Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

# CURRICULUM STRUCTURE

## RQF LEVEL 4

## TVET CERTIFICATE IV
## in
## NETWORKING AND INTERNET TECHNOLOGIES

**ICTNIT4001**

**Kigali, September 2023**

# ICTNIT4001-TVET CERTIFICATE IV

# NETWORKING AND INTERNET TECHNOLOGIES

Funded by:

TQUM
TVET Quality Management Project

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Rwanda TVET Board, 2023

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# List of Abbreviations

| | |
|---|---|
| **ICT** | Information and Communication Technology |
| **IT** | Information Technology |
| **NISR** | National Institute of Statistics of Rwanda |
| **NST1** | National Strategic Transformation 1 |
| **RQF** | Rwanda Qualification Framework |
| **RTB** | Rwanda TVET Board |
| **SDG** | Sustainable Development Goals |
| **TQUM** | TVET Quality Management |
| **TVET** | Technical Education and Vocational Training |

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# FOREWORD

The global rapid changes in the labour market tends to call for appropriate training and skills development through outcome-based training approaches. Skills development and employment promotion are central to Rwanda's transformative Vision 2050, aiming to secure high standards of living for all Rwandans. In a bid to transform Rwanda into a knowledge based economy, the National Strategic Transformation 1 (NST1) calls socio-economic transformation through TVET skills development. The Rwanda TVET Board (RTB) was established to promote quality education in technical and vocational education and training from level one (1) to five (5) aimed at fast tracking socio-economic development of the country. Designing and distributing curricula, teaching materials, trainer's guides, methodologies and establish training methods for technical and vocational education and training from level one (1) to five (5); is among other RTB's responsibilities.

The existing curricula were limited and narrowed in terms of acquired skills and knowledge and were not meeting the requirements of the current labour market at both national and regional level. In addition, there were. Barriers in vertical mobility and pathways in TVET which resulted in negative TVET perception. Furthermore, there were barriers to admission of TVET graduates of certain programs into higher learning institutions.

The TVET modernization process has begun with a clear picture of the programs focusing on sectors with the high employment potential like Networking and Internet Technologies among others. In this respect, Rwanda TVET Board, is honoured to avail the curriculum of Networking and Internet Technologies which serves as the official document and respond to the above mentioned concerns.

With the help of the training providers, trainers, parents whose role is central to the success of this curriculum, the trainees will gain appropriate hand on skills which will make a difference not only to their own lives but also to the success of Rwanda's economy.

I wish to sincerely extend my appreciation to the people who contributed towards the development of this document.

Dipl.-Ing. Paul UMUKUNZI

**Director General/ RTB**

# 1. GENERAL INTRODUCTION

The curriculum presents a coherent and significant set of competencies to acquire to perform the occupation of a network transmission technician. 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 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 outcomes 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 outcome. Also, the learning activities and resources for learning are suggested.

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

# 2. QUALIFICATION DETAILS

## 2.1. Description

| | |
|---|---|
| **Title:** | TVET Certificate IV in Networking and Internet Technologies |
| **Level:** | RQF Level 4 |
| **Credits:** | 120 |
| **Sector:** | ICT and Multimedia |
| **Trade:** | Networking and Internet Technologies |
| **Issue date:** | September, 2023 |

## 2.2 Graduate Profile

This qualification provides the skills, knowledge and attitudes for a learner to be competent in tasks and activities that require the application of practical skills in a defined context. Work would be undertaken in various Networking and Internet Technologies sectors/industries where Networking and Internet Technologies includes Develop IoT system, Deploy fiber optics network, Set up wireless network outdoor, Administer windows server, Develop IoT Web Application Using PHP, Set up Wide Area Network. Learners may work with some autonomy or in a team but usually under close supervision.

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

1. Develop a business plan
2. Use intermediate English at workplace
3. Apply computer skills
4. Gukoresha Ikinyarwanda cy'umunyamwuga

5. Exprimer des opinions en français élémentaire

6. Promote culture of peace

7. Apply Fundamental Mathematical Analysis

8. Apply Mechanics and properties of matter

9. Apply Basics of Technical Drawing

10. Develop Database

11. Develop IoT system

12. Deploy fiber optics network

13.Set up wireless network outdoor

14. Set up Wide Area Network

15. Administer windows server

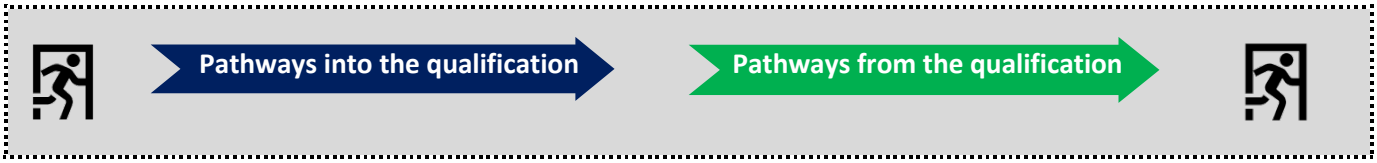
16. Develop IoT Web Application Using PHP

17. Integrate the workplace

## 2.3 Minimum entry requirements

The minimum entry requirement to this qualification is to have completed level III in Networking and Internet Technologies.

