Republic of Rwanda

Ministry of Education

RWANDA POLYTECHNIC

CURRICULUM

RTQF Level 5

TVET CERTIFICATE V
in
SOFTWARE DEVELOPMENT

CODE

ICTSFD5001

Kigali,June 2019

ICTSFD5001-TVET CERTIFICATE V

Software development

REQF Level 5 CURRICULUM

Supported by

Copies available from:

Rwanda Polytechnic (RP)

Email: info@rp.ac.rw

Web: www.rp.ac.rw

P.O Box 164 Kigali, Rwanda

Original published version updated:

June, 2019

Copyright

Published by
Rwanda Polytechnic (RP)
Internet: http://www.rp.ac.rw

Table of Contents

List of abbreviations

API	Application Programming Interface
AWS	Amazon web services
CBIS	Computer-based information system
CDU	Curriculum Development Unit
CM	Complementary Modules
CRUD	Create Retrieve Update Delete
DFD	Data flow diagram
GUI	Graphical User Interface
HDD	Hard disk drive
HTML	Hypertext Markup Language
IaaS	Infrustructure as a service
ICT	Information Communication Technology
ICTSFD	ICT/ Software development
IDE	Integrated Development Environment
IMAP	Internet Message Access Protocol
JSON	JavaScript Object Notation
LDS	Logical data structure
LU	Learning Unit
MVC	Model-View-Controller
MySQL	My Structured Query Language
PaaS	Platform as a service
PDO	PHP Data Objects
PHP	Hypertext Preprocessor
PPE	Personal Protective Equipment
RAM	Random access memory
RP	Rwanda Polytechnic
RTQF	Rwandan TVET Qualifications Framework

Saas	Software as a service
SMTP	Simple Mail Transfer Protocol
SQL	Structured Query language
SSADM	Structured system analysis and design method
TSS	Technical Secondary Schools
TVET	Technical and Vocational Education and Training
VM	Virtual machine
VTC	Vocational Training Center
WDA	Workforce Development Authority
www	World Wide Web
XAMPP	Cross-platform Apache MySQL PHP, Perl

Acknowledgments

Rwanda Polytechnic wishes to thank the following persons who participated in the development of this curriculum:

Coordination

RWAMASIRABO Aimable, CDU- RP

Facilitation

HABUMUGISHA Fulgence- IPRC Kigali/ KONIBE Ltd.

Curriculum Development Team

#	Names	Function	Company/Institution
1.	NAKURE Salathiel	Database administrator/ TVET trainer	Ecole Technique Saint KIZITO MUSHA
2.	NZABARINDA Jean Paul	Software developer	SOS Technical High School
3.	FUNDI Alain	Expert, CEO, Web and mobile software engineer	101Exp ltd
4.	MBARAGA NKEJUWIMYE Serge	Founder and senior software developer/ Assistant lecturer in IT & Architecture	Skyline digital / University of Kigali
5.	RUGWIRO Marie Ange Sonia	Software engineer	MeshPower ltd
6.	BYIGERO Fidele	IT engineer, Chief training officer	Algorithm inc.
7.	Jean Baptiste NSENGIYUMVA	Software developer	TRES ltd
8.	NYIRASAFARI Jemima	TVET Trainer	SOS Technical High School
9.	BYIRINGIRO David	Data cleansing and format editor	Mars construction ltd
10.	HAKIZIMANA Benjamin	IT Consultant	GIZ/ ICON Institute
11.	NTIRANTA Jean Claude	TVET Trainer/ assistant lecturer	Saint Joseph Integrated Technical College
12.	SIMBANDUMWE Eric	IT Specialist	N@tcom services ltd

13.	Christiane Voith	Int Expert, IT Manager	ICON, GIZ
14.	MUSAFIRI Ernest	Instructor	IPRC NGOMA
15.	MUSONI Jean Claude	Trainer	Nyabihu TVET School
16.	UWERA Marceline	Socio-linguistics Officer	RALC
17.	MUTAGANZWA Gilbert	Teacher	Ecole Secondaire de Rukara
18.	MATATA Jean Bosco	Teacher	College Ami des Enfants
19.	GASIMBA François Xavier	Lecturer	UR/College of Education
20.	KAMBARI Vincent	Teacher	GS St Marcel/Kayonza
21.	MUREGO Yves	Quality Assurance Officer	WDA
22.	BUCYENSENGE Vincent	Instructor	IPRC KARONGI
23.	GASANA Vedaste	Lecturer	INES
24.	Dominique Xavier KANYAMIRERA		
25.	FURAHA INEZA Jean Raymond	Trainer	Lycee de Gisenyi
26.	NGEZAHAYO Emmanuel	Maths teacher/author	Rusumo High School
27.	NIYODUSENGA Patrick	Physics teacher	Ecole des Sciences de Nyanza
28.	UWINEZA Patrice	Science teacher	Nyamata TVET School

