REPUBLIC OF KENYA

NATIONAL OCCUPATIONAL STANDARDS

FOR

COMPUTER SCIENCE TECHNICIAN

KNQF LEVEL 6

ISCED OCCUPATIONAL STANDARD CODE: 0613 554B

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, STATE DEPARTMENT FOR TVET

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.

COUNCIL CHAIR, 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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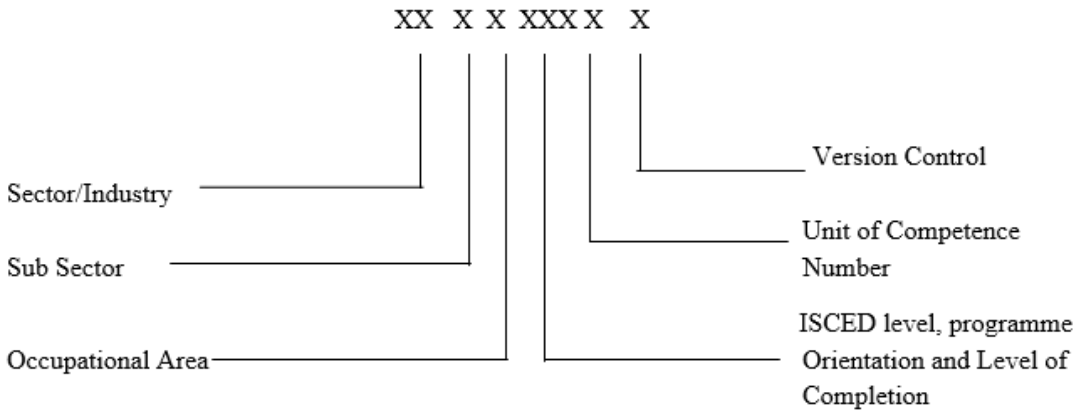
ABBREVIATIONS AND ACRONYMS

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



COURSE OVERVIEW

Computer Science Level 6 qualification consists of competencies that an individual must possess to offer Computer Science Services. It involves understanding computer organization and architecture, understanding operating systems, understanding mathematics for computer science, understanding fundamentals programming, demonstrating database management skills, developing an information system, understanding networking and distributed systems, understanding artificial intelligence, understanding algorithms and data structures, demonstrating web design skills and understanding graphic design.

Units of learning comprising Computer Science Level 6 qualification include the following basic, common and core units:

Basic Units of Competency

Unit code	Unit Title
ICT/OS/CS/BC/01/6/B	Apply IT Communication Skills
ICT/OS/CS/BC/02/6/B	Apply work Ethics and Practices
ICT/OS/CS/BC/03/6/B	Apply Entrepreneurial Skills

Common Unit of Competency

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

Core Units of Competency

Unit code	Unit Title
ICT/OS/CS/CR/01/6/B	Understand Computer Organization and Architecture
ICT/OS/CS/CR/02/6/B	Understand Operating Systems
ICT/OS/CS/CR/03/6/B	Understand Mathematics for Computer Science
ICT/OS/CS/CR/04/6/B	Understand Fundamentals Programming
ICT/OS/CS/CR/05/6/B	Demonstrate Database Management Skills
ICT/OS/CS/CR/06/6/B	Develop An Information System
ICT/OS/CS/CR/07/6/B	Understand Networking and Distributed Systems
ICT/OS/CS/CR/08/6/B	Understand Artificial Intelligence
ICT/OS/CS/CR/09/6/B	Understand Algorithms and Data Structures
ICT/OS/CS/CR/10/6/B	Demonstrate Web Design Skills
ICT/OS/CS/CR/11/6/B	Understand Graphic Design

BASIC UNITS OF COMPETENCY

APPLY IT COMMUNICATION SKILLS

UNIT CODE: CT/OS/CS/BC/01/6/B

UNIT DESCRIPTION

This unit covers the competencies required to demonstrate communication skills. It involves applying communication channels, written, non-verbal, oral, group communication skills job entry techniques.

