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 for purpose of developing Competency Based curriculum for Computer Science level 6.

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 basis for development of a competency-based curriculum for Computer Science level 6. These Standards will also be the basis for assessment of an individual for competence certification.

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

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

CHAIRPERSON, 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.

CHAIRPERSON ICT SECTOR SKILLS ADVISORY COMMITTEE

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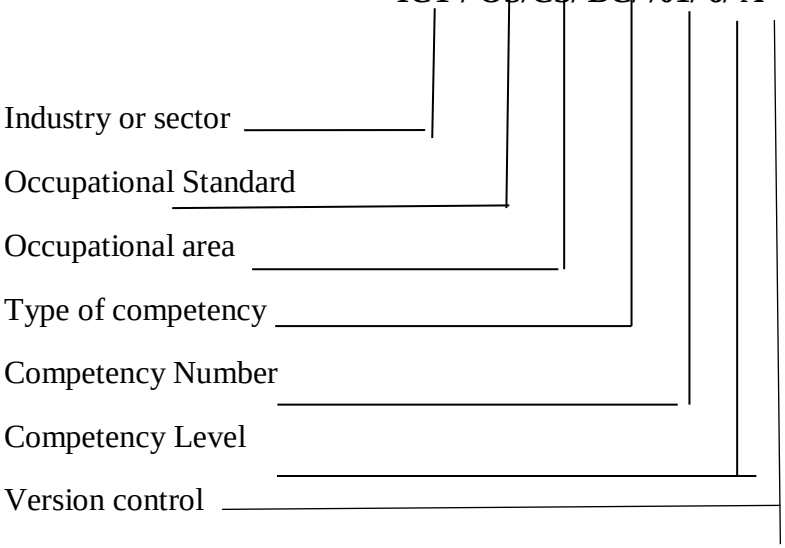
ABBREVIATIONS AND ACRONYMS

A	Control version
AIDS	Acquired Immunodeficiency Syndrome
BC	Basic Competency
CBET	Competency Based Education and Training
CC	Common Competency
CDACC	Curriculum Development Assessment Certification Council
CEO	Council Secretary
CPU	Central Processing Unit
CR	Core Unit
HIV	Acquired Immunodeficiency Virus
ICT	Information Communication Technology
OS	Occupational Standard
OSH	Occupational Safety and Health
PESTEL	Political Environmental Social Technological Economic Legal
PPE	Personal Protective Equipment
SOP	Standard Operating Procedure
SSAC	Sector Skills Advisory Committee
SWOT	Strength Weakness Opportunity Threat
TVET	Technical and Vocational Education and Training

KEY TO UNIT CODE

ICT / OS/CS/ BC/ /01/ 6/ A



OVERVIEW

Computer Science Level 6 qualification consists of competencies that a person must achieve to 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 units of competency as indicated below:

Basic Units of Competency

Unit code	Unit Title
ICT/OS/CS/BC/01/6/A	Demonstrate Communication Skills
ICT/OS/CS/BC/02/6/A	Demonstrate Numeracy Skills
ICT/OS/CS/BC/03/6/A	Demonstrate Digital Literacy
ICT/OS/CS/BC/04/6/A	Demonstrate Entrepreneurial Skills
ICT/OS/CS/BC/05/6/A	Demonstrate Employability Skills
ICT/OS/CS/BC/06/6/A	Demonstrate Environmental Literacy
ICT/OS/CS/BC/07/6/A	Demonstrate Occupational Safety and Health Practices

Common Unit of Competency

Unit code	Unit Title
ICT/OS/CS/CC/01/6/A	Demonstrate Basic Electronic Skills

Core Units of Competency

Unit code	Unit Title
ICT/OS/CS/CR/01/6/A	Understand Computer Organization and Architecture
ICT/OS/CS/CR/02/6/A	Understand Operating Systems
ICT/OS/CS/CR/03/6/A	Understand Mathematics for Computer Science
ICT/OS/CS/CR/04/6/A	Understand Fundamentals Programming
ICT/OS/CS/CR/05/6/A	Demonstrate Database Management Skills

ICT/OS/CS/CR/06/6/A	Develop An Information System
ICT/OS/CS/CR/07/6/A	Understand Networking and Distributed Systems
ICT/OS/CS/CR/08/6/A	Understand Artificial Intelligence
ICT/OS/CS/CR/09/6/A	Understand Algorithms and Data Structures
ICT/OS/CS/CR/10/6/A	Demonstrate Web Design Skills
ICT/OS/CS/CR/11/6/A	Understand Graphic Design

BASIC UNITS OF COMPETENCY

DEMONSTRATE COMMUNICATION SKILLS

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

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Meet communication needs of clients and colleagues	1.1 Specific communication needs of clients and colleagues are identified and met based on workplace requirements 1.2 Different communication approaches are identified and applied according to clients' needs 1.3 Conflict is identified and addressed as per the standards of the organization
2. Develop communication strategies	2.1 Strategies for effective internal and external dissemination of information are developed as per organization's requirements 2.2 Special communication needs are considered in developing strategies according workplace procedures 2.3 ***Communication strategies*** are analyzed, evaluated and revised based the workplace needs
3. Establish and maintain communication pathways	3.1 Pathways of communication are established as per organization policy 3.2 Pathways are maintained and reviewed according to organization procedures
4. Promote use of communication strategies	4.1 Information is provided to all areas of the organization as per strategy requirements 4.2 Effective communication techniques are articulated and modeled according work requirements 4.3 Personnel are given guidance about adapting communication strategies as per organization procedures

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

RANGE

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

Variable	**Range**

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

- Communication
- Active listening
- Interpretation
- Negotiation
- Writing

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

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

DEMONSTRATE NUMERACY SKILLS

UNIT CODE: ICT/OS/CS/BC/02/6/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

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

2. Use and apply ratios, rates and proportions for work	2.1 Information regarding ratios, rates and proportions extracted from a range of workplace tasks and texts as per SOPs 2.2 Mathematical information related to ratios, rate and proportions is analysed as per SOPs 2.3 Problem solving processes are used to undertake the task as per workplace procedures 2.4 Equivalent ratios and rates are simplified as per SOPs 2.5 Quantities are calculated using ratios, rates and proportions as per SOPS 2.6 Graphs, charts or tables are constructed to represent ratios, rates and proportions as per SOPs 2.7 The outcomes reviewed and checked as per job specifications 2.8 Information is record using mathematical language and symbols as per workplace procedures
3. Estimate, measure and calculate measurement for work	3.1 Measurement information embedded in workplace texts and tasks are extracted and interpreted as per job specifications 3.2 Appropriate workplace measuring equipment are identified and selected as per job specifications 3.3 Accurate measurements are estimated and made as per SOPs 3.4 The area of ***2D shapes*** including compound shapes are calculated as per SOPs 3.5 The volume of 3D shapes is calculated using relevant formulas as per SOPs 3.6 Sides of right angled triangles are calculated using Pythagoras' theorem as per SOPs 3.7 conversions are perform between units of measurement as per job specification 3.8 Problem solving processes are used to undertake the task as per workplace Procedures 3.9 The measurement outcomes are reviewed and checked as per workplace procedures 3.10 Information is recorded using mathematical language and symbols appropriate for the task as per workplace procedures
4. Use detailed maps to plan	4.1 Different types of maps are identified and interpreted as per job requirements

travel routes for work	4.2 Key features of maps are identified as per job requirements 4.3 Scales are identified and interpreted as per job requirements 4.4 Scales are applied to calculate actual distances 4.5 Positions or locations are determined using directional information as per job requirements 4.6 Routes are planned by determining directions and calculating distances, speeds and times as per job requirements 4.7 Information is gathered and identified and relevant factors related to planning a route checked as per job requirements 4.8 Relevant equipment is select and checked for accuracy and operational effectiveness as per job requirements 4.9 Task is planned and recorded using specialized mathematical language and symbols appropriate for the task as per job requirements
5. Use geometry to draw 2D shapes and construct 3D shapes for work	5.1 A range of 2D shapes and 3D shapes and their uses in work contexts is identified as per job specifications 5.2 Features of 2D and 3D shapes are named and described as per job specifications 5.3 Types of angles in 2D and 3D shapes are identified as per job specifications 5.4 Angles are drawn, estimated and measured using geometric instruments as per job requirements 5.5 Angle properties of 2D shapes are named and identified as per SOPs 5.6 Angle properties are used to evaluate unknown angles in shapes as per SOPs 5.7 Properties of perpendicular and parallel lines are applied to shapes as per SOPs 5.8 Understanding and use of symmetry is demonstrated as per SOPs 5.9 Understanding and use of similarity is demonstrated as per SOPs 5.10 The workplace tasks and mathematical processes required are identified as per workplace procedures

