NATIONAL COUNCIL FOR TECHNICAL EDUCATION

NOVEMBER 2022

PROPOSED OCCUPATIONAL STANDARDS

FOR COMPUTER ENGINEER

OCCUPATION: COMPUTER ENGINEERING

LEVEL: NTA 8

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FOREWORD

The National Council for Technical Education (NACTE) is a corporate body established by the National Council for Technical Education Act, Cap.129. The Act provides a legal framework for the Council to coordinate the provision of technical education and training in Tanzania. The mandate of NACTE is three-fold, namely; Regulatory, Quality Assurance and Policy Advisory.

In discharging its mandate, the Council has been charged with the responsibilities, among others, to:

(a) assist technical institutions in the transmission of knowledge, principles and training in the field of technical education and training for the benefit of the people of Tanzania;
(b) assist technical institutions in the overall development of the quality of education they provide and to promote and to maintain approved academic standards;
(c) establish and make awards in technical education which are consistent in standard and comparable to related awards in Tanzania and internationally; and
(d) ensure that the quality of education required for the awards is met and maintained throughout the duration of the delivery of the course.

In the course of execution of these responsibilities, the Council has been instituting various measures aiming at advancing the quality of training provided in technical institutions in respect of the changing demands of the labour market, both local and international.

To achieve the above obligation, NACTE, under the Ministry of Education, Science and Technology implemented the East Africa Skills for Transformation and Regional Integration Project (EASTRIP), a project aiming at promoting regional integration through supporting the regional corridors and sector markets, developing common standards and qualifications, and promoting mobility of students, faculty, and graduates. The project supports the Government of Tanzania to address shortage of skills in five sectors namely:

(a) Energy;
(b) Construction;
(c) Information and Communication Technology (ICT);
(d) Transportation; and
(e) Leather Technology.

To address the skills miss-match and shortage in the five (5) sectors in the country, the project funded, among others, a component of Development of Occupational Standards for Technical and Vocational Education and Training (TVET). In this regard, NACTE endeavored to identify qualified and highly experienced experts in the five sectors from both the industry and training institutions to carry out the development of Occupational Standards. The exercise was carried out at Morogoro Teachers College – Morogoro from 16th July to 10th August, 2021. The output of the exercise is Occupational Standards for 12 occupations. Occupational standards for Computer Engineers are among the 12 occupational standards which have been developed.

Since Occupational Standards are statements of work performance reflecting the ability to successfully complete the functions required in an occupation, as well as the application of knowledge, skills, attitudes and understanding in an occupation, it is the Council's expectations that the developed standards will form a robust base for decision making and provide explicit guidance to policy makers, curriculum developers, educators, employers and other stakeholders in matters related to manpower planning as well as execution of Technical and Vocational Education and Training undertakings.

Prof. J. W. Kondoro — Dar es Salaam

Chairman — **October 2022**

ACKNOWLEDGEMENT

The National Council for Technical Education (NACTE) is charged with the mandate to be the Quality Assurance organ of the Government in matters related to Technical and Vocational Education and Training (TVET) and production of qualified manpower for both local and international labour markets. In order to realize this obligation, NACTE endeavours to institute policies, guidelines and standards and to set the quality benchmarks for training institutions.

However, this is only possible if there is a strong base, linking the training institutions on one hand and the demands of the industry/labour market for relevant manpower on the other hand. Therefore, the Council undertook a step to develop Occupational Standards in sectors considered to be the engine to steer the country's desire to achieve an industrial economy. This exercise would not be a success without the input and support from our stakeholders. I am indebted to acknowledge some of them here.

I wish to acknowledge and appreciate the support from the Ministry of Education, Science and Technology through the East Africa Skills for Transformation and Regional Integration Project (EASTRIP)for the financial support which facilitated the preparation of this document. I wish also to appreciate Eng. Dr. Simon Baregu and Mrs Leah Lukindo for the tireless efforts and commitment in facilitating and guiding the standards development process, Ms. Eileen Tzamburakis and Ms. ChausikuYakweli Ibrahim for compiling and type setting the final document; andthe NACTE Secretariat for coordinating the whole activity.

In a very special way I wish further to extend my sincere gratitude to this team of wonderful experts who tirelessly dedicated their time and availed their invaluable intellect in the preparation of this document. I would like to recognise the colossal inputs of the following experts:

S/N	Name	Title	Institute
1	Dr. Dennis Lupiana	Lecturer	Institute of Finance Management (IFM)
2	Eng. Dr. Moses Makoko	Head of ICT	University of Dar-es-Salaam – College of Information Communication Technology
3	Dr. Kwame Ibwe	Lecturer	University of Dar-es-Salaam – College of Information Communication

			Technology
4	Dr. Nkundwe Mwasaga	Lecturer	Dar-es-Salam Institute of Technology

In addition, NACTE hopes to further enhance the internationalization of occupational standards and promote the modernization and internationalization of industries, facilitating Tanzania's integration into the international market and exploiting its development potential. Therefore, NACTE has invited China-Africa Vocational Education Alliance and China-Africa (Chongqing) Vocational Education Alliance to participate in the development, revision and review of occupational standards documents in collaboration with Chinese vocational institutions, so as to make use of their rich experience in vocational education efforts and rely on China's advanced and complete industrial chain and its position in the international market to contribute to the development of vocational education and related industries in Tanzania.

Therefore, I would like to express my sincere gratitude to this specialized team of Chinese institutions and experts. I thank them for their hard work and dedication, and for contributing their wisdom and experience to the preparation of this document. I would like to thank the following institutions and experts for their support:

S/N	Institute	Name	Title
1	Rizhao Polytechnic	Ma Wei	Associate Professor/Control Engineering
2		Liu Jing	Associate Professor/Computer Application
3		Zhang Xiaonuo	Associate Professor/Software Technology
4		Zhang Xiumin	Lecturer/Software Testing
5		Feng Man	Lecturer/Cloud Computing Technology

6		Zhang Li	Associate Professor/Internet of Things
7		Mou Zhihua	Professor/Computer Science
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Dr. A. B. Rutayuga
Executive Secretary

Dar es Salaam
October 2022

ABREVIATIONS

NACTE	**National Accreditation Council of Technical Education**
NOS	**National Occupational Standards**
OS	**Occupational Standards**
TET	**Technical Education and Training**
TVET	**Technical and Vocational Education and Training**

