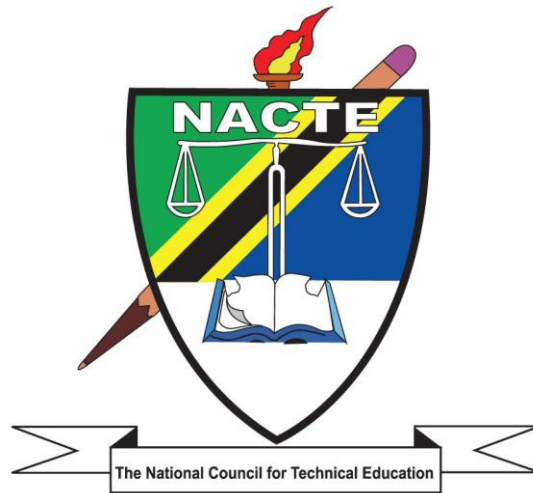


**THE NATIONAL COUNCIL FOR TECHNICAL AND VOCATIONAL EDUCATION AND
TRAINING**



OCCUPATIONAL STANDARDS

OCCUPATION: SOFTWARE ENGINEERING TECHNICIAN

LEVEL: NTA LEVEL 5

FEBRUARY 2024

TABLE OF CONTENTS

ABBREVIATIONS	ii
GLOSSARY OF TERMS	iii
1.0. INTRODUCTION	1
2.0. OCCUPATIONAL STANDARD DEVELOPMENT PROCESS	2
3.0. THE SCOPE AND OVERVIEW OF THE OCCUPATION STANDARDS FOR SOFTWARE ENGINEERING TECHNICIANS	2
4.0. VALIDITY PERIOD	3
5.0. OCCUPATIONAL STANDARDS	4
5.1 OCCUPATIONAL STANDARDS FOR SOFTWARE ENGINEERING TECHNICIAN - NTA LEVEL 5....	4
APPENDIX: DACUM CHARTS FOR SOFTWARE ENGINEERING TECHNICIAN - NTA LEVEL 5	26

ABBREVIATIONS

CBET	Competency Based Education and Training
CSS	Cascading Style Sheets
DCL	Data Control Language
DDL	Data Definition Language
DIV	Division
DML	Data Manipulation Language
DQL	Data Query Language
HTML	Hypertext Mark-up Language
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
JDK	Java Development Kit
LVM	Logical volume management
NACTVET	National Council for Technical and Vocational Education and Training
NOS	National Occupational Standards
OS	Occupational Standards
RAM	Random Access Memory
RAID	Redundant Array of Independent Disks
RPM	Redhat Package Manager
SQL	Structured Query Language
TCP	Transmission Control Protocol
TET	Technical Education and Training
TPS	Transactions Per Second
TVET	Technical and Vocational Education and Training
UI	User Interface
UML	Unified Modelling Language
URL	Uniform Resource Locator
WEB	World Wide Web

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 programme 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 Area:	This is a broad grouping of related jobs. (Example: food service)
Occupational Competence:	The application of knowledge and skills that consistently meet the standards required by the work context.
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 a performance tool of assessment of the prescribed outcomes.
Occupational/Job Analysis:	A process used to identify the tasks that are important to employees in any given occupation.
Performance Criteria:	Indicate expected end results or outcomes in the form of evaluative statements.

Skills:	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.
Standards:	A set of statements, 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, circumstantial knowledge, attitudes, performance standards, tools and materials needed, as well as safety concerns required for the employees performing it.
Task:	A work activity that has a definite beginning and ending, is observable or measurable, and consists of two or more definite steps that leads to a product, service, or decision.
Underpinning Knowledge:	Crucial knowledge that an individual must acquire in order to demonstrate competences that are associated in performing a given task.
Verification Process:	The process of having experts review and confirm 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.

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, with a high level of human development. This requires a skilled workforce that is aligned with the needs of the public and private sectors of the economy. The National Council for Technical and Vocational Education and Training (NACTVET) has begun the job of drafting Occupational Standards (OS) that will eventually be adopted as National Occupational Standards (NOS) for use in the delivery of TET that meets the needs of the labour market and the country's economic agenda.

Occupational Standards (OS) are performance criteria that are matched with labour market demands. Each of them describes the functions, performance standards, and understanding or knowledge underpinning a given occupation. They combine skills, knowledge, and attitudes to describe best practice. They are useful tools for establishing job roles, personnel recruitment, supervision, and appraisal, as well as TET Standards. They are also helpful for benchmarking and harmonizing job 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 application across all public and private institutions.