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes that make up workplace function	**PERFORMANCE CRITERIA** These are assessable statements that specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
1. Apply communication channels	1.1 Specific communication channels are identified and applied based on workplace requirements. 1.2 Challenges are identified and addressed as per the operational standards of the organization. 1.3 Communication channels are evaluated to meet workplace needs.
2. Apply written communication skills	2.1 Types of written communication are identified and applied according to the workplace requirements. 2.2 Written communication needs are identified and implemented according to workplace procedures. 2.3 Written communication guidelines are analyzed, evaluated, and revised based on workplace needs.
3. Apply non-verbal communication skills	3.1 Existing non-verbal communication techniques are identified and applied based on organization policy. 3.2 Non-verbal communication techniques are articulated to enhance inclusivity according to workplace requirements. 3.3 Non-verbal communication techniques are modeled to enhance inclusivity according to workplace requirements.
4. Apply oral communication skills	4.1 Types of oral communication are identified and established as per organization policy. 4.2 Pathways of oral communication are identified and established as per organization policy.

ELEMENT These describe the key outcomes that make up workplace function	PERFORMANCE CRITERIA These are assessable statements that specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the Range***
	4.3 Pathways of oral communication are reviewed according to organization procedures. 4.4 Pathways of oral communication are maintained according to the organization standards.
5. Apply group communication skills	5.1 Group communication strategies are applied based on the workplace needs. 5.2 Groups are organized in accordance with workplace procedures. 5.3 Effective questioning, listening and non-verbal communication techniques are used as per needs. 5.4 Group communication challenges are identified and addressed according to the workplace needs.
6. Apply job entry techniques	***6.1 Job opportunities*** are sought based on competencies. ***6.2*** A winning resume/CV is developed as per job advertisement. ***6.3*** An application/cover letter is developed based on the job advertisement. ***6.4 certificates and testimonials*** are organized as per resume. ***6.5 Interview skills*** are demonstrated as per job advertisement.

RANGE

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

Variable	Range
1. Communication strategies may include but are not limited to:	• Language switch • Comprehension check • Repetition • Asking confirmation • Paraphrasing • Clarification request • Translation • Restructuring • Generalization

Variable	Range
2. Effective group interaction may include but not limited to:	• Identifying and evaluating what is occurring within an interaction in a non-judgmental way. • Using active listening. • Making decision about appropriate words, behavior. • Putting together response which is culturally appropriate. • Expressing an individual perspective. • Expressing own philosophy, ideology and background and exploring impact with relevance to communication
3. Situations may include but are not limited to:	• Establishing rapport • Eliciting facts and information • Facilitating resolution of issues • Developing action plans

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:

- Active listening
- Interpretation
- Negotiation
- Writing
- Oral skills
- Creative thinking
- Critical thinking
- Decision making
- Analytical
- Innovation
- Conflict skills
- Leadership
- Problem solving skills
- Management
- Organizational
- Teamwork

Required Knowledge

The individual needs to demonstrate knowledge of:

- Communication process
- Dynamics of groups

- Styles of group leadership
- Key elements of communications strategy
- Principles of effective communication
- Turn-taking techniques
- Conflict resolution techniques
- Work planning
- Work organization
- Company policies
- Company operations and procedure standards
- Fundamental rights at the workplace
- Personal hygiene
- Accountability
- Workplace problems and how to deal with them

EVIDENCE GUIDE

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

1. Critical aspects of Competency.	Assessment requires evidence that the candidate: 1.1 Identified and applied specific communication channels based on workplace requirements. 1.2 Identified and applied specific written communication correspondence according to the workplace requirements. 1.3 Applied and developed non-verbal strategies to communicate in all areas of the workplace requirements. 1.4 Established pathways of oral communication as per workplace policy. 1.5 Applied group communication strategies based on workplace needs. 1.6 Searched for job opportunity based on competencies. 1.7 Prepared job requirement documentations based on job opportunity. 1.8 Demonstrated interview skills based on the job opportunity.
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. 2.3 Resources relevant to the proposed activity or tasks.