Section 1

GENERAL INTRODUCTION

The curriculum presents a coherent and significant set of competencies to acquire to perform the occupations of an **Assistant Application Developer, Assistant Database Developer, Web Database Administrator, Web Application Developer**. It is designed with an approach that takes into account the training needs, the work situation, as well as the goals and the means to implement training.

The modules of the curriculum include a description of the expected results at the end of training. They have a direct influence on the choice of the theoretical and practical learning activities. The competencies are the targets of training: the acquisition of each is required for certification.

The curriculum is the reference to carry out the assessment of learning. Assessment tools of learning are developed on the basis of this document.

The curriculum consists of three parts. The first part is of general interest and shows the nature and goals of a program and the key concepts and definitions used in the document. The second part presents the qualification, its level in the qualification framework, its purpose, its rationale and the list of modules it comprises. The third part deals with the training package. It includes the competencies chart, the sequencing of module learning, the description of each module and the course structure.

The pages describing the modules are the heart of a curriculum. They present the title of the module, the length of training, the amount of credits, the context in which the competency is performed, the prerequisite competencies, the learning units and the performance criteria.

In each module, a course structure is provided. The course structure describes the learning outcomes (knowledge, skills and attitude) and the learning contents related to each learning unit. Also, the learning activities and resources for learning are suggested.

Finally, the assessment specifications and guidelines are included in each module.

Section 2

QUALIFICATION DETAILS

2.1 Description

	TVET Certificate V in Software Development
Level:	REQF Level 5
Credits:	**119**
Sector:	ICT
Subsector:	Software development
Issue date:	June 2019

This qualification provides the skills, knowledge and attitudes for a learner to be competent in a range of routine tasks and activities that require the application of a limited range of basic practical skills in a defined context. Work would be undertaken in various construction enterprises where Develop a database, Setup a database server, deploy a web application, develop a web application are carried out. Learners may work with some autonomy or in a team but usually under non- directive supervision.

At the end of this qualification, qualified learners will be able to:

1. Monitor occupational SHE best practices
2. Maintain professional conversation in upper-intermediate English
3. Gukoresha ikinyarwanda cy''intyoza
4. Work in a socially diverse environment
5. Use ICT at workplace
6. Apply professional ethics
7. Organize a business
8. Apply dynamics and waves
9. Apply Mathematical Analysis, Statistics and Probability
10. Perform system analysis and design
11. Secure a database
12. Support small scale ICT projects
13. Develop a backend application
14. Develop a database
15. Setup a database server
16. Deploy a web application
17. Develop a web application
18. Integrate workplace

2.2 Minimum entry requirements

TVET Certificate IV in Software development or other relevant qualifications or through Recognition of Prior Learning.

2.3 Information about pathways

Pathways into the qualification

Preferred pathways for candidates entering this qualification include:

- Candidates enter this qualification after achieving TVET Certificate IV in Software development or other relevant qualifications or through Recognition of Prior Learning

Pathways from the qualification

Progression route of candidates achieving this qualification include:

- Candidates exiting this qualification are able to enter TVET diploma in Software development.

2.4 Job related information

This qualification prepares individuals to integrate the ICT sector and operate as an assistant application developer, assistant database developer, database administrator, web application developerwhereby he/she can develop a database, setup a database server, deploy a web application, develop a web application. This qualification constitutes a middle level in Software development. The individuals with this qualification can enter the TVET Diploma in Software development in order to be equipped with the necessary competencies to function as a software developer.