However, it must be noted that Occupational Standards are different from Training /Education Standards. Occupational standards are defined in terms of activities performed by a person in a selected occupation (e.g., an electrical engineer designs electrical circuits, performs troubleshooting in electrical circuits, etc.), and are usually defined by Employers following procedures as agreed upon by all the stakeholders. On the other hand, Training and Education Standards are developed from the activities defined in the occupational standards, and they specify learning objectives to ensure that the necessary skills and knowledge are developed by a person to enable him/her to function at an agreed level in an occupation. Training and Education Standards are used to define curricula in training institutions. It is critical, however, to establish a direct link between the occupational standards and the training standards for both of them to respond collaboratively to the demands of the labour market.

For the purpose of TET delivery, Tanzania has adopted the Competence Based Education and Training (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) programmes. Therefore, it is quite pertinent for TET institutions to use the relevant occupational standards as a benchmark for formulating their curricula.

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.

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 process of developing these Occupational Standards involved both local and international expertise. The process began with an examination of major documents that guide Tanzanian skills development including the *10-year National Skills Development Strategy (2016-2026)*. NACTVET 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 team of experts in consultation with practitioners developed draft occupational standards. The draft document was used to develop an occupational profile for each occupation (DACUM Chart), which is attached as an **Appendix** to every Occupational Standard.

The occupational standards were validated during the stakeholders' forum held on 22nd and 23rd February 2024 at Morogoro. The information from the stakeholders' forum provides insight from the workplace, professional bodies, regulatory bodies and sector ministries regarding trends and changes in the profession, including how well graduates are prepared for working in the occupation.

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

The standards cover a broad range of duties and tasks that can be performed by a Software Engineering Technician. However, the occupational standards are not meant to replace individual job descriptions. Instead, they are to be used for guidance in defining skill levels and knowledge for the technician in specific settings or positions. The Software Engineering Technician 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. The Software Engineering Technicians shall conduct computer software research, demand analysis, design, coding, testing, maintenance, management and other tasks under the supervision of Software Engineers. Generally, the Software Engineering Technician performs the following responsibilities:

- a) Operation of office software
- b) Installation of the Linux operating system
- c) Installation, update and deletion of Linux software
- d) Building Web server environment in the Linux system
- e) Writing Linux Shell script for automation
- f) Design of responsive webpage layout
- g) Use of CCS to beautify the webpage layout
- h) Writing webpage interaction script using JavaScript
- i) Use of CSS and JS frameworks for Web front-end development
- j) Programming HTML5 page
- k) Building small-scale local area network
- l) Troubleshooting network faults
- m) Design of database
- n) Programming and optimizing SQL language
- o) Developing dynamic website
- p) Programming using the object-oriented concept
- q) Programming and managing software development documents
- r) Conducting function test, automation test and performance test of the website using testing tools or by coding

The Occupational Standards have been clustered into NTA qualification levels, i.e. NTA level 4, 5 and 6.

4.0 VALIDITY PERIOD

Due to the rapid development of technology, the validity period of occupational standards is 3-5 years. The review will proceed in the same manner as the one before it, with new occupational standards being developed based on current trends of the labour market.

5.0 OCCUPATIONAL STANDARDS

5.1 OCCUPATIONAL STANDARDS FOR SOFTWARE ENGINEERING TECHNICIAN - NTA LEVEL 5

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	DESIGN PROGRAMMING USING THE OBJECT-ORIENTED CONCEPT	DUTY NO.	501
TASK TITLE	DESIGN AN OBJECT-ORIENTED PROGRAM STRUCTURE	TASK NO.	5011
PERFORMANCE CRITERIA	The person performing this task must be able to design the object-oriented program structure in accordance with business requirements.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. UML drawing tool. 4. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Acquire the requirements; 4. Analyse the system; 5. Draw UML diagrams;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Acquire the requirements; 1.2 Analyse the system 1.3 Design the object-oriented program structure using UML diagrams. 2.0 Principles	