3. Methods of Assessment	Competency in this unit may be assessed through: a. Observation b. Oral assessment c. Portfolio of evidence d. Interviews e. Third party report f. Written assessment g. Practical assessment h. Projects
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 In a simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY WORK ETHICS AND PRACTICES

UNIT CODE: CT/OS/CS/BC/02/6/B

UNIT DESCRIPTION

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

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 Range***
1. Apply self-management skills	1.1 Personal vision, mission and goals are formulated based on potential and concerning organization objectives and strategic plan 1.2 Self-esteem and a positive self-image are developed and maintained based on value 1.3 Emotional intelligence and stress management are demonstrated as per workplace requirements. 1.4 Assertiveness is developed and maintained based on the requirements of the job. 1.5 Accountability and responsibility for one's actions are demonstrated based on workplace instructions. 1.6 Time management, attendance and punctuality are observed as per the organization's policy. 1.7 Personal goals are managed as per the organization's objective 1.8 Self-strengths and weaknesses are identified based on personal objectives 1.9 Motivation, initiative and proactivity are utilized as per the organization policy 1.10 Individual performance is evaluated and monitored according to the agreed targets.
2. Promote ethical work practices and values	2.1 Integrity is demonstrated as per acceptable norms

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 Range***
	2.2 Codes of conduct is applied as per the workplace requirements 2.3 Policies and guidelines are observed as per the workplace requirements 2.4 Professionalism is exercised in line with organizational policies
3. Promote Team work	3.1 ***Teams*** are formed to enhance productivity based on organization's objectives 3.2 Duties are assigned to teams under the organization policy. 3.3 Team activities are managed and coordinated as per set objectives. 3.4 Team performance is evaluated based on set targets as per workplace policy. 3.5 ***Conflicts*** are resolved between team members in line with organization policy. 3.6 Gender and diversity-related issues are identified and mainstreamed in accordance with workplace policy. 3.7 Healthy ***relationships*** are developed and maintained in line with the workplace. 3.8 Adaptability and flexibility are applied in dealing with team members as per workplace policies
4. Maintain professional and personal development	4.1 ***Personal growth and development*** needs are identified and assessed in line with the requirements of the job. ***4.2 Training and career opportunities*** are identified and utilized based on job requirements. 4.3 ***Resources*** for training are mobilized and allocated based on organizations and individual skills needs. 4.4 Licenses and certifications relevant to the job and career are obtained and renewed as per policy. 4.5 Recognitions are sought as proof of career advancement in line with professional requirements. 4.6 Work priorities and personal commitments are balanced and managed based on the requirements of the job and personal objectives. 4.7 Dynamism and on-the-job learning are embraced in line with the organization's goals and objectives.

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 Range***
5. Apply Problem solving skills	5.1 ***Creative, innovative*** and practical solutions are developed based on the problem 5.2 Independence and initiative in identifying and solving problems are demonstrated based on the requirements of the job. 5.3 Team problems are solved as per the workplace guidelines 5.4 Problem-solving strategies are applied as per the workplace guidelines 5.5 Problems are analyzed and assumptions tested as per the context of data and circumstances
6. Promote Customer Care	6.1 Customers' needs are identified based on their characteristics 6.2 Customer ***feedback*** is allowed and facilitated in line with organization policies. 6.3 Customer concerns and complaints are analyzed and resolved in line with the set organizational culture. 6.4 Proactive customer outreach programs are implemented as per organizational policies 6.5 Customer retention strategies are developed and implemented in line with the organizational policy

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. Feedback may include but not limited to:	● Verbal ● Written ● Informal ● Formal
2. Conflicts include but are not limited to:	● Interpersonal Conflict. ● Intrapersonal Conflict. ● Intergroup Conflict. ● Intragroup Conflict.

Variable	Range
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. Team may include but not limited to:	• Small work group • Staff in a section/department • Inter-agency group • Virtual teams
5. 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
6. Personal objectives may include but not limited to:	• Long term • Short term • Broad • Specific
7. Trainings and career opportunities may include but not limited to	• Participation in training programs • Serving as Resource Persons in conferences and workshops • Capacity building
8. Resource may include may but not limited to:	• Human • Financial • Technology
9. Creative and innovative may include but not limited to:	• New ideas • Original ideas • Different ideas • Methods/procedures • Processes • New tools
10. Emerging issues may include but not limited to:	• Artificial Intelligence • Data confidentiality • National cohesion

Variable	Range
	• Open offices

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:

- Active listening
- Critical thinking
- Organizational
- Negotiation
- Monitoring
- Evaluation
- Problem solving
- Decision Making
- Leadership
- Creative/innovative thinking
- Adaptability
- Conflict management
- Emotional intelligence
- Teamwork

Required Knowledge

The individual needs to demonstrate knowledge of:

- Work values and ethics
- Company policies and procedures
- Company operations, procedures and standards
- Flexibility and adaptability
- Concept of time and leisure time
- Decision making
- Work planning
- Organizing work
- Monitoring and evaluation
- Record keeping
- Gender and diversity mainstreaming
- Drug and substance abuse
- Professional growth and development
- creativity

- Innovation
- problem solving
- customer care
- mentoring and coaching.
- 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 require evidence that the candidate: 1.1 Applied self-management skills as per organizational procedures. 1.2 Promoted ethical practices and values as per organizational procedures. 1.3 Promoted Teamwork as per workplace assignments. 1.4 Maintained professional and personal development as per organizational procedures. 1.5 Applied Problem-solving skills based on work requirements. 1.6 Identified customer needs based on their characteristics. 1.7 Gave back Customer feedback in line with organization policies.
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. 2.3 Resources 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 In a simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

APPLY ENTREPRENEURIAL SKILLS

UNIT CODE: CT/OS/CS/BC/03/6/B

UNIT DESCRIPTION

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

ELEMENTS AND PERFORMANCE CRITERIA

ELEMENT These describe the key outcomes that make up workplace function.	**PERFORMANCE CRITERIA** These are assessable statements that specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in Range***
1. Apply Financial Literacy	1.1 **Sources of personal and business *funds*** are identified as per financial procedures and standards 1.2 Personal finances are managed as per financial procedures and standards 1.3 Savings are managed as per financial procedures and standards 1.4 Debts are managed as per financial procedures and standards 1.5 Investments are undertaken as per financial procedures and standards 1.6 Insurance services are procured as per financial procedures and standards
2. Apply entrepreneurial concept	2.1 Entrepreneurs and Business persons are distinguished as per principles of entrepreneurship 2.2 ***Types of entrepreneurs*** are identified as per principles of entrepreneurship 2.3 Ways of becoming an entrepreneur are identified as per principles of Entrepreneurship 2.4 ***Characteristics of Entrepreneurs*** are identified as per principles of Entrepreneurship 2.5 Salaried employment and self-employment are distinguished as per principles of entrepreneurship 2.6 ***Requirements for entry into self-employment*** are identified according to business procedures and standards 2.7 Roles of an Entrepreneur in an enterprise are determined according to business procedures and standards

ELEMENT These describe the key outcomes that make up workplace function.	PERFORMANCE CRITERIA These are assessable statements that specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in Range***
	2.8 **Contributions of entrepreneurship** to National development are identified as per business procedures and standards
3. Identify entrepreneurial opportunities	3.1 Business ideas are identified as per business procedures and standards 3.2 Factors to consider when evaluating business opportunity viability are explored based on business procedure and standards 3.3 Entrepreneurial opportunities are evaluated as per business procedures and standards 3.4 Business ideas and opportunities are generated as per business procedures and standards 3.5 Business life cycle is analysed as per business procedures and standards
4. Apply business legal aspects	4.1 ***Forms of business ownership*** are identified as per legal procedures and practices 4.2 Business Registration and Licensing processes are identified as per legal procedures and practices 4.3 Types of Contracts and Agreements are analysed as per legal procedures and practices 4.4 Employment Laws are identified as per legal procedures and practices 4.5 Taxation laws are identified as per legal procedures and practices
5. Innovate Business strategies	5.1 Business innovation strategies are determined by the organization standards 5.2 Creativity in business development is demonstrated in accordance with business standards 5.3 ***Innovative business standards*** are developed as per business principles 5.4 Linkages with other entrepreneurs are created as per best practice 5.5 ICT is incorporated in business growth and development as per best practice
6. Develop Business Plan	6.1 Business idea is described as per business procedures and standards

ELEMENT These describe the key outcomes that make up workplace function.	PERFORMANCE CRITERIA These are assessable statements that specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in Range***
	6.2 Business description is developed as per business plan format 6.3 Marketing plan is developed as per business plan format 6.4 Organizational/Management plan is prepared in accordance with business plan format 6.5 Production/operation plan is prepared in accordance with business plan format 6.6 Financial plan is prepared in accordance with the business plan format 6.7 Executive summary is prepared in accordance with business plan format 6.8 Business plan is presented as per best practice 6.9 Business ideas are incubated as per institutional policy.

