluation
- Record keeping
- Gender mainstreaming
- HIV and AIDS
- Drug and substance abuse

0. Professional growth and development
1. Technology in the workplace
2. Innovation
3. Emerging issues

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Conducted self-management 1.2 Demonstrated interpersonal communication 1.3 Demonstrated critical safe work habits 1.4 Demonstrated the ability to lead a workplace team 1.5 Planned and organized work 1.6 Maintained professional growth and development 1.7 Demonstrated workplace learning 1.8 Demonstrated problem solving skills

	1.9 Demonstrated the ability to manage performance ethically
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENVIRONMENTAL LITERACY

UNIT CODE: MATH/OS/AS/BC/06/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to demonstrate environmental literacy. It involves, controlling environmental hazard and environmental pollution, demonstrating sustainable resource use, evaluating current practices in relation to resource usage, identifying environmental legislations/conventions for environmental concerns, implementing specific environmental programs, monitoring activities on environmental protection/Programs , analyzing resource use and developing resource conservation plans

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Control environmental hazard	1. 1 Storage methods for environmentally hazardous materials are strictly followed according to environmental regulations and OSHS. 1. 2 Disposal methods of hazardous wastes are followed according to environmental regulations and OSHS. 1. 3 ***PPE*** is used according to OSHS.
2. Control environmental Pollution	2.1 Environmental pollution ***control measures*** are implemented in accordance with international protocols. 2.2 Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999 2.3 Methods for minimizing noise pollution is complied with based on Noise and Excessive Vibration *Pollution and* Control *Regulations*, 2009
3. Demonstrate sustainable resource use	3.1 Methods for minimizing wastage are complied with based on organizational waste management guide

	3.2 Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle) 3.3 Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 .
4. Evaluate current practices in relation to resource usage	4.1 Information on resource efficiency systems and procedures are collected and provided as per work groups/sector 4.2 Current resource usage is measured and recorded as per work group 4.3 Current purchasing strategies are analyzed and recorded according to industry procedures. 4.4 Current work processes to access information and data is analyzed following enterprise protocol.
5. Identify environmental legislations/conventions for environmental concerns	5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 5.2 Industrial standard/environmental practices are described according to the different environmental concerns
6. Implement specific environmental programs	6.1 Programs/Activities are identified according to organizations policies and guidelines. 6.2 Individual roles/responsibilities are determined and performed based on the activities identified. 6.3 Problems/constraints encountered are resolved in accordance with organizations' policies and guidelines 6.4 Stakeholders are consulted based on company guidelines
7. Monitor activities on Environmental protection/Programs	7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program 7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations

	7.3 Data gathered are analyzed based on Evaluation requirements 7.4 Recommendations are submitted based on the findings 7.5 Management support systems are set/established to sustain and enhance the program 7.6 Environmental incidents are monitored and reported to 7.7 concerned/proper authorities
8. Analyze resource use	8.1 All resource consuming processes are Identified as per the organizational work plan 8.2 Quantity and nature of resource consumed is determined based on processes 8.3 Resource flow is analyzed as per different parts of the process. 8.4 Wastes are classified according to NEMA regulations on waste management.
9. Develop resource Conservation plans	9.1. Efficiency of use/conversion of resources is determined according to industry protocol. 9.2. Causes of low efficiency of use of resources are Determined based on industry protocol. 9.3. Plans for increasing the efficiency of resource use are developed based on findings.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	**Range**
1. PPE may include but not limited to	• Mask • Gloves • Goggles • Safety hat • Overall • Hearing protector

2. Control measures may include but not limited to	• Methods for minimizing or stopping spread and ingestion of airborne particles • Methods for minimizing or stopping spread and ingestion of gases and fumes • Methods for minimizing or stopping spread and ingestion of liquid wastes

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Measuring
- Recording
- Analytical
- Monitoring
- Communication
- Writing

Required Knowledge

The individual needs to demonstrate knowledge of:

- PPEs
- Environmental regulations
- OSHS
- Pollution
- Waste management
- Principle of 3Rs
- Types of resources
- Techniques in measuring current usage of resources
- Environmental hazards
- Regulatory requirements

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Controlled environmental hazard 1.2 Controlled environmental pollution 1.3 Demonstrated sustainable resource use 1.4 Evaluated current practices in relation to resource usage 1.5 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns. 1.6 Described industrial standard environmental practices according to the different environmental issues/concerns. 1.7 Resolved problems/ constraints encountered based on management standard procedures 1.8 Implemented and monitored environmental practices on a periodic basis as per company guidelines 1.9 Recommended solutions for the improvement of the program 1.10 Monitored and reported to proper authorities any environmental incidents
2. Resource Implications	The following resources should be provided: 2.1 Workplace with storage facilities 2.2 Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags) 2.3 PPE, manuals and references 2.4 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.5 Case studies/scenarios relating to environmental Protection
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning

		3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4	Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5	Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: MATH/OS/AS/BC/07/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to demonstrate occupational health and safety practices. It involves identifying workplace hazards and risks, identifying and implementing appropriate control measures to hazards and risks and implementing OSH programs, procedures and policies/guidelines.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify workplace hazards and risk	1.1 ***Hazards*** in the workplace are identified ***based their indicators*** 1.2 Risks and hazards are evaluated based on legal requirements. 1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements.
2. Control OSH hazards	2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement. 2.2 Risk assessment is conducted and a risk matrix developed based on likely impact. 2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures.
3. Implement OSH programs	3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements. 3.2 Company OSH programs are implemented as per legal requirements. 3.3 Workers are capacity built on OSH standards and procedures as per legal requirements

	3.4 ***OSH-related records*** are maintained as per legal requirements.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	**Range**
1. Hazards may include but not limited to:	• Physical hazards – impact, illumination, pressure, noise, • vibration, extreme temperature, radiation • Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects • Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors • Ergonomics • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, • varying metabolic cycles • Physiological factors – monotony, personal relationship, work out cycle • Safety hazards (unsafe workplace condition) – confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris • Unsafe workers' act (Smoking in off-limited areas, Substance and alcohol abuse at work)
2. Indicators may include but not limited to:	• Increased of incidents of accidents, injuries • Increased occurrence of sickness or health complaints/ symptoms • Common complaints of workers related to OSH • High absenteeism for work-related reasons

3. OSH concerns may include but not limited to:	• Workers' experience/observance on presence of work hazards • Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) • Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines
4. Safety gears /PPE (Personal Protective Equipment) may include but not limited to:	• Arm/Hand guard, gloves • Eye protection (goggles, shield) • Hearing protection (ear muffs, ear plugs) • Hair Net/cap/bonnet • Hard hat • Face protection (mask, shield) • Apron/Gown/coverall/jump suit • Anti-static suits • High-visibility reflective vest
5. Appropriate risk controls may include but not limited to:	• Appropriate risk controls in order of impact are as follows: • Eliminate the hazard altogether (i.e., get rid of the dangerous machine) • Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) • Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) • Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) • Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) • Use personal protective equipment (i.e., wear • gloves and goggles when using the machine)

6. Contingency measures may include but not limited to:	• Evacuation • Isolation • Decontamination • (Calling designed) emergency personnel
7. Incidents and emergencies may include but not limited to:	• Chemical spills • Equipment/vehicle accidents • Explosion • Fire • Gas leak • Injury to personnel • Structural collapse • Toxic and/or flammable vapors emission.
8. OSH-related Records may include but not limited to:	• Medical/Health records • Incident/accident reports • Sickness notifications/sick leave application • OSH-related trainings obtained