<p>6. Design the object-oriented program structure.</p> <p>7. Observe health, occupational and environmental safety, rules and regulations</p>	<p>The person performing this task must be able to explain the following principles:</p> <p>2.1 Design principles of object-oriented programs.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Design of the object-oriented program structure using UML diagrams.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	<p>The object-oriented program structure is designed in accordance with business requirements.</p>
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Specifications and precautions for code development; 2. Scope of duties; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	DESIGN PROGRAMMING USING THE OBJECT-ORIENTED CONCEPT	DUTY NO.	501
TASK TITLE	WRITE AN OBJECT-ORIENTED PROGRAM	TASK NO.	5012
PERFORMANCE CRITERIA	The person performing this task must be able to write the object-oriented program in accordance with business requirements.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Object-oriented program development software; 4. JDK. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Build a software running environment for object-oriented program development; 4. Write the object-oriented program using the object-oriented concept; 5. Debug the code.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Build a software running environment for object-oriented program development; 1.2 Conduct programming development to achieve project functions; 1.3 Debug the code. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Object-oriented design patterns; 2.2 Object-oriented inheritance principles;	

6. Observe health, occupational and environmental safety, rules and regulations	<p>2.3 Object-oriented encapsulation principles;</p> <p>2.4 Object-oriented polymorphism principles.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Methods and steps of programming using the object-oriented concept.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	The object-oriented program is written in accordance with business requirements.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Specifications and precautions for code development; 2. Scope of duties; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	MAKE DYNAMIC WEBPAGES	DUTY NO.	502
TASK TITLE	USE CSS WRITING TO STYLE WEB PAGES	TASK NO.	5021
PERFORMANCE CRITERIA	The person performing this task must be able to write CSS to style web pages in accordance with the business requirements of dynamic webpage making.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Webpage integrated development software; 4. Browsers. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Construct the runtime environment for webpage integrated development software; 4. Create HTML pages; 5. Write CSS to style web pages; 6. View page effects in the browser. 7. Observe health, occupational and environmental safety, rules and regulations		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install webpage integrated development software; 1.2 Build and layout HTML pages; 1.3 Write CSS. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Principles for using CSS selectors. 3.0 Theories	

	<p>The person performing this task must be able to explain the following:</p> <p>3.1 HTML page layout technology;</p> <p>3.2 CSS webpage beautification technology.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	CSS is written to style webpages in accordance with the business requirements of dynamic webpage making.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Specifications and precautions for code development; 2. Scope of duties; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	MAKE DYNAMIC WEBPAGES	DUTY NO.	502
TASK TITLE	DESIGN RESPONSIVE ELASTIC LAYOUT	TASK NO.	5022
PERFORMANCE CRITERIA	The person performing this task must be able to design responsive elastic layout in accordance with the business requirements of dynamic webpage making.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: <div><div>1.</div>Computers; <div>2.</div>Office software; <div>3.</div>Webpage integrated development software; <div>4.</div>Browsers. <div>5.</div>Safety gear</div>		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: <div><div>1.</div>Observe computer safety operating procedures when performing tasks; <div>2.</div>Select appropriate tools and equipment; <div>3.</div>Construct the runtime environment for webpage integrated development software; <div>4.</div>Create HTML pages; <div>5.</div>Write the code of responsive elastic layout framework; <div>6.</div>Use browser to simulate and display the page effect of different terminals.</div>		<div>Detailed knowledge about:</div> <div>1.0 Methods</div> <div>The person performing this task must be able to explain how to:</div> <div><div>1.1</div>Install webpage integrated development software; <div>1.2</div>Build and layout HTML pages; <div>1.3</div>Write the code of responsive elastic layout framework; <div>1.4</div>Use browser to simulate and display the page effect of different terminals.</div> <div>2.0 Principles</div> <div>The person performing this task must be able to explain the following principles:</div>	

7. Observe health, occupational and environmental safety, rules and regulations	<p>2.1 Realization principles of elastic layout;</p> <p>2.2 Webpage response rules for different terminals.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Realization steps of responsive elastic layout.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	The responsive elastic layout is designed in accordance with business requirements.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <p>1. Specifications and precautions for code development;</p> <p>2. Scope of duties;</p> <p>3. Occupational health and safety.</p>

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	MAKE DYNAMIC WEBPAGES	DUTY NO.	502
TASK TITLE	WRITE WEBPAGE INTERACTION SCRIPT USING JAVASCRIPT	TASK NO.	5023
PERFORMANCE CRITERIA	The person performing this task must be able to write webpage scripts and realize user interaction in accordance with the business requirements of dynamic webpage making.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Webpage integrated development software; 4. Browsers. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Construct the runtime environment for webpage integrated development software; 4. Create HTML pages; 5. Write JavaScript webpage script code to respond to user operations; 6. View page effects in the browser.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install webpage integrated development software; 1.2 Build and layout HTML pages; 1.3 Write webpage interaction scripts using JavaScript; 1.4 View, test, and improve page effects via the browser. 2.0 Principle The person performing this task must be able to explain the following principles:	