## 2.4 Information about pathways



| Preferred pathways for candidates entering this qualification include: | Progression route of candidates achieving this qualification include: |
|---|---|
| TVET Certificate III in Networking and Internet Technologies | TVET Certificate V in Networking and Internet Technologies |

## Rationale of the Qualification

A network transmission technician contributes to Rwanda's digital transformation and Internet based services as stated in ICT Sector Strategic Plan (2018-2024), several achievements have been registered by the sector in areas related to ICT infrastructure, networking and internet technologies, business and investments, system administration, global partnerships, among others.

Over the last decade and half, the Gross Domestic Product of the ICT sector in Rwanda has been growing at a median rate of 15.3% (NISR, 2016). Internet Penetration in Rwanda is increasing steadily. For instance, internet penetration increased from 7% in 2011 to 39.76% mid 2017. While mobile increased from 639,673 to 9.7 million over the period 2010 -2017.

In order to attain long term developmental goals of Rwanda and Africa, such as the Sustainable Development Goals (SDG), Rwanda's Vision 2050 and African Union's common goals under the Agenda 2063, it is essential to maximize the power of ICT as a true enabler of socio-economic development. The ICT sector remains one of the primary targets to boost country's economy, which will be achieved through:

- Positioning Rwanda as a world class and high end ICT hub.
- Job creation that reduces the poverty.
- Contribution to GDP growth.
- Facilitation of cost-effective public and private services.
- Impact of ICT-related capital investments on overall capital deepening.
- Increase of labor productivity & significant contribution to value-added by ICT jobs.

- Digital Literacy for all to promote integration of isolated communities into the national economy & Increase the access of larger markets coverage.
- Developing the ICT industry and build the capacity of the private sector to provide high levels of service delivery.

## 2.5 Job related information

This qualification prepares individuals to integrate in small and medium ICT companies, he/she can also work in other public and/or private sectors that require ICT related services with the professionalization of networking and internet technologies.

**Possible jobs related to this qualification**

Web Server Administrator

Wireless Network Technician

Wide Area Network Technician

Fiber Technician

IoT Technician

IoT Developer

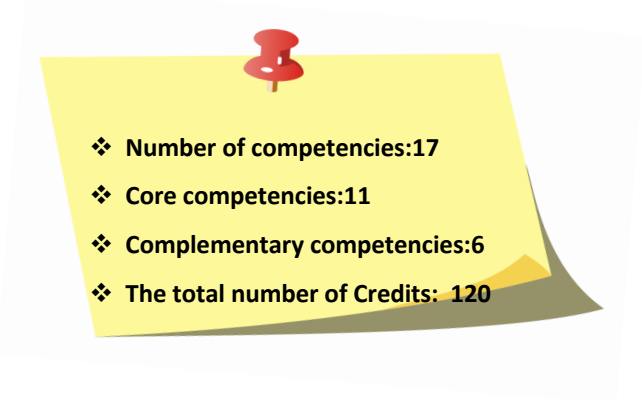
## 2.6 Information about competencies

| No | Code | Complementary competencies | Credit |
|---|---|---|---|
| 1. | **CCMBC402** | Develop a business plan | **3** |
| 2. | **CCMEN402** | Use intermediate English at workplace | **3** |
| 3. | **CCMCL402** | Apply computer skills | **3** |
| 4. | **CCMKN402** | Gukoresha Ikinyarwanda cy'umunyamwuga | **3** |

| | | | |
|---|---|---|---|
| 5. | **CCMFT402** | Exprimer des opinions en français élémentaire | **3** |
| 6. | **CCMCT401** | Promote culture of peace | **3** |
| Total | | | **18** |

| No | Co-Curricular activities | Credit |
|---|---|---|
| **1.** | Sports/clubs | **1** |
| **2.** | Self-study/ library research | **1** |
| **Total** | | **2** |