GLOSSARY OF TERMS

Circumstantial knowledge:	Detailed knowledge, which allows the decision-making in regard to different circumstances and cross cutting issues
Competence:	The ability to use knowledge, understanding, practical and thinking skills to perform effectively to the workplace standards required in employment.
Competency:	A description of the ability one possesses when able to perform a given occupational task effectively and efficiently.
Competency-based education:	An instructional program that derives its content from validated tasks and bases assessment on the learner's performance
Curriculum:	A description or composite of statements about "what is to be learned" by the trainee/student in a particular instructional programme; a product that states the "intended learning outcomes".
Educational/Training programme:	The complete curriculum and instruction (what and how) that is designed to prepare a person for employment in a job or other particular performance situation.
Occupation:	A specific position requiring the performance of specific tasks – essentially the same tasks are performed by all employees having the same title. (Example: baker)
Occupational analysis:	A process used to identify the tasks that are important to employees in any given occupation
Occupational area	This is a broad grouping of related jobs. Example: Information and Communication Technology (ICT).
Occupational Standards:	Specific requirements of competences people are expected to demonstrate in a particular occupational area, including knowledge and relevant attitudes. They also act as performance tool of assessment of the pre – scribed outcomes.
Occupational/job analysis:	A process used to identify the tasks that are important to employees in any given occupation**.**
Performance criteria:	indicate the expected end results or outcome in form of

	evaluative statements.
Skill:	The ability to perform occupational tasks with a high degree of proficiency within a given occupation. Skill is conceived of as a composite of three completely interdependent components: cognitive, affective, and psychomotor.
Standard:	it is a set of statement, which if proved true under working conditions, means that an individual is meeting an expected level and type of performance
Task analysis:	The process of analysing each task to determine the steps, related knowledge, attitudes, performance standards, tools and materials needed, and safety concerns required of employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, consists of two or more definite steps, and leads to a product, service, or decision.
Underpinning Knowledge:	This is crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification:	The process of having experts review and conform the importance of the task (competency) statements identified through occupational analysis. Other questions, such as the degree of task learning difficulty are also frequently asked. This process is also sometimes referred to as validation.
Occupational Competence	The application of knowledge and skills to perform consistently to the standards required in the work context.

1.0 INTRODUCTION

Technical Education and Training (TET) is one of the most important education sub-sectors in Tanzania, responsible for developing a skilled workforce to support the country's industrialization economic agenda. Tanzania's Development Vision 2025 intends to raise the country's economy to a middle-income status. This needs a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical Education has begun the job of drafting Occupational Standards that will eventually be adopted as National Occupational Standards for TET in order to ensure that TET meets the needs of the labour market and the country's economic agenda.

National Occupational Standards (NOS) are performance criteria that are matched with labour market demands. Each National Occupation Standard describes functions, performance standards, and knowledge/understanding for one important function or task. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruiting, supervision, and appraisal, as well as for TET standards. They're also helpful for benchmarking and harmonizing qualifications on a national and international level. Standards, in general, provide a solid framework for high-quality TET that is labour market-relevant, current and consistent in delivery across all public and private TET institutions,

In TET, Tanzania adopted the Competence Based Education (CBET) approach. The CBET approach focuses on providing learners with the skills and knowledge required to meet the occupational standards. Occupational standards are thus the starting point for developing competency-based training (CBET) programs. TET institutions will be required to benchmark their curricula with relevant occupational standards.

Occupational Standards are developed based on a given occupation's current and future demands. As a result, they serve as a means of bridging the gap between the worlds of employment and technical education and training (TET).

The Civil Engineering Technician Occupation has its own set of occupational standards. The document explains how the occupational standards were developed, as well as the scope, the occupational profile in the form of DACUM charts, and the Occupational Standards.

2.0 OCCUPATIONAL STANDARD DEVELOPMENT PROCESS

The Occupational standards development process began with an examination of major documents that guide Tanzanian skill development. The 10-year National Skills Development Strategy (2016-2026) was one of the documents reviewed, and it outlined six (6) economic sectors that should be prioritized when developing skills development programmes.

These sectors include: Transport and logistics, Tourism and Hospitality, Agribusiness, Construction, Energy and ICT. NACTE labour market reports were also used in the literature review to determine the skills demand in the Tanzanian labour market as a whole.

After the literature review, a workshop comprised of expert workers and educators with substantial knowledge and experience in the occupation conducted an occupational analysis utilizing the DACUM approach to produce the occupational profile. The analysis resulted in DACUM Charts, which are attached as **Appendix 1** to this document.

The occupational standards were then developed. Experts in Occupational Analysis and the Development of Occupational Standards facilitated the workshop. Interviews, online surveys, and a stakeholder forum were used to validate the occupational standards. Engineers, supervisory technicians on the job, and experienced Civil Engineering technicians were key informants in the survey to discover occupational trends. This information was used to gain insight from the workplaces regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation. A total of …….. online surveys were completed by experts from the labour market across the country. Apart from the survey aiding in defining the scope for the occupational analysis, they served to engage a wide cross-section of experts in the occupation. The stakeholders' forum was attended by 100 participants from different parts of the country representing various companies.

3.0 THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR COMPUTER ENGINEERING TECHNICIANS

These standards cover a broad range of duties and tasks that can be performed by a Computer Engineer. However, the occupational standards are not meant to replace individual job descriptions, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Computer Engineer may perform tasks in a number of key areas of the occupational standards, but not necessarily in all areas. For

example, in large operations other individuals may be employed or designated to perform specific tasks.

A Computer Engineer is someone who creates, implements, tests, and maintains computer software and hardware. He/she verifies that all hardware and software components are in good working order. A hardware computer engineer studies, creates, develops, and tests computer systems and components such computer circuits and circuit components. S/He also monitors the functioning of an operating system in order to make any necessary adjustments or modifications to the computer system's hardware. A software engineer's job entails conducting research, designing, developing, testing, and maintaining software programs. These programs include operating systems and application software. .S/he also analyses software performance to ensure that it is optimized for the hardware of the computer system. To test, produce, and alter prototypes, they both use functioning or theoretical models built with computer simulation. Both sorts of Computer Engineers work together closely. These Occupational standards cover the following main duties for a Computer Engineer:

1. Developing ICT systems;
2. Supervising daily computer-related operations;
3. Managing software licenses;
4. Managing ICT assets;
5. Managing vendors and suppliers of ICT systems;
6. Managing network services;
7. Managing server-based software;
8. Performing Root-Cause Analysis;
9. Preparing reports on computer-related operations;
10. Managing maintenance plan;
11. Managing ICT governance tools;
12. Preparing procurement plan of ICT systems and services;
13. Managing computer systems security;
14. Managing user technical support;
15. Training ICT systems' users on new technologies;
16. Managing computer networks in a business with multiple office environments;
17. Introducing emerging ICT solutions; and
18. Managing cloud computing based services.

These Occupational Standards have been clustered to fit into qualification levels i.e. NTA level 7 and 8.

4.0 VALIDITY PERIOD

The occupational standards will be valid for 3-5 years due to the fast-changing nature of technology. The review will proceed in the same manner as the previous one, with new occupational standards being developed based on current labor market Information.

5.0 OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR COMPUTER ENGINEERS NTA -8

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE MAINTENANCE PLAN	**DUTY NO.**	801
TASKTITLE	PREPARE MAINTENANCE PLAN	**TASK NO**	8011
Performance criteria	A person performing this task must be able to prepare maintenance plan as per industry standards and maintenance manual.		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Maintenance manual 2. Operating Systems resource monitors 3. Computer system This person will work independently.		

EVIDENCEREQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify ICT systems and services 2. Identify required manpower Develop maintenance plan	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Identify ICT systems and services 1.2. Identify required manpower 1.3. Develop maintenance plan **2.0. Principle** The person must be able to explain the principles of: 2.1. Identifying ICT systems and services; and required manpower 2.2. Developing maintenance plan **3.0. Theories** The person must be able to explain: 3.1. Types of maintenance plan 3.2. Developing maintenance plan **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Maintenance plan prepared as per industry standards and maintenance manual.

Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of computer system 2. Safe handling of software 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE MAINTENANCE PLAN	**DUTY NO.**	801
TASKTITLE	ASSESS IMPLEMENTATION SCHEDULE	**TASK NO**	8012
Performance criteria	A person performing this task must be able to assess implementation schedule as per industry standards and maintenance manual.		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Maintenance manual 2. Operating Systems resource monitors 3. Computer system This person will work independently.		

EVIDENCEREQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Review implementation schedule 2. Analyse implementation schedule 3. Create an assessment report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Review implementation schedule 1.2. Analyse implementation schedule Create an assessment report **2.0. Principle** The person must be able to explain the principles of: 2.1. Analysis of implementation schedule 2.2. Creating assessment report **3.0. Theories** The person must be able to explain: 3.1. Types of assessment report 3.2. Developing assessment report **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Implementation schedule assessed as per industry standards and maintenance manual.

Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of computer system 2. Safe handling of software 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE MAINTENANCE PLAN	**DUTY NO.**	801
TASKTITLE	PREPARE REPORT OF IMPLEMENTATION	**TASK NO**	8013
Performance criteria	A person performing this task must be able to prepare report of implementation as per industry standards and maintenance manual.		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Maintenance manual 2. Operating Systems resource monitors 3. Computer system The person will work independently		

EVIDENCEREQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Review implementation schedule 2. Analyze implementation schedule Create an assessment report	**Detailed knowledge about:** 1.0. **Methods** This person performing this task must be able to explain how to: 1.1. Scrutinize an assessment report 1.2. Extracts status of implementation schedule 1.3. Compile a report **2.0. Principle** The person must be able to explain the principles of: 2.1. Managing assessment report 2.2. Compiling implementation schedule report **3.0. Theories** The person must be able to explain: 3.1. Types of implementation schedule report 3.2. Developing implementation schedule report **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Report of implementation prepared as per industry standards and maintenance manual.

Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of computer system 2. Safe handling of software 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE ICT GOVERNANCE TOOLS	**DUTY NO.**	802
TASKTITLE	PREPARE ICT GOVERNANCE TOOLS	**TASK NO**	8021
Performance criteria	A person performing this task must be able to prepare ICT governance tools as per industry standards and ICT governance manual.		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. ICT governance manual 2. Operating Systems resource monitors 3. Computer system This person will work independently.		

EVIDENCEREQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify required ICT governance tools 2. Identify report structures of ICT governance tools Develop ICT governance tools	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: **1.1.** Identify required ICT governance tools **1.2.** Identify report structures of ICT governance tools **1.3.** Develop ICT governance tools **2.0. Principle** The person must be able to explain the principles of: 2.1. Managing ICT governance tools 2.2. Developing ICT governance tools **3.0. Theories** The person must be able to explain: 3.1. Types of ICT governance tools 3.2. Developing ICT governance tools **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	ICT governance tools prepared as per industry standards and maintenance manual.

Circumstantial knowledge	**Detailed knowledge about:** 4. Safe handling of computer system 5. Safe handling of software 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE ICT GOVERNANCE TOOLS	**DUTY NO.**	802
TASKTITLE	ASSESS IMPLEMENTATION OF ICT GOVERNANCE TOOLS	**TASK NO**	8022
Performance criteria	A person carrying out this task must be able to assess instruments that are necessary for proper governance of ICT at work places as per industry standards, international' standards and national guidelines		
Range statement	This task can be achieved in a client's office. The following equipment and tools should be available: 1. ICT Risk management standards 2. ICT structures manual 3. ICT Policies manuals 4. ICT Strategies Manual 5. Computer system 6. ICT Projects Management Manual 7. Relevant Software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Monitor implementation of ICT governance tools 2. Identify risk factors 3. Review resource management 4. Evaluate ICT governance tools 5. Create assessment report	**Detailed knowledge about:** 1.0. **Methods** This person performing this task must be able to explain how to: 1.1. Identify ICT Governance tools 1.2. Perform risk assessment 1.3. Manage ICT resources 1.4. Assess ICT Governance tools 1.5. Prioritize ICT Governance tools 1.6. Check the implementation of the tools 1.7. Report the implementation assessment **2.0. Principle** The person must be able to explain the principles of: 2.1. Resources Management 2.2. Risk Management 2.3. Value Delivery 2.4. Strategic Management 2.5. Performance Management **3.0. Theories** The person must be able to explain: 3.1. ICT risks assessments 3.2. ICT assets management 3.3. ICT balanced score card

	3.4. ICT Strategy and Plans 3.5. Value driven ICT services **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Instruments that are necessary for proper governance of ICT at work places assessed as per industry standards, international' standards and national guidelines
Circumstantial knowledge	**Detailed knowledge about:** 1. Engineering management 2. Organization Structures 3. ICT Controls 4. ICT procedures and rules 5. ICT Processes 6. Extent of responsibilities

<table>
<tr><td>OCCUPATION</td><td>COMPUTER ENGINEER</td><td>OCCUPATION CODE</td><td></td></tr>
<tr><td>DUTY TITLE</td><td>MANAGE ICT GOVERNANCE TOOLS</td><td>DUTY NO.</td><td>802</td></tr>
<tr><td>TASKTITLE</td><td>REVIEW OF GOVERNANCE ICT TOOLS</td><td>TASK NO</td><td>8023</td></tr>
<tr><td>Performance criteria</td><td colspan="3">A person carrying out this task must be able to review instruments that are necessary for proper governance of ICT at work places as per industry standards, international standards and national guidelines</td></tr>
<tr><td>Range statement</td><td colspan="3">This task can be achieved in a client’s office.
The following equipment and tools should be available:
1. ICT Risk management standards
2. ICT structures manual
3. ICT Policies manuals
4. ICT Strategies Manual
5. Computer
6. ICT Projects Management Manual
7. Relevant Software tools
This person will work independently</td></tr>
<tr><td colspan="4">EVIDENCE REQUIREMENTS</td></tr>
<tr><td colspan="2">PRACTICAL PERFORMANCE</td><td colspan="2">UNDERPINNING KNOWLEDGE</td></tr>
<tr><td colspan="2">The person should be able to review the:
1. Interpretation of assessment reports for implementation of ICT governance tools
2. Identification of technology changes
3. Identification of organization needs
4. Control of risk factors
5. Update of ICT governance tools</td><td colspan="2">Detailed knowledge about:
1.0. Methods
This person performing this task must be able to explain how to:
1.1. Review the implementation of ICT governance tools
1.2. Use ICT governance tools
1.3. Perform risk assessment review
1.4. Review ICT resources utilization
1.5. ICT governance tools relate with technology changes
1.6. Review the risk management strategies
1.7. Review organization ‘s ICT governance needs
1.8. Improve ICT governance tools

2.0. Principle
The person must be able to explain the principles of:
2.1. Resources Management
2.2. Risk Management
2.3. Value Delivery
2.4. Strategic Management
2.5. Performance Management