7. Observe health, occupational and environmental safety, rules and regulations	<p>2.1 JavaScript event principles;</p> <p>2.2 JavaScript event processing runtime principles.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Event manipulation of DOM elements.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	JavaScript webpage scripts are written according to business requirements to respond to user actions.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Specifications and precautions for code development; 2. Scope of duties; 3. Security and vulnerability; 4. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CONDUCT DATABASE OPERATION	DUTY NO.	503
TASK TITLE	DESIGN DATABASE	TASK NO.	5031
PERFORMANCE CRITERIA	The person performing this task should be able to design the database and tables according to business requirements and database specifications.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Database system software; 4. Database visual management software. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment for the task; 3. Install database system software and build a database operating environment; 4. Install database visual management software; 5. Design database and table structure according to business requirements and database specifications, and develop table fields; 6. Connect to local or remote database systems through database visual management software; 7. Create database instances in the database		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install the operating environment for the database; 1.2 Design database and table structure, and develop table fields; 1.3 Create database and table instances. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 Theory of three paradigms of database; 2.2 SQL syntax for database and table creation.	

<p>system;</p> <p>8. Create a table structure in the database instance;</p> <p>9. Create table data and test it.</p> <p>10. Observe health, occupational and environmental safety, rules and regulations</p>	<p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Database design specifications.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
<p>DESCRIPTION OF THE END PRODUCT / SERVICE</p>	<p>Databases and tables are created in accordance with business requirements and database design specifications.</p>
<p>CIRCUMSTANTIAL KNOWLEDGE</p>	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Scope of duties; 2. Security and vulnerability; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CONDUCT DATABASE OPERATION	DUTY NO.	503
TASK TITLE	WRITE SQL STATEMENTS	TASK NO.	5032
PERFORMANCE CRITERIA	The person performing this task should be able to write SQL statements according to business requirements and database specifications.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Database system software; 4. Database visual management software. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment for the task; 3. Install database system software and build a database operating environment; 4. Install database visual management software; 5. Connect to local or remote database systems through database visual management software;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install the operating environment for the database; 1.2 Write SQL statements. 2.0 Principle The person performing this task must be able to explain the following principles: 2.1 SQL syntax. 3.0 Theories	

<p>6. Write SQL statements in database visual management software, including DDL, DML, DQL, and DCL statements;</p> <p>7. Execute SQL statements and test them.</p> <p>8. Observe health, occupational and environmental safety, rules and regulations</p>	<p>The person performing this task must be able to explain the following:</p> <p>3.1 SQL operation database.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	<p>The SQL statements that return to the correct results are written in accordance with business requirements and database specifications.</p>
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Scope of duties; 2. Security and vulnerability; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CONDUCT DATABASE OPERATION	DUTY NO.	503
TASK TITLE	PERFORM SQL STATEMENT OPTIMIZATION	TASK NO.	5033
PERFORMANCE CRITERIA	The person performing this task should optimize SQL statements according to business requirements and database specifications.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Computers; 2. Office software; 3. Database system software; 4. Database visual management software. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment for the task; 3. Install database system software and build a database operating environment; 4. Install database visual management software; 5. Connect to local or remote database systems through database visual management software;		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Install the operating environment for the database; 1.2 Optimize SQL statements through the EXPLAIN command. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 Principle of optimizing SQL; 2.2 The EXPLAIN command in SQL syntax.	

<p>6. Analyse SQL statements through the EXPLAIN command in the database visual management software, and optimize SQL statements based on the returned results;</p> <p>7. Verify the correctness and efficiency of the optimized SQL statements.</p> <p>8. Observe health, occupational and environmental safety, rules and regulations</p>	<p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Technologies for optimizing SQL statements.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	The SQL statements optimization is conducted in accordance with business requirements and database specifications.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <ol style="list-style-type: none"> 1. Scope of duties; 2. Security and vulnerability; 3. Occupational health and safety.