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Interpersonal
- Presentation
- Risk assessment
- Evaluation
- Critical thinking
- Problem solving
- Negotiation

Required Knowledge

The individual needs to demonstrate knowledge of:

- General OSH Principles
- Occupational hazards/risks recognition
- OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)

- National OSH regulations; company OSH policies and protocols
- Systematic gathering of OSH issues and concerns
- General OSH principles
- National OSH regulations
- Company OSH and recording protocols, procedures and policies/guidelines
- Training and/or counseling methodologies and strategies

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified hazards in the workplace based their indicators 1.2 Evaluated workplace hazards based on legal requirements. 1.3 Addressed OSH concerns raised by workers as per legal requirements. 1.4 Implemented hazard prevention and control measures as per legal requirement. 1.5 Conducted risk assessment as per legal requirement. 1.6 Developed risk matrix based on likely impact. 1.7 Recognized and established contingency measures in accordance with organization procedures. 1.8 Identified, evaluated and reviewed company OSH program based on legal requirements. 1.9 Implemented company OSH programs as per legal requirements. 1.10 Capacity built workers on OSH standards and procedures as per legal requirements 1.11 Maintained OSH-related records as per legal requirements.
2. Resource Implications	The following resources should be provided: 2.3 Access to relevant workplace where assessment can take place 2.4 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning

	3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COMMON UNITS OF COMPETENCY

APPLY MATHEMATICS FOR STATISTICS

UNIT CODE: MATH/OS/AS/CC/01/6/A

UNIT DESCRIPTION:

This unit describes the competencies required by a technician in order to apply algebra apply trigonometry and hyperbolic functions, apply complex numbers, apply coordinate geometry, carry out binomial expansion, apply calculus, solve ordinary differential equations, apply power series, apply statistics, apply numerical methods, apply vector theory, apply matrix and apply quantitative techniques.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Apply Algebra	1.1 Calculations involving Indices are performed as per the concept 1.2 Calculations involving Logarithms are performed as per the concept 1.3 Scientific calculator is used in solving mathematical problems in line with manufacturer's manual 1.4 Solution to system of linear equations involving three unknowns are performed as per the rules and procedure. 1.5 Calculations involving quadratic equations are performed as per the concept. 1.6 Calculations involving sequence and series are performed as per the concept
2. Apply Trigonometry and hyperbolic functions	2.1 Calculations are performed using trigonometric rules 2.2 Calculations are performed using hyperbolic functions 2.3 Calculations involving One-to-one relationship in functions are performed 2.4 Calculations involving applications of trigonometry to obtain area and perimeter of shapes and solids are performed 2.5 Calculations involving hyperbolic identities are performed

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
3. Apply complex numbers	3.1 Complex numbers are represented using Argand diagrams 3.2 ***Operations*** involving complex numbers are performed 3.3 Calculations involving complex numbers are performed using De Moivre's theorem 3.4 Calculations involving conjugate argument and Modulus are performed as per procedure
4. Apply Coordinate Geometry	4.1 Polar equations are calculated using coordinate geometry 4.2 Graphs of given polar equations are drawn using the Cartesian plane 4.3 Normal and tangents are determined using coordinate geometry
5. Carry out Binomial Expansion	5.1 Roots of numbers are determined using binomial theorem 5.2 Errors of small changes are estimated using binomial theorem 5.3 Calculation involving Power series using binomial theorem is performed as per the procedures
6. Apply Calculus	6.1 Derivatives of functions are determined using Differentiation 6.2 Derivatives of ***hyperbolic functions*** are determined using Differentiation 6.3 Derivatives of inverse trigonometric functions are determined using Differentiation 6.4 Rate of change and small change are determined using Differentiation. 6.5 Calculation involving stationery points of functions of two variables are performed using differentiation. 6.6 Integrals of algebraic functions are determined using integration 6.7 Integrals of trigonometric functions are determined using integration

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
	6.8 Integrals of logarithmic functions are determined using integration 6.9 Integrals of hyperbolic and inverse functions are determined using integration
7. Solve Ordinary differential equations	7.1 First order and second order differential equations are solved using the method of undetermined coefficients 7.2 First order and second order differential equations are solved from given boundary conditions
8. Apply Power Series	8.1 Power series are obtained using Taylor's Theorem 8.2 Power series are obtained using McLaurin's 's theorem
9. Apply Numerical methods	9.1 Roots of polynomials are obtained using iterative ***numerical methods*** 9.2 Interpolation and extrapolation are performed using numerical methods
10. Apply Vector theory	10.1Vectors and scalar quantities are obtained in two and three dimensions 10.2 Operations on vectors are performed 10.3 Position of vectors is obtained 10.4 Resolution of vectors is done
11. Apply Matrix	11.1 Determinant and inverse of 3x3 matrix are obtained as per the method 11.2 Solutions of simultaneous equations in three unknowns are obtained as per the procedure 11.3 Calculation involving Eigen values and Eigen vectors are performed

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
12. Apply quantitative techniques	12.1 The constrains are expressed in Standard Form as per the procedure 12.2 The Slack Variables are determined as per the procedure 12.3 The Tableau is drawn and the coefficients and the constrains indicated as per the procedure 12.4 Optimality Check is performed as per the procedure 12.5 The Pivot Variable is Identified as per the optimality results 12.6 The optimum solution is obtained as per the procedure

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1 Operations may include but not limited to:	• Addition • Subtraction
2 Hyperbolic functions may include but not limited to:	• Sinh x • Cosh x • Cosec x • Coth x • Tanh x • Sech x
3 Numerical Methods may include but not limited to:	• Newton Raphson • Gregory Newton

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Applying fundamental operations (addition, subtraction, division, multiplication)
- Using and applying mathematical formulas
- Logical thinking
- Problem solving
- Applying statistics
- Drawing graphs
- Using different measuring tools

Required knowledge

The individual needs to demonstrate knowledge of:

- Fundamental operations (addition, subtraction, division, multiplication)
- Calculating area and volume
- Types and purpose of measuring instruments
- Units of measurement and abbreviations
- Rounding techniques
- Types of fractions
- Types of tables and graphs
- Presentation of data in tables and graphs
- Vector operations
- Matrix operations
- Statistics
- Simplex method

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Applied Trigonometry and hyperbolic functions 1.2 Applied complex numbers 1.3 Applied Calculus 1.4 Solved Ordinary differential equations 1.5 Applied Power Series 1.6 Applied Vector theory 1.7 Applied Matrix in solving system of linear equations 1.8 Applied Numerical methods 1.9 Apply simplex method in solving linear programming problems

2. Resource Implications	The following resources should be provided: Access to relevant workplace or appropriately simulated environment where assessment can take place 2.1 Measuring equipment 2.2 Materials relevant to the proposed activity or tasks
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Practical Tests 3.2 Oral Questioning 3.3 Written tests
4. Context of Assessment	Competency may be assessed 4.1 On –Job 4.2 Off- Job 4.3 During Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY STATISTICAL TECHNIQUES

UNIT CODE: MATH/OS/AS/CC/02/6/A

UNIT DESCRIPTION:

This unit describes the competencies required by a statistician in order to apply statistical concepts, apply statistical methods, apply statistical methods 2 and apply statistics for business in a work place environment.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
1. Apply statistical concepts	1.1 Definitions of key terms are done as per the statistical concepts 1.2 Demonstrate knowledge of types, importance and limitations of statistics as per the required standard 1.3 Demonstrate knowledge of symbols used as per the concepts 1.4 Demonstrate knowledge of levels of measurements as per the data type 1.5 Data is classified and tabulated as per the class and intervals 1.6 Demonstrate knowledge of sources and methods of data collection 1.7 Graphical data presentation is performed as per the procedures 1.8 Data compilation is performed as per the requirement 1.9 Calculations involving means, mode and median are performed as per the procedures 1.10 Calculations involving measures of dispersion is performed as per the procedures

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
2. Apply statistical methods 1	5.1 Demonstrate knowledge of techniques and types of sampling procedures as per the requirements 5.2 Demonstrate knowledge and calculations involving population and samples. I.e. Statistic and ***parameter*** as per the procedures 5.3 Knowledge about sampling distributions is demonstrate as per the procedures 5.4 Knowledge and calculation involving probability theory is demonstrated as per the procedures 5.5 Calculation involving ***probability distributions***, expected values etc. are performed as per the procedures 5.6 Calculation involving moments and moments generating functions is done as per the procedures 5.7 Knowledge and calculations involving central limit theorem is performed as per the procedures

3. Apply statistical methods 2	3.1 Knowledge and calculation involving theory of estimation is performed as per the procedure 3.2 Pearson's and spearman's correlation coefficients are calculated as per the procedures 3.3 Coefficients (slope and constant) of ***simple linear regression*** are calculated as per the procedures 3.4 Estimation, forecasting or prediction in linear regression is performed as per the predictor values. 3.5 Confidence intervals for regression parameters is performed as per the procedure. 3.6 Test for significance of the models and goodness of fit is done as per the procedure 3.7 Demonstrate knowledge of use of alternative measures to determine goodness of for a regression model. 3.8 Calculate and interpret coefficient of determination (R^2) for the regression model as per the procedure. 3.9 Demonstrate knowledge of multiple linear regression as per the concept. 3.10 Demonstrate knowledge and use of ***logistic regression*** in data analysis as per the concept. 3.11 Confidence intervals are calculated as per the procedures 3.12 Demonstrate knowledge Rejection criteria in hypothesis testing as per the procedure. 3.13 Demonstrate use of contingency tables to determine critical values as per the procedure. 3.14 Decisions involving rejection and failure to reject the null hypotheses is determ as per the procedure 3.15 Test for normality and heteroscedasticity is performed as per the procedure. 3.16 Comparison (Testing for equality) for the means of two independent groups is done as per the procedure. 3.17 Comparison of variances from two groups is performed as per the procedures.

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range.***
	3.18 Comparison of two sample proportions is done as per the procedures. 3.19 Calculations involving one sample and two sample Wilcoxon tests in non-parametric tests is performed as per the procedure. 3.20 Designs one way and two experiments as per the procedure

4. Apply statistics for business	4.1 Calculations involving simple index numbers is performed as per the procedures 4.2 Simple aggregative, weighted aggregative and Index of weighted average is calculated as per the procedure. 4.3 Knowledge in special issues and problems in constructions of index numbers is demonstrate as per the index numbers 4.4 Knowledge of time series data is demonstrated as per the procedure 4.5 Trend, seasonal and irregular components of time series data are determined as per the procedures 4.6 Forecasting using time series data is performed as per the procedures 4.7 Demonstrate knowledge of definitions in economics as per the concept 4.8 Calculations involving quantity demanded and quantity supplied is performed as per the procedure 4.9 Use of matrix method in calculations involving quantity demanded and quantity supplied as per the procedure. 4.10 Knowledge and calculations statistical quality control is demonstrated as per the procedures. 4.11 Sampling and measurements is industrial production is done as per workplace procedure. 4.12 Control limits in an industrial quality control is determined as per the procedure. 4.13 Control charts are generated as per the data 4.14 Demonstrate professional ethics and customer service in statistical consulting as per the procedures. 4.15 Demonstrate knowledge statistical consulting as per the industry 4.16 Demonstrate knowledge of professional ethics and customer service in statistical consulting is done as per the industry standard.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

	Range *May include but not limited to:*
• Simple linear regression	• $y = a + bx$
• Parameter estimates	• Slope • constants
• Probability Distributions	• Binomial • Poisson • Normal • Exponential

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Logical thinking
- Problem solving
- Drawing graphs
- Communication skills

Required knowledge

The individual needs to demonstrate knowledge of:

- Data presentation
- Data compilation
- Data organisation
- Measures of dispersion
- Measures of central tendency
- Types of data
- Parameter and statistic
- Sampling procedures
- Sampling distributions

- Probability theory
- Probability distributions
- Moments and moments generating functions
- Central limit theorem
- Theory of estimation

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1.Critical aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Demonstrate data collection tools and data collection 1.2 Demonstrate data presentation techniques 1.3 Demonstrate data organisation techniques 1.4 Carry out calculations involving measures of central tendency and dispersion 1.5 Demonstrate knowledge of sampling and sampling procedures 1.6 Carry out calculations involving sampling distributions 1.7 Obtain coefficients if simple linear regression 1.8 Demonstrate knowledge of multiple linear regression 1.9 Carry out calculation involving confidence intervals and test of hypothesis 1.10 Designs a one way and two-way experiment 1.11 Carry out calculation confidence intervals and test of hypothesis 1.12 Demonstrate knowledge and calculation involving index numbers 1.13 Carry out calculation involving time series 1.14 Carry out statistical quality control 1.15 Carry out calculations involving central limit theorem

	1.16 Carry out calculations involving probability distributions 1.17 Carry out calculations involving moments and moments generating functions
2. Resource Implications	The following resources should be provided: Access to relevant workplace or appropriately simulated environment where assessment can take place: 2.1 Measuring equipment for an industrial quality control 2.2 Data sets 2.3 Computer 2.4 Statistical Software 2.5 Stationary
3.Methods of Assessment	Competency in this unit may be assessed through: 3.1 Practical Tests 3.2 Oral Questioning 3.3 Written tests
4.Context of Assessment	Competency may be assessed 4.1 On- job 4.2 Off-Job 4.3 During Industrial attachment
5.Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY RESEARCH METHODS

UNIT CODE: MATH/OS/AS/CC/03/6/A

UNIT DESCRIPTION

This unit covers the competencies required to carry out statistical data management. It involves formulating the research problem, carry out literature review, develop research objectives, develop research design and sample design, develop research budget proposal & time plan, collect research data, analyse collected research data, interpret findings and present findings

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** ***(Bold and italicised terms are elaborated in the Range)***
1. Formulating the Research Problem	1.1 The proposal title is stated as per the problem and general objectives/research questions/hypotheses. 1.2 The background of the study is outlined as per the study problem. 1.3 The problem statement is formulated as per the research proposal 1.4 Hypotheses are stated as per the research objectives. 1.5 The importance/significance of the study is stated as per the problem statement.
2. Carry out Extensive Literature Review	2.1 Literature is reviewed as per the problem statement 2.2 Information sources including citations and authors relevant to the research is assessed and captured as per the literature review. 2.3 Referencing is done as per the citations 2.4 Theoretical and conceptual framework are captured as per the problem statement
3. Develop research objectives	4.4 Research objectives are developed as per the research problem 4.5 Research objectives are stated as per the research problem 4.6 Research hypotheses are formulated as per the objective