3.0. Theories
The person must be able to explain:</td></tr>
</table>

	3.1. ICT risks assessments 3.2. ICT assets management 3.3. ICT balanced score card 3.4. ICT Strategy and Plans 3.5. Value driven ICT services **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Instruments that are necessary for proper governance of ICT at work places reviewed as per industry standards, international' standards and national guidelines
Circumstantial knowledge	**Detailed knowledge about:** 1. Engineering management 2. Organization Structures 3. ICT Controls 4. ICT procedures and rules 5. ICT Processes 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	PREPARE PROCUREMENT PLAN OF ICT SYSTEMS AND SERVICES	**DUTY NO.**	803
TASKTITLE	REVIEW PROCUREMENT LISTS	**TASK NO**	8031
Performance criteria	A person carrying out this task must be able to review the list of ICT items to be procured as per industry standards and national guidelines		
Range statement	This task can be achieved in a client's office. The following equipment and tools should be available: 1. Procurement manuals 2. Designers' manuals 3. Manufacturers' manuals 4. Computer system 5. Standard Specifications Documents 6. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Examine 2. Compare 3. Organize	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Scrutinize the list of items to be procured 1.2. Differentiate the items 1.3. Prioritize the items 1.4. Compare with other lists 1.5. Organize the list 1.6. Prepare the review report **2.0. Principle** The person must be able to explain the principles of: 2.1. Procurement of ICT items 2.2. Review of list of ICT items **3.0. Theories** The person must be able to explain: 3.1. ICT Assets inventory 3.2. ICT Services Outsourcing 3.3. ICT Acquisition 3.4. ICT Development and Maintenance **4.0. Essential skills** 4.1. Problem solving skills

	4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	List of ICT items to be procured reviewed as per industry standards and national guidelines
Circumstantial knowledge	**Detailed knowledge about:** 1. ICT Services Management 2. Cloud computing services, etc. 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	PREPARE PROCUREMENT PLAN OF ICT SYSTEMS AND SERVICES	**DUTY NO.**	803
TASKTITLE	ASSESS ICT PROCUREMENT PLAN	**TASK NO**	8032
Performance criteria	A person carrying out this task must be able to assess the procurement plan as per industry standards and national guidelines		
Range statement	This task can be achieved in a client's office. The following equipment and tools should be available: 1. Procurement manuals 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Standard Specifications Documents 6. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Review procurement plan 2. Evaluate implementation of the plan 3. Create a report on implementation status	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Interpret procurement plan review report 1.2. Evaluate procurement plan implementation 1.3. Assess the implementation weaknesses 1.4. Recommend implementation improvement 1.5. Report on the implementation status **2.0. Principle** The person must be able to explain the principles of: 2.1. Procurement of ICT items 2.2. Evaluation of ICT procurement plan **3.0. Theories** The person must be able to explain: 3.1. ICT Assets inventory 3.2. ICT Services Outsourcing 3.3. ICT Acquisition 3.4. ICT Development and Maintenance **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills

	4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Procurement plan assessed as per industry standards and national guidelines
Circumstantial knowledge	**Detailed knowledge about:** 1. ICT Services Management 2. Cloud computing services, etc. 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	PREPARE PROCUREMENT PLAN OF ICT SYSTEMS AND SERVICES	**DUTY NO.**	803
TASKTITLE	COMPILE PROCUREMENT PLAN OF ICT SYSTEMS AND SERVICES	**TASK NO**	8033
Performance criteria	A person carrying out this task must be able to compile the procurement plan of ICT systems as per industry standards and national guidelines		
Range statement	This task can be achieved in a client's office. The following equipment and tools should be available: 1. Procurement manuals 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Standard Specifications Documents 6. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify system and services to be procured 2. Outline specifications 3. Prepare indicative prices 4. Compile a procurement list	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Gather systems requirements 1.2. Gather services requirements 1.3. Identify systems and services as per requirements 1.4. Obtain systems specifications 1.5. Obtain services specifications 1.6. Find indicative costs 1.7. Assign indicative costs 1.8. Organize the procurement list 1.9. Compile a procurement plan **2.0. Principle** The person must be able to explain the principles of: 2.1. Procurement of ICT items 2.2. Preparation of ICT procurement plan **3.0. Theories** The person must be able to explain: 3.1. ICT Assets inventory 3.2. ICT Services Outsourcing 3.3. ICT Acquisition 3.4. ICT Development and Maintenance

	4.0. Essential skills 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Procurement plan compiled as per industry standards and national guidelines
Circumstantial knowledge	**Detailed knowledge about:** 1. ICT Services Management 2. Cloud computing services, etc. 3. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER SYSTEMS SECURITY	**DUTY NO.**	804
TASKTITLE	DEVELOP SECURITY POLICIES AND STANDARDS	**TASK NO**	8041
Performance criteria	A person carrying out this task must be able to develop security policies and standards as per the industry standards, international standards, legislations and regulations		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. ISO security Standards 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Security tools 6. Security Laws 7. Security Regulations 8. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Set policies and standards for management security 2. Set operational security policies 3. Set physical security procedures 4. Identify common cyber attacks	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Gather operation information 1.2. Perform gap analysis between available and desired practice 1.3. Identify common cyber security attacks 1.4. Prioritize the attack vectors 1.5. Develop policies and standards for security management 1.6. Develop operational policies and standards 1.7. Develop standards and procedures for physical security **2.0. Principle** The person must be able to explain the principles of: 2.1. Information security management 2.2. Physical security management **3.0. Theories** The person must be able to explain: 3.1. Ethical Hacking 3.2. Penetration Testing 3.3. Vulnerability Assessment

	3.4. Intrusion detection and prevention 3.5. Threats hunting 3.6. Incidents response **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Security policies and standards developed as per the industry standards, international standards, legislations and regulations
Circumstantial knowledge	**Detailed knowledge about:** 1. Human risk behaviour 2. Cyber security attacks 3. Industrial espionage 4. Authentication and Authorization 5. Data leakage prevention 6. Critical information infrastructure protection 7. Protection of personally identifiable information 8. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER SYSTEMS SECURITY	**DUTY NO.**	804
TASKTITLE	IMPLEMENT SECURITY SYSTEM	**TASK NO**	8042
Performance criteria	A person carrying out this task must be able to implement security systems as per the industry standards, international standards, legislations and regulations		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. ISO security guidelines 2. Designers' manuals 3. Manufacturers' manuals 4. Networking tools 5. High end computers 6. Security hacking tools 7. Security Laws 8. Security Regulations 9. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify security tools 2. Identify security control measures 3. Customize the IT security solution for cyber attacks 4. Encrypt network nodes and access 5. Maintain confidentiality, privacy, quality, reliability and integrity	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Differentiate different ICT security tools 1.2. Use ICT security tools 1.3. Harden ICT systems security 1.4. Customize ICT security solutions 1.5. Maintain security of ICT devices 1.6. Maintain security of ICT systems users **2.0. Principle** The person must be able to explain the principles of: 2.1. Information security management 2.2. Physical security management **3.0. Theories** The person must be able to explain: 3.1. Ethical Hacking 3.2. Penetration Testing 3.3. Vulnerability Assessment 3.4. Intrusion detection and prevention 3.5. Threats hunting 3.6. Incidents response

