REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

COMPUTER SCIENTIST

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 of Kenya's development blueprint 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 to 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 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 have been developed.

It is my conviction that these occupational standards will play a great role towards development of competent human resource for the ICT Sector's growth and 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 on Reforming Education and Training in Kenya, emphasized the need to reform curriculum development, assessment and certification. This called for a shift to CBET to address the mismatch between skills acquired through training and skills needed by industry as well as increase the global competitiveness of Kenyan labour force.

The TVET Curriculum Development, Assessment and Certification Council (TVET CDACC), in conjunction with ICT Sector Skills Advisory Committee (SSAC) have developed these Occupational Standards for Computer Scientist level 6. These standards will be the bases for development of a competency-based curriculum for Computer Science level 6. These Standards will also be the bases 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.

These occupational standards have been developed following the CBET framework policy; the CBETA Standards and guidelines provided by the TVET Authority and the Kenya National Qualification framework designed by the Kenya National Qualification Authority.

I am grateful to the Council Members, Council Secretariat, ICT SSAC, expert workers and all those who participated in the development of these occupational standards.

Prof. CHARLES M. M. ONDIEKI, PhD, FIET (K), Con. Eng. Tech.

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 ICT 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.

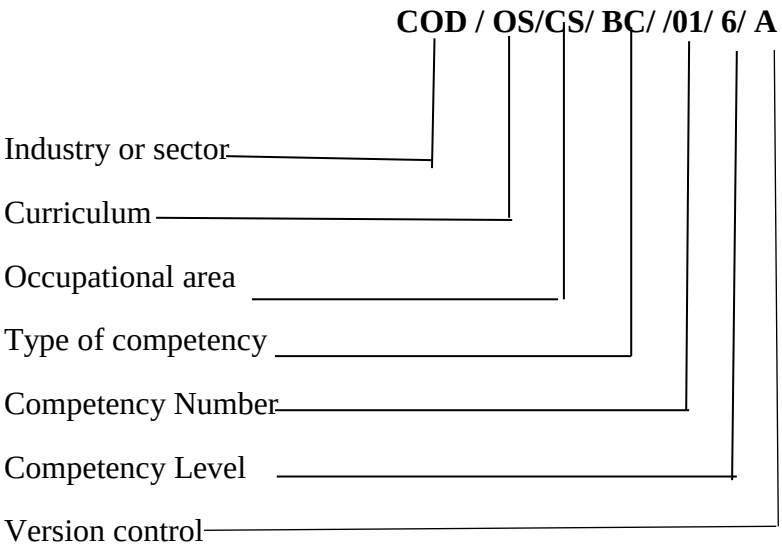
I acknowledge all other institutions which in one way or another contributed to the development of these Standards.

CHAIRMAN ICT SECTOR SKILLS ADVISORY COMMITTEE

ACRONYMS

CDACC	Curriculum Development Assessment and Certification Council
CU	Curriculum
BC	Basic Competency
CC	Core Competency
CO	Common Units
KCSE	Kenya Certificate of Secondary Education
KNQA	Kenya National Qualifications Authority
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
SSAC	Sector Skills Advisory Committee
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE



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COURSE OVERVIEW

Description

The Computer Science Level six (6) qualification consists of competencies that a person must achieve to demonstrate understand computer organization and architecture, understand operating systems, understand mathematics for computer science, understand fundamentals programming, demonstrate database management skills, develop an information system, understand networking and distributed systems, understand artificial intelligence, understand algorithms and data structures, demonstrate web design skills and Understand graphic design.

This course consists of basic, common and core competencies as indicated below:

Basic competencies

1. Demonstrate communication skills
2. Demonstrate occupational safety and health practices
3. Demonstrate numeracy skills
4. Demonstrate digital literacy
5. Demonstrate understanding of entrepreneurship
6. Demonstrate employability skills
7. Demonstrate environmental literacy

Common competencies

1. Demonstrate Basic Electronic Skills

Core competencies

1. Understand computer organization and architecture
2. Understand operating systems
3. Understand mathematics for computer science
4. Understand fundamentals programming
5. Demonstrate database management skills
6. Develop an information system
7. Understand networking and distributed systems
8. Understand artificial intelligence
9. Understand algorithms and data structures
10. Demonstrate web design skills
11. Understand graphic design

BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

UNIT CODE: IT/OS/CS/BC/01/6/A

UNIT DESCRIPTION

This unit covers the competencies required in meeting communication needs of clients and colleagues; developing, establishing, maintaining communication pathways and strategies. It also covers competencies for conducting interview, facilitating group discussion and representing the organization in various forums.

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 1.2 Different approaches are used to meet communication needs of clients and colleagues 1.3 Conflict is addressed promptly and in a timely way and in a manner which does not compromise the standing of the organization
2. Develop communication strategies	2.1 Strategies for effective internal and external dissemination of information are developed to meet the organization's requirements 2.2 Special communication needs are considered in developing strategies to avoid discrimination in the workplace 2.3 Communication ***strategies*** are analyzed, evaluated and revised where necessary to make sure they are effective
3. Establish and maintain communication pathways	3.1 Pathways of communication are established to meet requirements of organization and workforce 3.2 Pathways are maintained and reviewed to ensure personnel are informed of relevant information
4. Promote use of communication strategies	4.1 Information is provided to all areas of the organization to facilitate implementation of the strategy

	4.2 Effective communication techniques are articulated and modelled to the workforce 4.3 Personnel are given guidance about adapting communication strategies to suit a range of contexts
5. Conduct interview	5.1 A range of appropriate communication strategies are employed in ***interview situations*** 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 to ensure that required message is communicated
6. Facilitate group discussion	6.1 Mechanisms which enhance ***effective group interaction*** is defined and implemented 6.2 Strategies which encourage all group members to participate are used routinely 6.3 Objectives and agenda for meetings and discussions are routinely set and followed 6.4 Relevant information is provided to group to facilitate outcomes 6.5 Evaluation of group communication strategies is undertaken to promote participation of all parties 6.6 Specific communication needs of individuals are identified and addressed
7. Represent the organization	7.1 When participating in internal or external forums, presentation is relevant, appropriately researched and presented in a manner to promote the organization 7.2 Presentation is clear and sequential and delivered within a predetermined time 7.3 Appropriate media is utilized to enhance presentation 7.4 Differences in views are respected 7.5 Written communication is consistent with organizational standards 7.6 Inquiries are responded in a manner consistent with 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*** include but not limited to:	• Language switch • Comprehension check • Repetition • Asking confirmation • Paraphrase • Clarification request • Translation • Restructuring • Approximation • Generalization
2. ***Effective group interaction*** includes but not limited to:	• Identifying and evaluating what is occurring within an interaction in a non-judgmental 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*** 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:

- Effective communication
- Active listening
- Giving/receiving feedback

- Interpretation of information
- Role boundaries setting
- Negotiation
- Establishing empathy
- Openness and flexibility in communication
- Communication skills required to fulfill job roles as specified by the organization
- Writing communications strategy
- Applying key elements of communications strategy

Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process
- Dynamics of groups and different styles of group leadership
- Communication skills relevant to client groups
- Flexibility in communication
- 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/Demonstration with Oral Questioning 3.2 Written Examination

4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
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: IT/OS/CS/BC/02/6/A

UNIT DESCRIPTION

This unit describes the competencies required by a worker in order to apply a wide range of mathematical calculations for work; apply ratios, rates and proportions to solve problems; estimate, measure and calculate measurement for work; Use detailed maps to plan travel routes for work; Use geometry to draw and construct 2D and 3D shapes for work; Collect, organize and interpret statistical data; Use routine formula and algebraic expressions for work and use 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 1.2 Mathematical information is interpreted and comprehended 1.3 A range of mathematical and problem solving processes are select and used 1.4 Different forms of fractions, decimals and percentages are flexibly used 1.5 Calculation performed with positive and negative numbers 1.6 Numbers are expressed as powers and roots and are used in calculations 1.7 Calculations done using routine formulas 1.8 Estimation and assessment processes are used to check outcome 1.9 Mathematical language is used to discuss and explain the processes, results and implications of the task
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

	2.2 Mathematical information related to ratios, rate and proportions is analyzed 2.3 Problem solving processes are used to undertake the task 2.4 Equivalent ratios and rates are simplified 2.5 Quantities are calculated using ratios, rates and proportions 2.6 Graphs, charts or tables are constructed to represent ratios, rates and proportions 2.6 The outcomes reviewed and checked 2.7 Information is record using mathematical language and symbols
3. Estimate, measure and calculate measurement for work	3.1 Measurement information embedded in workplace texts and tasks are extracted and interpreted 3.2 Appropriate workplace measuring equipment are identified and selected 3.3 Accurate measurements are estimate and made 3.4 The area of 2D shapes including compound shapes are calculated 3.5 The volume of 3D shapes is calculated using relevant formulas 3.6 Sides of right angled triangles are calculated using Pythagoras' theorem 3.7 conversions are perform between units of measurement 3.8 Problem solving processes are used to undertake the task 3.9 The measurement outcomes are reviewed and checked 3.10 Information is recorded using mathematical language and symbols appropriate for the task
4. Use detailed maps to plan travel routes for work	4.1 Different types of maps are identified and interpreted 4.2 Key features of maps are identified 4.3 Scales are identified and interpreted 4.4 Scales are applied to calculate actual distances 4.5 Positions or locations are determined using directional information 4.6 Routes are planned by determining directions and calculating distances, speeds and times