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
4. Develop Research Design and Sample Design	4.1 Research design is determined as per the problem statement. 4.2 The ***scientific methodology*** is captured as per the problem statement. 4.3 The sample size is determined as per the procedure
5. Develop research budget proposal & Time plan	5.4 Direct costs are determined and estimated as per the research design 5.5 Indirect costs are determined and estimated as per the research design. 5.6 The budget narratives are captured as per the cost estimates. 5.7 Total estimates are made and captured as per the costs. 5.8 Time plan is developed as per stipulated time
6. Collect research Data	1.1 Use of proposed research design is demonstrated as per the research proposal. 1.2 Knowledge of data ethics and confidentiality is demonstrated as per the procedure. 1.3 Questionnaires are Digitised as per the procedure 1.4 Knowledge of law and human rights as well as religious and cultural believes is demonstrated as per the research. 1.5 Data collection is done as per the set research design. 1.6 Representative samples are selected as per the research design
7. Analyse collected research Data	7.1 Data processing techniques are applied as per the procedures 7.2 Descriptive tools and techniques are applied as per the procedures 7.3 Inferential data analysis tools are applied as per the research design
8. Interpretation research findings	8.1 Descriptive outputs are interpreted as per the summaries

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
	8.2 ***Parameter estimates*** are interpreted as per the statistical model output 8.3 Predictions are made as per the model estimates 8.4 Hypothesis are tested and decisions made as per the problem
9. Present research findings	9.1 Report is prepared for presentation to stakeholders and interested parties as per results 9.2 The findings are presented as per the workplace procedure

RANGE

This section provides work environment and conditions to which the performance Criteria apply. It allows for different work environment and situations that will affect Performance.

Variable	Range
• Scientific methodology may include but is not limited to:	• Methods of data collection and analysis
• Parameter estimates may include but is not limited to:	• Slope • constants

REQUIRED KNOWLEDGE AND UNDERSTANDING

The individual needs to demonstrate knowledge and understanding of:

- Sources of research problems
- Steps in formulation of a research problem
- Reviewing the literature
- Formulation of objectives
- Research design

- Sample design
- Research instruments
- Piloting the questionnaire
- Collecting data
- Processing and analysing data
- Reporting the findings

EVIDENCE GUIDE

This provides advice on assessment and must be in conjunction with the performance criteria, required knowledge and understanding and range.

1. Critical Aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Demonstrate knowledge of source of research problems 1.2 Demonstrate knowledge to formulation of a research a problem 1.3 Demonstrate knowledge research objectives 1.4 Demonstrate knowledge of research hypothesis 1.5 Demonstrate knowledge of reviewing of literature 1.6 Demonstrate knowledge of citations and referencing 1.7 Demonstrate formulation of research objectives 1.8 Demonstrate knowledge of research designs 1.9 Demonstrate knowledge of research instruments 1.10 Demonstrate knowledge of piloting of research instrument 1.11 Demonstrate knowledge of data collection
2. Resource Implications	***The following resources must be provided:*** 2.1 Computer 2.2 Internet 2.3 Datasets 2.4 Books in statistics 2.5 Library books
3. Methods of Assessment	**Competency may be assessed through:** 3.1 Oral questioning 3.2 Practical Tests 3.3 Witten Tets

4. Context of Assessment	Competency may be assessed individually in the actual workplace or through a simulated work place environment or during Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEVELOP DATABASE MANAGEMENT SYSTEMS

UNIT CODE: MATH/OS/AS/CC/04/6/A

UNIT DESCRIPTION

This unit covers the competencies required to carry out management of databases systems. It involves identification of database management systems, designing of database, Creation and manipulation of database, database testing, implementation of the designed database, establishing transaction and concurrency mechanism and managing database security.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** *(Bold and italicised terms are elaborated in the Range)*
1. Identify database management system	1.1 ***Database requirements*** are established based on user needs. 1.2 Main features in databases are identified according to expected output. 1.3 ***Database components*** are identified as per the database and user needs. 1.4 Classification and categories of database***s*** is done 1.5 Functionality of databases is identified as per the requirements 1.6 Suitable database system is adopted as per user requirements
2. Design database system	2.1 ***Appropriate database structures*** are determined 2.2 Database design is implemented based on requirements. 2.3 Database modelling is done as per the design implemented 2.4 ***Database operations*** are performed
3. Create and manipulate database system	3.1 Appropriate ***data Attributes*** are applied appropriately

	3.2 Data relationships are established as per the tables created 3.3 Model and index of the data is done. 3.4 Data is extracted from database using SQL
4. Perform database testing	4.1 Test data is prepared according to the database design 4.2 Run the test data based on the expected output 4.3 Check the test results based on the clients' needs 4.4 Validate the results based on the client's needs 4.5 Report the findings as per the results.
5. Implement designed database	5.1 Scope is defined as per the design 5.2 Organize database project according to time frame 5.3 Select database management system products 5.4 Develop initial implementation plan and schedule 5.5 Design the database 5.6 Install and test database 5.7 Develop detailed conversion plan 5.8 Convert existing applications 5.9 Fine tune the database 5.10 Perform training 5.11 Periodically review database performance
6. Establish transaction and concurrency mechanism	6.1 Transaction mechanisms used in database management system are identified 6.2 Management of multiple transactions in database management system are identified
7. Manage database security	7.1 Restriction of access to the database is established 7.2 Backup and recovery methods are identified and implemented.

RANGE

This section provides work environment and conditions to which the performance Criteria apply. It allows for different work environment and situations that will affect Performance.

Variable	**Range**
1. Database components may include but is not limited to:	• Software • Hardware • Data • Procedures • Database Access Language • Query Processor • Run Time Database Manager • Data Manager • Database Engine • Data Dictionary • Report Writer
2. Database structures may include but is not limited to:	• Record Types. • Fields.
3. Database operations may include but is not limited to:	• INSERT • SELECT • UPDATE • DELETE
4. data Attributes may include but is not limited to:	• Atomic Attribute • Composite Attribute • Single Valued Attribute • Multi Valued Attribute • Stored Attribute • Derived Attribute • Null Valued Attribute

REQUIRED KNOWLEDGE AND SKILLS

KNOWLEDGE

The individual needs to demonstrate knowledge and understanding of:

- Database management system types
- Database manipulation and creation
- Types of database testing
- Database testing techniques
- Database structures and operations
- Data Models, Attributes and relationships
- Transactions and concurrency mechanisms
- Database design and implementation methods
- Database security features

SKILLS

- Communications (verbal and written);
- Proficient in ICT;
- Time management;
- Analytical
- Problem solving;
- Planning;
- Decision making;
- Report writing;

EVIDENCE GUIDE

This provides advice on assessment and must be in conjunction with the performance criteria, required knowledge and understanding and range.