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT MAINTENANCE OF THE LINUX SYSTEM ENVIRONMENT	DUTY NO.	504
TASK TITLE	MANAGE RPM SOFTWARE PACKAGE	TASK NO.	5041
PERFORMANCE CRITERIA	The person performing this task must be able to manage the RPM software package based on the sequential dependency principle and business requirements.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Windows operating system; 2. Linux operating system; 3. Virtual machine software; 4. Remote connection tools. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Install local sources; 4. Configure network sources; 5. Install the software package; 6. Update the software package; 7. Uninstall the software package.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Configure different software sources; 1.2 Manage RPM software package. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 The sequential dependency principle of the installation package;	

8. Observe health, occupational and environmental safety, rules and regulations	<p>2.2 The principle of C/S architecture;</p> <p>2.3 The specifications of release version of Linux.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 Reasons for circular dependency errors and related solutions;</p> <p>3.2 Possible failure reasons for installing software;</p> <p>3.3 Maintenance and operating policies of software system;</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	The software is installed, updated, and uninstalled according to business requirements.
CIRCUMSTANTIAL KNOWLEDGE	<p>Detailed knowledge about:</p> <p>1. Occupational health and cybersecurity specifications.</p>

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT MAINTENANCE OF THE LINUX SYSTEM ENVIRONMENT	DUTY NO.	504
TASK TITLE	CONSTRUCT WEB SERVER ENVIRONMENT	TASK NO.	5042
PERFORMANCE CRITERIA	The person performing this task must be able to construct the server environment based on the principles of the C/S architecture and business requirements.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Windows operating system; 2. Linux operating system; 3. Virtual machine software; 4. Remote connection tools. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Configure network sources; 4. Install and configure the software packages; 5. Deploy the service codes; 6. Test the running environment of the server.		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Configure the network fundamental environment; 1.2 Configure server-side software; 1.3 Deploy server-side codes. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 The principle of C/S architecture;	

<p>7. Observe health, occupational and environmental safety, rules and regulations</p>	<p>2.2 HTTP protocol and request-response principle; 2.3 Cybersecurity group policies and terminals; 2.4 The specifications of release version of Linux.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 HTTP status codes; 3.2 Automotive starting of background process after start-up; 3.3 Possible reasons for service access failures; 3.4 Maintenance and operating policies of software system.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills; 4.2 Teamwork skills; 4.3 Time management.</p>
<p>DESCRIPTION OF THE END PRODUCT / SERVICE</p>	<p>The running environment of Web server is constructed according to business requirements.</p>
<p>CIRCUMSTANTIAL KNOWLEDGE</p>	<p>Detailed knowledge about:</p> <p>1. Occupational health and cybersecurity specifications.</p>

OCCUPATION	SOFTWARE ENGINEERING TECHNICIAN	OCCUPATION CODE	
DUTY TITLE	CARRY OUT MAINTENANCE OF THE LINUX SYSTEM ENVIRONMENT	DUTY NO.	504
TASK TITLE	WRITE AUTOMATION SHELL SCRIPTS	TASK NO.	5043
PERFORMANCE CRITERIA	The person performing this task must be able to write Shell scripts according to the syntax specifications for Shell script and business requirements.		
RANGE STATEMENT	The task can be performed in the computer room under the supervision of senior software engineering technicians or software engineers. The tools and equipment to be used include: 1. Windows operating system; 2. Linux operating system; 3. Virtual machine software; 4. Remote connection tools. 5. Safety gear		
EVIDENCE REQUIREMENT			
PRACTICAL PERFORMANCE		UNDERPINNING KNOWLEDGE	
The person performing this task must be able to do the following: 1. Observe computer safety operating procedures when performing tasks; 2. Select appropriate tools and equipment; 3. Configure network sources; 4. Install and configure editors; 5. Write script codes of Shell; 6. Configure script permissions of Shell; 7. Test the running effect of Shell scripts. 8. Observe health, occupational and environmental safety, rules and regulations		Detailed knowledge about: 1.0 Methods The person performing this task must be able to explain how to: 1.1 Configure the development environment of scripts; 1.2 Write script codes of Shell. 2.0 Principles The person performing this task must be able to explain the following principles: 2.1 The working principles of Shell scripts;	