	4.7 Information is gathered and identified and relevant factors related to planning a route checked 4.8 Relevant equipment is select and checked for accuracy and operational effectiveness 4.9 Task is planned and recorded using specialized mathematical language and symbols appropriate for the task
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 5.2 Features of 2D and 3D shapes are named and described 5.3 Types of angles in 2D and 3D shapes are identified 5.4 Angles are drawn, estimated and measured using geometric instruments 5.5 Angle properties of 2D shapes are named and identified 5.6 Angle properties are used to evaluate unknown angles in shapes 5.7 Properties of perpendicular and parallel lines are applied to shapes 5.8 Understanding and use of symmetry is demonstrated 5.9 Understanding and use of similarity is demonstrated 5.10 The workplace tasks and mathematical processes required are identified 5.11 2D shapes is drawn for work 5.12 3D shapes is constructed for work 5.13 The outcomes are reviewed and checked 5.14 Specialized mathematical language and symbols appropriate for the task are used
6. Collect, organize, and interpret statistical data for work	6.1 Workplace issue requiring investigation are identified 6.2 Audience / population / sample unit is determined 6.3 Data to be collected is identified 6.4 Data collection method is selected 6.5 Appropriate statistical data is collected and organized 6.6 Data is illustrated in appropriate formats

	6.7 The effectiveness of different types of graphs are compared 6.8 The summary statistics for collected data is calculated 6.9 The results / findings are interpreted 6.10 Data is checked to ensure that it meets the expected results and content 6.11 Information from the results including tables, graphs and summary statistics is extracted and interpreted 6.12 Mathematical language and symbols are used to report results of investigation
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 7.2 Simple algebraic expressions and equations are developed 7.3 Operate on algebraic expressions 7.4 Algebraic expressions are simplified 7.5 Substitution into simple routine equations is done 7.6 Routine formulas used for work tasks are identified and comprehended 7.7 Routine formulas are evaluated by substitution 7.8 Routine formulas transposed 7.9 Appropriate formulas are identified and used for work related tasks 7.10Outcomes are checked and result of calculation used
8. Use common functions of a scientific calculator for work	8.1 Required numerical information to perform tasks is located 8.2 The order of operations and function keys necessary to solve mathematical calculation are determined 8.3 Function keys on a scientific calculator are identified and used 8.4 Estimations are referred to check reasonableness of problem solving process 8.5 Appropriate mathematical language, symbols and conventions are used to report results

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. Geometry	May include but not limited to: • Scale drawing • Triangles • Simple solid • Round • Square • Rectangular • Triangle • Sphere • Cylinder • Cube • Polygons • Cuboids

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 calculator
- Using different measuring tools

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: 1.1 Performed calculations with positive and negative numbers 1.2 Used numbers expressed as powers and roots in calculations 1.3 Simplified ratios and rates 1.4 Constructed graphs, charts or tables to represent ratios, rates and proportions 1.5 Calculate the volume of 3D shapes using relevant formulas 1.6 Calculated sides of right-angle triangles using Pythagoras' theorem 1.7 Applied scales in calculation of actual distances 1.8 Planned routes by determining directions, distance calculation, speeds and time. 1.9 Identified types of angles in 2D and 3D shapes 1.10 Used angle properties in evaluating unknown angles 1.11 Applied properties of perpendicular and parallel lines in shapes construction. 1.12 Collected and organized appropriate statistical data 1.13 Collected and organized appropriate statistical data 1.14 Identified and used appropriate formulas for work related tasks 1.15 Identified and used function keys on a scientific calculator
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/Demonstration with Oral Questioning 3.2 Written Examination
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through accredited institution
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: IT/OS/CS/BC/03/6/A

UNIT DESCRIPTION

This unit covers the competencies required to effectively use digital devices such as smartphones, tablets, laptops and desktop PCs. It entails identifying and using digital devices such as smartphones, tablets, laptops and desktop PCs for purposes of communication, work performance and management at the work place.

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*** are identified according to manufacturer's specification 1.4 ***Appropriate computer hardware*** are 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*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected. 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 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 build 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 software may include but not limited to:	A collection of instructions or computer tools that enable the user to interact with a computer, its hardware, or perform tasks.
2. 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
3. Data security and privacy may include but not limited to:	• Confidentiality of data • Cloud computing • Integrity -but-curious data surfing
4. Security and control measures may include but not limited to:	• Counter measures against cyber terrorism • Risk reduction • Cyber threat issues • Risk management • Pass-wording
5. Security threats may include but not limited to:	• Cyber terrorism • Hacking
6. Word processing concepts may include but not limited to:	Using a special program to create, edit and print documents
7. Network configuration may include but not limited to:	Organizing and maintaining information on the components of a computer network

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:

- Computer software and hardware
- Data security and privacy
- Computer security
- Computer networking
- Computer crimes
- Laws governing protection of ICT
- Word processing;
    - ✓ Functions 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;
    - ✓ Sorting, indexing, storage retrieval and security
- Desktop publishing;
    - ✓ Manipulation and use 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;
    - ✓ Use of computer networking and internet.
    - ✓ Use of electronic mail and world wide web (www)
- Emerging trends and issues in ICT;
    - ✓ Identify 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	2.1 Tablets 2.2 Laptops and 2.3 Desktop PCs 2.4 Desktop computer 2.5 Lap top 2.6 Calculator 2.7 Internet 2.8 Smart phone 2.9 Operations Manuals
3. Methods of Assessment	Competency may be assessed through: 3.1 Written Test 3.2 Demonstration 3.3 Practical assignment 3.4 Interview/Oral Questioning 3.5 Demonstration
4. Context of Assessment	Competency may be assessed in an off and on the job setting
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE UNDERSTANDING OF ENTREPRENEURSHIP

UNIT CODE: IT/OS/CS/BC/04/6/A

UNIT DESCRPTION

This unit covers the outcomes required to build and develop the enterprise to be more competitive within a changing business environment, specifically responding to consumer demands while maintaining product quality and accessibility, building a customer base and employee motivation.

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 but not limited to:	1.1 Innovators 1.2 Imitators 1.3 Craft 1.4 Opportunistic **1.5** Speculators
2. Principles of Entrepreneurship but not limited to:	2.1 Visionary 2.2 Solution provider 2.3 Accountability 2.4 Growth and marketing 2.5 Resilient 2.6 Tenacious
3. Characteristics of Entrepreneurs include but not limited to:	3.1 Creative 3.2 Innovative 3.3 Planner 3.4 Risk taker 3.5 Networker 3.6 Confident 3.7 Flexible 3.8 Persistent 3.9 Patient 3.10 Independent 3.11 Future oriented 3.12 Goal oriented
4. Requirements for entry into self-employment	4.1 Technical skills 4.2 Management skills 4.3 Entrepreneurial skills 4.4 Resources 4.5 Infrastructure
5. Internal motivation include but not limited to:	5.1 Interest 5.2 Passion 5.3 Freedom 5.4 Prestige

6. Business environment	6.1 External 6.2 Internal 6.3 Intermediate
7. Forms of businesses	7.1 Sole proprietorship 7.2 Partnership 7.3 Limited companies 7.4 Cooperatives
8. Governing policies	8.1 Increasing scope for finance 8.2 Promoting cooperation between entrepreneurs and private sector 8.3 Reducing regulatory burden on entrepreneurs 8.4 Developing IT tools for entrepreneurs
9. External motivation include but not limited to:	9.1 Rewards 9.2 Punishment 9.3 Enabling environment 9.4 Government policies
10. Entrepreneurial orientation include but not limited to:	10.1 Passion 10.2 Interest 10.3 Hobbies 10.4 Skills
11. Innovative business strategies include but not limited to:	11.1 New products 11.2 New methods of production 11.3 New markets 11.4 New sources of supplies 11.5 Change in industrialization
12. Communication principles include but not limited to:	12.1 Feed back 12.2 Attention 12.3 Clarity 12.4 Timeliness 12.5 Adequacy 12.6 Consistency 12.7 Informality

13. Motivational theories include but not limited to:	13.1 Marslows theory 13.2 McClelland theory 13.3 Fredrick Tylors theory

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:

- Assessing a range of alternative products and strategies
- Critically analyzing information, summarizing and making sense of previous and current market trends
- Identifying changing consumer preferences and demographics
- Thinking "outside the box"
- Ensuring quality consistency
- Reducing lead time to product/service delivery
- Managing operations/ production
- Using formal problem-solving procedures, e. g., root-cause analysis, six sigma
- Communication skills
- Applying motivational principles, e. g., positive stroking, behavior modification
- Assessing range of alternatives rather than choosing the easiest option
- Achieving ownership and credibility for the enterprise vision
- Critically analyzing information, summarizing and making sense of previous and current market trends
- Developing solutions and practical strategies which are "outside the box"

Required Knowledge

The individual needs to demonstrate knowledge of:

- Entrepreneurial competencies
    - ✓ Decision making
    - ✓ Business communication
    - ✓ Change management
    - ✓ Coping with competition
    - ✓ Risk taking
    - ✓ 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
- Concepts of change management
- Relevant developments in other industries
- Regional/ County business expansion strategies
- Innovation in business

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 Distinguished entrepreneurs and business persons correctly 1.2 Identified ways of becoming an entrepreneur appropriately 1.3 Explored factors affecting entrepreneurship development appropriately 1.4 Analysed importance of self-employment accurately 1.5 Identified requirements for entry into self-employment correctly 1.6 Identified sources of business ideas correctly 1.7 Generated Business ideas and opportunities correctly 1.8 Analysed business life cycle accurately 1.9 Identified legal aspects of business correctly