1. Critical Aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Established Database requirements 1.2 Identified database components 1.3 Adopted a Suitable database system 1.4 Performed Database operations

	1.5 Applied Appropriate Data Attributes 1.6 Extracted data from database using SQL 1.7 Performed test data and validated the results 1.8 Identified transaction and concurrency mechanisms 1.9 Established restrictions to the database
2. Resource Implications	The following resources must be provided: 2.1 Computer 2.2 Servers 2.3 Database Software
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical Tests 3.3 Written Tests
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through a simulated work place environment or During Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

MANAGE STATISTICAL DATA

UNIT CODE: MATH/OS/AS/CC/05/6/A

UNIT DESCRIPTION

This unit covers the competencies required to carry out statistical data management. It involves data management using excel, R, SPSS and python.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** ***(Bold and italicised terms are elaborated in the Range)***
1. Manage statistical data on excel spreadsheet	1.1 Applied coding and validation of data as per the procedure. 1.2 Applied Multiple-key sorting as per the procedure 1.3 Applied Sorting of data based on custom lists as per the procedure 1.4 Applied creating single- and multi-level subtotals as per the procedure. 1.5 Applied Filtering of data using text, numeric, date etc. as per the data headers 1.6 Applied Filtering of tables using slicers as per the procedures 1.7 Applied use of Advanced Filter as per the data structures 1.8 Applied knowledge of eliminating duplicate data as per the duplicates 1.9 Applied Use of SUMIF and related functions for quick data analysis as per the procedures 1.10 Applied use of Index & Match as per the procedures 1.11 Applied Conditional Formatting as per the data 1.12 Applied knowledge of Filtering & Sorting as per the procedures 1.13 Applied knowledge of Find & Replace as per the procedures

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
	1.14 Applied use of data analysis tool as per the procedures 1.15 Interpretation of results from data analysis tool is done as per the coefficients
2. Manage statistical data in R	2.1 Installed R Programming Language & R Studio as per the procedure 2.2 Installed Install ***R Packages*** as per the procedure 2.3 Created variables in R as per the data 2.4 Performed Arithmetic calculation in R as per the data 2.5 Built data structures in R as per the data 2.6 Used ***built-in functions*** in R as per the required operations and function 2.7 Used character functions in R as per the required procedure 2.8 Used ***Statistical Probability and density Functions*** in R as per the required data 2.9 Use other related functions in R as per the required output 2.10 Applied Importation of data into R as per the required format 2.11 Applied Sorting of Data in R as per the data 2.12 Merged data in R per the procedure 2.13 Perform Aggregation in R as per the procedures 2.14 Applied Basic Statistics I.e. Mean, variance, median etc. in R as per the procedure 2.15 Generated Static graphics in R i.e. Basic plots, graphic maps etc. as per the procedure 2.16 Applied data analysis in R as per the procedures.
3. Manage statistical data on SPSS	3.1 Created variables in SPSS as per the procedure 3.2 Entered data in SPSS as per the procedure

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
	3.3 Coded data in SPSS as per the data 3.4 Imported data from other sources to SPSS as per the data format. 3.5 Applied ***commands in SPSS*** as per the function 3.6 Merged data in SPSS as per the data headers 3.7 Generated graphs and charts in SPSS as per the data 3.8 Performed various data Transformation in SPSS as per the procedure 3.9 Performed data analysis using SPSS as per the model.
4. Manage statistical data on Python	4.1 Applied ***Python Basic operations*** as per the python procedures 4.2 Applied ***python Functions and Modules*** as per the procedures 4.3 Performed ***Mathematical operations*** in python as per the developers 4.4 Performed ***Strings operations*** on Python as per the developer's procedures 4.5 Applied Sequences, Dictionaries, and Sets on python as per the developers' procedures 4.6 Performed python ***Flow Control functions*** as per the developers' procedures 4.7 Applied ***File Processing*** in python as per the developers' procedures 4.8 Applied Exception Handling on python as per the developer's procedures 4.9 Performed operations on Dates and Times as per the developer's procedures 4.10 Run Python Scripts from the Command Line as per the developer's procedures

RANGE

This section provides work environment and conditions to which the performance Criteria apply. It allows for different work environment and situations that will affect Performance.

Variable	**Range**
1. Python Basic operations may include but is not limited to:	• Literals • Python Comments • Data Types • Variables • Writing a Python Module • print () Function • Naming Arguments • Collecting User Input
2. Python Functions and Modules may include but is not limited to:	• Defining Functions • Variable Scope • Global Variables • Function Parameters • Returning Values • Importing Modules
3. Mathematical operations may include but is not limited to:	• Arithmetic Operators • Modulus and Floor Division • Assignment Operators • Built-in Math Functions • The math Module • The random Module • Seeding
4. Strings operations may include but is not limited to:	• Quotation Marks and Special Characters • String Indexing • Slicing Strings • Concatenation and Repetition • Common String Methods • String Formatting

Variable	Range
	• Built-in String Function
5. Flow Control functions may include but is not limited to:	• Conditional Statements • The is and is not Operators • Python's Ternary Operator • Loops in Python • The enumerate () Function • Generators • List Comprehensions
6. File Processing may include but is not limited to:	• Opening Files • The os and os.path Modules

REQUIRED KNOWLEDGE AND SKILLS

KNOWLEDGE

The individual needs to demonstrate knowledge and understanding of:

- Use of various menus and functions in excel
- Use of various menus and functions in SPSS
- Use of various functions in R
- Use of various functions in python
- Interpretation of outputs in Excel, r and SPSS
- Computer applications

SKILLS

- Communication skills
- ICT skills

EVIDENCE GUIDE

This provides advice on assessment and must be in conjunction with the performance criteria, required knowledge and understanding and range.

1.Critical Aspects of Competency	**Assessment requires evidence that the candidate:** 1.1 Demonstrated knowledge of coding of data 1.2 Demonstrated knowledge of data entry 1.3 Demonstrate knowledge of sorting of data 1.4 Demonstrated knowledge eliminating duplicates in applications in excel 1.5 Demonstrated knowledge of filtering of data 1.6 Demonstrated knowledge of manipulating data 1.7 Demonstrated knowledge of generating graphs, charts and tables 1.8 Demonstrated knowledge generating parameter estimates for regression models 1.9 Demonstrated knowledge of generating an ANOVA table 1.10 Demonstrated knowledge generating random numbers 1.11 Demonstrated knowledge running time series and obtaining its components 1.2 Demonstrated knowledge of use of R as a statistical package for data analysis 1.3 Demonstrated knowledge of use of SPSS as a statistical package for data analysis 1.4 Demonstrated knowledge of use of python as a statistical package for data analysis
2.Resource Implications	***The following resources must be provided:*** 2.1 Computer 2.2 Internet 2.3 Datasets 2.4 Books in statistics
3.Methods of Assessment	**Competency may be assessed through:** 3.1 Oral questioning 3.2 Practical demonstration 3.3 Observation 3.4 Written texts

4.Context of Assessment	Competency may be assessed individually in the actual workplace or through a simulated work place environment or During Industrial Attachment.
5.Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CORE UNITS OF COMPETENCY

DEVELOP RESEARCH CONCEPTS

UNIT CODE: MATH/OS/AS/CR/01/6/A

Unit description

This unit describes the skills, knowledge and competences required to: Formulate a research problem, objectives/hypothesis, develop research proposal/literature review, develop sampling procedures, develop data collection tools, develop data analysis framework, develop research budget proposal & time plan, pilot data collection tools, analyse pilot data and validate data collection tools

It applies to leaders or managers using applied research to ensure learning can enhance individual, team and organisational performance. The intended purpose and approach to applied research may vary across a range of contexts and organisations. In this unit, the focus is on applied research to attain improved organisational outcomes.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA**
Elements describe the essential outcomes.	*Performance criteria describe the performance needed to demonstrate achievement of the element.*
1. Formulate a research problem, objectives/hypothesis	1.1 The proposal title is stated as per the problem and general objectives/research questions/hypotheses. 1.2 The background of the study is outlined as per the study problem. 1.3 The problem statement is formulated as per the research proposal 1.4 Hypotheses are stated as per the research objectives.
2. Develop research proposal/literature review	2.1 The importance/significance of the study is stated as per the problem statement. 2.2 Research design is determined as per the problem statement.