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. Sources of personal funds may include but not limited to:	• Salary/Wages • Investments • Savings • Inheritance • Government Benefits
2. Sources of business finance may include but not limited to:	• Equity Financing • Debt Financing, • Personal Savings/Investment • Retained Earnings • Grants and Subsidies • Crowdfunding • supplier Credit: • Leasing and Asset Financing:
3. Types of entrepreneurs may include but not limited to:	• Innovators • Imitators • Craft • Opportunistic

Variable	Range
	• Speculators
4. Characteristics of Entrepreneurs may include but not limited to:	• Creative • Innovative • Planner • Risk taker • Networker • Confident • Flexible • Persistent • Patient • Independent • Future oriented • Goal oriented
5. Requirements for entry into self-employment may include but not limited to	• Technical skills • Management skills • Entrepreneurial skills • Resources • Infrastructure
6. Forms of businesses ownership may include but not limited to:	• Sole proprietorship • Partnership • Limited companies • Cooperatives
7. Innovative business standards 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 standards
- 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 standards
- Market and feasibility studies
- Government and regulatory processes
- Local and international business environment
- Relevant developments in other industries
- Regional/ County business expansion standards

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 Sources of personal and business finance as per financial procedures and standards 1.2 Managed Personal finances as per financial procedures and standards 1.3 Made Investment decisions as per financial procedures and standards 1.4 Generated Business ideas and opportunities based on business procedure and standards 1.5 Analysed business life cycle based on business procedure and standards 1.6 Determined business innovative standards as per business principles 1.7 Developed and presented a business plan as per regulatory framework.
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 Written tests 3.2 Oral questions 3.3 Third party report 3.4 Interviews 3.5 Portfolio
4. Context of Assessment	Competency may be assessed: 4.1 On-the-job 4.2 In a simulated work environment
5. Guidance information for assessment	Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

COMMON UNITS OF COMPETENCY

APPLY BASIC ELECTRONIC SKILLS

UNIT CODE: CT/OS/CS/CC/01/6/B

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	2.1 ***Types of number systems*** are identified 2.2 Base conversion is done 2.3 Binary arithmetic operations are done 2.4 ***Binary codes*** are identified 2.5 Representation of decimals in BCD is done 2.6 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**
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
Types of electrical circuits may include but is not limited to:	• AC – Alternating Current • DC – Direct Current

Types and operations of transistors may include but is not limited to:	• Types
	  • PNP
	  • NPN
	• Operations

Variable	Range
	• Forward biasing • Reverse Biasing
Types of memories may include but is not limited to:	• Semi-conductor • Magnetic • Optical
Levels of memory storage may include but is not limited to:	• Internal • Main • Online • Offline bulk
Classification of memories may include but is not limited to:	• RAM • ROM
Types of number systems may include but is not limited to:	• Decimal • Binary • Octal • Hexadecimal • Binary Arithmetic's
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	5.1 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: CT/OS/CS/CR/01/6/B

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 Concepts of ICT are determined in accordance with computer equipment 1.2 Computer organisation is defined 1.3 Computer architecture is explained 1.4 Structure and function of ***computer hardware components*** is explained
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

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.)***
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**
Computer hardware components	• Input devices • Output devices • Storage devices • Central Processing unit (CPU)
CPU specifications may include but is not limited to:	• Brand • Chipset • Speed • Series
Storage Technologies may include but is not limited to:	• Solid state • Magnetic • Optical
Memory specifications may include but is not limited to:	• Speed • Size • Form factor • Type • Part Number
Modes of data transfer may include but is not limited to:	• Programmed I/O • Direct Memory Access I/O • Interrupt initiated I/O

Variable	Range
Computer hardware components	• Input devices • Output devices • Storage devices • Central Processing unit (CPU)
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
Number systems may include but is not limited to:	• Decimal • Positional • Binary • Hexadecimal
Logic Operators may include but is not limited to:	• AND • OR NOT
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:

- Fundamentals of ICT
- 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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND OPERATING SYSTEMS