	1.10 Assessed product demand accurately 1.11 Determined Internal and external motivation factors appropriately 1.12 Carried out communications effectively 1.13 Identified sources of business finance correctly 1.14 Determined Governing policy on small scale enterprise appropriately 1.15 Explored problems of starting and operating SSEs effectively 1.16 Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 1.17 Prepared executive summary correctly 1.18 Determined business innovative strategies appropriately 1.19 Presented business plan effectively
2. Resource Implications	The following resources should be provided: 2.1 Check list 2.2 Research tools (Questionnaire, interview guide, observation schedule) 2.3 Materials, tools, equipment and machines relevant
3. Methods of Assessment	3.1 Case problems 3.2 Written tests 3.3 Observation 3.4 Oral questions 3.5 Third party report 3.6 Interviews 3.7 Case problems 3.8 Portfolio
4. Context of Assessment	4.1 Competency may be assessed in workplace or in a simulated workplace setting 4.2 Assessment shall be observed while tasks are being undertaken whether individually or in-group
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: IT/OS/CS/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 Emotions are managed 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. 1.6 Self-esteem and a positive self-image are developed and maintained. 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 as per ***personal objectives*** 1.10 Critics are managed as per personal objectives

2. Demonstrate interpersonal communication	2.1 Listening and understanding is demonstrated as per communication policy 2.2 Writing to the needs of the audience is demonstrated as per communication policy 2.3 Speaking, reading and writing is demonstrated as per communication policy 2.4 Negotiation skills are demonstrated as per communication policy 2.5 Empathizing is demonstrated as per the communication policy 2.6 Numeracy is applied as per the communication policy 2.7 Internal and external customers' needs are identified and interpreted as per the communication policy 2.8 Persuasion is demonstrated as per the communication policy 2.9 Communication networks are established as per the SOPs 2.10 Information is shared as per communication structure
3. Demonstrate critical safe work habits	3.1 Stress is managed in accordance with workplace procedures. 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 procedures. 3.6 Leisure time is recognized in line with organization policy. 3.7 Abstinence from ***drug and substance abuse*** is observed as per workplace policy. 3.8 Awareness of HIV and AIDS is demonstrated in line with workplace requirements. 3.9 Safety consciousness is demonstrated in the workplace based on organization safety policy.

	3.10 ***Emerging issues*** are dealt with in accordance with organization policy.
4. Lead a workplace team	4.1 Performance expectations for the ***team*** are set 4.2 Duties and responsibilities are assigned in accordance with the organization policy. 4.3 Team parameters and ***relationships*** are identified according to set rules and regulations. 4.4 ***Forms of communication*** in a team are established according to office policy. 4.5 Communication is carried out as per workplace place policy and requirements of the job. 4.6 Team performance is supervised 4.7 ***Feedback*** on performance is collected and analyzed based on established team learning process 4.8 Conflicts are resolved between team members in line with organization rules and regulations. 4.9 ***Gender mainstreaming*** is undertaken in accordance with set regulations. 4.10 Human rights are adhered to in accordance with existing protocol. 4.11 Healthy relationships are developed and maintained for harmonious co-existence in line with workplace.
5. Plan and organize work	5.1 Task requirements are identified as per the workplace objectives 5.2 Task is interpreted in accordance with safety (OHS), environmental requirements and quality requirements 5.3 Work activity is organized with other involved personnel as per the SOPs 5.4 Resources are mobilized, allocated and utilized to meet project goals and deliverables. 5.5 Work activities are monitored and evaluated in line with organization procedures.

	5.6 Job planning is documented in accordance with workplace requirements. 5.7 Planning and organizing of work activities is reviewed as per the workplace requirements 5.8 Time is managed achieve workplace set goals and objectives.
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 availed based on job requirements. 6.3 Resources for training are mobilized and allocated based organizations skills needs. 6.4 Licensees and certifications relevant to job and career are obtained and renewed. 6.5 ***Personal growth*** is pursued towards improving the qualifications set for the profession. 6.6 Work priorities and commitments are managed based on requirement of the job and workplace policy. 6.7 Recognitions are sought as proof of career advancement in line with professional requirements.
7. Demonstrate workplace learning	7.1 Own learning is managed as per workplace policy. 7.2 Learning opportunities are sought and allocated based on job requirement and in line with organization policy. 7.3 Contribution to the learning community at the workplace is carried out. 7.4 ***Range of media for learning*** are established as per the training need 7.5 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job 7.6 Enthusiasm for ongoing learning is demonstrated 7.7 Time and effort is invested in learning new skills-based job requirements

	7.8 Willingness to learn in different context is demonstrated based on available learning opportunities arising in the workplace. 7.9 Awareness of Occupational Health and Safety procedures are demonstrated in use of technology in the workplace. 7.10 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 7.11 New systems are developed and maintained in accordance with the requirements of the job. 7.12 Opportunities that are not obvious are identified and exploited in line with organization objectives. 7.13 Opportunities for performance improvement are identified proactively in area of work. 7.14 Awareness of personal role in workplace ***innovation*** is demonstrated.
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. 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 workplace ethics	9.1 Policies and guidelines are observed as per the workplace requirements 9.2 Self-worth and profession is exercised in line with personal goals and organizational policies 9.3 Code of conduct is observed as per the workplace requirements 9.4 Personal and professional integrity is demonstrated as per the personal goals 9.5 Commitment to jurisdictional laws is demonstrated as per the workplace requirements

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.

Range	**Variable**
1. Drug and substance abuse includes but not limited to:	Commonly abused • Alcohol • Tobacco • Miraa • Over-the-counter drugs • Cocaine • Bhang • Glue
2. Feedback includes but not limited to:	• Verbal • Written • Informal • Formal
3. Relationships includes 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 include but not limited to:	• Written • Visual • Verbal • Non verbal • Formal and informal
5. Team includes but not limited to:	• Small work group • Staff in a section/department • Inter-agency group
6. Personal growth includes 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 include but not limited to:	• Long term • Short term • Broad • Specific

8. Trainings and career opportunities includes but not limited to	• Participation in training programs
	  ○ Technical
	  ○ Supervisory
	  ○ Managerial
	  ○ Continuing Education
	• Serving as Resource Persons in conferences and workshops

9. Resource include but not limited to:	• Human
	• Financial
	• Technology
	  ○ Hardware
	  ○ Software

10. Innovation include but not limited to:	• New ideas • Original ideas • Different ideas • Methods/procedures • Processes • New tools
11. Emerging issues include but not limited to:	• Terrorism • Social media • National cohesion • Open offices
12. Range of media for learning 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:

- Personal hygiene practices
- Intra and Interpersonal skills
- Communication skills
- Knowledge management

- Interpersonal skills
- Critical thinking skills
- Observation skills
- Organizing skills
- Negotiation skills
- Monitoring skills
- Evaluation skills
- Record keeping skills
- Problem solving skills
- Decision Making skills
- Resource utilization skills
- Resource mobilization skills

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
- Personal hygiene practices
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning
- Resources and allocating resources
- Organizing work
- Monitoring and evaluation
- Record keeping
- Workplace problems and how to deal with them
- Negotiation
- Assertiveness
- Team work
- Gender mainstreaming
- HIV and AIDS
- Drug and substance abuse
- Leadership
- Safe work habits
- Professional growth and development
- Technology in the workplace
- Learning
- Creativity
- Innovation
- Emerging issues
    - Social media
    - Terrorism
    - National cohesion

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 ethical performance
2. Resource Implications	The following resources should be provided: • Case studies/scenarios
3. Methods of Assessment	Competency in this unit may be assessed through: • Oral Interview • Observation • Third Party Reports • Written
4. Context of Assessment	• Competency may be assessed in workplace or in a simulated workplace setting • Assessment shall be observed while tasks are being undertaken whether individually or in-group
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: IT/OS/CS/BC/06/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to follow procedures for environmental hazard control, follow procedures for environmental pollution control, comply with workplace sustainable resource use, evaluate current practices in relation to resource usage, develop and adhere to environmental protection principles/strategies/guidelines, analyze resource use, develop resource conservation plans and implement selected 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 at all times 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 compiled following standard protocol. 2.2 Procedures for solid waste management are observed according Environmental Management and Coordination Act 1999 2.3 Methods for minimizing ***noise pollution*** complied following environmental regulations.
3. Demonstrate sustainable resource use	3.1 Methods for minimizing wastage are complied with. 3.2 Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle) 3.3 Methods for economizing or reducing resource consumption are practiced.