| | No | Code | Core competences | Credit |
|---|---|---|---|---|
| GENERAL | **1.** | **GENFA402** | Apply Fundamental Mathematical Analysis | **6** |
| | **2.** | **GENMP402** | Apply Mechanics and properties of matter | **4** |
| | **3.** | **GENDD401** | Develop Database | **7** |
| | **4** | **GENTD401** | Apply Basics of Technical Drawing | **5** |
| SPECIFIC | **5.** | **NITID401** | Develop IoT system | **14** |
| | **6.** | **NITFO401** | Deploy fiber optics network | **6** |
| | **7.** | **NITWO401** | Set up wireless network outdoor | **8** |
| | **8.** | **NITWN401** | Set up Wide Area Network | **10** |
| | **9.** | **NITWA401** | Administer windows server | **10** |
| | **10** | **NITIW401** | Develop IOT web application using PHP | **10** |
| | **11** | **NITIA401** | Integrate the workplace | **20** |
| Total | | | | **100** |



## 2.7. Allocation of Learning Hours

| NO | Module name | Learning outcome | Theoretical hours | Practical hours | Total hours |
|---|---|---|---|---|---|
| 1 | Entrepreneurship | LO1. Identify elements of business plan | 3 | 7 | 10 |
| | | LO2. Write a business plan | 3 | 7 | 10 |
| | | LO3. Establish business contingency plan | 2 | 5 | 7 |
| | | LO4. Present a business plan | 1 | 2 | 3 |
| Total hours module 1 | | | 9 hours | 21 hours | 30 hours |
| 2 | ICT | LO1. Describe the operating system | 5 | 10 | 15 |
| | | LO2. Customize the computer features | 3 | 7 | 10 |
| | | LO3. Protect computer system | 2 | 3 | 5 |
| Total hours module 2 | | | 9 hours | 21 hours | 30 hours |
| 3 | Citizenship | LO1. Make a Comparative study of Genocides. | 3 | 7 | 10 |
| | | LO2. Protect human rights | 3 | 7 | 10 |
| | | L.O3. Promote social cohesion | 3 | 7 | 10 |
| Total hours module 3 | | | 9 hours | 21 hours | 30 hours |
| 4 | English | L.O1. Write factual, descriptive, and explanatory correspondence text. | 3 | 6 | 9 |
| | | L.O2. Apply a range of listening strategies and activities to understand predictable messages | 2 | 5 | 7 |

| | | | | | |
|---|---|---|---|---|---|
| | | L.O3. Discussion, supporting or refute ideas on general and trade-related topics | 2 | 5 | 7 |
| | | L.O4. Read medium texts on general and trade-related topics | 2 | 5 | 7 |
| Total hours module 4 | | | 9 hours | 21 hours | 30 hours |
| 5 | Ikinyarwanda | L.O1. Gukoresha ubuvanganzo gakondo bufatiye ku mwuga ashyikirana n'abandi , gutandukanya ubwoko bw'inshinga no gukoresha ikomorazina n'ikomoranshinga . | 3 | 7 | 10 |
| | | L.O2. Gukoresha Ikinyarwanda uwiga agaragaza ibyiza by'ikoranabuhanga mu iterambere ry'umwuga no gusesengura ibinyazina binyuranye. | 2 | 3 | 5 |
| | | L.O3. Gukoresha Ikinyarwanda uwiga agaragaza ububi bw'ibiyobyabwenge mu rubyiruko, kugaragaza amategeko y'igenamajwi yerekeye n'ingombajwi mu izina mbonera no kunoza imyandikire y'inyuguti nkuru mu nteruro. | 2 | 3 | 5 |
| | | L.O4. Gukoresha Ikinyarwanda uwiga agaragaza uburyo bunyuranye bwo gufata neza ibidukikije no gukoresha indangahantu n'ibyungo. | 2 | 3 | 5 |
| | | L.O5. Gukoresha Ikinyarwanda uwiga agaragaza akamaro k'ubutabazi bw'ibanze no gukoresha impakanyi | 2 | 3 | 5 |