	5.11 2D shapes is drawn for work as per job specification 5.12 3D shapes is constructed for work as per job specification 5.13 The outcomes are reviewed and checked as per workplace procedures 5.14 Specialized mathematical language and symbols appropriate for the task are used as per SOPs
6. Collect, organize, and interpret statistical data for work	6.1 Workplace issue requiring investigation are identified as per workplace procedures 6.2 Audience / population / sample unit is determined as per workplace procedures as per workplace procedures 6.3 Data to be collected is identified as per workplace procedures 6.4 Data collection method is selected as per workplace procedures 6.5 Appropriate statistical data is collected and organized as per SOPs 6.6 Data is illustrated in appropriate formats as per SOPs 6.7 The effectiveness of different types of graphs are compared as per SOPs 6.8 The summary statistics for collected data is calculated as per SOPs 6.9 The results / findings are interpreted as per SOPs 6.10 Data is checked to ensure that it meets the expected results and content as per workplace procedures 6.11 Information from the results including tables, graphs and summary statistics is extracted and interpreted as per workplace procedure 6.12 Mathematical language and symbols are used to report results of investigation as per workplace procedure
7. Use routine formula and algebraic expressions for work	7.1 Understanding of informal and symbolic notation, representation and conventions of algebraic expressions is demonstrated as per SOPs 7.2 Simple algebraic expressions and equations are developed as per job specification

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

RANGE

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

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1. 1Developed communication strategies to meet the organization requirements and applied in the workplace 1. 2Established and maintained communication pathways for effective communication in the workplace

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

DEMONSTRATE DIGITAL LITERACY

UNIT CODE: ICT/OS/CS/BC/03/6/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify appropriate computer software and hardware	1.1 Concepts of ICT are determined in accordance with computer equipment 1.2 Classifications of computers are determined in accordance with manufacturers specification 1.3 Appropriate computer software is identified according to manufacturer's specification 1.4 Appropriate computer hardware is identified according to manufacturer's specification 1.5 Functions and commands of operating system are determined in accordance with manufacturer's specification
2. Apply security measures to data, hardware, software in automated environment	2.1 ***Data security and privacy are classified*** in accordance with the prevailing technology 2.2 ***Security threats*** reidentified ***and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected in accordance to Information Management security guidelines 2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
3. Apply computer	3.1 ***Word processing concepts*** are applied in resolving workplace tasks, report writing and documentation as per the job requirements

software in solving tasks	3.2 ***Word processing utilities*** are applied in accordance with workplace procedures 3.3 Worksheet layout is prepared in accordance with work procedures 3.4 Worksheet is built and data manipulated in the worksheet in accordance with workplace procedures 3.5 Continuous data manipulated on worksheet is undertaken in accordance with work requirements 3.6 Database design and manipulation is undertaken in accordance with office procedures 3.7 Data sorting, indexing, storage, retrieval and security is provided in accordance with workplace procedures
4. Apply internet and email in communication at workplace	4.1 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy 4.2 Office internet functions are defined and executed in accordance with office procedures 4.3 ***Network configuration*** is determined in accordance with office operations procedures 4.4 Official World Wide Web is installed and managed according to workplace procedures
5. Apply Desktop publishing in official assignments	5.1 Desktop publishing functions and tools are identified in accordance with manufactures specifications 5.2 Desktop publishing tools are developed in accordance with work requirements 5.3 Desktop publishing tools are applied in accordance with workplace requirements 5.4 Typeset work is enhanced in accordance with workplace standards
6. Prepare presentation packages	6.1 Types of presentation packages are identified in accordance with office requirements 6.2 Slides are created and formulated in accordance with workplace procedures 6.3 Slides are edited and run-in accordance with work procedures 6.4 Slides and handouts are printed according to work requirements

RANGE

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

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

- Software concept
- Functions of computer software and hardware
- Data security and privacy
- Computer security threats and control measures
- Technology underlying cyber-attacks and networks
- Cyber terrorism
- Computer crimes
- Detection and protection of computer crimes
- Laws governing protection of ICT
- Word processing;
    - ✓ Functions and concepts of word processing.
    - ✓ Documents and tables creation and manipulations
    - ✓ Mail merging
    - ✓ Word processing utilities
- Spread sheets;
    - ✓ Meaning, formulae, function and charts, uses and layout
    - ✓ Data formulation, manipulation and application to cells
    - ✓
- Database;
    - ✓ Database design, data manipulation, sorting, indexing, storage retrieval and security
- Desktop publishing;
    - ✓ Designing and developing desktop publishing tools
    - ✓ Manipulation of desktop publishing tools
    - ✓ Enhancement of typeset work and printing documents
- Presentation Packages;
    - ✓ Types of presentation Packages
    - ✓ Creating, formulating, running, editing, printing and presenting slides and handouts
- Networking and Internet;
    - ✓ Computer networking and internet.
    - ✓ Electronic mail and world wide web
- Emerging trends and issues in ICT;
    - ✓ Identify and integrate emerging trends and issues in ICT
    - ✓ Challenges posed by emerging trends and issues

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified and controlled security threats 1.2 Detected and protected computer crimes 1.3 Applied word processing in office tasks 1.4 Designed, prepared work sheet and applied data to the cells in accordance to workplace procedures 1.5 Opened electronic mail for office communication as per workplace procedure 1.6 Installed internet and World Wide Web for office tasks in accordance with office procedures 1.7 Integrated emerging issues in computer ICT applications 1.8 Applied laws governing protection of ICT
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE ENTREPRENEURIAL SKILLS

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

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

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

	2. 5 Contributions of Entrepreneurs to National development are identified as per business procedures and strategies 2. 6 Entrepreneurship culture in Kenya is explored as per business procedures and strategies 2. 7 Born or made Entrepreneurs are distinguished as per entrepreneurial traits
3. Identify Entrepreneurship opportunities	3.1 Sources of business ideas are identified as per business procedures and strategies 3.2 Business ideas and opportunities are generated as per business procedures and strategies 3.3 Business life cycle is analysed as per business procedures and strategies 3.4 Legal aspects of business are identified as per procedures and strategies 3.5 Product demand is assessed as per market strategies 3.6 Types of ***business environment*** are identified and evaluated as per business procedures 3.7 Factors to consider when evaluating business environment are explored based on business procedure and strategies 3.8 Technology in business is incorporated as per best practice
4. Create entrepreneurial awareness	4.1 ***Forms of businesses*** are explored as per business procedures and strategies 4.2 Sources of business finance are identified as per business procedures and strategies 4.3 Factors in selecting source of business finance are identified as per business procedures and strategies 4.4 ***Governing policies*** on Small Scale Enterprises (SSEs) are determined as per business procedures and strategies 4.5 Problems of starting and operating SSEs are explored as per business procedures and strategies

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

RANGE

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

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

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

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

- Decision making
- Business communication
- Change management
- Competition
- Risk
- Net working
- Time management
- Leadership
- Factors affecting entrepreneurship development

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

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	1. 1 Assessment requires evidence that the candidate: 1. 2 Distinguished entrepreneurs and businesspersons correctly 1. 3 Identified ways of becoming an entrepreneur appropriately 1. 4 Explored factors affecting entrepreneurship development appropriately 1. 5 Analysed importance of self-employment accurately 1. 6 Identified requirements for entry into self-employment correctly 1. 7 Identified sources of business ideas correctly 1. 8 Generated Business ideas and opportunities correctly 1. 9 Analysed business life cycle accurately 1. 10 Identified legal aspects of business correctly 1. 11 Assessed product demand accurately

	1. 12 Determined Internal and external motivation factors appropriately 1. 13 Carried out communications effectively 1. 14 Identified sources of business finance correctly 1. 15 Determined Governing policy on small scale enterprise appropriately 1. 16 Explored problems of starting and operating SSEs effectively 1. 17 Developed Marketing, Organizational/Management, Production/Operation and Financial plans correctly 1. 18 Prepared executive summary correctly 1. 19 Determined business innovative strategies appropriately 1. 20 Presented business plan effectively
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	3.1 Written tests 3.2 Oral questions 3.3 Third party report 3.4 Interviews 3.5 Portfolio of Evidence
4. Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE EMPLOYABILITY SKILLS