4. Evaluate current practices in relation to resource usage	4.1 Information on resource efficiency systems and procedures are collected and provided to the work group where appropriate. 4.2 Current resource usage is measured and recorded by members of the 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 concerned/proper authorities
8. Analyze resource use	8.1. All resource consuming processes are Identified

	8.2. Quantity and nature of Resource consumed is determined 8.3. Resource flow is analyzed through different parts of the process. 8.4. Wastes are classified for possible source of resources.
9. Develop resource Conservation plans	9.1. Efficiency of use/conversion of resources is determined following 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 are not limited to	• Mask • Gloves • Goggles • Safety hat • Overall • Hearing protector
2. Environmental pollution control measures may include but are 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
3. Wastes may include but are not limited to:	• Unnecessary waste • Necessary waste
4. Waste management Procedures may include but are not limited to:	• Sorting • Storing of items • Recycling of items • Disposal of items

5. Resources may include but are not limited to:	• Electric • Water • Fuel • Telecommunications • Supplies • Materials
6. Workplace environmental hazards may include but are not limited to:	• Biological hazards • Chemical and dust hazards • Physical hazards
7. Organizational systems and procedures may include but are not limited to:	• Supply chain, procurement and purchasing • Quality assurance • Making recommendations and seeking approvals
8. Legislations/Conventions may include but are not limited to:	• EMCA 1999 • Montreal Protocol • Kyoto Protocol
9. Environmental aspects/impacts may include but are not limited to:	• Air pollution • Water pollution • Noise pollution • Solid waste • Flood control • Deforestation/Denudation • Radiation/Nuclear /Radio Frequency/ Microwaves • Situation • Soil erosion (e.g. Quarrying, Mining, etc.) • Coral reef/marine life protection
10. Industrial standards / Environmental practices may include but are not limited to:	• ISO standards • Company environmental management systems (EMS)

11. Periodic may include but are not limited to:	• hourly • daily • weekly • monthly • quarterly • yearly
12. Programs/Activities may include but are not limited to:	• Waste disposal (on-site and off-site) • Repair and maintenance of equipment • Treatment and disposal operations • Clean-up activities • Laboratory and analytical test • Monitoring and evaluation • Environmental advocacy programs

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:

- Following storage methods of environmentally hazardous materials
- Following disposal methods of hazardous wastes
- Using PPE
- Practicing OSHS
- Complying environmental pollution control
- Observing solid waste management
- Complying methods of minimizing noise Pollution
- Complying methods of minimizing wastage
- Employing waste management procedures
- Economizing resource consumption
- Listing of resources used
- Measuring current usage of resources
- Identifying and reporting workplace environmental hazards
- Conveying all environmental issues
- Following environmental regulations
- Identifying environmental regulations
- Assessing procedures for assessing compliance
- Collecting information on environmental and resource efficiency systems and procedures, and Providing information to the work group
- Measuring and recording current resource usage
- Analysing and recording current purchasing strategies.

- Analysing current work processes to access information and data and Assisting identifying areas for improvement
- Analysing resource flow
- Determining efficiency of use/conversion of resources
- Determining causes of low efficiency of use
- Developing plans for increasing the efficiency of resource use
- Checking resource use plans
- Complying to regulations/licensing requirements
- Determining benefit/cost of plans
- Ranking proposals based on benefit/cost compared to limited resources
- Checking proposals meet regulatory requirements
- Monitoring implementation
- Making adjustments to plan and implementation
- checking new resource usage

Required Knowledge

The individual needs to demonstrate knowledge of:

- Storage methods of environmentally hazardous materials
- Disposal methods of hazardous wastes
- Usage of PPE Environmental regulations
- OSHS
- Types of pollution
- Environmental pollution control measures
- Different solid wastes
- Solid waste management
- Different noise pollution
- Methods of minimizing noise pollution
- Methods of minimizing wastage
- Waste management procedures
- Economizing of resource consumption
- Principle of 3Rs
- Types of resources
- Techniques in measuring current usage of resources
- Calculating current usage of resources
- Types of workplace environmental hazards
- Environmental regulations
- Environmental regulations applying to the enterprise.
- Procedures for assessing compliance with environmental regulations.
- Collection of information on environmental and resource efficiency systems and procedures,

- Measurement and recording of current resource usage
- Analysis and recording of current purchasing strategies.
- Analysis current work processes to access information and data Analysis of data and information
- Identification of areas for improvement
- Resource consuming processes
- Determination of quantity and nature of resource consumed
- Analysis of resource flow of different parts of the resource flow process
- Use/conversion of resources
- Causes of low efficiency of use
- Increasing the efficiency of resource use
- Inspection of resource use plans
- Regulations/licensing requirements
- Determine benefit/cost for alternative resource sources
- Benefit/costs for different alternatives
- Components of proposals
- Criteria on ranking proposals
- Regulatory requirements
- Proposals for improving resource efficiency
- Implementation of resource efficiency plans
- Procedures in monitor implementation
- Adjustments of implementation plan
- Inspection of new resource usage

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 Demonstration 3.2 Oral questioning 3.3 Written examination 3.4 Interview/Third Party Reports

		3.5 Portfolio (citations/awards from GOs and NGOs, certificate of training – local and abroad) 3.6 Simulations and role-play
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.

DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

UNIT CODE: IT/OS/CS/BC/07/6/A

UNIT DESCRIPTION

This unit specifies the competencies required to lead the implementation of workplace's safety and health program, 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 and/or its ***indicators*** of its presence, are identified 1.2 ***Evaluation and/or work environment*** measurements of OSH hazards/risk existing in the workplace is conducted by Authorized personnel or agency 1.3 ***OSH issues and/or concerns*** raised by workers are Gathered
2. Identify and implement appropriate control measures	2.1 Prevention ***and control measures***, including use of s***afety gears / PPE (personal protective equipment)*** for specific hazards identified and implemented 2.2 ***Appropriate risk controls*** based on result of OSH hazard evaluation is recommended. 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, procedures and policies/ guidelines	3.1 Information to work team about company OSH program, procedures and policies/guidelines are provided 3.2 Implementation of OSH procedures and policies/ guidelines are participated

	3.3 Team members are trained and advised on OSH standards and procedures 3.4 Procedures for maintaining ***OSH-related records*** are implemented

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 are 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 are 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. ***Evaluation and/or work environment measurements*** may include but are not limited to:	• Health Audit • Safety Audit • Work Safety and Health Evaluation • Work Environment Measurements of Physical and Chemical • Hazards

4. ***OSH issues and/or concerns*** may include but are 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
5. ***Prevention and control measures*** may include but are not limited to:	• Eliminate the hazard (i.e., get rid of the dangerous machine • Isolate the hazard (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. give trainings on how to use equipment safely; OSH-related topics, issue warning signage, rotation/shifting work schedule) • Use engineering controls to reduce the risk (i.e. use safety guards to machine) • Use personal protective equipment • Safety, Health and Work Environment Evaluation • Periodic and/or special medical examinations of workers
6. ***Safety gears /PPE (Personal Protective Equipment)*** may include but are 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

7. ***Appropriate risk controls***	• 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)
8. ***Contingency measures*** may include but are not limited to:	• Evacuation • Isolation • Decontamination • (Calling designed) emergency personnel
9. ***Emergency procedures*** may include but are not limited to:	• Fire drill • Earthquake drill • Basic life support/CPR • First aid • Spillage control • Decontamination of chemical and toxic • Disaster preparedness/management • Use of fire-extinguisher
10. ***Incidents and emergencies*** may include but are not limited to:	• Chemical spills • Equipment/vehicle accidents • Explosion • Fire • Gas leak • Injury to personnel • Structural collapse • Toxic and/or flammable vapors emission

11. ***OSH-related Records*** may include but are not limited to:	• Medical/Health records • Incident/accident reports • Sickness notifications/sick leave application • 11.4 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:

- Skills on preliminary identification of workplace hazards/risks
- Knowledge management
- Critical thinking skills
- Observation skills
- Coordinating skills
- Communication skills
- Interpersonal skills
- Troubleshooting skills
- Presentation skills
- Training skills

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 Identifies hazards/risks in the workplace and/or its indicators 1.2 Requests for evaluation and/or work environment measurements of OSH hazards/risk in the workplace 1.3 Gathers OSH issues and/or concerns raised by workers 1.4 Identifies and implements prevention and control measures, including use of PPE (personal protective equipment) for specific hazards 1.5 Recommends appropriate risk controls based on result of OSH hazard evaluation and OSH issues gathered 1.6 Establish contingency measures, including emergency procedures in accordance with organization procedures 1.7 Provides information to work team about company OSH program, procedures and policies/guidelines 1.8 Participates in the implementation of OSH procedures and policies/guidelines 1.9 Trains and advises team members on OSH standards and procedures 1.10 Implements procedures for maintaining OSH-related records
2. Resource Implications	The following resources should be provided: 2.1 Workplace or assessment location 2.2 OSH personal records 2.3 PPE 2.4 Health records
3. Methods of Assessment	Competency may be assessed through: 3.1 Portfolio Assessment 3.2 Interview 3.3 Case Study/Situation 3.4 Observation/Demonstration and oral questioning
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.

COMMON UNITS OF COMPETENCY

APPLY BASIC ELECTRONIC SKILLS

UNIT CODE: IT/OS/CS/CC/01/6/A

Relationship to Occupational Standards
This unit addresses the unit of competency: Demonstration of basic electronic skills

Unit description
This unit specifies the competencies required to demonstrate basic skills of electronics. It involves identification of electric circuits, electronic components, understand semi-conductor theory, identify and classify memories, apply number systems and identify emerging trends in electronics.