	4.0. Essential skills 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Security systems to implemented as per the industry standards, international standards, legislations and regulations
Circumstantial knowledge	**Detailed knowledge about:** 1. Human risk behaviour 2. Cyber security attacks 3. Industrial espionage 4. Authentication and Authorization 5. Data leakage prevention 6. Critical information infrastructure protection 7. Protection of personally identifiable information 8. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER SYSTEMS SECURITY	**DUTY NO.**	804
TASK TITLE	IMPLEMENT PRIVACY PROCEDURES	**TASK NO**	8043
Performance criteria	A person carrying out this task must be able to implement privacy procedures as per the industry standards, international standards, legislations and regulations		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. ISO privacy guidelines 2. Designers' manuals 3. Manufacturers' manuals 4. Networking tools 5. High end computers 6. Security hacking tools 7. Security Laws 8. Security Regulations 9. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Track users' activities 2. Maintain physical site security to avoid unauthorized access (hacking) to close proximity 3. Restrict access to systems resources 4. Maintain network and devices inventory 5. Train staff on systems security	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Check if user's activities are tracked 1.2. Protect secondary site 1.3. Ensure there is authentication 1.4. Ensure that there is authorization 1.5. Manage Network Assets 1.6. Provide system security awareness **2.0. Principle** The person must be able to explain the principles of: 2.1. Information security management 2.2. Physical security management **3.0. Theories** The person must be able to explain: 3.1. Ethical Hacking 3.2. Penetration Testing 3.3. Vulnerability Assessment 3.4. Intrusion detection and prevention 3.5. Threats hunting 3.6. Incidents response

	3.7. Privacy protection **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Privacy procedures implemented as per the industry standards, international standards, legislations and regulations
Circumstantial knowledge	**Detailed knowledge about:** 1. Human risk behaviour 2. Cyber security attacks 3. Industrial espionage 4. Authentication and Authorization 5. Data leakage prevention 6. Critical information infrastructure protection 7. Protection of personally identifiable information 8. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER SYSTEMS SECURITY	**DUTY NO.**	804
TASK TITLE	ASSESS SECURITY SYSTEM	**TASK NO**	8044
Performance criteria	A person carrying out this task must be able to assess security system as per the industry standards, international standards, legislations and regulations		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. ISO security guidelines 2. Designers' manuals 3. Manufacturers' manuals 4. Networking tools 5. High end computers 6. Security assessment tools 7. Security Laws 8. Security Regulations 9. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Perform security testing 2. Interpret test results 3. Compile report on systems security	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Plan security testing 1.2. Communicate security testing 1.3. Implement security testing 1.4. Interpret test results 1.5. Recommend Improvement 1.6. Prepare test report 1.7. Present test report **2.0. Principle** The person must be able to explain the principles of: 2.1. Information security management 2.2. Physical security management **3.0. Theories** The person must be able to explain: 3.1. Ethical Hacking 3.2. Penetration Testing 3.3. Vulnerability Assessment 3.4. Intrusion detection and prevention

	3.5. Threats hunting 3.6. Incidents response **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/Services	Security system assessed as per the industry standards, international standards, legislations and regulations
Circumstantial knowledge	**Detailed knowledge about:** 1. Human risk behavior 2. Cyber security attacks 3. Industrial espionage 4. Authentication and Authorization 5. Data leakage prevention 6. Critical information infrastructure protection 7. Protection of personally identifiable information 8. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE USER TECHNICAL SUPPORT	**DUTY NO.**	805
TASK TITLE	CREATE TECHNICAL SUPPORT SYSTEM	**TASK NO**	8051
Performance criteria	A person carrying out this task must be able to create technical support system as per industry standards, designers' manuals and manufactures' manuals		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. Helpdesk manual 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Service Management tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Define technical support processes and procedures 2. Set guiding principles in supporting customers 3. Identify supporting technology 4. Propose acquisition of the proposed technologies	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Identify technical support processes 1.2. Identify ICT helpdesk procedures 1.3. Set ICT service management guidelines 1.4. Find helpdesk support technologies 1.5. Prepare technology purchase plan 1.6. Present helpdesk technology support plan **2.0. Principle** The person must be able to explain the principles of: ICT Services delivery and support **3.0. Theories:** The person must be able to explain: 3.1. ICT Support Agreement 3.2. ICT Services Management 3.3. ICT Support processes 3.4. Customer Management **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills

	4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/Services	Technical support system created as per industry standards, designers' manuals and manufactures' manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. ICT Service Delivery Principles 2. ICT Service Support Principles 3. ICT Service Management Processes 4. Customer care management 5. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE USER TECHNICAL SUPPORT	**DUTY NO.**	805
TASK TITLE	ASSESS TECHNICAL SUPPORT SYSTEM	**TASK NO**	8052
Performance criteria	A person carrying out this task must be able to assess technical support team as per industry standards, designers' manuals and manufactures' manuals		
Range statement	This task can be performed in a client's office. The following equipment and tools should be available: 1. Helpdesk manual 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Service Management tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Monitor performance of support team 2. Review user feedback 3. Evaluate the support team 4. Produce weekly and monthly management reports on technical support tickets	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Set performance standards of support team 1.2. Monitor the performance of the support team 1.3. Set customer feedback mechanism 1.4. Review feedback from customers 1.5. Evaluate the performance of the work done 1.6. Prepare management reports **2.0. Principle** The person must be able to explain the principles of: ICT Services delivery and support **3.0. Theories** The person must be able to explain: 3.1.ICT Support Agreement 3.2.ICT Services Management 3.3.ICT Support processes 3.4.Customer Management **4.0. Essential skills** 4.1.Problem solving skills 4.2.Communication skills 4.3.Report writing skills

	4.4.Analytical skills 4.5.Mathematics skills: algebra 4.6.Interpersonal skills 4.7.Teamwork
Description on the end products/service	Technical support team assessed as per industry standards, designers' manuals and manufactures' manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. ICT Service Delivery Principles 2. ICT Service Support Principles 3. ICT Service Management Processes 4. Customer care management 5. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	TRAIN ICT SYSTEMS' USERS ON NEW TECHNOLOGIES	**DUTY NO.**	806
TASK TITLE	CONDUCT TRAINING NEEDS ASSESSMENT OF ICT PROGRAM	**TASK NO**	8061
Performance criteria	A person carrying out this task must be able to conduct training needs assessment of ICT program as per industry standards, designers' manuals and manufactures' manuals		
Range statement	This task can be performed in a client's office. The following materials and tools should be available: 1. User's manual 2. Designers' manuals 3. Manufacturers' manuals 4. Computer 5. Corporate and ICT strategies 6. Performance report 7. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify system users 2. Identify training requirements 3. Document training needs	**Detailed knowledge about:** 1.0. **Methods** This person performing this task must be able to explain how to: 1.1. Identify different users of the system 1.2. Assess systems usage issues 1.3. Gather training requirements 1.4. Assess users training needs of ICT program 1.5. Document training needs assessment **2.0. Principle** The person must be able to explain the principles of: Training needs assessments **3.0. Theories** The person must be able to explain: 3.1. User training 3.2. Security awareness training 3.3. Trainers 's training program **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills

	4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Training needs assessment of ICT program conducted as per industry standards, designers' manuals and manufactures' manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. User Manual 2. ICT governance tools 3. Safe handling of equipment and tools 4. Safe handling of network devices 5. Safe handling of software 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	TRAIN ICT SYSTEMS' USERS ON NEW TECHNOLOGIES	**DUTY NO.**	806
TASK TITLE	CREATE TRAINING ACTION PLAN	**TASK NO**	8062
Performance criteria	A person carrying out this task must be able to create a training action plan as per industry standards		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Computer 2. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Plan ICT training 2. Train the trainers 3. Set clear and realizable deadlines and rollout methods 4. Implement training initiatives 5. Review training program	**Detailed knowledge about:** **1.0 Methods** This person performing this task must be able to explain how to: 1.1 Prepare training program 1.2 Prepare training materials 1.3 Facilitate training sessions for adult participants 1.4 Get feedback of training sessions **2.0 Principle** The person must be able to explain the principles of: 2.1 Conducting professional training 2.2 Training planning **3.0 Theories** The person must be able to explain: 3.1 Training delivery methods 3.2 Types of learners **4.0 Essential skills** 4.1 Problem solving skills 4.2 Communication skills 4.3 Report writing skills 4.4 Analytical skills 4.5 Mathematics skills: algebra 4.6 Interpersonal skills 4.7 Teamwork
Description on the end products/service	Training action plan created as per industry standards

Circumstantial knowledge	**Detailed knowledge about:** 1. User Manual 2. ICT governance tools 3. Safe handling of equipment and tools 4. Safe handling of network devices 5. Safe handling of software 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	TRAIN ICT SYSTEMS' USERS ON NEW TECHNOLOGIES	**DUTY NO.**	806
TASK TITLE	ASSESS ICT TRAINING PROGRAMS	**TASK NO**	8063
Performance criteria	A person carrying out this task must be able to assess ICT training programs as per industry standards		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Computer 2. Relevant software tools This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Monitor training program 2. Evaluate ICT training program 3. Revise ICT training program 4. Compile report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Set performance criteria 1.2. Gather data about training sessions 1.3. Analyze gathered data 1.4. Present findings **2.0. Principles** The person must be able to explain the principles of: 2.1. Conducting training research 2.2. Conducting professional training **3.0. Theories** The person must be able to explain: 3.1. Research methods 3.2. Presentation of training plans **4.0. . Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	ICT training programs assessed as per industry standards
Circumstantial knowledge	**Detailed knowledge about:** 1. User Manual 2. ICT governance tools 3. Safe handling of equipment and tools

	4. Safe handling of network devices 5. Safe handling of software 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER NETWORKS IN A BUSINESS WITH MULTIPLE OFFICE ENVIRONMENTS	**DUTY NO.**	807
TASKTITLE	MONITOR ENTERPRISE COMPUTER NETWORKS	**TASK NO**	8071
Performance criteria	A person carrying out this task must be able to monitor enterprise computer networks as per industry standards		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Manufacturers' manuals 2. Computer 3. Network tools kit 4. Network diagnostic tools 5. Relevant software tools 6. Other relevant equipment 7. Static-free workbench This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify network monitoring tools 2. Identify network aspects to be monitored 3. Create network performance benchmarks 4. Analyze gathered network data 5. Create a network monitoring report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Gather data on network 1.2. Measure performance aspects 1.3. Interpret measurements of monitoring tools 1.4. Create network monitoring report **2.0. Principle** The person must be able to explain the principles of: Network monitoring **3.0. Theories** The person must be able to explain: 3.1. Types of networks 3.2. Network monitoring methods and their steps 3.3. Types of network monitoring tools and their functions **4.0. Essential skills** 4.1. Problem solving skills

	4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Enterprise computer networks monitored as per industry standards
Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of equipment and tools 2. Safe handling of network devices 3. Safe handling of software 4. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER NETWORKS IN A BUSINESS WITH MULTIPLE OFFICE ENVIRONMENTS	**DUTY NO.**	807
TASKTITLE	TROUBLESHOOT ENTERPRISE COMPUTER NETWORKS	**TASK NO**	8072
Performance criteria	A person carrying out this task must be able to troubleshoot enterprise computer networks as per industry standards		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Manufacturers' manuals 2. Computer 3. Network tools kit 4. Network diagnostic tools 5. Relevant software tools 6. Other relevant equipment 7. Static-free workbench This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify network diagnostic tools 2. Run diagnostic test tools 3. Interpret diagnosis reports 4. Repair faulty computer network 5. Test repaired network 6. Compile report on repaired computer network	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Assemble network devices 1.2. Connect network devices 1.3. Visually inspect faulty network devices 1.4. Diagnose network devices 1.5. Interpret readings of network diagnostic tools 1.6. Change settings of network devices 1.7. Disconnect network devices **2.0. Principle** The person must be able to explain the principles of: 2.1. Network troubleshooting 2.2. Configuration of network devices **3.0. Theories:** The person must be able to explain: 3.1. Types of networks 3.2. Network troubleshooting methods and their steps 3.3. Types of network diagnostic tools and their functions

	4.0. Essential skills 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products	Enterprise computer networks monitored as per industry standards
Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of equipment and tools 2. Safe handling of network devices 3. Safe handling of software 4. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER NETWORKS IN A BUSINESS WITH MULTIPLE OFFICE ENVIRONMENTS	**DUTY NO.**	807
TASK TITLE	CONFIGURE ENTERPRISE COMPUTER NETWORKS	**TASK NO**	8073
Performance criteria	A person carrying out this task must be able to configure enterprise computer networks as per industry standards and designers' manuals		
Range statement	This task can be performed in a workshop or in a client's office. The following equipment and tools should be available: 1. Designers' manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify business requirements 2. Identify involved network devices 3. Customize settings of the involved network devices 4. Check the customized settings	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. View settings of network devices 1.2. Change settings of network devices **2.0. Principle** The person must be able to explain the principles of: 2.1. Network configuration **3.0. Theories** The person must be able to explain: 3.1. Types of networks 3.2. Types of networks devices and their functions 3.3. Device settings **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra

	4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Enterprise computer networks configured and functioning as per industry standards and designers' manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of equipment and tools 2. Safe handling of network devices 3. Safe handling of software 4. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE COMPUTER NETWORKS IN A BUSINESS WITH MULTIPLE OFFICE ENVIRONMENTS	**DUTY No.**	807
TASK TITLE	UPGRADE ENTERPRISE COMPUTER NETWORKS	**TASK NO**	8074
Performance criteria	A person carrying out this task must be able to upgrade enterprise computer networks as per industry standards and instruction manuals		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Designers' manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify requirements for upgrading the network 2. Identify network devices to be upgraded 3. Install advanced network devices 4. Customize settings of the installed devices 5. Test upgraded network	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Assemble network devices 1.2. Connect network devices 1.3. Install new version of firmware 1.4. Change settings of network devices 1.5. Disconnect network devices 1.6. Test the upgraded server-based software **2.0. Principle** The person must be able to explain the principles of: 2.1. Upgrading network devices 2.2. Upgrading firmware **3.0. Theories** The person must be able to explain: 3.1. Types of networks 3.2. Network technologies 3.3. Firmware **4.0. Essential skills** 4.1. Problem solving skills