ELEMENT	PERFORMANCE CRITERIA
	2.3 Information sources including citations and authors relevant to the research is assessed and captured as per the problem statement. 2.4 The scientific methodology is captured as per the problem statement. 2.5 Relevant research ethics and codes of conduct are reviewed as per the research proposal and target group.
3. Develop sampling procedures	3.1 The population characteristics are determined as per the target population 3.2 The sample size is determined based on statistical procedures 3.3 The sampling method is determined as per the population characteristics
4. Develop data collection tools	4.1 Data collection questions are determined as per the research objectives 4.2 Tool (s) for collecting data is identified as per research design 4.3 The tool (s) is developed as per the research hypotheses
5. Develop data analysis framework	5.1 The appropriate tools are selected as per the research design. 5.2 The constructs/items of the research tools are determined based on the hypotheses/objectives/research question. 5.3 ***Appropriate tools*** for use in data collection are developed as per the type of data and available resources.
6. Develop research budget proposal & Time plan	6.1 ***Direct costs*** are determined and estimated as per the research design

ELEMENT	PERFORMANCE CRITERIA
	6.2 ***Indirect costs*** are determined and estimated as per the research design. 6.3 The budget narratives are captured as per the cost estimates. 6.4 Total estimates are made and captured as per the costs. 6.5 Time plan is developed as per stipulated time
7. Pilot data collection tools	7.1 Stationeries and other material are procured and organized as per the workplace procedures. 7.2 Data collection tools are prepared as per the number of respondents. 7.3 Data collection tools are piloted as per the research design
8. Analyse pilot data and validate data collection tools	8.1 Piloted data is entered and analysed as per the methodology 8.2 Reliability and validity tests are performed as per the procedure 8.3 Data collection tools are validated as per the analysis results and responses

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range

1. Prepare research concept may include but not limited to:	• Research purpose and needs of the target group • Statement of a problem • research strategy and hypothesis • sources of information and contributors relevant to the research • available literature on other similar researches
2. Research design may include but not limited to.	• applied research methods, theories and suitable data collection techniques • appropriate methods for use to gather research data
3. Research tools may include but is not limited to:	• questionnaires • emails • calls • list • interview guides • audio recording • observation • experimental etc.
4. Direct costs may include but is not limited to:	• transport/travel • stationary • wages
5. Indirect costs may include but is not limited to	• Administrative • Miscellaneous

Required skills and Knowledge

The trainee needs to demonstrate knowledge of:

- Communication skills
- Data collection techniques
- Data analysis methods including the use of technology and technology services
- ICT literacy skills
- Research skills
- Report writing skills
- Use of Internet
- Citation and Referencing skills
- Laws relating to piracy and plagiarism

- Development of data collection tools
- Legal requirements, policies, procedures and guidelines relating to research including handling storing data and freedom of information
- Research ethics and codes of conduct
- Applied research tools and methods and their applications.
- Research design

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills, knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Formulated a research proposal or plan as per the problem 1.2 Specified and stated the research questions as per the objectives 1.3 Stated the hypotheses as the objectives 1.4 Formulated the research budget and costing as the research design 1.5 Developed research design as per the set objectives 1.6 Developed data collection tools as per the research design 1.7 Planned and conducted research as per the research design 1.8 Determined sample size as per the procedures 1.9 Described the geographical, cultural, social or institutional context within which the research will be carried out as per the procedure 1.10 Analysed the limitations to research design including the reliability and validity of data as per the problem statement.
2. Resource Implications	The following resources should be provided: 2.1 Computer 2.2 Printer 2.3 Printing papers 2.4 Stationary

3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Practical Tests
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or during Industrial Attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COLLECT AND MANAGE RESEARCH DATA

UNIT CODE: MATH/OS/AS/CR/02/6/A

Unit description

This unit specifies the competencies required to collect and manage research data. It involves, preparing data collection tools and equipment, selecting a representative sample, carrying out data collection, preparing code book, entering research data/merging to servers, performing data clean-up, developing, and storing data source files.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Prepare data collection tools and equipment	1.1 ***Data collection tools*** are printed and stapled as per the number of respondents. 1.2 Stationeries and other material are procured and organized as per the workplace procedures.
2. Select a representative sample	2.1 The representative sample is determined as per the statistical procedure 2.2 The representative sample is selected as per the research methods
3. Carry out data collection	3.1 Use of proposed research design is demonstrated as per the research proposal. 3.2 Knowledge of data ethics and confidentiality is demonstrated as per the procedure. 3.3 Knowledge of law and human rights as well as religious and cultural believes is demonstrated as per the research. 3.4 Data collection is done as per the set research design.
4. Prepare code book	4.1 Codes are prepared as per the variable and responses. 4.2 The codebook is prepared as per the codes. 4.3 Code book is tested as per the available data

5. Enter research data/Upload to servers	5.1 The data is captured in the codebook as per the data collection tool. 5.2 The serial number in the codebook is recorded on the face of the questionnaire as it appears on the codebook. 5.3 Data entered is stored as per the organisation procedures.
6. Perform data clean-up	6.1 The raw ***data clean-up*** is done to as per the procedures. 6.2 Ensuring that raw data is consistent with expectations and reasonable ranges is done as per the procedures. 6.3 Missing data variables and errors are handled as per the procedures.
7. Store data source files	7.1 Data source files are filled, labelled and coded as per the workplace filling procedures 7.2 The data source files are stored as per the organisation procedure.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. Data collection tools may include but is not limited to:	• Questionnaires • Emails • Call records • Lists • Measurement tools • Interview records etc.
2. Data collection may include but is not limited to:	• Observation • Using a questionnaire • Measurements • Counting etc.