ELEMENTS AND PERFORMANCE CRETIRIA

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 electrical circuits	1.1 Electrical circuit are identified 1.2 ***Electrical quantities and their units*** are identified 1.3 ***Types of electrical circuits*** are identified
2. Identify Electronic components	2.1 Identification of electrical components is done 2.2 Characteristic of electronic components are identified 2.3 Application of electronic components are Identified 2.4 Characteristics of integrated circuit are identified
3. Understand Semi-conductor theory	3.1 Explanation of semiconductor theory is done 3.2 Structure of matter is described 3.3 Electrons in conductors and semiconductors are explained 3.4 Types of semiconductor materials are identified 3.5 P-type and N-type materials are explained 3.6 Description of P-N junction diodes operations is done 3.7 ***Types and operations of transistors*** are identified

4. Identify and classify memory	4.1 ***Types of memories*** are identified 4.2 Memory hierarchy is identified 4.3 ***Levels of memory storage*** are identified 4.3 ***Classification of memories*** is done
5. Apply Number Systems and binary coding	5.1 ***Types of number systems*** are identified 5.2 Base conversion is done 5.3 Binary arithmetic operations are done 5.4 ***Binary codes*** are identified 5.5 Representation of decimals in BCD is done 5.6 BCD arithmetic are performed
6. Emerging trends in Electronics	6.1 Description of emerging trends is done 6.2 Challenges of emerging trends are explained 6.3 Explanation on coping with the emerging trends is done

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Electrical quantities and their units	E.M.F in volts • Power in watts • Energy in joules • Resistance in ohms • Current in amperes
2. Types of electrical circuits	• AC – Alternating Current • DC – Direct Current
3. Types and operations of transistors	• Types ✓PNP ✓NPN • Operations ✓Forward biasing ✓Reverse Biasing
4. Types of memories	• Semi-conductor • Magnetic • Optical

Variable	Range *May include but is not limited to:*
5. Classification of memories	• RAM • ROM
6. Levels of memory storage	• Internal • Main • Online • Offline bulk
7. Types of number systems	• Decimal • Binary • Octal • Hexadecimal • Binary Arithmetic's
8. Binary codes	• 8421 BCD • Excess 3 • BCD arithmetic's

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:

- Communications (verbal and written);
- Proficient in ICT
- Time management
- Problem solving
- Decision making
- First aid

Required knowledge

The individual needs to demonstrate knowledge of:

- Electrical Components
- Electrical Quantities and units of measurement
- Electrical circuits
- Semiconductor theory
- Number systems
- Types of Computer memories

FOUNDATION SKILLS

The individual needs to demonstrate the following foundation skills:

- Communications (verbal and written);
- Proficient in ICT
- Time management
- Problem solving
- Decision making
- First aid

EVIDENCE GUIDE

This provides advice on assessment and must be read 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 Identified Electrical Components, quantities and their units of measurement 1.2 Constructed a simple circuit 1.3 Identified types of transistors and their operations 1.4 Categorized the memories according to their levels, types and hierarchy 1.5 Identified the number systems, binary codes and their operations.
2. Resource Implications	The following resources must be provided: Resources same as that of workplace are advised to be applied Including resistors, Transistors, soldering wire, soldering Iron, printed circuit board, ammeter, volt meter, connecting wires, wire stripper, pliers, wire cutter, screw driver, driller, clamps, vise
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Practical demonstration
4. Context of Assessment	Competency may be assessed individually in the actual workplace and simulated setting of the actual work place
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

DEMONSTRATE FOUNDATIONAL COMPUTER SCIENCE SKILLS

UNIT CODE: IT/OS/CS/CR/01/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate foundational computer science skills. It involves identifying computer components, performing computer arithmetic, solving digital logic, demonstrating basic networking skills, demonstrating spreadsheet skills using MS Excel, demonstrating presentation skills using MS PowerPoint and recognising ethical, social and legal issues in computing and big 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.)***
1. Identify computer components	1.1 Hardware and software are defined 1.2 ***Types of software*** are outlined 1.3 ***Computer hardware components*** are explained 1.4 Functions of computer hardware components are outlined according to manufacturer's specifications 1.5 Functions of computer software types are outlined according to manufacturer's specifications 1.6 Troubleshooting of a computer is demonstrated
2. Perform computer arithmetic	2.1 ***Number systems*** are explained 2.2 Integer and floating point representations are demonstrated according to IEEE standard 2.3 Integer and floating point arithmetic is explained
3. Solve Digital Logic Problems	3.1 Boolean algebra is explained. 3.2 ***Boolean operations*** are outlined 3.3 Writing of boolean expressions is illustrated 3.4 ***Methods of simplifying boolean expressions*** are illustrated.
4. Demonstrate basic networking skills	4.1 Key ***computer networking terminologies*** are explained 4.2 ***Components of a computer network*** are explained 4.3 ***Types of networks*** are explained 4.4 ***Network topologies*** are identified based on IEEE standards. 4.5 Network troubleshooting tools are demonstrated
5. Demonstrate spreadsheet skills using MS Excel	5.1 Spreadsheet is explained. 5.2 Worksheets are created 5.3 Data importation and linking is demonstrated.

	5.4 Formulas and functions in MS excel are demonstrated. 5.5 Use of excel data tools is demonstrated 5.6 Creation of pivot tables is demonstrated 5.7 Visualization using charts is demonstrated
6. Demonstrate presentation skills using MS PowerPoint	6.1 Presentation software is explained. 6.2 Development of a PowerPoint presentation is demonstrated 6.3 Use of ***presentation views*** is demonstrated 6.4 ***Presentation masters*** are designed 6.5 Data importation into PowerPoint is demonstrated 6.6 A presentation is created using a set of requirements
7. Recognise ethical, social and legal issues in computing and Big Data	7.1 Computing ethics is explained 7.2 Legal and ethical issues are classified based on guidelines of regulatory bodies 7.3 Social issues and emerging trends in computing are explained 7.4 Big data ethics concerns and principles are explained

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Types of software	• Application software • System software • Utility software • Language translators
2. Computer hardware components	• I/O devices • CPU • Memory
3. Number systems	• Decimal • Positional • Binary • Hexadecimal
4. Boolean operations	• AND OR • NOT • NAND • NOR • EX-OR • EX-NOR
5. Methods of simplifying Boolean expressions	• Using algebraic functions • Using Truth tables • Using Karnaugh Maps
6. Computer networking terminologies	• Network server • Client server • Intranet • Extranet • Transmission media • VoIP • Download • Upload
7. Components of a network	• Hub • Network interface card

Variable	Range *May include but is not limited to:*
	• Switch • Connecting media • Network OS
8. Types of networks	• LAN • WAN • MAN • PAN
9. Network topologies	• Star • Bus • Ring • Mesh
10. Presentation views	• Normal view • Slide sorter view • Notes page view • Slide show view
11. Presentation masters	• Slide masters • Notes master • Handout master

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Computer components
- Computer arithmetic
- Digital logic problems
- Basic networking skills

- Ethical, social and legal issues in computing and big data

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1.Differentiated computer hardware and software 1.2.Explained the different types of software 1.3.Demonstrated troubleshooting of a computer 1.4.Explained number systems 1.5.Demonstrated Integer and floating point representations according to IEEE standard 1.6.Performed boolean operations 1.7.Explained different types of networks 1.8.Identified network topologies based on IEEE standards. 1.9.Demonstrated network troubleshooting tools 1.10. Developed spreadsheet solutions using Excel 1.11. Created Powerpoint presentations. 1.12. Classified legal, social and ethical issues based on guidelines of regulatory bodies 1.13. Explained ethical concerns arising from using big data
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, MSOffice, Internet, network devices
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE MATHEMATICAL SKILLS FOR DATA SCIENCE

UNIT CODE: IT/OS/CS/CR/02/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate mathematical skills for

data science. It involves performing calculus operations, performing linear algebra operations, analysing events using probability theory and analysing data using statistics.

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. Perform Calculus Operations	1.1 Calculus is explained 1.2 Applications of calculus in data science are cited. 1.3 Functions and graphs are explained 1.4 Differential calculus is illustrated 1.5 Integral calculus is illustrated
2. Perform Linear Algebra Operations	2.1 Linear Algebra is defined 2.2 Applications of Linear Algebra in data science are cited. 2.3 Linear equations are solved 2.4 Vectors are explained 2.5 ***Vector operations*** are illustrated 2.6 Matrices are explained 2.7 ***Matrix operations*** are illustrated 2.8 Inverse of a square matrix is illustrated
3. Analyse events using Probability Theory	3.1 *Key terminologies in Probability* are explained 3.2 Applications of probability theory in data science are cited. 3.3 Probability axioms and simple counting problems are illustrated 3.4 Permutations and combinations are illustrated 3.5 Conditional probability and the multiplication rule are illustrated
4. Analyse data using statistics	4.1 ***Key terminologies in statistics*** are explained 4.2 Applications of Statistics in data science are cited. 4.3 ***Distribution in stastics*** are illustrated 4.4 Data representation techniques are illustrated

	4.5 Descriptive statistics are explained 4.6 ***Measures of central tendency*** are illustrated 4.7 ***Measures of spread*** are illustrated 4.8 Inferential statistics is explained 4.9 Linear regression and correlation are illustrated

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Vector operations	• Addition • Multiplication • Dot product
2. Matrix operations	• Sum of two matrices • Sum of a matrix and a scalar • Matrix subtraction • Product of two matrices • Product of a matrix and a vector
3. Key terminologies in probability theory	• Event • Outcome • Experiment • Chance • Sample space • Mutually exclusive event • Independent events
4. Key terminologies in statistics	• Population • Sample • Parameter • Statistic • Distribution
5.Distribution in statistics	• Binomial • Normal • Poison
6. Measures of central tendency	• Mean • Median • Mode

Variable	Range *May include but is not limited to:*
7.Measures of spread	• Variance • Standard deviation • Percentile • Quartiles

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Calculus
- Linear Algebra
- Probability
- Statistics

EVIDENCE GUIDE

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

1.Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Solved real life problems using differential calculus 1.2 Solved real life problems using integral calculus 1.3 Solved real life problems Linear equations 1.4 Performed vector operations 1.5 Performed matrix operations 1.6 Explained samples spaces, events and sets 1.7 Solved real life problems using probability axioms

	1.8 Solved real life problems using permutations and combinations 1.9 Solved real life problems using conditional probability 1.10 Explained various types of distribution in statistics 1.11 Differentiated descriptive and inferential statistics 1.12 Represented data using statistical techniques 1.13 Illustrated measures of central tendency 1.14 Illustrated measures of spread 1.15 Illustrated measures of location 1.16 Illustrated linear regression and correlation
2.Resource Implications	Resources the same as that of workplace are advised to be applied including computers, Internet, Calculator,log tables
3.Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4.Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5.Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE PROGRAMMING SKILLS USING PYTHON

UNIT CODE: IT/OS/CS/CR/03/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate programming skills using python. It involves identifying programming building blocks, working in the python environment, performing data operations, using control structures, applying functions for problem solving and demonstrating Object Oriented programming.