UNIT CODE: ICT/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 Emotional intelligence is demonstrated as per workplace requirements. 1.3 Individual performance is evaluated and monitored according to the agreed targets. 1.4 Assertiveness is developed and maintained based on the requirements of the job. 1.5 Accountability and responsibility for own actions are demonstrated based on workplace instructions. 1.6 Self-esteem and a positive self-image are developed and maintained based on values. 1.7 Time management, attendance and punctuality are observed as per the organization policy. 1.8 Goals are managed as per the organization's objective 1.9 Self-strengths and weaknesses are identified based on personal objectives
2. Demonstrate interpersonal communication	2.1 Writing skills are demonstrated as per communication policy 2.2 Negotiation and persuasion skills are demonstrated as per communication policy

	2.3 Internal and external stakeholders' needs are identified and interpreted as per the communication policy 2.4 Communication networks are established based on workplace policy 2.5 Information is shared as per communication policy
3. Demonstrate critical safe work habits	3.1 Stress is managed in accordance with workplace policy. 3.2 Punctuality and time consciousness is demonstrated in line with workplace policy. 3.3 Personal objectives are integrated with organization goals based on organization's strategic plan. 3.4 ***Resources*** are utilized in accordance with workplace policy. 3.5 Work priorities are set in accordance to workplace goals and objectives. 3.6 Leisure time is recognized and utilized in line with personal objectives. 3.7 ***Drugs and substances of abuse*** are identified and avoided based on workplace policy. 3.8 HIV and AIDS prevention awareness is demonstrated in line with workplace policy. 3.9 Safety consciousness is demonstrated in the workplace based on organization safety policy. 3.10 ***Emerging issues*** are identified and dealt with in accordance with organization policy.
4. Lead a workplace team	4.1 Performance targets for the ***team*** are set based on organization's objectives 4.2 Duties are assigned in accordance with the organization policy. 4.3 ***Forms of communication*** in a team are established according to organization's policy. 4.4 Team performance is evaluated based on set targets as per workplace policy. 4.5 Conflicts are resolved between team members in line with organization policy. 4.6 Gender related issues are identified and mainstreamed in accordance workplace policy. 4.7 Human rights and fundamental freedoms are identified and respected as Constitution of Kenya 2010.

	4.8 Healthy relationships are developed and maintained in line with workplace.
5. Plan and organize work	5.1 Work plans are prepared based on activities and budget. 5.2 Assigned tasks are interpreted and expectations identified as per the workplace instructions. 5.3 Task occupational safety and health requirements are identified and observed regulations. 5.4 Work resources are identified, mobilized, allocated and utilized based on organization work plans. 5.5 Work activities are monitored and evaluated in line with work plans and workplace policy. 5.6 Work plans are reviewed based on target and available resources.
6. Maintain professional growth and development	6.1 Personal training needs are identified and assessed in line with the requirements of the job. 6.2 ***Training and career opportunities*** are identified and utilized based on job requirements. 6.3 Resources for training are mobilized and allocated based organizations and individual skills needs. 6.4 Licensees and certifications relevant to job and career are obtained and renewed as per policy. 6.5 Work priorities and personal commitments are balanced and managed based on requirements of the job and personal objectives. 6.6 Recognitions are sought as proof of career advancement in line with professional requirements.
7. Demonstrate workplace learning	7.1 Learning opportunities are sought and managed based on job requirement and organization policy. 7.2 Improvement in performance is demonstrated based on courses attended. 7.3 Application of learning is demonstrated in both technical and non-technical aspects based on requirements of the job 7.4 Time and effort is invested in learning new skills based on job requirements 7.5 Initiative is taken to create more effective and efficient processes and procedures in line with workplace policy. 7.6 New systems are developed and maintained in accordance with the requirements of the job.

	7.7 Awareness of personal role in workplace ***innovation*** is demonstrated based on requirements of the job.
8. Demonstrate problem solving skills	8.1 Creative, innovative and practical solutions are developed based on the problem 8.2 Independence and initiative in identifying and solving problems is demonstrated based on requirements of the job. 8.3 Team problems are solved as per the workplace guidelines 8.4 Problem solving strategies are applied as per the workplace guidelines 8.5 Problems are analyzed and assumptions tested as per the context of data and circumstances
9. Manage ethical performance	9.1 Policies and guidelines are observed as per the workplace requirements 9.2 Self-worth and professionalism is exercised in line with personal goals and organizational policies 9.3 Code of conduct is observed as per the workplace requirements 9.4 Integrity is demonstrated as per legal requirement

RANGE

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

Variable	**Range**
1. Drug and substance abuse may include but not limited to:	Commonly abused • Alcohol • Tobacco • Miraa • Over-the-counter drugs • Cocaine • Bhang • Glue
2. Feedback may include but not limited to:	• Verbal • Written • Informal • Formal

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

11. Emerging issues may include but not limited to:	• Terrorism • Social media • National cohesion • Open offices
12. Range of media for learning may include but not limited to:	• Mentoring • peer support and networking • IT and courses

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies
- Company operations, procedures and standards
- Occupational Health and safety procedures
- Fundamental rights at work
- Workplace communication
- Concept of time
- Time management
- Decision making
- Types of resources
- Work planning

- Organizing work
- Monitoring and evaluation
- Record keeping
- Gender mainstreaming
- HIV and AIDS
- Drug and substance abuse
- Professional growth and development
- Technology in the workplace
- Innovation
- Emerging issues

EVIDENCE GUIDE

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

1. Critical aspects of Competency	Assessment requires evidence that the candidate: 1.1 Conducted self-management 1.2 Demonstrated interpersonal communication 1.3 Demonstrated critical safe work habits 1.4 Demonstrated the ability to lead a workplace team 1.5 Planned and organized work 1.6 Maintained professional growth and development 1.7 Demonstrated workplace learning 1.8 Demonstrated problem solving skills 1.9 Demonstrated the ability to manage performance ethically
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job

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

DEMONSTRATE ENVIRONMENTAL LITERACY

UNIT CODE: ICT/OS/CS/BC/06/6/A

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

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

	3.2 Waste management procedures are employed following principles of 3Rs (Reduce, Reuse, Recycle) 3.3 Methods for economizing and reducing resource consumption are practiced as per the Constitution of Kenya 2010 Article 69 .
4. Evaluate current practices in relation to resource usage	4.1 Information on resource efficiency systems and procedures are collected and provided as per work groups/sector 4.2 Current resource usage is measured and recorded as per work group 4.3 Current purchasing strategies are analyzed and recorded according to industry procedures. 4.4 Current work processes to access information and data is analyzed following enterprise protocol.
5. Identify environmental legislations/conventions for environmental concerns	5.1 Environmental legislations/conventions and local ordinances are identified according to the different environmental aspects/impact 5.2 Industrial standard/environmental practices are described according to the different environmental concerns
6. Implement specific environmental programs	6.1 Programs/Activities are identified according to organizations policies and guidelines. 6.2 Individual roles/responsibilities are determined and performed based on the activities identified. 6.3 Problems/constraints encountered are resolved in accordance with organizations' policies and guidelines 6.4 Stakeholders are consulted based on company guidelines
7. Monitor activities on Environmental protection/Programs	7.1 Activities are periodically monitored and Evaluated according to the objectives of the environmental program 7.2 Feedback from stakeholders are gathered and considered in Proposing enhancements to the program based on consultations 7.3 Data gathered are analyzed based on Evaluation requirements

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

RANGE

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

Variable	**Range**
1. PPE may include but not limited to	• Mask • Gloves • Goggles • Safety hat • Overall • Hearing protector
2. Control measures may include but not limited to	• Methods for minimizing or stopping spread and ingestion of airborne particles • Methods for minimizing or stopping spread and ingestion of gases and fumes • Methods for minimizing or stopping spread and ingestion of liquid wastes

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

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

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Controlled environmental hazard 1.2 Controlled environmental pollution 1.3 Demonstrated sustainable resource use 1.4 Evaluated current practices in relation to resource usage