	<p>2.2 The permission management principles of document Linux;</p> <p>2.3 The specifications of release version of Linux.</p> <p>3.0 Theories</p> <p>The person performing this task must be able to explain the following:</p> <p>3.1 The basic composition of the scripts of Shell;</p> <p>3.2 Internal commands of bash;</p> <p>3.3 Maintenance and operating policies of software system.</p> <p>4.0 Essential Skills</p> <p>4.1 Communication skills;</p> <p>4.2 Teamwork skills;</p> <p>4.3 Time management.</p>
DESCRIPTION OF THE END PRODUCT / SERVICE	<p>The Shell scripts are written and the automated tasks are performed in accordance with the business requirements.</p>
	<p>Detailed knowledge about:</p> <p>1. Occupational health and cybersecurity specifications.</p>

**APPENDIX: DACUM CHARTS FOR SOFTWARE ENGINEERING TECHNICIAN - NTA
LEVEL 5**

DUTYS	TASKS	ENABLERS
1.0 Design programming using the object-oriented concept	1.1 Design an object-oriented program structure.	General skills and knowledge <ul style="list-style-type: none"> • Diagram drawing of UML • Object-oriented design patterns • Object-oriented programming to design language syntax • Object-oriented inheritance, encapsulation and polymorphism characteristics • Program code specification skills • Program debugging and problem handling Tools and equipment <ul style="list-style-type: none"> • Intel I5 and higher-level processors • Memory of 8GB and above • Hard disk with a capacity of 500GB and above Materials <ul style="list-style-type: none"> • Commonly-used operating systems such as Windows, Linux and so on • Office software • Virtual machine environments • Object-oriented program development software • JDK Requirements for employees
	1.2 Write an object-oriented program.	

		<ul style="list-style-type: none"> • Teamwork spirit • Integrity • Time management • Self-motivation • Clear verbal expression • Working hard
2.0 Make dynamic webpages	2.1 Use CSS writing to style web pages.	General skills and knowledge <ul style="list-style-type: none"> • Use of webpage integrated development software • The static webpage development of HTML • Use of CSS selectors • Introduction of responsive elastic layout • Writing webpage interaction scripts using JavaScript • JavaScript event processing mechanism; Tools and equipment <ul style="list-style-type: none"> • Intel I5 and higher-level processors • Memory of 8GB and above • Hard disk with a capacity of 500GB and above Materials <ul style="list-style-type: none"> • Commonly-used operating systems such as Windows, Linux and so on • Office software • Webpage integrated development software
	2.2 Design responsive elastic layout.	
	2.3 Write webpage interaction script using JavaScript.	

		<ul style="list-style-type: none"> • Browsers <p>Requirements for employees</p> <ul style="list-style-type: none"> • Teamwork spirit • Integrity • Time management • Self-motivation • Clear verbal expression • Working hard
3.0 Conduct database operation	3.1 Design database.	<p>General skills and knowledge</p> <ul style="list-style-type: none"> • The three major paradigms of database design • Use of database visual management software • The DML grammars of database • The DDL grammars of database • The DQL grammars of database • The DCL grammars of database • SQL commands and operations to the database • SQL statements optimization through EXPLAIN command. <p>Tools and equipment</p> <ul style="list-style-type: none"> • Intel I5 and higher-level processors • Memory of 8GB and above • Hard disk with a capacity of 500GB and above <p>Materials</p>
	3.2 Write SQL statements.	
	3.3 Perform SQL statement optimization.	

		<ul style="list-style-type: none"> • Commonly-used operating systems such as Windows, Linux and so on • Office software • Database system software • Database visual management software <p>Requirements for employees</p> <ul style="list-style-type: none"> • Teamwork spirit • Integrity • Time management • Self-motivation • Clear verbal expression • Working hard
4.0 Carry out maintenance of the Linux system environment	4.1 Manage RPM software packages	<p>General skills and knowledge</p> <ul style="list-style-type: none"> • Basic and commonly-used commands of Linux • Installation and maintenance of Linux operating systems • Network configuration and security of Linux operating systems • Software package management of Linux operating systems • Software management of Linux operating systems • Server environment construction of Linux operating systems • The working principles of Shell scripts <p>Tools and equipment</p>
	4.2 Construct web server environment.	
	4.3 Write automation Shell scripts.	

		<ul style="list-style-type: none"> • Intel I5 and higher-level processors • Memory of 8GB and above • Hard disk with a capacity of 500GB and above <p>Materials</p> <ul style="list-style-type: none"> • Commonly-used operating systems such as Windows, Linux and so on • Office software • Virtual machine software • Remote connection tools <p>Requirements for employees</p> <ul style="list-style-type: none"> • Teamwork spirit • Integrity • Time management • Self-motivation • Clear verbal expression • Working hard
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