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 programming building blocks	1.1 **Programming is defined** 1.2 ***Phases of program development*** **are explained** 1.3 ***Key terms used in programming*** are defined 1.4 ***Types of code*** are explained 1.5 Translators are explained 1.6 Program specification is designed
2. Work in the Python environment	2.1 Python is installed 2.2 Python programming environment is demonstrated 2.3 Features of Python are outlined 2.4 Python syntax is demonstrated
3. Perform data operations	3.1 ***Python data types*** are outlined 3.2 ***Types of statements*** are illustrated 3.3 Variables and constants are explained 3.4 ***Data operations*** are illustrated 3.5 Program to perform specified operations is created.
4. Use Control Structures	4.1 ***Control Structures*** are explained 4.2 Uses of different control structures are demonstrated 4.3 Programs using control structures are created
5. Apply functions for problem solving	5.1 Functions are explained 5.2 ***Types of functions*** are explained 5.3 Methods are demonstrated 5.4 Programs using methods are created
6. Demonstrate Object Oriented Programming	6.1 Object oriented programming concepts are explained 6.2 Classes and objects are demonstrated. 6.3 Programs demonstrating inheritance are developed

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Phases of program development	• Establish program requirements • Design a program • Coding • Code test and debug • Document • Maintain
2. Key terms used in programming	• Algorithm • Source code • Executable • Compiling • Debugging
3. Types of code	• Source code • Object code • Machine code
4. Python data types	• Integer • Float • Strings • Boolean • Lists
5. Types of statements	• Declaration • Executable
6. Data Operations	• Number operations • String operations
7. Control Structures	• Decision • Looping
8. Types of functions	• User defined • Built in functions • Lambda functions

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Programming building blocks
- The Python environment
- Data Operations
- Control Structures
- Functions for problem solving
- Object oriented programming

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1.Explained phases of program development 1.2.Installed Python 1.3.Demonstrated understanding of Python environment 1.4.Created a program to perform data operations 1.5.Explained different types of control statements 1.6.Created a program using control statements 1.7.Created a program using various types of functions 1.8. Explained applications of Object Oriented Programming 1.9. Demonstrated classes and objects 1.10. Demonstrated inheritance
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, Python IDE
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning

	3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY QUANTITATIVE MODELLING SKILLS

UNIT CODE: IT/OS/CS/CR/04/6/A

UNIT DESCRIPTION

This unit covers the competencies required to apply quantitative modelling skills. It involves identifying key quantitative modelling concepts, performing regression modelling, performing linear programming, applying simulation modelling techniques and performing statistical quality control.

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 key quantitative modelling concepts	1.1 Quantitative modelling is defined 1.2 ***Key terms in quantitative modelling*** are explained 1.3 Quantitative modelling techniques are explained
2. Perform regression modelling	2.1 ***Types of regression*** models are explained 2.2 ***Key assumptions in regression*** are explained 2.3 Linear regression modeling is illustrated 2.4 The regression model is evaluated 2.5 Linear regression models are created to solve real world problems
3. Perform linear programming	3.1 Linear programming using graphical method is illustrated 3.2 Linear programming modelling using simplex method is illustrated 3.3 Linear programming models are created to solve real world problems
4. Apply simulation modelling techniques	4.1 ***Types of simulation models*** are explained 4.2 Monte Carlo simulation model is illustrated 4.3 Monte Carlo simulation models are created to solve financial related problems
5. Perform statistical quality control	5.1 Statistical quality control is explained. 5.2 ***Key terms in statistical quality control*** are explained 5.3 Quality problems related to manufacturing are specified 5.4 ***Statistical quality control tools*** are selected and applied to analyse and solve specified quality problem

	5.5 Statistical quality controls are applied in the ***lean six sigma*** process

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Key terms in quantitative modelling	• Simulation • Equations • Optimization
2. Types of regression	• Linear regression • Logistic regression • Lasso regression • Ridge regression • Polynomial regression
3. Key Assumptions in regression	• Linear relationship • Multivariate normality • No or little multicollinearity • No auto correlation
4. Types of simulation models	• Monte Carlo • Agent Based • Discrete events • system dynamics
5. steps of lean six sigma	• Define • Measure • Analyse • Improve • Control
6. Key terms in statistical quality control	• Upper Control Limit • Lower Control Limit • Mean control Limit

Variable	Range *May include but is not limited to:*
7. Statistical quality control tools	• Fishbone diagram • Check sheet • Control chart • Pareto diagram • Scatter diagram • Histogram

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Key quantitative modelling Concepts
- Regression modelling
- Linear programming modelling
- Simulation modelling techniques
- Statistical quality control

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Explained modelling 1.2 Explained applications of quantitative modelling 1.3 Explained regression 1.4 Created a regression model

	1.5 Explained linear programming 1.6 Created a linear programming model 1.8 Explained simulation modelling 1.10 Created a Monte Carlo simulation model 1.11 Explained statistical quality control 1.12. Specified quality problems related to manufacturing 1.13 Selected and applied statistical quality control tools to analyse and solve specified quality problem 1.14 Applied statistical quality controls in the ***lean six sigma*** process
2. Resource Implications	Resources the same as that of workplace are advised to be applied including calculators, graph papers, log tables
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY PYTHON IN DATA SCIENCE

UNIT CODE: IT/OS/CS/CR/05/6/A

UNIT DESCRIPTION

This unit covers the competencies required to apply Python in Data Science. It involves identifying data science concepts, performing python data processing, performing python data visualization and performing statistical data analysis.

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 key data science concepts	1.1 **Data Science is defined** 1.2 ***Key terms used in data science*** are defined 1.3 ***Foundations of Data Science*** are explained. 1.4 ***Data science libraries*** in python are explained 1.5 ***Data requirements*** are specified from a problem statement 1.6 Dataset is prepared from specified data requirements.
2. Perform Python data processing	2.1 Python scientific libraries are installed 2.2 Choice of scientific libraries to use in python data processing is are explained 2.3 ***Data formats*** is imported using pandas 2.4 Exploratory Data Analysis is demonstrated. 2.5 Data formatting and ***data type conversions*** are demonstrated. 2.6 Data cleaning is demonstrated using the dataset 2.7 ***Pandas operations*** are demonstrated using the dataset.
3. Perform Python data visualization	3.1 Visualizations are explained. 3.2 ***Types of data visualizations*** are demonstrated. 3.3 Sub plots are created from given data 3.4 Addition of ***elements of visualizations*** is demonstrated. 3.5 Data visualizations using Matplotlib and seaborn are created using the dataset.
4. Perform statistical data analysis	4.1 ***Types of statistics*** are explained 4.2 Descriptive statistics measures are demonstrated. 4.3 Inferential statistics measures are demonstrated

	4.4 Data Science blog is published from the dataset analysis and visualizations.

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Key terms used in data science	• Dataset • Data mining • Data visualization • Data wrangling • Business intelligence • Data modelling • Data governance
2. Foundations of Data Science	• Mathematics • Programming • Databases • Research • Computer networks
3. Data science libraries	• Numpy • Pandas • Matplotlib • Seaborn • Scipy • Statsmodels
4. Data requirements	• Sources • Users • Type • Format
5. Data formats	• Excel files • SQL files • CSV files
6. Data type conversions	• Integer • Float • Strings • Datetime

Variable	Range *May include but is not limited to:*
	• Categorical
7. Pandas operations	• Dropping rows and columns • Indexing columns • Slicing data frames • Sorting • Grouping and melting • Concatenating, merging and joining data frames • Pivoting Data
8. Types of data visualizations	• Histograms • Bar graphs • Line plots • Scatter plots • Pie charts • Box plots
9. Elements of visualizations	• Title • Legend/ key • Axis labels • Annotations
10. Types of statistics	• Descriptive • Inferential

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Key data science concepts
- Python data processing

- Python data visualization
- Statistical data analysis

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1.Explained foundations of data science 1.2.Specified data requirements from a problem statement 1.3.Explained data science libraries in python. 1.4.Imported data in various formats using pandas 1.5.Conducted Exploratory Data Analysis. 1.6.Performed data cleaning from a dataset 1.7.Demonstrated Pandas operations using a dataset 1.8.Created different types of data visualizations using Matplotlib and Seaborn from the dataset 1.9.Created sub plots from the dataset. 1.10. Differentiated descriptive and inferential of statistics 1.11. Published a data science blog from the dataset analysis and visualization
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, internet, Python IDE
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DESIGN AND DEVELOP DATABASES AND DATA WAREHOUSES

UNIT CODE: IT/OS/CS/CR/06/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate designing and development of databases and data warehouses. It involves identifying key database concepts, designing a relational database from given requirements, using Structured Query Language to implement a database design, designing a data warehouse and implementing a data warehouse

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 key Database concepts	1.1 **Databases are explained** 1.2 Key concepts in relational modelling are explained 1.3 Relational Database Management Systems (RDBMSs) products are compared 1.4 Installation of MS SQL server is demonstrated 1.5 MS SQL server interface is explained 1.6 Properties of MS SQL server database are explained 1.7 RDBMS product for a simulated environment is prescribed
2. Design a relational Database from given requirements	2.1 ***Phases of database design*** are explained 2.2 ***Entity modeling*** is illustrated using Unified Modelling Language (UML) notation 2.3 Normalisation is demonstrated 2.4 Validation of the Entity Relationship (ER) model is done according to the requirements
3. Use Structured Query Language to implement database design	3.1 Structured Query Language (SQL) is explained 3.2 ***Data definition queries*** are explained 3.3 Creation of tables using the SQL CREATE TABLE statement is demonstrated 3.4 ***CREATE TABLE statement constraints*** are demonstrated