Possible jobs related to this qualification

- **Assistant Application Developer**
- **Assistant Database Developer**
- **Database Administrator**
- **Web Application Developer**

2.5 Employability skills and life skills

Through the generic modules, individuals with this qualification have acquired the life and employability skills to meet the following industry or enterprise requirements:

Communication

- Documenting technical work in plain English
- Writing and presenting reports

Safety and security precautions

- Working collaboratively with project team members

Health and environment

- Health reproduction
- Rwanda environmental protection, practices rules and regulations

Business Plan

- Producing a small IT business plan

Planning and organizing

- Preparing feasibility reports that take into account project scope, time, cost, quality, communications and risk management

Self-management

- Taking responsibility for own outputs in relation to specified quality standards
- Working according to the Rwandan Computer Society Code of Ethics regarding security, legal, moral and ethical issues

Technology

- **Manipulate computer**
- **Using internet**

Languages other than Kinyarwanda

- **Using English as the medium of communication in the working environment**

2.6 Information about competencies

No	Code	Complementary competencies	Credit
1	CCMMS501	Monitor occupational SHE at workplace	3
2	CCMUE501	Maintain professional conversation in upper-intermediate English	3
3	CCMKN501	Gukoresha ikinyarwanda cy'intyoza	3
4	CCMSE501	Work in a socially diverse environment	3
5	CCMIW501	Use ICT at workplace	3
6	CCMBO501	Organize a business	3
7	CCMPE501	Apply professional ethics	3
Total			21

	No	Code	Core competencies	Credit
GENERAL	1.	GENAM501	Apply Mathematical Analysis, Statistics and Probability	8
	2.	GENGP501	Apply dynamics and waves	4
	3.	SFDDS501	Secure a database	8
	4.	SFDAD501	Perform system analysis and design	5
	5.	SFDIP501	Support small scale ICT projects	3
	6.	SFDBA501	Develop a backend application	6
SPECIFIC	7.	SFDDD501	Develop a database	12
	8.	SFDSS501	Setup a database server	6
	9.	SFDWD501	Deploy a web application	4
	10.	SFDWA501	Develop a web application	12
	11.	SFDIA501	Integrate workplace	30
	Total			98

- Number of competencies: **18**
- Core competencies : **11**
- Complementary competencies : **7**
- The total number of Credits: **119**

Section 3

TRAINING PACKAGE

The training package includes the competencies chart, the flowchart, the modules, the course structure, and the assessment guidelines.

3.1 Course structure

The course structure describes the learning outcomes for each learning unit. These learning outcomes are the essential skills and knowledge to be acquired. The contents to be covered for each learning outcome are prescriptive. The Learning Activities contain a series of suggestions, usually with several options, that will guide the learner and the trainer.

3.2 Competencies chart

The competencies chart is a table that presents an overview of the specific competencies, the general competencies, the work process and the time allocated to each competency. This table provides an overall view of the competencies of the training program and allows identification of the logical sequence of the learning of these competencies.

The competencies chart shows the relationship between general competencies and specific competencies that are particular to the occupation, as well as the key stages of the work process. It shows the links between the elements in the horizontal axis and those in the vertical axis. The symbol (o) marks a relationship between a general competency and specific competency. The symbol (Δ) indicates a relationship between a specific competency and a step in the process of work. When the symbols are darkened, it indicates that the link is taken into account in the description of the specific competency.

The competencies chart allows the trainer to consider the complexity of the competencies in the organization of the progress of learning. Therefore, the vertical axis shows the specific competencies in the order they should be acquired.

This is the starting point of the presentation of the competencies in the flowchart presented in the following pages.

Assistant Application developer,Assistant database developer, Webdatabase administrator, Web application developer			PROCESS			GENERAL AND COMPLEMENTARY COMPETENCIES												
SPECIFIC COMPETENCIES		Duration (640Hrs)	Prepare environment	Performdevelopment	Deliver the product	Monitor occupational SHE at workplace	Maintain professional conversation in upper-intermediate English	Gukoresha ikinyarwanda cy'intyoza	Work in a socially diverse environment	Use ICT at workplace	Apply professional ethics	Organize a business	Apply Mathematical Analysis, Statistics and Probability	Apply dynamics and waves	Secure a database	Perform system analysis and design	Support small scale ICT projects	Develop a backend application
#	Duration (550Hrs)					1	2	3	4	5	6	7	8	9	10	11	12	13
						30	30	30	30	30	30	30	80	40	80	50	30	60
1	Develop a database	120	Δ	Δ	Δ	●	o	o	o	o	o	o	o	o	●	●	o	o
2	Setup a database server	60	Δ	Δ	Δ	●	o	o	o	o	o	o	o	o	●	●	o	o
3	Deploy a web application	40	▲	▲	▲	●	o	o	o	o	o	o	o	o	●	●	o	o
4	Develop a web application	120	▲	▲	▲	●	o	o	o	o	o	o	o	o	●	●	o	o
5	Integrate workplace	300	▲	▲	▲	●	●	●	●	●	●	●	●	●	●	●	●	●