UNIT CODE: CT/OS/CS/CR/02/6/B

UNIT DESCRIPTION

This unit covers the competencies required to understand operating systems. It involves understanding fundamentals of operating systems, applying computer application software to solving tasks, 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 softwares*** is identified according to manufacturer's specification 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. Apply computer application softwares to solving tasks	1.1 ***Word documents are prepared*** as per job requirements 1.2 ***Presentation slides are prepared*** in accordance to workplace procedures 1.3 ***Worksheets and workbooks are prepared*** as per job requirements 1.4 ***Database is designed , created and manipulated*** in accordance with workplace procedures 1.5 Office internet functions are defined and executed in accordance with office procedure 1.6 Electronic mail addresses are opened and applied in workplace communication in accordance with office policy
3. Understand process management	1.1 Process management is explained 1.2 Manage ***computer resources*** 1.3 Process states and transitions are explained 1.4 Process scheduling is explained 1.5 Use of the Task Manager is demonstrated 1.6 Use of performance monitor tool is demonstrated

ELEMENT	PERFORMANCE CRITERIA *(Bold and italicised terms are elaborated in the Range)*
4. Understand memory management	4.1 Memory management is explained. 4.2 ***Memory management techniques*** are explained. 4.3 Virtual memory management settings are demonstrated
5. Understand input and output management	5.1 Input - output management is explained 5.2 Disk operations are explained 5.3 Computer clock system is explained 5.4 Virtual Input Output is explained 5.5 Disk selection criteria are outlined 5.6 Verification of disk properties is demonstrated 5.7 ***Disk storage management operations*** are demonstrated 5.8 ***Device management operations*** are demonstrated
6. Understand file management and local policy settings	6.1 File management is explained. 6.2 ***File access methods*** are explained. 6.3 File allocation techniques are explained. 6.4 File protection and security are explained. 6.5 ***File and directory operations*** are demonstrated 6.6 ***Local policy settings*** 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
Computer softwares may include but not limited to:	• System software • Application software • Utility software
Structures of operating system may include but is not limited to:	• Monolithic • Layered • Virtual • Client server model
Types of operating system may include but is not limited to:	• Real time • Normal • Batch • Time sharing
Word documents preparation may include but not limited to:	• Creation • Editing • Formatting • Mail merging • Printing
Slides preparation may include but not limited to:	• Creation • Editing • Formatting • Printing
Worksheets and workbooks preparation may include but not limited to:	• Creation • Data entry • Basic formulae and functions • Formatting • Data sorting and filtering • Printing
Database design creation and manipulation may include but not limited to:	• Table design • Form design • Report design • Data sorting • Indexing • Storage • Retrieval/querying • Security • Printing

Computer Resources may include but is not limited to:	• Processor • Storage space
Computer Resources may include but is not limited to:	• Processor • Storage space
Memory management techniques may include but is not limited to:	• Partitions • Virtual
Disk storage management operations may include but is not limited to:	• Shrinking volume • Extending volume • Formatting volume • Partitioning volume • Disk Optimization and defragmentation
Device Management Operations may include but is not limited to:	• Driver Installation • Resolving driver conflicts
File access methods may include but is not limited to:	• Sequential • Random • Indexed sequential
File and directory operations may include but is not limited to:	• Setting attributes • Share settings • Security settings • Customization of files and folders
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:

- Classification of computer software
- Word processing;
- Spread sheets;
- Database;
- Presentation Packages;
- Office internet
- 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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND MATHEMATICS FOR COMPUTER SCIENCE

UNIT CODE: CT/OS/CS/CR/03/6/B

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

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.)***
	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
Vector operations may include but not limited to:	• Addition • Multiplication • Dot product
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
Basic Boolean operations may include but not limited to:	• AND • OR • NOT
Secondary operations may include but not limited to:	• NAND • NOR • EX-OR • EX-NOR
Methods of simplifying Boolean expressions may include but not limited to:	• Using algebraic functions • Using Truth tables • Using Karnaugh Maps
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
Methods of Set representation may include but not limited to:	• Statement form • Tabular form • Set builder notation
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
Set Operations may include but not limited to:	• Set Union and Set Intersection • Set Difference/Relative Complement • Set Complement • Cartesian Product
Measures of central tendency may include but not limited to:	• Mean • Median • Mode
Measures of spread may include but not limited to:	• Variance • Standard deviation
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND FUNDAMENTALS OF PROGRAMMING