	1.5 Demonstrated knowledge of environmental legislations and local ordinances according to the different environmental issues /concerns. 1.6 Described industrial standard environmental practices according to the different environmental issues/concerns. 1.7 Resolved problems/ constraints encountered based on management standard procedures 1.8 Implemented and monitored environmental practices on a periodic basis as per company guidelines 1.9 Recommended solutions for the improvement of the program 1.10 Monitored and reported to proper authorities any environmental incidents
2. Resource Implications	The following resources should be provided: 2.1 Workplace with storage facilities 2.2 Tools, materials and equipment relevant to the tasks (e.g. Cleaning tools, cleaning materials, trash bags) 2.3 PPE, manuals and references 2.4 Legislation, policies, procedures, protocols and local ordinances relating to environmental protection 2.5 Case studies/scenarios relating to environmental Protection
3 Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4 Context of Assessment	Competency may be assessed 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE OCCUPATIONAL SAFETY AND HEALTH PRACTICES

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

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes which make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Identify workplace hazards and risk	1.1 ***Hazards*** in the workplace are identified ***based their indicators*** 1.2 Risks and hazards are evaluated based on legal requirements. 1.3 ***OSH concerns*** raised by workers are addressed as per legal requirements.
2. Control OSH hazards	2.1 Hazard prevention ***and control measures*** are implemented as per legal requirement. 2.2 Risk assessment is conducted and a risk matrix developed based on likely impact. 2.3 ***Contingency measures***, including ***emergency procedures*** during workplace ***incidents and emergencies*** are recognized and established in accordance with organization procedures.
3. Implement OSH programs	3.1 Company OSH program are identified, evaluated and reviewed based on legal requirements. 3.2 Company OSH programs are implemented as per legal requirements. 3.3 Workers are capacity built on OSH standards and procedures as per legal requirements 3.4 ***OSH-related records*** are maintained as per legal requirements.

RANGE

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

Variable	Range
1. Hazards may include but not limited to:	• Physical hazards – impact, illumination, pressure, noise, • vibration, extreme temperature, radiation • Biological hazards- bacteria, viruses, plants, parasites, mites, molds, fungi, insects • Chemical hazards – dusts, fibers, mists, fumes, smoke, gasses, vapors • Ergonomics • Psychological factors – over exertion/ excessive force, awkward/static positions, fatigue, direct pressure, • varying metabolic cycles • Physiological factors – monotony, personal relationship, work out cycle • Safety hazards (unsafe workplace condition) – confined space, excavations, falling objects, gas leaks, electrical, poor storage of materials and waste, spillage, waste and debris • Unsafe workers' act (Smoking in off-limited areas, Substance and alcohol abuse at work)
2. Indicators may include but not limited to:	• Increased of incidents of accidents, injuries • Increased occurrence of sickness or health complaints/ symptoms • Common complaints of workers related to OSH • High absenteeism for work-related reasons
3. OSH concerns may include but not limited to:	• Workers' experience/observance on presence of work hazards • Unsafe/unhealthy administrative arrangements (prolonged work hours, no break time, constant overtime, scheduling of tasks) • Reasons for compliance/non-compliance to use of PPEs or other OSH procedures/policies/guidelines

4. Safety gears /PPE (Personal Protective Equipment) may include but not limited to:	• Arm/Hand guard, gloves • Eye protection (goggles, shield) • Hearing protection (ear muffs, ear plugs) • Hair Net/cap/bonnet • Hard hat • Face protection (mask, shield) • Apron/Gown/coverall/jump suit • Anti-static suits • High-visibility reflective vest
5. Appropriate risk controls may include but not limited to:	• Appropriate risk controls in order of impact are as follows: • Eliminate the hazard altogether (i.e., get rid of the dangerous machine) • Isolate the hazard from anyone who could be harmed (i.e., keep the machine in a closed room and operate it remotely; barricade an unsafe area off) • Substitute the hazard with a safer alternative (i.e., replace the machine with a safer one) • Use administrative controls to reduce the risk (i.e., train workers how to use equipment safely; train workers about the risks of harassment; issue signage) • Use engineering controls to reduce the risk (i.e., attach guards to the machine to protect users) • Use personal protective equipment (i.e., wear • gloves and goggles when using the machine)
6. Contingency measures may include but not limited to:	• Evacuation • Isolation • Decontamination • (Calling designed) emergency personnel
7. Incidents and emergencies may include but not limited to:	• Chemical spills • Equipment/vehicle accidents • Explosion • Fire • Gas leak • Injury to personnel • Structural collapse • Toxic and/or flammable vapors emission.

8. OSH-related Records may include but not limited to:	• Medical/Health records • Incident/accident reports • Sickness notifications/sick leave application • OSH-related trainings obtained

REQUIRED SKILLS AND KNOWLEDGE

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

Required Skills

The individual needs to demonstrate the following skills:

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

Required Knowledge

The individual needs to demonstrate knowledge of:

- General OSH Principles
- Occupational hazards/risks recognition
- OSH organizations providing services on OSH evaluation and/or work environment measurements (WEM)
- National OSH regulations; company OSH policies and protocols
- Systematic gathering of OSH issues and concerns
- General OSH principles
- National OSH regulations
- Company OSH and recording protocols, procedures and policies/guidelines
- Training and/or counseling methodologies and strategies

EVIDENCE GUIDE

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

1. Critical Aspects of Competency	Assessment requires evidence that the candidate: 1.1 Identified hazards in the workplace based their indicators 1.2 Evaluated workplace hazards based on legal requirements.

	1.3 Addressed OSH concerns raised by workers as per legal requirements. 1.4 Implemented hazard prevention and control measures as per legal requirement. 1.5 Conducted risk assessment as per legal requirement. 1.6 Developed risk matrix based on likely impact. 1.7 Recognized and established contingency measures in accordance with organization procedures. 1.8 Identified, evaluated and reviewed company OSH program based on legal requirements. 1.9 Implemented company OSH programs as per legal requirements. 1.10 Capacity built workers on OSH standards and procedures as per legal requirements 1.11 Maintained OSH-related records as per legal requirements.
2. Resource Implications	The following resources should be provided: 2.3 Access to relevant workplace where assessment can take place 2.4 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency in this unit may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Written test 3.4 Portfolio of Evidence 3.5 Interview 3.6 Third party report
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 Off-the –job 4.3 During Industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COMMON UNITS OF COMPETENCY

APPLY BASIC ELECTRONIC SKILLS

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

Unit description

This unit specifies the competencies required to apply basic electronics skills. It involves identifying electric circuits and electronic components, understanding semi-conductor theory, identifying and classifying memories, applying number systems and binary coding and identifying 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. Identify 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**
1. Electrical quantities and their units may include but is not limited to:	E.M.F in volts • Power in watts • Energy in joules • Resistance in ohms • Current in amperes
2. Types of electrical circuits may include but is not limited to:	• AC – Alternating Current • DC – Direct Current
3. Types and operations of transistors may include but is not limited to:	• Types ✓PNP ✓NPN

Variable	Range
	• Operations ✓Forward biasing ✓Reverse Biasing
4. Types of memories may include but is not limited to:	• Semi-conductor • Magnetic • Optical
5. Levels of memory storage may include but is not limited to:	• Internal • Main • Online • Offline bulk
6. Classification of memories may include but is not limited to:	• RAM • ROM
7. Types of number systems may include but is not limited to:	• Decimal • Binary • Octal • Hexadecimal • Binary Arithmetic's
8. Binary codes may include but is not limited to:	• 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

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 should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Observation 3.2 Oral questioning 3.3 Practical demonstration
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

CORE UNITS OF COMPETENCY

UNDERSTAND COMPUTER ORGANISATION AND ARCHITECTURE

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

UNIT DESCRIPTION

This unit covers the competencies required to understand Computer Organisation and Architecture. It involves understanding principles of computer organisation and design, understanding central processing unit functions, understanding computer memory functions, understanding input-output functions and understanding computer arithmetic and logic.