Figure I: Competencies chart

Between the process and particular competencies | Between general and particular competencies

▲:Functional link application
Δ: Functional link existence

●: Functional link application
o: Functional link existence

3.4 Flowchart

The flowchart of sequencing of learning is a schematic representation of the order of acquisition of the competencies. It provides an overall planning of the entire training programme and shows the relationship between the modules. This type of planning is to ensure consistency and progression of learning. For each module, the flowchart shows the learning that is already in place, the learning that is to take in parallel or later. The positions defined will have a decisive impact on all subsequent pedagogical choices. The flowchart of the sequence of learning of the modules of the training programme is presented on the following page.

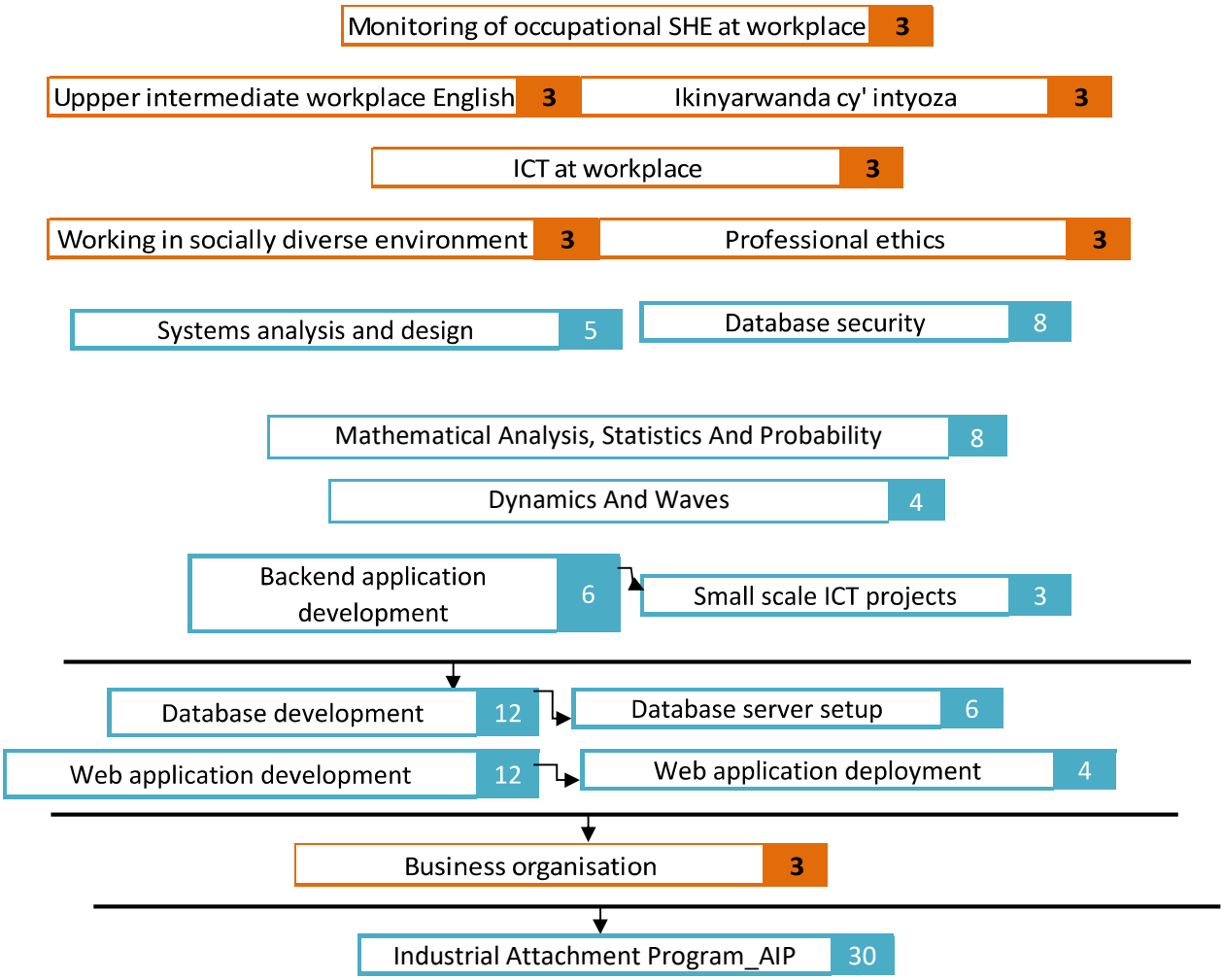

Figure II: Flowchart

Section 4

ASSESSMENT GUIDELINES

4.1 Assessment Methodology

To assess knowledge, practical, and application skills through any form of continuous evaluation that encourages learners to display understanding of the principles in application to set practical tasks and their attendant theory to assess self-learning.

4.2 Portfolio

A portfolio is a collection of learner work representing learner performance. It is a folder (or binder or even a digital collection) containing the learner's work as well as the learner's evaluation of the strengths and weaknesses of the work. Portfolios reflect not only work produced (such as papers and assignments, direct demonstration, indirect demonstration, products, documents), but also it is a record of the activities undertaken over time as part of learner learning. The portfolio is meant to show learner growth, development, and achievements in the education system. It also shows that you have met specific learning goals and requirements. A portfolio is not a project; it is an ongoing process for the formative assessment.. Besides, it will serve as a verification tool for each candidate that he/she attended the whole training before he/she undergoes the summative assessment for specific modules.
There are two types of assessment (Formative Assessment and Summative/Integrated Assessment).

Formative Assessment

- The formative assessment is an assessment which is given progressively during the training
- This is applied on all types of modules (e.g. Complementary, General and Specific modules)
- Formative assessment are recommended to prepare the trainee for summative/integrated assessment

Summative/Integrated Assessment

This is given at the end of the module delivery. It helps to make sure that the learner has successfully acquired the competence and he is able to translate the knowledge, skills and attitude into workplace situation.