	4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Enterprise computer networks upgraded and functioning as per industry standards and instruction manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Safe handling of equipment and tools 2. Safe handling of network devices 3. Safe handling of software 4. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	OCCUPATION CODE	
DUTY TITLE	INTRODUCE EMERGING ICT SOLUTIONS	**DUTY No.**	808
TASK TITLE	RESEARCH ON NEW ICT SOLUTIONS	**TASK NO**	8081
Performance criteria	A person carrying out this task must be able to conduct research on new ICT solutions as per industry standards		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Computer 2. Network tools kit 3. Technician toolkit 4. Relevant software tools 5. Relevant equipment This person will work independently.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify business needs 2. Identify ICT solutions 3. Appraise ICT solutions 4. Document findings	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Install new computer hardware and software 1.2. Change settings of installed computer hardware and software 1.3. Appraise installed computer hardware and software 1.4. Uninstall new computer hardware and software **2.0. Principle** The person must be able to explain the principles of: 2.1. New technology adoption 2.2. Researching for new ICT solutions 2.3. Installing computer hardware and software **3.0. Theories** The person must be able to explain: 3.1. Network ICT solutions and their features 3.2. New technology research methods **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills

	4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	New ICT solutions researched as per industry standards
Circumstantial knowledge	**Detailed knowledge about:** 1. New ICT introduction 2. New ICT solutions 3. New ICT research methods 4. New ICT rollout 5. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	INTRODUCE EMERGING ICT SOLUTIONS	**DUTY No.**	808
TASK TITLE	PLAN INTRODUCTION OF NEW ICT SOLUTIONS	**TASK NO**	8082
Performance criteria	A person carrying out this task must be able to plan introduction of new ICT solutions as per industry standards		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Computer 2. Network tools kit 3. Technician toolkit 4. Relevant software tools 5. Relevant equipment This person will work independently.		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Present research findings 2. Identify rollout methods 3. Identify resources needed 4. Set clear and realistic deadlines	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Interpret research findings on new ICT solutions 1.2. Outline activities required to rollout new ICT solutions 1.3. Set timelines for the activities required to rollout new ICT solutions 1.4. Outline milestones for rolling out new ICT solutions **2.0. Principle** The person must be able to explain the principles of: 2.1. New technology adoption 2.2. Planning of ICT solutions launching **3.0. Theories** The person must be able to explain: 3.1. Technology rollout methods 3.2. New technology rollout planning **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills

	4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Introduction of new ICT solutions planned as per industry standards
Circumstantial knowledge	**Detailed knowledge about:** 1. New ICT introduction 2. New ICT solutions 3. New ICT research methods 4. New ICT rollout 5. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	INTRODUCE NEW ICT SOLUTIONS	**DUTY No.**	808
TASK TITLE	CONDUCT TRAINING ON NEW ICT SOLUTIONS	**TASK NO**	8083
Performance criteria	A person carrying out this task must be able to conduct training on new ICT solutions as per industry standards		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Computer 2. Network tools kit 3. Technician toolkit 4. Relevant software tools 5. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify knowledge and skills gap 2. Prepare training program 3. Prepare training materials 4. Run training sessions 5. Create training report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Prepare training program 1.2. Prepare training materials 1.3. Facilitate training sessions for adult participants **2.0. Principle** The person must be able to explain the principles of: Conducting professional training **3.0. Theories:** The person must be able to explain: 3.1. Training delivery methods 3.2. Types of learners **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Training on new ICT solutions planned conducted as per industry standards

Circumstantial knowledge	**Detailed knowledge about:** 1. New ICT introduction 2. New ICT solutions 3. New ICT research methods 4. New ICT rollout 5. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE CLOUD COMPUTING BASED SERVICES	**DUTY No.**	809
TASK TITLE	BUILD CLOUD COMPUTING INFRASTRUCTURE AND APPLICATIONS	**TASK NO**	8091
Performance criteria	A person carrying out this task must be able to build cloud computing infrastructure and applications as per industry standards and instruction manuals		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Instruction manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify cloud computing services 2. Identify cloud computing infrastructure 3. Implement cloud computing infrastructure 4. Scale cloud computing infrastructure 5. Create cloud computing applications and services	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Configure computer network for cloud computing 1.2. Virtualize computing resources 1.3. Build Application Programming Interfaces (APIs) 1.4. Change settings of cloud computing architectures **2.0. Principle** The person must be able to explain the principles of: 2.1. Building cloud computing infrastructure 2.2. Data and service abstraction **3.0. Theories** The person must be able to explain: 3.1. Virtualization 3.2. Cloud computing infrastructure and its components 3.3. Types of cloud computing applications 3.4. Cloud computing architectures and their

	features **4.0. Essential skills** 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Cloud computing infrastructure and applications built and functioning as per industry standards and instruction manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Cloud computing technology 2. Virtualization 3. Safe handling of equipment and tools 4. Safe handling of network devices 5. Safe handling of software 6. Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE CLOUD COMPUTING BASED SERVICES	**DUTY No.**	809
TASK TITLE	DEPLOY CLOUD COMPUTING APPLICATIONS	**TASK NO**	8092
Performance criteria	A person carrying out this task must be able to deploy cloud computing applications as per industry standards and instruction manuals		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Instruction manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS	
PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify deployment platforms 2. Review security and compliance policies 3. Test cloud applications 4. Install cloud computing applications	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Configure computer networks for cloud computing 1.2. Change settings of deployment platforms 1.3. Install cloud applications 1.4. Change settings of cloud computing applications **2.0. Principle** The person must be able to explain the principles of: Installing cloud computing applications **3.0. Theories** The person must be able to explain: 3.1. Cloud platforms and their features 3.2. Cloud infrastructure and its components 3.3. Types of cloud computing applications 3.4. Cloud computing architectures and their features **4.0. Essential skills** 4.1. Problem solving skills

	4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Cloud computing applications deployed and functioning as per industry standards and instruction manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Cloud computing technology 2. Virtualization 3.Safe handling of equipment and tools 4.Safe handling of network devices 5.Safe handling of software 6.Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE CLOUD COMPUTING BASED SERVICES	**DUTY No.**	809
TASK TITLE	CONFIGURE CLOUD COMPUTING APPLICATIONS AND SERVICES	**TASK NO**	8093
Performance criteria	A person carrying out this task must be able to configure cloud computing applications as per industry standards and instruction manuals		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Instruction manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify business requirements 2. Identify involved applications and services 3. Customize settings of the applications and services 4. Test the customized settings 5. Prepare cloud computing configuration report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Perform data backup 1.2. Change settings of deployment platforms 1.3. Change settings of cloud computing applications 1.4. Test the configured cloud computing applications **2.0. Principle** The person must be able to explain the principles of: 2.1. Configuring cloud computing applications 2.2. Data backup **3.0. Theories** The person must be able to explain: 3.1. Cloud platforms and their features 3.2. Cloud infrastructure and its components 3.3. Types of cloud computing applications 3.4. Cloud computing architectures and their features

	4.0. Essential skills 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Cloud computing applications configured and functioning as per industry standards and instruction manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Cloud computing technology 2. Virtualization 3.Safe handling of equipment and tools 4.Safe handling of network devices 5.Safe handling of software 6.Extent of responsibilities