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. Understand principles of computer organization and design	1.1 Computer organisation is defined 1.2 Computer architecture is explained 1.3 Structure and function of computer components is explained 1.4 Hardware components of a computer are identified
2. Understand central processing unit functions	2.1 The Central Processing Unit is explained. 2.2 CPU architecture is explained 2.3 Role of registers is explained 2.4 Instruction representation and execution is explained 2.5 ***CPU specifications*** are prescribed for a user 2.6 CPU specifications are verified for a given computer
3. Understand computer memory functions	3.1 Memory organization is explained. 3.2 Various ***storage technologies*** are explained. 3.3 Cache and Virtual memory are explained 3.4 ***Memory specifications*** are prescribed for a user 3.5 Memory specifications are verified for a given computer
4. Understand input-output functions	4.1 Peripherals devices are explained 4.2 Input-output processing is explained 4.3 Bus interface is explained 4.4 ***Modes of data transfer*** are explained 4.5 ***Input-output device specifications*** are prescribed for a user

	4.6 Input-output device specifications are verified for a given computer
5. Understand computer arithmetic and logic	5.1 ***Number systems*** are explained 5.2 Integer and Floating point representations are demonstrated according to IEEE standard 5.3 Integer and Floating point arithmetic is explained 5.4 ***Logic operators*** are explained 5.5 Logic operations are explained 5.6 ***Methods of representing logic operations*** are demonstrated

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**
1. CPU specifications may include but is not limited to:	• Brand • Chipset • Speed • Series
2. Storage Technologies may include but is not limited to:	• Solid state • Magnetic • Optical
2. Memory specifications may include but is not limited to:	• Speed • Size • Form factor • Type • Part Number
3. Modes of data transfer may include but is not limited to:	• Programmed I/O • Direct Memory Access I/O • Interrupt initiated I/O
4. Input-output device specifications may include but is not limited to:	• Monitor: Size, Resolution, Brand • Printer/Copier: Function, Speed, Resolution, Brand • Storage: Size, Brand, Data Transfer Rate
5. Number systems	• Decimal • Positional

Variable	Range
may include but is not limited to:	• Binary • Hexadecimal
6. Logic Operators may include but is not limited to:	• AND • OR NOT
7. Methods of representing logic operations may include but is not limited to:	• Karnaugh maps • Logic gates • Truth tables

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:

- Principles of computer organisation and design
- Central Processing Unit functions
- Computer memory functions
- Input-Output functions
- Computer arithmetic and logic

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 ccomputer organization and architecture

	1.2 Explained structure and function of computer components 1.3 Identified hardware components of a computer 1.4 Explained CPU architecture 1.5 Explained role of registers 1.6 Explained instruction representation and execution 1.7 Prescribed CPU specifications according to a user's needs 1.8 Verified CPU specifications for a given computer 1.9 Explained memory organization 1.10 Explained various storage technologies 1.11 Explained Cache and Virtual memory 1.12 Prescribed memory specifications according to a user's needs 1.13 Verified memory specifications for a given computer 1.14 Explained input-output processing 1.15 Explained the bus interface 1.16 Explained modes of data transfer 1.17 Prescribed input-output device specifications according to a user's needs 1.18 Verified specifications of input/output devices for a given computer 1.19 Explained number systems 1.20 Demonstrated integer and floating point representations 1.21 Explained integer and floating point arithmetic 1.22 Explained logic operations 1.23 Demonstrated methods of representing logic operations
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test

4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5 Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND OPERATING SYSTEMS

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

UNIT DESCRIPTION

This unit covers the competencies required to understand operating systems. It involves understanding fundamentals of operating systems, understanding process management, understanding memory management, understanding input-output management and understanding file management.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	**PERFORMANCE CRITERIA** *(Bold and italicised terms are elaborated in the Range)*
1. Understand fundamentals of operating systems	1.1 Computer Software is explained 1.2 Operating system is explained 1.3 ***Structures of operating systems*** are described. 1.4 ***Types of operating systems*** are explained. 1.5 Installation requirements for Windows are outline 1.6 Installation of Windows is demonstrated
2. Understand process management	2.1 Process management is explained 2.2 Manage **computer resources** 2.3 Process states and transitions are explained 2.4 Process scheduling is explained 2.5 Use of the Task Manager is demonstrated 2.6 Use of performance monitor tool is demonstrated
3. Understand memory management	3.1 Memory management is explained. 3.2 ***Memory management techniques*** are explained. 3.3 Virtual memory management settings are demonstrated
4. Understand input and output management	4.1 Input - output management is explained 4.2 Disk operations are explained 4.3 Computer clock system is explained 4.4 Virtual Input Output is explained 4.5 Disk selection criteria are outlined 4.6 Verification of disk properties is demonstrated 4.7 ***Disk storage management operations*** are demonstrated 4.8 ***Device management operations*** are demonstrated

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
5. Understand file management and local policy settings	5.1 File management is explained. 5.2 ***File access methods*** are explained. 5.3 File allocation techniques are explained. 5.4 File protection and security are explained. 5.5 ***File and directory operations*** are demonstrated 5.6 ***Local policy settings*** are demonstrated

RANGE

Variable	Range
1. Structures of operating system may include but is not limited to:	• Monolithic • Layered • Virtual • Client server model
2. Types of operating system may include but is not limited to:	• Real time • Normal • Batch • Time sharing
3. Computer Resources may include but is not limited to:	• Processor • Storage space
4. Memory management techniques may include but is not limited to:	• Partitions • Virtual
5. Disk storage management operations may include but is not limited to:	• Shrinking volume • Extending volume • Formatting volume • Partitioning volume • Disk Optimization and defragmentation
6. Device Management Operations may include but is not limited to:	• Driver Installation • Resolving driver conflicts

Variable	Range
7. File access methods may include but is not limited to:	• Sequential • Random • Indexed sequential
8. File and directory operations may include but is not limited to:	• Setting attributes • Share settings • Security settings • Customization of files and folders
9. Local policy settings may include but is not limited to:	• Password policy • Account lockout policy • Audit policy • Security options

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:

- Concepts of operating systems
- Process management
- Memory management
- Input/output management
- File management and local security policy settings

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 Identified types of operating systems 1.2 Explained structures of operating systems 1.3 Explained functions of operating systems 1.4 Installed Windows operating system 1.5 Explained process scheduling 1.6 Demonstrated process management using the task manager 1.7 Demonstrated resource allocation using performance monitor tool 1.8 Explained memory management techniques 1.9 Demonstrated disk storage management operations 1.10 Demonstrated device management using the Device Manager 1.11 Demonstrated file and directory operations 1.12 Configured local policy security settings
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	**Competency may be assessed through:** 3.1 Oral test 3.2 Observation 3.3 Practical demonstration 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND MATHEMATICS FOR COMPUTER SCIENCE

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

UNIT DESCRIPTION

This unit covers the competencies required to understand mathematics for computer science. It involves understanding Linear Algebra, understanding Boolean Algebra, understanding Set Theory, understanding Calculus and understanding Probability and 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. Understand Linear Algebra	1.1 Linear Equations are explained 1.2 Linear equations are solved 1.3 Vectors are explained 1.4 ***Vector operations*** are illustrated 1.5 Matrices are explained 1.6 ***Matrix operations*** are illustrated 1.7 Inverse of a square matrix is illustrated
2. Understand Boolean Algebra	2.1 Boolean algebra is explained 2.2 ***Basic Boolean operations*** are explained 2.3 ***Secondary operations*** are explained 2.4 Writing of Boolean Expressions is illustrated 2.5 ***Methods of simplifying Boolean expressions*** are illustrated 2.6 ***Boolean Laws and Theorems*** are illustrated 2.7 Simplification rules for Boolean expressions are illustrated
3. Understand Set Theory	3.1 Sets Theory is explained 3.2 ***Methods of Set representation*** are illustrated 3.3 Cardinality of a set explained 3.4 ***Types of sets*** are illustrated 3.5 Venn Diagrams are illustrated 3.6 ***Set Operations*** are illustrated
4. Understand Calculus	4.1 Functions and graphs are explained 4.2 Differential calculus is illustrated 4.3 Integral calculus is illustrated
5. Understand Probability and Statistics	5.1 Key terminologies in Probability are explained 5.3 Probability axioms and simple counting problems are illustrated

	5.4 Permutations and combinations are illustrated 5.5 Conditional probability and the multiplication rule are illustrated 5.6 Key terminologies in Probability are explained 5.7 Data representation techniques are illustrated 5.8. ***Measures of central tendency*** are illustrated 5.9 ***Measures of spread*** are illustrated 5.10 ***Measure of Location*** 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**
1. Vector operations may include but not limited to:	• Addition • Multiplication • Dot product
2. Matrix operations may include but not limited to:	• Sum of two matrices • Sum of a matrix and a scalar • Matrix subtraction • Product of two matrices • Product of a matrix and a vector
2. Basic Boolean operations may include but not limited to:	• AND • OR • NOT
3. Secondary operations may include but not limited to:	• NAND • NOR • EX-OR • EX-NOR
4. Methods of simplifying Boolean expressions may include but not limited to:	• Using algebraic functions • Using Truth tables • Using Karnaugh Maps
5. Boolean Laws and Theorems may include but not limited to:	• AND law • OR law • Inversion law • Commutative