UNIT CODE: CT/OS/CS/CR/04/6/B

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

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***(Bold and italicized terms are elaborated in the range.)***
	6.5 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**
Phases of program development may include but not limited to:	• Establish program requirements • Design a program • Coding • Code test and debug • Document • Maintain
Key terms used in programming may include but not limited to:	• Algorithm • Source code • Executable • Compiling • Debugging
Types of code may include but not limited to:	• Source code • Object code • Machine code
Java data types may include but not limited to:	• Integer • Float • Strings • Boolean
Types of statements may include but not limited to:	• Declaration • Executable
Data Operations may include but not limited to:	• Number operations • String operations
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE DATABASE MANAGEMENT SKILLS

UNIT CODE: CT/OS/CS/CR/05/6/B

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

ELEMENT These describe the **key outcomes** which make up **workplace function**.	**PERFORMANCE CRITERIA** These are **assessable** statements which specify the required level of performance for each of the elements. ***Bold and italicized terms are elaborated in the range.)***
	3.7 ***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**
Terminologies used with databases may include but not limited to:	• Table • Records • Field • DBMS

Variable	Range
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
Phases of database design may include but not limited to:	• Conceptual design • Logical design • Physical design
Data definition queries may include but not limited to:	• CREATE • DROP • ALTER
CREATE TABLE statement constraints may include but not limited to:	• Primary key • Foreign key • UNIQUE • CHECK • NOT NULL • DEFAULT
Data manipulation query statements may include but not limited to:	• INSERT • SELECT • UPDATE • DELETE
Types of joins may include but not limited to:	• Simple Join or Inner Join • Left Join • Right Join • Outer Join
Object oriented database concepts may include but not limited to:	• Classes • Objects • Attributes • Inheritance
Views may include but not limited to:	• Create a view • Rename a view • Drop a view
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEVELOP AN INFORMATION SYSTEM

UNIT CODE: CT/OS/CS/CR/06/6/B

UNIT DESCRIPTION

This unit covers the competencies required to develop an information system. It involves understanding fundamentals of information systems, applying security measures to data, hardware, software in automated environment, 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. Apply security measures to data, hardware, software in automated environment	2.1 ***Data security and privacy are classified*** in accordance with the prevailing technology 2.2 ***Security threats*** are identified ***and control measures*** are applied in accordance with laws governing protection of ICT 2.3 Computer threats and crimes are detected in accordance to Information Management security guidelines 2.4 Protection against computer crimes is undertaken in accordance with laws governing protection of ICT
3. Understand the Software Development Process	1.7 Software Development Life Cycle is explained 1.8 ***Software Development Methodologies*** are explained 1.9 ***Modeling techniques*** are demonstrated using CASE tools
4. Demonstrate Human Computer Interaction Principles	1.1 Human Computer Interaction is explained 1.2 ***Interface design principles*** are explained 1.3 Interface design is demonstrated using a design software
4. Understand the VB.NET	4.1. The .Net framework is explained 4.2 Visual Studio is installed 4.3 Features of VB.Net are outlined

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.)***
programming environment	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	5.9 ***Basic VB.Net Controls*** are outlined 5.10 ***Elements of a control*** are explained 5.11 Basic VB.Net Controls' Properties, Methods and Events are demonstrated 5.12 Event handling is demonstrated 5.13 Forms design using HCI principles is demonstrated 5.14 Connection of VB.Net applications to a database is demonstrated 5.15 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**
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
Data security and privacy may include but not limited to:	• Confidentiality of data • Cloud computing • Integrity -but-curious data surfing
Security and control measures may include but not limited to:	• Counter measures against cyber terrorism • Risk reduction • Cyber threat issues • Risk management • Pass-wording
Security threats may include but not limited to:	• Cyber terrorism

Variable	Range
	• Hacking
Software development methodologies may include but not limited to:	• Waterfall • Spiral • Rapid Application Development • Agile
Modeling techniques may include but not limited to:	• Data Flow Diagrams • ER diagrams • Use Case Diagrams
Interface Design Principles may include but not limited to:	• Usability • Learnability • Flexibility
Basic VB.Net Controls may include but not limited to:	• Form • Text Box • Label • Button • List Box • Combo Box • Radio Button • Check Box • Picture Box • Progress Bar • Scroll Bar • Date Time Picker • Tree View • List View
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
- 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
- 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 Security threats are identified and control measures are applied in accordance with laws governing protection of ICT 1.3 Explained Software Development Life Cycle 1.4 Described Software Development Methodologies 1.5 Demonstrated Modelling techniques using CASE tools 1.6 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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND NETWORKING AND DISTRIBUTED SYSTEMS