3. Data clean-up may include but is not limited to	• Handling missing data • Handling outliers • Handling outliers etc.

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Organisational skills
- Problem solving skills
- Communication skills
- Leadership skills
- Confidentiality
- Data collection skills
- ICT literacy skills
- Report writing skills
- Use of Internet

Required Knowledge

The individual needs to demonstrate knowledge of:

- Organization work procedure and processes
- Law relating to confidentiality of research data
- Research methods
- research design
- data ethics and procedures
- laws and human rights
- sampling
- data storage
- data cleaning
- data entry
- data coding
- data collection methods

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills, knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated knowledge of Research design 1.2 Demonstrated data collection skills 1.3 Developed a code book as per the variables in the data collection tool 1.4 Entered research data as per the responses in the collection tool 1.5 Performed data clean-up as per the procedure 1.6 Stored the entered data as per the organisation procedures 1.7 Demonstrate knowledge of sampling skills
2. Resource Implications	The following resources should be provided: 2.1 Printers 2.2 Computer 2.3 Means of transport 2.4 Stationary 2.5 Internet 2.6 Telephone 2.7 Reagents for clinical and biological data 2.8 Appropriate apparatus and equipment for experimental data
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Practical Tests 3.5 Oral questioning
4. Context of Assessment	4.1 Competency may be assessed on the job, off the job or a combination of these or during Industrial Attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM DESCRIPTIVE DATA ANALYSIS

UNIT CODE: UNIT CODE: MATH/OS/AS/CR/03/6/A

Unit description

This unit specifies the competencies required to perform descriptive data analysis. The analysis describes the basic features of the data in a study. they provide simple summaries about the sample and the measures used in the data. The unit involves, receive data from primary or secondary source, perform further clean up if from secondary source, apply descriptive statistical tools, record descriptive statistics output, interpret output and prepare report, prepared presentation tools

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Receive data from primary or secondary source	1.1 Data is received as per the workplace procedures 1.2 Data is imported from storage database as per the procedures 1.3 Data is converted into ***relevant format*** as appropriate as per the ***available software***.
2. Perform further clean up if from secondary source	2.1 Missing values are handled as per the procedure. 2.2 Inconsistent values are handled as per the procedure 2.3 Outliers are handled as per the procedure 2.4 New variables are created as per the clean-up needs
3. Apply descriptive statistical tools	3.1 Descriptive tools and techniques are applied as per the procedures 3.2 Percentages, ratios and proportions from the data are generated as per the procedure

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	3.3 Summary, frequency tables and charts are generated and analysed as per the data and procedure. 3.4 Ungrouped data is grouped as per the required classes size and number of classes.
4. Record descriptive statistics output	4.1 The results obtained are recorded as per the summary output. 4.2 The report is prepared as per the descriptive output
5. Interpret output and prepare report.	5.1 Descriptive outputs are interpreted as per the summaries 5.2 A report is prepared for presentation to stakeholders and interested parties as per results 5.3 Report formatting is done as per the workplace procedure
6. Prepared presentation tools	5.1 **Presentation template** is prepared as per the report. 5.2 Presentation tools and equipment's are prepared and assembles as per the workplace procedure 5.3 The template is presented to the relevant stakeholders as per the workplace procedure.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range

1. Available Software may include but is not limited to:	• Excel • R • SPSS • Stata • Minitab • GenStat etc.
2. relevant format includes but is not limited to:	• excel • SPSS
3. Descriptive statistical tools include but is not limited to	• Frequency tables • Charts • Graphs • Summaries e.g. Percentages, ratios, proportions
4. Charts may include but is not limited to:	• Linear Graphs • Histogram • Pie charts • Bar graphs • Scatter plot • Stemplots etc.

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Analytical Skills
- Teamwork
- Problem solving
- Decision making
- Concentration
- Attention to detail
- Able to meet deadlines
- Communication skills
- Leadership skills
- Presentation skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Computer applications e.g. Excel, Microsoft Word, PowerPoint etc.
- Generating frequency tables, charts, line graphs, histogram, stemplot, bar graphs etc.
- Descriptive statistics

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Summary and or frequency tables are generated using software of choice as per the data. 1.2 Graphs and charts etc. are generated using a software of choice as per the data 1.3 PowerPoint presentation is prepared as per the generated results 1.4 The results are presented to stakeholders as per the workplace procedures.
2. Resource Implications	The following resources should be provided: 2.1 Computer with software i.e. R, SPSS, excel etc. 2.2 Projector 2.3 Seminar, board rooms or a presentation room. 2.4 Stationary
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Oral questioning 3.5 Written Tests
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or During Industrial Attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

PERFORM INFERENTIAL DATA ANALYSIS

UNIT CODE: UNIT CODE: MATH/OS/AS/CR/04/6/A

Unit description

This unit specifies the competencies required to perform inferential data analysis. It involves applying data transformation techniques, creating new variables, performing statistical model selection, obtaining parameter estimates, interpreting analysis results, preparing analysis report and preparing finding's presentation

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Apply data transformation techniques	1.1 Testing for ***statistical assumption*** is done as per the distribution 1.2 Data ***transformation*** is done as per the required assumptions 1.3 Transformed data is presented using a number of significant figures and decimal places.
2. Create new variables.	2.1 New variable names are created as per the data transformation 2.2 The transformed data is stored in new variable as per the transformation 2.3 The old variables are replaced as per the transformation
3. Perform statistical model selection	3.1 Independent and dependent variables are defined as per the problem statement 3.2 Run a complete statistical model with all the variables as per the problem statement 3.3 Select the variables as per the generated p-values and estimates 3.4 Select the best ***distribution/statistical model*** based on the adjusted coefficient of determination.

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
4. Obtain parameter estimates.	4.1 Generate parameter estimates as per the selected model. 4.2 The ***test*** statistics to determine the significance of the test results are carried out as per the models. 4.3 The goodness of fit test is performed as per the procedure
5. Interpret analysis results.	5.1 Parameter estimates are interpreted as per the statistical model output 5.2 Predictions are made as per the model estimates 5.3 Hypothesis are tested and decisions made as per the problem statement 5.4 The confidence interval is interpreted as per the data
6. Prepare analysis report.	1.1 The analysis results are written and the report prepared as per the workplace procedures. 1.2 The conclusions and recommendations are made as per the results and problem statement. 1.3 Need for and an appropriate approach to further research is identified and recommended as per the research findings. 1.4 Research finding adherence to any legal requirements is determined as per the ethical requirements
2. Prepare findings presentation	2.1 A PowerPoint presentation is prepared and the report presented to the stakeholders as per the workplace procedures. 2.2 The analysis report is presented to the management and stakeholders as per the workplace procedures

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
• Data transformation may include but is not limited to:	• Squares • Square roots • Reciprocals • Powers • Logarithms • Differences • Sums
• Testing for statistical assumption may include but is not limited to:	• Test for normality • Test for linearity • Test for equality of variance • Test for homogeneity • Test for heteroscedasticity
• Distribution may include but is not limited to:	• Normal • Poisson • Binomial
• Statistical model may include but is not limited to	• Simple Linear regression • Multiple linear regression • ANOVA

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Creative thinking
- Use of computer and software
- Analytical skills
- Communication skills
- Presentation techniques
- Reporting methods
- Problem solving
- Social trends, cultural, environmental context

Required Knowledge

The individual needs to demonstrate knowledge of:

- Variable types
- Introduction to Probability theory
- Probability distributions
- statistically analysis of data and identification of possible trends and confirmation of reliability
- Statistical models
- Test of hypothesis
- Use of statistical tables
- Use of data analysis software
- Parametric tests
- Preparation of PowerPoint presentation

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 The data is prepared for analysis as per the transformations done 1.2 Model is selected as per the significance of the model parameters 1.3 Parameter estimates are generated based on the selected model 1.4 The parameter estimated are interpreted as per the model 1.5 Computed values are compared with critical statistical table values as per the distribution 1.6 Ability to use of a statistical software is demonstrated as per the models used 1.7 Conclusions and recommendations are made as per the problem statement and hypothesis tested. 1.8 Used communication strategies involving statistical inferences and outputs.
2. Resource Implications	The following resources should be provided: 2.1 Computer 2.2 Internet 2.3 Statistical software