Variable	Range
	• Associative • Distributive • De-Morgan's Theorems
6. Methods of Set representation may include but not limited to:	• Statement form • Tabular form • Set builder notation
7. Types of sets may include but not limited to:	• Finite Set • Infinite Set • Subset • Proper Subset • Universal Set • Empty or Null • Equal • Equivalent Set • Singleton Set or Unit Set • Overlapping Set • Disjoint Set
8. Set Operations may include but not limited to:	• Set Union and Set Intersection • Set Difference/Relative Complement • Set Complement • Cartesian Product
9. Measures of central tendency may include but not limited to:	• Mean • Median • Mode
10. Measures of spread may include but not limited to:	• Variance • Standard deviation
11. Measures of location may include but not limited to:	• 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:
- Linear Algebra
- Boolean algebra
- Set Theory
- Calculus
- Probability and 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 Linear equations 1.2 Performed vector operations 1.3 Performed matrix operations 1.4 Performed Boolean algebra operations 1.5 Performed set operations 1.6 Explained samples spaces, events and sets 1.7 Solved problems using Probability axioms 1.8 Solved permutations and combinations 1.9 Solved problems using conditional probability 1.10 Represented data using statistical technique 1.11 Illustrated measures of central tendency 1.12 Illustrated measures of spread 1.13 Illustrated measures of location
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation

	3.4 Written test
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND FUNDAMENTALS OF PROGRAMMING

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

UNIT DESCRIPTION

This unit covers the competencies required to understand fundamentals of programming. It involves understanding programming concepts, understanding the Java environment, performing data operations, using control structures, using methods and understanding 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. Understand Programming Concepts	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
2. Understand the Java environment	2.1 Java is installed 2.2 Java programming environment is demonstrated 2.3 Features of Java are explained 2.4 Java syntax is demonstrated
3. Perform data operations	3.1 ***Java data types*** are explained 3.2 ***Types of statements*** are explained 3.3 Variables and constants are explained 3.4 ***Data operations*** are demonstrated 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 statements are demonstrated 4.3 Programs using control statements are created
5. Use methods	5.1 Procedures/Functions/Methods are explained 5.2 Methods are demonstrated 5.3 Programs using methods are created
6. Understand Object Oriented Programming	6.1 Object oriented programming is explained 6.2 Classes and objects are explained 6.3 Classes and objects are demonstrated. 6.4 Inheritance is demonstrated

	6.5 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**
1. Phases of program development may include but not limited to:	• Establish program requirements • Design a program • Coding • Code test and debug • Document • Maintain
2. Key terms used in programming may include but not limited to:	• Algorithm • Source code • Executable • Compiling • Debugging
3. Types of code may include but not limited to:	• Source code • Object code • Machine code
4. Java data types may include but not limited to:	• Integer • Float • Strings • Boolean
5. Types of statements may include but not limited to:	• Declaration • Executable
6. Data Operations may include but not limited to:	• Number operations • String operations
7. Control Structures may include but not limited to:	• Decision • Looping

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 concepts
- Compiler operations
- The Java environment
- Data Operations
- Control Structures
- Procedures
- 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 Java 1.3.Demonstrated understanding of Java 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 methods 1.8.Explained applications of Object Oriented Programming 1.9.Demonstrated classes and objects 1.10. Demonstrated inheritance
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place

	2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DATABASE MANAGEMENT SKILLS

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

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate database management skills. It involves understanding database fundamentals, designing a database, using Structured Query Language, understanding design of object oriented databases, understanding indexing and hashing and understanding database applications.

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. Understand Database fundamentals	1.1 A database is defined 1.2 ***Terminologies used with databases*** are explained 1.3 Reasons of using databases are explained 1.4 Relational Model is defined 1.5 Key concepts in relational modelling are explained 1.6 Properties of a table/relation are explained 1.7 Relational Database Management Systems (RDBMSs) products are compared 1.8 Installation of MS SQL server is demonstrated 1.9 MS SQL server interface is explained 1.10 ***Properties of MS SQL server database*** are explained
2. Design a database	2.1 ***Phases of database design*** are explained 2.2 Entity modeling is illustrated using UML notation 2.3 Normalisation is demonstrated 2.4 Validation of the ER model is done according to the requirements
3. Use Structured Query Language	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 ***Types of joins*** are demonstrated
4. Understand design of object oriented databases	4.1 An object oriented database is explained. 4.2 ***Object oriented database concepts*** are explained. 4.3 Object Oriented database concepts are implemented from a set of requirements. 4.4 Creating of **views and triggers** in object oriented databases is demonstrated.
5. Understand indexing and hashing	5.1 Indexing and hashing are explained. 5.2 Indexing in databases is demonstrated. 5.3 Hashing in databases is demonstrated. 5.4 Indexing and hashing is implemented in an existing database
6. Understand Database applications	6.1 Decision support systems are explained. 6.2 Data mining is explained 6.3 Distributed databases are demonstrated 6.4 Data warehousing is illustrated 6.5 Spatial and geographical databases are explained 6.6 Multi-media databases are illustrated 6.7 Mobility and personal databases are explained. 6.8 Data warehouses are designed and implemented from a given set of requirements.

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**
1. Terminologies used with databases may	• Table • Records

Variable	Range
include but not limited to:	• Field • DBMS
2. Properties of MS SQL server database may include but not limited to:	• Deleting a database • Deleting data or log files • Increasing database size • Shrinking database • Renaming database • Importing a database • Exporting a database
3. Phases of database design may include but not limited to:	• Conceptual design • Logical design • Physical design
4. Data definition queries may include but not limited to:	• CREATE • DROP • ALTER
5. CREATE TABLE statement constraints may include but not limited to:	• Primary key • Foreign key • UNIQUE • CHECK • NOT NULL • DEFAULT
6. Data manipulation query statements may include but not limited to:	• INSERT • SELECT • UPDATE • DELETE
7. Types of joins may include but not limited to:	• Simple Join or Inner Join • Left Join • Right Join • Outer Join
8. Object oriented database concepts may include but not limited to:	• Classes • Objects • Attributes • Inheritance
9. Views may include but not limited to:	• Create a view • Rename a view

Variable	Range
	• Drop a view
10. Triggers may include but not limited to:	• Create a trigger • Alter a trigger • Drop a trigger

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
- Database design
- Structured Query Language
- Object oriented database design
- Applications of object oriented databases

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 Installed MS SQL server 1.2 Explained reasons for using databases 1.3 Explained relational modeling concepts 1.4 Created an entity relationship model 1.5 Normalized database tables 1.6 Validated an ER model

	1.7 Created, edited and dropped tables using SQL 1.8 Retrieved, added, removed and updated records using SQL statements 1.9 Created and queried a database from a validated ER model. 1.10 Retrieved data from several tables using joins 1.11 Explained object oriented database concepts 1.12 Prescribed a database type based on user requirements. 1.13 Demonstrated Object Oriented Concepts 1.14 Demonstrated designing of views and triggers in object oriented databases. 1.15 Implemented Indexing and hashing 1.16 Explained the applications databases.
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical demonstration 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEVELOP AN INFORMATION SYSTEM

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

UNIT DESCRIPTION

This unit covers the competencies required to develop an information system. It involves understanding fundamentals of information systems, understanding the software development process, demonstrating human computer interaction principles, understanding the VB.net programming environment and developing and testing a VB.NET application.