- All Summative/Integrated assessment should match with the content of the module in the curriculum.
- Summative/Integrated Assessment is always in practical, giving it as a theoretical type of assessment is not acceptable.
- The integrated situation provided in the curriculum is a sample of the assessment to be carried out, the Trainer/Teacher has the role of developing another one referring to the task to be carried out in the integrated situation in accordance to the circumstances inside school, but the integrated situation should stick on the components of a task.
- During Summative/Integrated assessment, assessor panel members should be three (3).
- This Summative/Integrated assessment can be seen in specific modules and the Trainee can be declared competent by the following rules:
    - ✓ **For YES or NO scoring of indicators in Summative/Integrated Checklist**

The trainee can be declared competent based on the assessment CRITERIA and its respective assessment indicators

Assessment Criteria	*Passing Line in the assessment indicators*
Quality of Process	90%
Quality of Product	100%
Relevance	90%
Rest of Criteria/ any other criteria (example: Safety)	100%

Note: Theassessor should check if the 10% indicator (quality of process and relevance) in which the trainee was not able to meet during summative/integrated assessment should not be among those indicators that can cause any hazard, or the one indicator that is performed poorly where there is room for improvement.

- During assessment, trainees with special needs (e.g. people with disability) should be assisted accordingly.

- Deputy school manager in-charge of studies, class teacher, and trainer should consider the status (competent/not yet competent) of trainees before delivering the next module with pre-requisites.
- Respect of flowchart particularly in considering the delivery of modules which has prerequisite of a following/subsequent module is considered in issuing TVET certificate, otherwise other modules can be given anytime.
- All evidences during assessment (e.g. quiz, checklist, forms) should have a written form that is compiled in the trainer (source) and trainee (result) portfolio. Portfolio is the responsibility of school, class teacher, and trainees. It should be given to trainees after certification.
- Industrial Attachment Program (IAP)
  - All trainees should finish and declared competent on all modules before taking IAP module.
  - Trainees should finish and declared competent on the 30 hours content of IAP module written in the curriculum before they go to workplace or industry.
  - The school should organize visit for all trainees in the workplace or industry to confirm and assist IAP especially in filling up the logbook.
  - An interview to the trainee should be conducted in the school after the IAP has been completed and should be documented in the trainee portfolio.
  - All completed logbooks should be part of the trainee portfolio.