	2.4 Stationery 2.5 Printer
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Oral questioning 3.5 Practical Tests
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment or During Industrial Attachment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DESIGN RESEARCH EXPERIMENTS

UNIT CODE: UNIT CODE: MATH/OS/AS/CR/05/6/A

Unit description

This unit specifies the competencies required to design experiments. It involves recognise and develop statement of the problem, Determine the treatments and outcome variables, Design research experiments, Conduct the experiment, analyse experimental data, write report, draw conclusions and make recommendation sand making recommendations.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Recognise and develop statement of the problem	1.1 The problem statement is developed as per the workplace procedures. 1.2 Research objectives are stated as per the problem statement. 1.3 The null and alternative hypothesis are stated as per the research objectives.
2. Determine the treatments and outcome variables	2.1 The ***levels of treatment(s)*** are determined based on research objectives. 2.2 The outcome variables are determined as per the research objectives.
3. Design research experiments	3.1 The research site is identified as based on problem statement. 3.2 The study population is defined based on problem statement. 3.3 The data collection tools are identified based on the data to be collected. 3.4 Randomization criteria is determined as per the levels of treatment. 3.5 A control experiment is set as per the problem statement

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	3.6 The manual data spreadsheet is prepared as per the treatments.
4. Conduct the experiment	4.1 The site is prepared based on the levels of treatments 4.2 The plots are prepared based on the population or site 4.3 Treatment are applied to the plots based on randomisation 4.4 The outcome variable is measured based on the treatments 4.5 The data is recorded as per the measurements.
5. Analyse experimental data	5.1 The various assumptions of Analysis of variance (ANOVA) are checked and explained as per the methodology. 5.2 The ANOVA is performed as per the procedures 5.3 The ANOVA output is explained as per the results and the information required. 5.4 Sources of variation are explained as per the results obtained
6. Write report, draw conclusions and make recommendations	2.3 Conclusions are drawn and recorded as per the results and the problem statement. 2.4 Recommendations are made as per the results and conclusions made. 2.5 Recommendations are implemented as per the workplace procedures. 2.6 The analysis results are written and the report prepared as per the workplace procedures. 2.7 Need for and an appropriate approach to, further research is identified and recommended as per the research findings.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range

• levels may include but is not limited to:	• The settings or possible values of a factor in an experimental design e.g.
	  • 5g, 10g or 20g of fertilizer A
	  • 10ml, 15ml or 20ml of syrup B

• treatments may include but is not limited to:	• amount or type fertilizer • type and dosage of drug • Levels of temperature etc. • Education level • Teaching method etc.

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Creative thinking
- Use of computer and software to design random experiments
- Analytical skills
- Communication skills
- Numeracy skills
- Presentation techniques
- Reporting methods

Required Knowledge

The individual needs to demonstrate knowledge of:

- Assumptions in using ANOVA
- Randomisation
- Completely randomised block design
- Experiments with random factors
- Using ANOVA in CRBD
- Pooling variance (within and between samples)

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrated knowledge of designing a research experiment 1.2 Demonstrated knowledge designing an experiment with replications, blocking, randomisation etc. 1.3 Demonstrated knowledge designing a manual spreadsheet and capturing experimental data. 1.4 Demonstrated knowledge analysing experimental data using ANOVA 1.5 Demonstrated knowledge of interpreting ANOVA results and writing a report
2. Resource Implications	The following resources should be provided: 2.1 Computer 2.2 Internet 2.3 Statistical software 2.4 Stationery 2.5 Measuring tools 2.6 Treatments
3. Methods of Assessment	3.1Competency may be assessed through: 3.2Portfolio Assessment 3.3Interview 3.4Case Study/Situation 3.5Oral questioning 3.6Written Tests
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken

	in a closely simulated workplace environment or During Industrial Attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

IMPROVE PROCESS QUALITY

UNIT CODE: UNIT CODE: MATH/OS/AS/CR/06/6/A

Unit description

This unit specifies the competencies required to improve industrial process quality. It involves determining process quality characteristics (attributes and/or variables), developing sampling plans, collecting quality-control data, performing Statistical Process Control (SPC), Preparing and interpreting control charts.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Determine process quality characteristics (attributes and/or variables)	1.1 Measurement outcome is determined as per product specification 1.2 Outcome is classified as per the measurement. 1.3 Controls tools are determined as per the workplace procedures
2. Develop sampling plans	2.1 ***Sampling plan*** is developed a to as per the workplace procedure 2.2 Probability of lot rejection is determined at each sampling levels as per sampling plan. 2.3 Develop a sample selection criterion as per the workplace procedure.
3. Collect quality-control data	3.1 Select the samples to be measured as per the develop selection plan. 3.2 Selected samples are measured the as per the quality specifications. 3.3 The measurements are recorded as per the determined measurement
4. Perform Statistical Process Control (SPC)	4.1 The standard deviation is computed as per the collected data. 4.2 The ***control limits*** are determined as per the sampled data.

ELEMENT These describe the key outcomes which make up workplace function.	PERFORMANCE CRITERIA These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	4.3 Statistical process control is done as per the set process limits and the observed data.
5. Prepare and interpret control charts	5.1 The ***control charts*** are prepared as per measurements. 5.2 The control chart is interpreted as per the sampled data. 5.3 Recommendations on the production process are made as per the control charts.

RANGE

This section provides work environments and conditions to which the performance criteria apply. It allows for different work environments and situations that will affect performance.

Variable	Range
1. control charts may include but not limited to:	• $\bar{X}$chart • R-chart • np-chart • c-chart • S^2chart
2. control limits may include but not limited to:	• upper control limit • centreline • lower control limit
3. Sampling plan may include but not limited to:	• Single Sampling Plan • Double Sampling Plan • Sequential Sampling Plan

REQUIRED SKILLS AND KNOWLEDGE

This section describes the skills and knowledge required for this unit of competency.

Required Skills

The individual needs to demonstrate the following skills:

- Creative thinking
- Use of computer and software to generate random numbers
- Analytical skills
- Communication skills
- Numeracy skills
- Accuracy in measurements
- Organisation skills

Required Knowledge

The individual needs to demonstrate knowledge of:

- Randomisation
- Acceptance sampling
- Control charts
- Standard deviation charts
- R charts
- X-bar charts
- np charts
- Statistical control process
- Validation of measurements process

EVIDENCE GUIDE

This provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge and range.

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Demonstrate knowledge of Process quality characteristics to be used. 1.2 Demonstrated knowledge of developing, selecting and apply sampling plans to a process. 1.3 Demonstrated knowledge of measuring selected samples. 1.4 Demonstrated knowledge of performing statistical process control (SPC) 1.5 Demonstrated knowledge of interpreting control charts
2. Resource Implications	The following resources should be provided: 2.1 Computer 2.2 Internet

	2.3 Statistical software 2.4 Stationery 2.5 Measuring tools
3. Methods of Assessment	3.1 Competency may be assessed through: 3.2 Portfolio Assessment 3.3 Interview 3.4 Case Study/Situation 3.5 Oral questioning 3.6 Written Tests
4. Context of Assessment	Competency may be assessed on the job, off the job or a combination of these. Off the job assessment must be undertaken in a closely simulated workplace environment.
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.