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. Understand fundamentals of Information Systems	1.1.Information system is explained 1.2.***Types of information systems*** are outlined 1.3.Emerging trends in information systems are explained 1.4.Information systems are recommended for different scenarios
2. Understand the Software Development Process	2.1.Software Development Life Cycle is explained 2.2.***Software Development Methodologies*** are explained 2.3.***Modeling techniques*** are demonstrated using CASE tools
3. Demonstrate Human Computer Interaction Principles	3.1. Human Computer Interaction is explained 3.2 ***Interface design principles*** are explained 3.3 Interface design is demonstrated using a design software
4. Understand the VB.NET programming environment	4.1. The .Net framework is explained 4.2 Visual Studio is installed 4.3 Features of VB.Net are outlined 4.4 The IDE environment is explained 4.5 VB.Net program structure is explained 4.6. VB.Net project is created and compiled
5. Develop and test a VB.NET application	5.1 ***Basic VB.Net Controls*** are outlined 5.2 ***Elements of a control*** are explained

	5.3 Basic VB.Net Controls' Properties, Methods and Events are demonstrated 5.4 Event handling is demonstrated 5.5 Forms design using HCI principles is demonstrated 5.6 Connection of VB.Net applications to a database is demonstrated 5.7 Deployment of VB.NET applications is demonstrated

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**
1.Types of information systems may include but not limited to:	• Transaction Processing Systems • Management Information systems • Decision Support systems • Executive Information Systems • Office Automation Systems • Knowledge based systems • Expert Systems
2. Software development methodologies may include but not limited to:	• Waterfall • Spiral • Rapid Application Development • Agile
3. Modeling techniques may include but not limited to:	• Data Flow Diagrams • ER diagrams • Use Case Diagrams
4. Interface Design Principles may include but not limited to:	• Usability • Learnability • Flexibility
5. Basic VB.Net Controls may include but not limited to:	• Form • Text Box • Label • Button • List Box

Variable	Range
	• Combo Box • Radio Button • Check Box • Picture Box • Progress Bar • Scroll Bar • Date Time Picker • Tree View • List View
6. Elements of a control may include but not limited to:	• Properties • Methods • Events

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:
- Fundamentals of Information Systems
- Software Development Process
- Human Computer Interaction Principles
- VB.NET programming environment
- Developing and testing a VB.NET application

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 Outlined *Types of information systems* 1.2 Explained Software Development Life Cycle 1.3 Described Software Development Methodologies 1.4 Demonstrated Modelling techniques using CASE tools 1.5 Created a VB.NET project demonstrating event handling, form design and connection to the database
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND NETWORKING AND DISTRIBUTED SYSTEMS

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

UNIT DESCRIPTION:

This unit specifies the competencies required to understanding networking and distributed systems concept. It involves understanding networking and distributed systems, distributed system architectures, distributed processing and file management, setting up a network in a distributed environment understanding data communication standards and IP addressing and troubleshooting a network.

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. Understand networking and distributed systems concepts	1.1 Fundamentals of networking are explained 1.2 ***Types of networks*** are illustrated 1.3 ***Network topologies*** are illustrated 1.4 Transmission media are outlined 1.5 Distributed system is explained 1.6 ***Types of distributed systems*** are illustrated 1.7 ***Models in distributed systems*** are illustrated 1.8 Network requirements for a site are specified
2. Understand distributed systems architectures	2.1 Distributed architecture is illustrated 2.2 ***Architecture styles*** are illustrated 2.3 ***Types of distributed system architectures*** are illustrated 2.4 Distributed system architecture requirements for a simulated site are specified.
3. Understand distributed processing and file management	3.1 ***Types of distributed processing*** are illustrated 3.2 Types of file systems are illustrated 3.3 ***File sharing and accessing methods*** are illustrated 3.4 Distributed file sharing and access is demonstrated
4. Set up a network in a distributed environment	4.1 Tools, materials and devices for network set up are identified according to the network type 4.2 The network devices are connected and configured according to local and international standards 4.3 Network software is installed and configured according to the user manual 4.4 Network performance is tested

5. Understand Data Communication Standards and IP addressing	5.1 OSI Model is outlined 5.2 Data communication components are explained 5.3 Network IP address classes are demonstrated
6. Troubleshoot a network	6.1 Troubleshooting is explained. 6.2 ***Troubleshooting tools*** are demonstrated. 6.3 Troubleshooting of a network is done as per IEEE standards

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**
1. Types of networks may include but not limited to:	• LAN • WAN • MAN • PAN
2. Network topologies may include but not limited to:	• Bus • Star • Delta • Ring • mesh point-to-point
3. Types of distributed systems may include but not limited to:	• Computing • Information • Pervasive
4. Models in distributed systems may include but not limited to:	• Architecture • Interaction • Fault
6. Architecture styles may include but not limited to:	• Layered Architecture • Object Based Architecture • Data-centered Architecture • Event Based Architecture • Hybrid Architecture
6. Types of distributed system	• Centralized • Decentralized

Variable	Range
architecture may include but not limited to:	• Hybrid
7. Types of distributed processing	• Distributed • Parallel
8. File sharing and access methods may include but not limited to:	• Remote Access • Data-Caching
9. Troubleshooting tools may include but not limited to:	• Ping • Tracert / traceroute • Nslookup • Netstat • Pathping/mtr

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:

- Fundamentals of networking and distributed systems
- Distributed systems architectures
- Distributed processing and file management
- Setting up a network in a distributed environment
- Troubleshooting a network

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 Illustrated different types of networks 1.2 Illustrated different types of topologies 1.3 Specified network requirements for a site 1.4 Illustrated different types of distributed systems 1.5 Illustrated different types of distributed system architectures 1.6 Specified distributed system architecture requirements for a simulated site 1.7 Illustrated different types of distributed processing 1.8 Illustrated different types of file systems 1.9 Illustrated file sharing and accessing methods 1.10 Set up a network as per site requirements 1.11 Troubleshot a network as per IEEE standard 1.12 Illustrated different functions of OSI layers
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral tests 3.2 Observation 3.3 Practical demonstration 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
8. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND ARTICICIAL INTELLIGENCE CONCEPTS

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

UNIT DESCRIPTION

This unit covers the competencies required to understand artificial intelligence. It involves understanding fundamentals of Artificial Intelligence, understanding problem solving techniques, understanding Python programming environment and developing Artificial Intelligence programs using Python.

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. Understand fundamentals of Artificial Intelligence	1.1 Artificial Intelligence is defined 1.2 The history of Artificial Intelligence is explained 1.3 Foundations of Artificial Intelligence are explained 1.4 Applications of Artificial Intelligence are explained 1.5 Intelligence agents are explained 1.6 Artificial Intelligence applications in real life are recognized
2. Understand problem solving techniques	2.1 Logical operators are outlined. 2.2 Prepositional and Predicate logic are explained. 2.3 ***Types of inferencing*** are explained. 2.4 Machine Learning is defined. 2.5 ***Types of Machine Learning*** are explained. 2.6 Applications of different types of inferencing are recognized
3. Understand Python programming environment	3.1 Installation of Python is demonstrated. 3.2 Python syntax is demonstrated. 3.3 ***Data types*** in Python are demonstrated. 3.4 Control structures in Python are demonstrated. 3.5 Functions in python are demonstrated 3.6 Object Oriented Python is demonstrated. 3.7 ***Scientific Modules*** in Python are demonstrated.
4. Develop Artificial Intelligence programs using python	4.1 Sci-Kit Learn is explained. 4.2 Machine Learning with K-Nearest Neighbours is demonstrated. 4.3 Machine Learning with Naïve Bayes Algorithm is demonstrated.

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
1. Types of inferencing may include but not limited to:	• Single • Multiple • Case based
2. Types of Machine Learning may include but not limited to:	• Supervised • Unsupervised
3. Data types may include but not limited to:	• Integers • Floats • Strings • Lists • Tuple • Sets • Dictionaries
4. Scientific Modules may include but not limited to:	• Numpy • Pandas • Matplotlib

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:

- Concepts of Artificial Intelligence

- Problem solving techniques
- Python programming environment
- Development of Artificial Intelligence programs using python

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 applications of artificial intelligence 1.2 Explained the role of intelligence agents 1.3 Explained types of inferencing 1.4 Explained types of machine learning 1.5 Demonstrated installation of Python 1.6 Demonstrated Python syntax 1.7 Demonstrate data types in Python 1.8 Demonstrated use of control structures in Python 1.9 Demonstrated use of functions in Python 1.10 Demonstrated use of Object Oriented Python 1.11 Demonstrated use of scientific modules 1.12 Demonstrated machine learning
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND ALGORITHMS AND DATA STRUCTURES

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

UNIT DESCRIPTION

This unit covers the competencies required to understand algorithms and data structure. It involves Understand fundamental principles of algorithms understanding fundamental concepts of data structures, linked lists, stacks and queues, search techniques and sorting techniques