UNIT CODE: CT/OS/CS/CR/07/6/B

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

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.)***
5. Understand Data Communication Standards and IP addressing	5.1 OSI Model is outlined 5.2 Data communication components are explained 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**
Types of networks may include but not limited to:	• LAN • WAN • MAN • PAN
Network topologies may include but not limited to:	• Bus • Star • Delta • Ring • mesh point-to-point
Types of distributed systems may include but not limited to:	• Computing • Information • Pervasive
Models in distributed systems may include but not limited to:	• Architecture • Interaction • Fault
Architecture styles may include but not limited to:	• Layered Architecture • Object Based Architecture • Data-centered Architecture • Event Based Architecture

Variable	Range
	• Hybrid Architecture
Types of distributed system architecture may include but not limited to:	• Centralized • Decentralized • Hybrid
Types of distributed processing	• Distributed • Parallel
File sharing and access methods may include but not limited to:	• Remote Access • Data-Caching
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
5. Guidance information for assessment	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND ARTICICIAL INTELLIGENCE CONCEPTS

UNIT CODE: CT/OS/CS/CR/08/6/B

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.

ELEMENT These describe the **key outcomes** which make up **workplace function**.	PERFORMANCE CRITERIA These are **assessable** statements which specify the required level of performance for each of the elements. ***(Bold and italicized terms are elaborated in the range.)***
	4.3 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
Types of inferencing may include but not limited to:	• Single • Multiple • Case based
Types of Machine Learning may include but not limited to:	• Supervised • Unsupervised
Data types may include but not limited to:	• Integers • Floats • Strings • Lists • Tuple • Sets • Dictionaries
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND ALGORITHMS AND DATA STRUCTURES

UNIT CODE: CT/OS/CS/CR/09/6/B

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
6. 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++
7. 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++
8. 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++
9. Understand Search Techniques	5.1 Search is defined 5.2 Linear Search is explained 5.3 Binary Search is explained

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.)***
	5.4 Search techniques are demonstrated using C++
10. 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**
Complexities may include but is not limited to:	• Space • Time
Greedy algorithms may include but is not limited to:	• Counting coins
Key concepts in data structures may include but is not limited to:	• Data • Object • Type
Basic operations for various linked lists may include but is not limited to:	• Insertion • Deletion • Reverse • Display
Basic operations in stacks may include but is not limited to:	• Push • Pop
Basic operations in queues may include but is not limited to:	• Enqueue • Dequeue
Categories of sorting techniques may include but is not limited to:	• In place • Not in place • Stable • Not stable • Adaptive

Variable	Range
	• Non-adaptive
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

DEMONSTRATE WEB DESIGN SKILLS

UNIT CODE: CT/OS/CS/CR/10/6/B

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

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.)***
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**
Terminologies used in HTML may include but not limited to:	• Document • Stylesheet • Element • Attribute
HTML core elements may include but not limited to:	• <head> • <title> • <body> • <html>
Basic HTML elements may include but not limited to:	• <p> • • <h1>
Attributes may include but not limited to:	• src • alt • href
Layout elements may include but not limited to:	• <header> • <nav> • <section>

Variable	Range
	• <footer>
Layout element attributes may include but not limited to:	• Class • Id • name
Style concepts may include but not limited to:	• Background • Padding • Alignment • Border
JavaScript data types may include but not limited to:	• Strings • Numbers • Booleans
Operations on arrays may include but not limited to:	• count () • pop() • push ()
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.

UNDERSTAND GRAPHIC DESIGN

UNIT CODE: CT/OS/CS/CR/11/6/B

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
Graphic design equipment may include but not limited to:	• Computer • Scanner • Printer • Camera • Digital Tablet
Image file types may include but not limited to:	• Raster • Vector
Typographical tools may include but not limited to:	• Microsoft Publisher • Illustrator • Adobe InDesign • Adobe Photoshop • Paint.net • Corel Draw
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	5.1 Holistic assessment with other units relevant to the industry sector, workplace and job role is recommended.