	3.5 The table schema is edited using the SQL ALTER statement 3.6 A table is dropped using the SQL DROP TABLE statement 3.7 ***Data manipulation query statements*** are demonstrated. 3.8 SQL joins are explained 3.9 Database is created and queried from validated ER model 3.10 A simple join is created from the database
4. Design a data warehouse	4.1 Data warehousing is explained 4.2 Online Analytical Processing (OLAP) is illustrated 4.3 Online Transaction Processing (OLTP) is illustrated 4.4 ***Data warehouse schemas*** are designed from a set of requirements
5. Implement a Data warehouse Design	5.1 Data Mining Query Language (DMQL) is explained 5.2 Cubes and dimension tables are created using schema specifications 5.3 Extract Transform Load (ETL) operations are performed from the created data warehouse

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Terminologies used with databases	• Table • Records • Field • DBMS
2. Phases of database design	• Conceptual design • Logical design • Physical design
3. Data definition queries	• CREATE • DROP

Variable	Range *May include but is not limited to:*
	• ALTER
4. CREATE TABLE statement constraints	• Primary key • Foreign key • UNIQUE • CHECK • NOT NULL • DEFAULT
5. Data manipulation query statements	• INSERT • SELECT • UPDATE • DELETE
6. Data warehouse schemas	• Star • Snowflake • Fact Constellation Schema

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Database concepts
- Relational Database Design
- Using Structured Query Language
- Designing a data warehouse
- Implementing a data warehouse design

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Prescribed RDMBS product as per user requirements 1.2 Installed MS SQL server 1.3 Explained relational modelling concepts 1.4 Created an entity relationship model 1.5 Normalised database tables 1.6 Validated an ER model 1.7 Used SQL to create, edit and drop tables 1.8 Used SQL to add, retrieve, update and delete records from tables. 1.9 Designed data warehouse schemas from a set of requirements 1.10 Used DMQL to implement data warehouse schemas 1.11 Demonstrated data warehouse ETL operations
2. Resource Implications	Resources the same as that of workplace are advised to be applied including Computers, MS SQL server
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical demonstration 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEVELOP MACHINE LEARNING APPLICATIONS USING PYTHON

UNIT CODE: IT/OS/CS/CR/07/6/A

UNIT DESCRIPTION

This unit covers the competencies required to develop machine learning applications. It involves identifying concepts of machine learning, developing classification based applications, developing regression based applications, developing clustering based applications, applying gradient boosting techniques and using cross validation to optimize machine learning methods.

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 key concepts of machine learning	1.1 Machine learning is explained 1.2 ***Key terms used in Machine learning*** are defined 1.3 ***Foundations of machine learning*** are explained 1.4 ***Types of machine learning*** are explained. 1.5 Applications of machine learning are explained 1.6 Scikit-learn library is explained 1.7 Prescribe real life application areas of machine learning.
2. Develop classification based applications	2.1 Classification is explained 2.2 Features and targets are identified from given data 2.3 ***Data preprocessing*** is demonstrated from given data 2.4 Fitting a classifier is demonstrated 2.5 Predictions are demonstrated 2.6 ***Evaluation of the classifier*** is demonstrated. 2.7 Classifiers are created using given data
3. Develop regression based applications	3.1 Regression is explained 3.2 Features and targets are identified from given data 3.3 Data preprocessing is demonstrated. 3.4 Fitting a regressor is demonstrated 3.5 Predictions are demonstrated 3.6 Evaluation of the regressor is demonstrated. 3.7 Regressors are created using given data
4. Develop clustering based applications	4.1 Clustering is explained 4.2 Clusters are identified from given data 4.3 Data preprocessing is demonstrated. 4.4 Fitting a cluster is demonstrated 4.5 Predictions are demonstrated

	4.6 Evaluation of the cluster is demonstrated. 4.7 Clusters are created using given data
5. Apply gradient boosting techniques	5.1 Gradient boosting is explained. 5.2 Gradient boosting in regression and classification are demonstrated using given data 5.3 Gradient boosted regressor and classifier are evaluated
6. Use cross validation to optimize machine learning methods	6.1 Cross validation is defined 6.2 ***Cross validation techniques*** are illustrated 6.3 Cross validation is demonstrated using given data 6.4 Hyper parameter tuning is demonstrated using GridSearchCV

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Key terms used in Machine learning	• Train • Predict • Features • Labels • Encoding • Overfitting and under fitting • Bias-variance trade-off
2. Foundations of machine learning	• Math • Programming • Databases
3. Types of machine learning	• Supervised • Unsupervised
4. Data preprocessing	• Label encoding • Scaling • Cleaning data • Feature extraction
5. Evaluation of the classifier	• Accuracy • Precision • Recall • F1 score

Variable	Range *May include but is not limited to:*
6. Evaluation of the regressor	9. Root mean squared error 10. Mean absolute error 11. R^2
7. Evaluation of the cluster	• Accuracy • F1 score
8. Cross validation techniques	• K-fold • Stratified K-fold • Leave one out cross validation (LOOCV)

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Key concepts of machine learning
- Classification based applications
- Regression based applications
- Clustering based applications
- Gradient boosting techniques
- Cross validation to optimize machine learning methods

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1.Explained machine learning 1.2.Explained the foundations of machine learning 1.3.Explained the Scikit-learn library 1.4.Identified features and targets 1.5.Created a classifier using given data 1.6.Explained Regression 1.7.Created a regressor using given data 1.8.Clustering is explained 1.9.Created a cluster using given data 1.10. Demonstrated gradient boosting in regression and classification using given data 1.11. Illustrated cross validation techniques 1.12. Demonstrated cross validation using given data 1.13. Demonstrated hyper parameter tuning using GridSearchCV
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, internet, Python IDE
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DATA MINING AND ANALYTICS SKILLS IN BIG DATA MANAGEMENT

UNIT CODE: IT/OS/CS/CR/08/6/A

UNIT DESCRIPTION

This unit covers the competencies required to understand demonstrate data mining and analytics skills in big data management. It involves identifying key concepts of data mining and Big Data, applying data mining techniques, visualising real world big data problems and managing Big data using Hadoop.

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 key concepts of data mining and Big data	1.1 Data mining concept is explained 1.2 Architecture of data mining is illustrated 1.3 Data mining process is illustrated 1.4 Applications of data mining are cited 1.5 Target mining data is sourced and pre-processed. 1.6 Big Data Concept is explained 1.7 Big data analytics areas in business are prescribed
2. Apply data mining techniques	2.1 Mining technique is selected on the basis of given data characteristics 2.2 ***Data mining software tool*** is selected 2.3 Classification technique is demonstrated from a given dataset 2.4 Regression technique is demonstrated from a given dataset 2.5 Clustering technique is demonstrated from a given dataset
3. Visualize real world big data problems	3.1 ***Big Data visualization tools*** are identified 3.2 Visualization using Ms Excel is demonstrated from a given dataset 3.3 Visualization using Ms PowerBi is demonstrated from a given dataset
4. Manage Big data using Hadoop	4.1 Hadoop framework is explained 4.2 Hadoop Environment set up is demonstrated 4.3 ***Hadoop File System (HDFS) operations*** are demonstrated using Python 4.4 Hadoop Processing using MapReduce is demonstrated using Python

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1.Data mining software tool	• Python • R • Microsoft Power Bi • SaaS • Tableau • Orange • Weka • Apache Mahout • Oracle data Mining • Rattle • DataMelt
2.Big data visualization tools	• Python • R • Microsoft Power Bi • SaaS • Oracle Visual Analyser • Tableau • Google Chart
3.Hadoop File System (HDFS) operations	• Listing Files • Inserting data • Retrieving data •

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:

- Communications (verbal and written);
- Time management;
- Problem solving;

- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Key concepts of data mining and analytics
- Data mining techniques
- Visualizing real world big data problems
- Managing Big data using Hadoop

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Explained the Data mining concept 1.2 Illustrated the data mining aarchitecture 1.3 Explained the process of data mining. 1.4 Explained the Big Data Concept. 1.5 Prescribe application areas for data mining and big data. 1.6 Demonstrated classification technique from a given dataset using Python 1.7 Demonstrated regression technique from a given dataset using Python 1.8 Demonstrated clustering technique from a given dataset using Python 1.9 Demonstrated various forms of visualizations from a given dataset using Python 1.10 Demonstrated various forms of visualizations using PowerBi from a given dataset using Python 1.11 Explained the Hadoop framework 1.12 Demonstrated Hadoop Environment set up 1.13 Demonstrated Hadoop File System (HDFS) operations using Python

	1.14 Demonstrated Hadoop Processing using MapReduce using Python
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, Python and Microsoft Power BI
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE PROJECT MANAGEMENT SKILLS FOR DATA SCIENCE

UNIT CODE: IT/OS/CS/CR/09/6/A

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate project management skills for data science. It involves identifying concepts in project management, demonstrating business understanding using CRISP-DM, demonstrating data understanding using CRISP-DM, demonstrating data preparation skills using CRISP-DM, demonstrating data modelling and evaluation skills using CRISP-DM and deploying data mining model using CRISP-DM.