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. Understand fundamental principles of algorithms	1.1 Algorithm is defined 1.2 Characteristics of an Algorithm are explained 1.3 Algorithm writing is demonstrated 1.4 Algorithm Analysis is explained 1.5 ***Complexities*** of algorithms are explained 1.6 ***Greedy algorithms*** are outlined 1.7 Divide and conquer is demonstrated
2. Understand fundamental concepts of data structures	2.1 ***Key concepts in data structures*** are explained 2.2 Arrays are explained 2.3 Array insertion operations are explained 2.4 Array delete, search and update are explained 2.5 Array operations are demonstrated using C++
3. Understand Linked lists	3.1 Linked lists are explained 3.2 Doubly linked lists are explained. 3.3 Circular linked lists are explained. 3.4 ***Basic operations for the various linked lists*** are demonstrated using C++
4. Understand Stacks and Queues	4.1 Stacks and queues are defined 4.2 Stack and queue representation are outlined 4.3 ***Basic operations in stacks*** are explained 4.4 ***Basic operations in Queue*** are explained 4.5 Basic operations in stacks and queue are demonstrated using C++
5. Understand Search Techniques	5.1 Search is defined 5.2 Linear Search is explained 5.3 Binary Search is explained 5.4 Search techniques are demonstrated using C++

6. Understand Sorting Techniques	6.1 Sorting is defined 6.2 ***Categories of sorting techniques*** are outlined 6.3 ***Types of Sorting algorithms*** are explained 6.4 Sorting algorithms are demonstrated using C++

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**
1. Complexities may include but is not limited to:	• Space • Time
2. Greedy algorithms may include but is not limited to:	• Counting coins
3. Key concepts in data structures may include but is not limited to:	• Data • Object • Type
4. Basic operations for various linked lists may include but is not limited to:	• Insertion • Deletion • Reverse • Display
5. Basic operations in stacks may include but is not limited to:	• Push • Pop
6. Basic operations in queues may include but is not limited to:	• Enqueue • Dequeue
7. Categories of sorting techniques may include but is not limited to:	• In place • Not in place • Stable • Not stable • Adaptive • Non-adaptive

Variable	Range
9. Types of Sorting algorithms may include but is not limited to:	• Bubble sort • Insertion sort • Selection sort

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:

- Fundamental principles of algorithms
- Fundamental concepts of data structures
- Linked lists
- Stacks and queues
- Search techniques
- Sorting techniques

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 Wrote an algorithm 1.2 Demonstrated array operations 1.3 Demonstrated basic operations for the various linked lists 1.4 Demonstrated basic operations in stacks and queues 1.5 Demonstrated search techniques

	1.6 Demonstrated sorting algorithms
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE WEB DESIGN SKILLS

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

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate web design skills. It involves understanding HTML basics, using HTML elements, demonstrating web page formatting, applying styles, understanding JavaScript basics, using JavaScript data types, using JavaScript functions and using JavaScript libraries.

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. Understand HTML basics	1.1 HTML is defined 1.2 ***Terminologies used in HTML*** are defined 1.3 A HTML file is created 1.4 ***HTML core elements*** are explained 1.5 HTML core elements are added to the file
2. Use HTML elements	2.1 ***Basic HTML elements*** are explained 2.2 Basic HTML elements are added to a HTML document 2.3 ***Attributes*** are defined 2.4 Attributes are added to elements
3. Demonstrate web page formatting	3.1 ***Layout elements*** are explained 3.2 Layout elements are added to the HTML document 3.3 ***Layout element attributes*** are added to the HTML document
4. Apply styles	4.1 ***Style concepts*** are explained 4.2 Internal styles are applied 4.3 External CSS file is created
5. Understand JavaScript basics	5.1 Purpose of JavaScript is highlighted 5.2 JavaScript syntax is outlined 5.3 Access to HTML element attributes is demonstrated using JavaScript Document Object Model (DOM) 5.4 Changing HTML element attributes is demonstrated using DOM
6. Use JavaScript data types	6.1 ***JavaScript data types*** are explained 6.2 Operations on the data types are demonstrated 6.3 ***Operations on arrays*** are demonstrated

7. Use JavaScript functions	7.1 Structure of a JavaScript function is explained 7.2 A JavaScript function is created 7.3 A JavaScript function is invoked 7.4 Values are returned using functions
8. Use JavaScript libraries	8.1 Concept of libraries is explained 8.2 JQuery framework is explained 8.3 Installation of JQuery is demonstrated 8.4 Referencing of JQuery is demonstrated 8.5 JQuery syntax is demonstrated 8.6 ***JQuery events*** are explained 8.7 DOM Manipulation with JQuery is demonstrated

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**
1. Terminologies used in HTML may include but not limited to:	• Document • Stylesheet • Element • Attribute
2. HTML core elements may include but not limited to:	• <head> • <title> • <body> • <html>
3. Basic HTML elements may include but not limited to:	• <p> • • <h1>
4. Attributes may include but not limited to:	• src • alt • href
5. Layout elements may include but not limited to:	• <header> • <nav> • <section> • <footer>
6. Layout element attributes may	• Class • Id • name

Variable	Range
include but not limited to:	
7. Style concepts may include but not limited to:	• Background • Padding • Alignment • Border
8. JavaScript data types may include but not limited to:	• Strings • Numbers • Booleans
9. Operations on arrays may include but not limited to:	• count () • pop() • push ()
10. JQuery events may include but not limited to:	• Mouse events • Keyboard events • Form events • Document / window events

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:

- HTML basics
- HTML elements
- Web page formatting
- Styling
- JavaScript basics
- JavaScript data types
- JavaScript functions
- JavaScript libraries

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 Created a HTML document 1.2 Added attributes to HTML documents 1.3 Formatted a web page 1.4 Added styles to a web page 1.5 Explained the importance of JavaScript 1.6 Use JavaScript to change HTML elements 1.7 Demonstrated event handling in JQuery
2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical demonstration 3.3 Observation 3.4 Written test
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND GRAPHIC DESIGN

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

UNIT DESCRIPTION

This unit covers the competencies required to understand Graphic Design. It involves understanding fundamentals of graphic design, understanding elements and principles of graphic design, applying typography techniques, creating and editing of images, performing layout design and printing the design.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
1. Understand fundamentals of graphic design	1.1 Graphic Design is explained 1.2 ***Graphic design equipment*** is identified based on the design. 1.3 Applications areas of Graphic design are explained. 1.4 Specification of requirements as per the user
2. Understand elements and principles of graphic design	2.1 Elements of graphic design are explained 2.2 Principles of graphic design are explained 2.3 Elements of graphic design project as per user requirements are selected
3. Apply typography techniques	3.1 Typography is explained 3.2 Typography guidelines are explained 3.3 Measurements and standards of typography are demonstrated 3.4 Typography technique for a graphic design project as per user requirements is selected
4. Create and edit images	4.1 Software and tools for graphic design and photography are identified 4.2 ***Image file types*** are explained. 4.3 Letter forms, lines of type and body copy are created using appropriate software 4.4 Images are created and manipulated using appropriate software.
5. Perform layout design	5.1 Proportion on layout design is explained 5.2 Creation of unified systems out of dissimilar elements is done. 5.3 Dynamic layouts are created by using ***typographic tools*** 5.4 Type and image project is created.

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
6. Print design	6.1 Tools and Equipment for printing are identified. 6.2 ***Types of printing*** are identified based on the design. 6.3 Paper is classificatied according to types, size and weight. 6.4 Chemicals used in Printing are selected. 6.5 Printing of the actual design is demonstrated

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. Graphic design equipment may include but not limited to:	• Computer • Scanner • Printer • Camera • Digital Tablet
2. Image file types may include but not limited to:	• Raster • Vector
3. Typographical tools may include but not limited to:	• Illustrator • Adobe InDesign • Adobe Photoshop • Paint.net • Corel Draw
4. Types of printing may include but not limited to:	• Digital • Flexography • Letterpress • Off set • Rotogravure • Screen

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:

- Fundamentals of graphic design
- Elements and principles of graphic design
- Typography techniques
- Creating and editing Images
- Layout Design
- Printing graphics

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 Identified graphic design equipment as per user requirements 1.2 Selected graphic design elements as per design requirements 1.3 Explained Measurements, standards and guidelines of typography. 1.4 Selected software and tools for graphic design and photography. 1.5 Created and manipulated images using appropriate software. 1.6 Used typographic tools to create dynamic layout 1.7 Selected and used appropriate printing tools and equipment

2. Resource Implications	The following resources should be provided: 2.1 Access to relevant workplace where assessment can take place 2.2 Appropriately simulated environment where assessment can take place
3. Methods of Assessment	Competency may be assessed through: 3.1 Oral questioning 3.2 Practical tests 3.3 Observation 3.4 Written tests
4. Context of Assessment	Competency may be assessed 4.1 Off the job 4.2 on the job 4.3 During industrial attachment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.