OCCUPATION	COMPUTER ENGINEER	**OCCUPATION CODE**	
DUTY TITLE	MANAGE CLOUD COMPUTING BASED SERVICES	**DUTY No.**	809
TASK TITLE	MONITOR CLOUD COMPUTING APPLICATIONS AND SERVICES	**TASK NO**	8094
Performance criteria	A person carrying out this task must be able to monitor cloud computing applications and services as per industry standards and instruction manuals		
Range statement	This task can be achieved in a workshop or in a client's office. The following equipment and tools should be available: 1. Instruction manuals 2. Computer 3. Network tools kit 4. Technician toolkit 5. Relevant software tools 6. Relevant equipment This person will work independently		

EVIDENCE REQUIREMENTS

PRACTICAL PERFORMANCE	**UNDERPINNING KNOWLEDGE**
The person should be able to: 1. Identify required tools 2. Setup performance metrics 3. Gather performance data 4. Analyze gathered performance data 5. Create performance monitoring report	**Detailed knowledge about:** **1.0. Methods** This person performing this task must be able to explain how to: 1.1. Gather data on cloud computing applications and services 1.2. Measure performance aspects of cloud computing applications and services 1.3. Interpret measurements of monitoring tools 1.4. Create cloud computing applications and services monitoring report **2.0. Principle** The person must be able to explain the principles of: Monitoring cloud computing applications and services **3.0. Theories** The person must be able to explain: Cloud platforms and their features 3.1. Cloud infrastructure and its components 3.2. Types of cloud computing applications 3.3. Cloud computing architectures and their features

	4.0. Essential skills 4.1. Problem solving skills 4.2. Communication skills 4.3. Report writing skills 4.4. Analytical skills 4.5. Mathematics skills: algebra 4.6. Interpersonal skills 4.7. Teamwork
Description on the end products/service	Cloud computing applications and services monitored and functioning as per industry standards and instruction manuals
Circumstantial knowledge	**Detailed knowledge about:** 1. Cloud computing technology 2. Virtualization 3.Safe handling of equipment and tools 4.Safe handling of network devices 5.Safe handling of software 6.Extent of responsibilities

TABLE 1: DACUM CHARTS FOR COMPUTER ENGINEERS NTA 8

DUTIES	TASKS	ENABLERS
1.0. Manage maintenance plan	1.1. Prepare maintenance plan 1.2. Assess implementation schedule 1.3. Prepare report of implementation	**Generic Skills and Knowledge** • Skills on database technologies • Skills on computer networks • Skills on hardware • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Diagnostic tools • Technician toolbox • MySQL. • SQL Server Management Studio. • DevOpsTools • Visual Studio Code • Enterprise Service Management (ESM) Tools. • PhpMyAdmin Tool. • Computer **Materials** Data, computer, etc. **Work Behaviors** • Patience • Meticulous attention to detail • A logical approach to work
2.0. Manage ICT governance tools	2.1. Prepare ICT governance tools 2.2. Assess implementation of ICT governance tools	**Generic Skills and Knowledge** • ICT management skills • Engineering ethics • Human resource management • Engineering management • Risk management skills • Computer skills on hardware

DUTIES	TASKS	ENABLERS
		and software • Skills and knowledge in testing, recording and interpretation of findings in computer systems • Learning and research skills • Leadership and decision making skills • Audio/visual/written presentation skills • Communication and report writing skills to prepare • Analytical skills **Tools and Equipment** • ICT inventory • Policy manual • Insurance policy **Work Behaviors** Team work Time management
	2.3. Review of governance ICT tools	
3.0. Prepare procurement plan of ICT systems and services	3.1. Review procurement lists	**Generic Skills and Knowledge** • Basic computer skills on hardware and software • Engineering economics • Hands on experience in testing, recording and interpretation of findings in computer systems • Communication and report writing skills to prepare • Analytical skills **Tools and Equipment** • Procurement manual **Work Behaviors** Team work Time management
	3.2. Assess ICT procurement plan	
	3.3. Compile procurement plan of ICT systems and services	
4.0. Manage computer systems security	4.1. Develop security policies and standards	**Generic Skills and Knowledge**

DUTIES	TASKS	ENABLERS
	4.2. Implement security system 4.3. Implement safety procedures 4.4. Assess security system	• Cyber security • Skills on database technologies • Skills on computer networks • Skills on hardware • Basic skills on Operating Systems • Basic skills on Cyber Security • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Computer **Materials** Data **Work Behaviors** • Patience • Meticulous attention to detail • A logical approach to work
5.0. Manage user technical support	5.1. Create technical support system 5.2. Formulate job description of technical support team 5.3. Assess technical support system	**Generic Skills and Knowledge** • Skills on database technologies • Skills on computer networks • Skills on hardware • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Diagnostic tools • Technician toolbox • MySQL. • SQL Server Management Studio. • DevOpsTools • Visual Studio Code • Enterprise Service

DUTIES	TASKS	ENABLERS
		Management (ESM) Tools. • PhpMyAdmin Tool. • Computer **Materials** • Data **Work Behaviors** • Patience • Meticulous attention to detail • A logical approach to work
6.0. Train ICT systems' users on new technologies	6.1. Conduct Training Needs Assessment of ICT program 6.2. Create training action plan 6.3. Assess ICT training program	**Generic Skills and Knowledge** • Training skills • Skills on database technologies • Skills on computer networks • Skills on hardware • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Diagnostic tools • Technician toolbox • MySQL. • SQL Server Management Studio. • DevOpsTools • Visual Studio Code • Enterprise Service Management (ESM) Tools. • PhpMyAdmin Tool. • Computer • Projector • Printer **Materials** • Data **Work Behaviors** • Patience • Meticulous attention to detail

DUTIES	TASKS	ENABLERS
		• A logical approach to work
7.0. Manage computer networks in a business with multiple office environments	7.1. Monitor enterprise computer networks 7.2. Troubleshoot enterprise computer networks 7.3. Configure enterprise computer networks 7.4. Upgrade enterprise computer networks	**Generic Skills and Knowledge** • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Operating Systems resource monitors **Materials** • User profiles • User management manual **Work Behaviors** • Team work • Time management
8.0. Introduce emerging ICT solutions	8.1. Research on new ICT solutions 8.2. Plan introduction of ICT solutions 8.3. Conduct training on new ICT solutions	**Generic Skills and Knowledge** • Skills on research • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Operating Systems resource monitors **Materials** • User profiles • User management manual

DUTIES	TASKS	ENABLERS
		Work Behaviors • Team work • Time management
9.0. Manage cloud computing based services	9.1. Build cloud computing infrastructure and applications 9.2. Deploy cloud computing applications 9.3. Configure cloud computing applications and services 9.4. Monitor cloud computing applications and services	**Generic Skills and Knowledge** • Knowledge on development environments i.e. Azure Cloud Services, Huawei Cloud Services or Alibaba Cloud Services • Visual Studio skills. • Knowledge on cloud deployment applications languages like NET, Java, Node.js, PHP, Python or Ruby • Basic skills on Operating Systems • Basic skills on Cyber Security • Basic skills on scripting languages • Communication and report writing skills • Analytical skills • Problem solving skills • Ethical skills **Tools and Equipment** • Cloud Operating Systems resource monitors **Materials** • User profiles • User management manual