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 concepts in project management	1.1 Project management is explained 1.2 ***Project management methodologies*** in data science are explained 1.3 ***Project management software*** features are compared 1.4 Appropriate project management software and methodology are selecting
2. Demonstrate business understanding using CRISP-DM	2.1 Desired outputs of the project are identified 2.2 The current situation is assessed 2.3 Goals of data mining are identified 2.4 A project plan is created using selected project management software
3. Demonstrate data understanding using CRISP-DM	3.1 Data collection is performed 3.2 Data description is performed 3.3 Data exploration is performed 3.4 Verification of data quality is performed 3.5 Data quality report is prepared
4. Demonstrate data preparation skills using CRISP-DM	4.1 Data selection is demonstrated 4.2 Data cleaning is performed 4.3 Data construction is demonstrated 4.5 Data integration is performed
5. Demonstrate data modelling and evaluation skills using CRISP-DM	5.1 Model selection is performed 5.2 Test metrics are identified 5.3 Model building is demonstrated

	5.4 Model assessment is performed 5.5 Process review is demonstrated 5.6 Next steps are determined
6. Deploy data mining model using CRISP-DM	6.1 Model deployment plan is created 6.2 Monitoring and maintenance plan is created 6.3 Final project report is created and reviewed.

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Project management methodologies	• Kanban • Scrum • Waterfall • Research and Development • CRISP-DM
2. Project management software	• Jira • Asana • Trello • Microsoft project

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Project management concepts

- Business understanding using CRISP-DM
- Data understanding using CRISP-DM
- Data preparation skills using CRISP-DM
- Data modelling and evaluation skills using CRISP-DM
- Deploying data mining model using CRISP-DM

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.14. Explained project management methodologies in data science 1.15. Selected appropriate project management software 1.16. Identified desired outputs of the project 1.17. Assessed the current situation 1.18. Identified data mining goals 1.19. Created a project plan using the selected project management software 1.20. Performed data exploration 1.21. Prepared a data quality report 1.22. Performed data cleaning, construction and integration 1.23. Selected model design and test metrics 1.24. Built and assessed the model design 1.25. Reviewed the model design and determined the next steps 1.26. Created a model deployment plan 1.27. Created a monitoring and maintenance plan 1.28. Created and reviewed the final project report
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, internet, project management software
3. Methods of Assessment	Competency may be assessed through: 3.5 Oral questioning 3.6 Practical tests 3.7 Observation 3.8 Written test

4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment

DEMONSTRATE RESEARCH SKILLS FOR DATA SCIENCE

UNIT CODE: IT/OS/CS/CR/10/6/A

UNIT DESCRIPTION

This unit covers the competencies required to Identify foundational research concepts, select and use data collection methods, organise collected data using a statistical software tool , analyse research data using a statistical software tool and presentation and reporting of research findings.

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 foundational research concepts	1.1 Key foundational research concepts are explained 1.2 ***Types of data*** are explained 1.3 ***Levels of measurements*** *are explained* 1.4 ***Sources of data*** are explained 1.5 Different sources of data are recommended for a given research assignment.
2. Select and use data collection methods	2.1 ***Methods of data collection*** are explained 2.2 An interview instrument is developed 2.3 A questionnaire instrument is developed 2.4 Data collection process is demonstrated
3. Organize collected data using a statistical software tool	3.1 ***Types of data*** in data organization are identified 3.2 ***Data organization methods*** are demonstrated from the collected data 3.3 Features of ***statistical software tools*** are compared 3.4 A codebook is developed using R 3.5 Data entry is performed using the codebook 3.6 ***Data cleaning*** is demonstrated using R
4. Analyse research data using a statistical software tool	4.1 Data is summarized using descriptive statistics in R 4.2 Data is summarized using Inferential statistics in R 4.3 Visualizations are created using R
5. Presentation and reporting of research findings	5.1 ***Methods of data presentation*** are explained 5.2 Data is presented using various methods of data Presentation 5.3 Research reports are generated using R outputs

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Types of data	• Quantitative • Qualitative
2. Levels of measurements	• Nominal • Ordinal • Interval • ratio
3. Sources of data	• primary source • secondary source
4. methods of data collection	• Observation • Interviews • Questionnaires
5. Types of data organization	• Structured data • Unstructured data
6. Data organization methods	• Location • Alphabetical organization • Time • Hierarchy • Category
7. Statistical software tools	• SPSS • R (R Foundation for Statistical Computing) • Matlab • Microsoft Excel • SAS
8. Data cleaning	• Removing duplicates • Removing outliers • Sorting
9. Types of Data visualization	• Bar Chart • Line Graph • Histogram • Pie Chart • Scatter Plot

Variable	Range *May include but is not limited to:*
10. Methods of data presentation	• Textual • Tabular • Graphical

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Foundational research concepts
- Research data collection
- Organizing research data using a statistical software tool
- Analysing research data using a statistical software tool
- Presentation and reporting of research findings

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Explained types of data 1.2 Recommended sources of data for a research assignment 1.3 Explained methods of data collection 1.4 Demonstrated data collection process 1.5 Developed interview and questionnaire instruments for a research assignment. 1.6 Administered interview and questionnaire instruments 1.7 Compared features of statistical software tools

	1.8 Developed a codebook using R 1.9 Performed data entry using R 1.10 Performed data cleaning using R 1.11 Generated descriptive and inferential statistics from an R dataset 1.12 Generated visualizations using the dataset 1.13 Demonstrated textual methods of data presentation 1.14 Demonstrated tabular and graphical methods of data presentation using R 1.15 Created a presentation of key research outputs 1.16 Generated a report on research findings
2. Resource Implications	Resources the same as that of workplace are advised to be applied including Computers, Statistical software (SPSS, R studio), MS office
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical demonstration 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DESIGN AND IMPLEMENT CLOUD DATA SOLUTIONS

UNIT CODE: IT/OS/CS/CR/11/6/A

UNIT DESCRIPTION

This unit covers the competencies required to design and implement cloud data solutions. It involves identifying key concepts of cloud computing, designing and implementing database solutions for SQL Server, monitoring and troubleshooting database implementation in Azure.

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 key concepts of cloud computing	1.1 Cloud computing is explained 1.2 Cloud computing architecture is explained 1.3 ***Cloud computing technologies*** are illustrated 1.4 ***Cloud computing deployment models*** are illustrated 1.5 ***Cloud computing service models*** are illustrated 1.6 ***Cloud service providers*** are outlined by service category 1.7 Deployment and service models are prescribed for a simulated organisation
2. Design and implement database solutions for SQL Server and Microsoft Azure	2.6 Microsoft Azure is explained 2.7 Azure account is created 2.8 ***Azure components*** are illustrated 2.9 A SQL server database solution on Azure is developed 2.10 SQL Server on Azure virtual machines is implemented
3. Manage, design and implement database security and privacy	3.1 ***SQL Server Database security issues*** are explained 3.2 Security authentication and authorization requirements are specified. 3.3 SQL Server authentication and authorization is implemented 3.4 ***Azure SQL Database security capabilities*** are explained 3.5 Azure SQL Database security capabilities are implemented

4. Monitor and Troubleshoot Database implementation in Azure	4.1 Resources that need monitoring on Azure SQL database are identified. 4.2 Database performance problems are diagnosed 4.3 Monitoring tools are selected and configured

RANGE

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

Variable	**Range** ***May include but is not limited to:***
1. Cloud computing technologies	• Virtualization • Grid computing • Utility computing
2. Cloud computing deployment models	• Public • Private • Hybrid • Community
3. Cloud computing service models	• Infrastructure • Platform • Software • Identity • Network
4. Cloud service providers	• Infrastructure as a Service(IaaS) ✓ Amazon web Services ✓ Google Cloud Platform (GCP) ✓ AT&T ✓ Microsoft Azure Cloud ✓ CA Technologies ✓ Cloudscaling. ✓ DATAPIPE ✓ Eucalyptus Systems. ✓ HP • Platform as a Service (PaaS) ✓ Amazon web Services – AWS Elastic Beanstalk

Variable	Range ***May include but is not limited to:***
	✓ Microsoft Azure Cloud ✓ Google Cloud Platform (GCP) ✓ Appistry – CloudQ Platform. ✓ App Scale ✓ CA technologies ✓ Engine Yard ✓ Flexi Scal. • Software as a Service (SaaS) ✓ Abiquo ✓ Akamai. ✓ App Dynamics ✓ Cloud Switch ✓ CloudTran ✓ Eloqua • Software as a Service (SaaS) ✓ Google Cloud Platform (GCP)
5. Azure components	• Data Management • Networking • Identity and Access • Caching • Big Data and Big Compute • Mobile Service • Back Up • Media • Commerce
6. SQL Server Database security issues	• Authentication • Authorisation
7. Azure SQL Database security capabilities	• Access management • Authentication

Variable	Range *May include but is not limited to:*
	• Data protection • Monitoring, logging and auditing • Network security

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:

- Communications (verbal and written);
- Time management;
- Problem solving;
- Planning;
- Decision Making;
- Research;

Required knowledge

The individual needs to demonstrate knowledge of:

- Key concepts of cloud computing
- Designing and implementing database solutions for SQL Server and Microsoft Azure
- Managing, designing and implementing database security and privacy
- Monitoring and troubleshooting Database implementation in Azure

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Explained cloud computing architecture 1.2 Illustrated cloud computing technologies 1.3 Illustrated cloud computing deployment models 1.4 Illustrated Cloud computing service models 1.5 Prescribed deployment and service models for a simulated organization 1.6 Created an account on the Azure portal 1.7 Developed an SQL server database 1.8 Implemented SQL server on Azure virtual machines 1.9 Implemented SQL server authentication and authorization 1.10 Implemented Azure SQL server database security capabilities 1.11 Diagnosed database performance problems 1.12 Selected and configured appropriate database monitoring tools
2. Resource Implications	Resources the same as that of workplace are advised to be applied including computers, MS SQL Server, MS Azure
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed individually in the actual workplace or through simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.