| | | | | | |
|---|---|---|---|---|---|
| | | n'indango z'inshinga. | | | |
| Total hours module 5 | | | 9 hours | 21 hours | 30 hours |
| 6 | Français | L.O1. Préciser des informations, | 3 | 8 | 11 |
| | | L.O2. Décrire des personnes et des lieux et exprimer ses goûts | 3 | 5 | 8 |
| | | L.O3. Indiquer l'itinéraire. | 3 | 8 | 11 |
| Total hours module 6 | | | 9 hours | 21 hours | 30 hours |
| 8 | Applied Mathematics | LO1: Analyse algebraic functions | 5 | 10 | 15 |
| | | LO2: Apply fundamentals of differentiation | 6 | 14 | 20 |
| | | LO3: Apply exponential functions | 4 | 11 | 15 |
| | | LO4: Apply logarithmic functions | 3 | 7 | 10 |
| Total hours module 8 | | | 18 hours | 42 hours | 60 hours |
| 9 | Applied Physics | LO1: Describe laws of motion and their applications | 1 | 3 | 4 |
| | | LO2: Apply static equilibrium and elasticity | 2 | 6 | 8 |
| | | LO3: Analyse fluid mechanics | 2 | 4 | 6 |
| | | LO4: Apply thermodynamics | 3 | 6 | 9 |
| | | LO5: Examine effects of electric current flow in DC electric circuit | 2 | 5 | 7 |
| | | LO6: Apply geometric instruments | 2 | 4 | 6 |
| Total hours module 9 | | | 12 hours | 28 hours | 40 hours |
| 10 | **Basics of** | 1. Identify materials, instruments and equipment | 3 | 7 | 10 |

| | | | | | |
|---|---|---|---|---|---|
| | **Technical Drawing** | 2. Draw symbols, geometric figures and solids used in technical drawing | 6 | 14 | 20 |
| | | 3.Apply 2 and 3 dimensional | 6 | 14 | 20 |
| Total hours module 10 | | | 15 hours | 35 hours | 50 hours |
| 11 | Database Development | 1.Analyse Database | 5 | 10 | 15 |
| | | 2.Design Database | 6 | 14 | 20 |
| | | 3.Implement Database | 6 | 14 | 20 |
| | | 4.Secure Database | 4 | 11 | 15 |
| Total hours module 11 | | | **21 hours** | **49 hours** | **70 hours** |
| 12 | **Fiber Optic Network Deployment** | 1.Plan fiber optic network | 5 | 10 | 15 |
| | | 2.Implement fiber optic network | 7 | 18 | 25 |
| | | 3.Maintain fiber optic network | 6 | 14 | 20 |
| Total hours module 12 | | | 18 hours | 42 hours | 60 hours |
| 13 | **Wireless Network Outdoor** | Plan wireless network outdoor | 6 | 14 | 20 |
| | | Deploy wireless network outdoor | 12 | 28 | 40 |
| | | Maintain wireless network outdoor | 6 | 14 | 20 |
| Total hours module 13 | | | **24 hours** | **56 hours** | **80 hours** |
| 14 | **Windows Server** | Prepare Server Environment | 5 | 10 | 15 |

| | | | | | |
|---|---|---|---|---|---|
| | **Administration** | Deploy Active Directory Services | 6 | 14 | 20 |
| | | Deploy DHCP services | 3 | 7 | 10 |
| | | Deploy DNS service | 3 | 7 | 10 |
| | | Deploy web services | 3 | 7 | 10 |
| | | Deploy FTP services | 3 | 7 | 10 |
| | | Perform Load balancing | 3 | 7 | 10 |
| | | Perform server maintenance | 4 | 11 | 15 |
| Total hours module 14 | | | 30 hours | 70 hours | 100 hours |
| 15 | **IoT Web Application Development Using PHP** | Develop Application Programming Interface(API) Using PHP | 8 | 32 | 40 |
| | | Develop User Interface | 5 | 20 | 25 |
| | | Integrate Application Programming Interface(API) | 7 | 28 | 35 |
| Total hours module 15 | | | 20 hours | 80 hours | 100 hours |
| 16 | **Wide Area Network** | Install WAN equipment | 6 | 14 | 20 |
| | | Apply VLAN Configurations | 9 | 21 | 30 |
| | | Apply Router Configurations | 8 | 17 | 25 |
| | | Maintain WAN | 7 | 18 | 25 |
| Total hours | | | 30 hours | 70 hours | 100 hours |
| 17 | **IoT System Development** | Plan IoT system development | 9 | 21 | 30 |
| | | Build IoT system | 25 | 60 | 85 |

| | | | | | |
|---|---|---|---|---|---|
| | | Deploy IoT system | 8 | 17 | 25 |
| **Total hours** | | | **42 hours** | **98 hours** | **140 hours** |
| 18 | Integrate the Workplace | Investigate and secure industrial attachment place. | 10 | 0 | 10 |
| | | Deal with workplace challenges. | 10 | 0 | 10 |
| | | Get briefed on industrial attachment program. | 10 | 0 | 10 |
| | | Develop one's competencies on the workplace. | 0 | 170 | 170 |
| Total hours for 17 modules | | | 30 hours | 170 hours | 200 hours |
| Total hours for all modules | | | 317 hours | 863 hours | 1180 hours |

# 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 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.

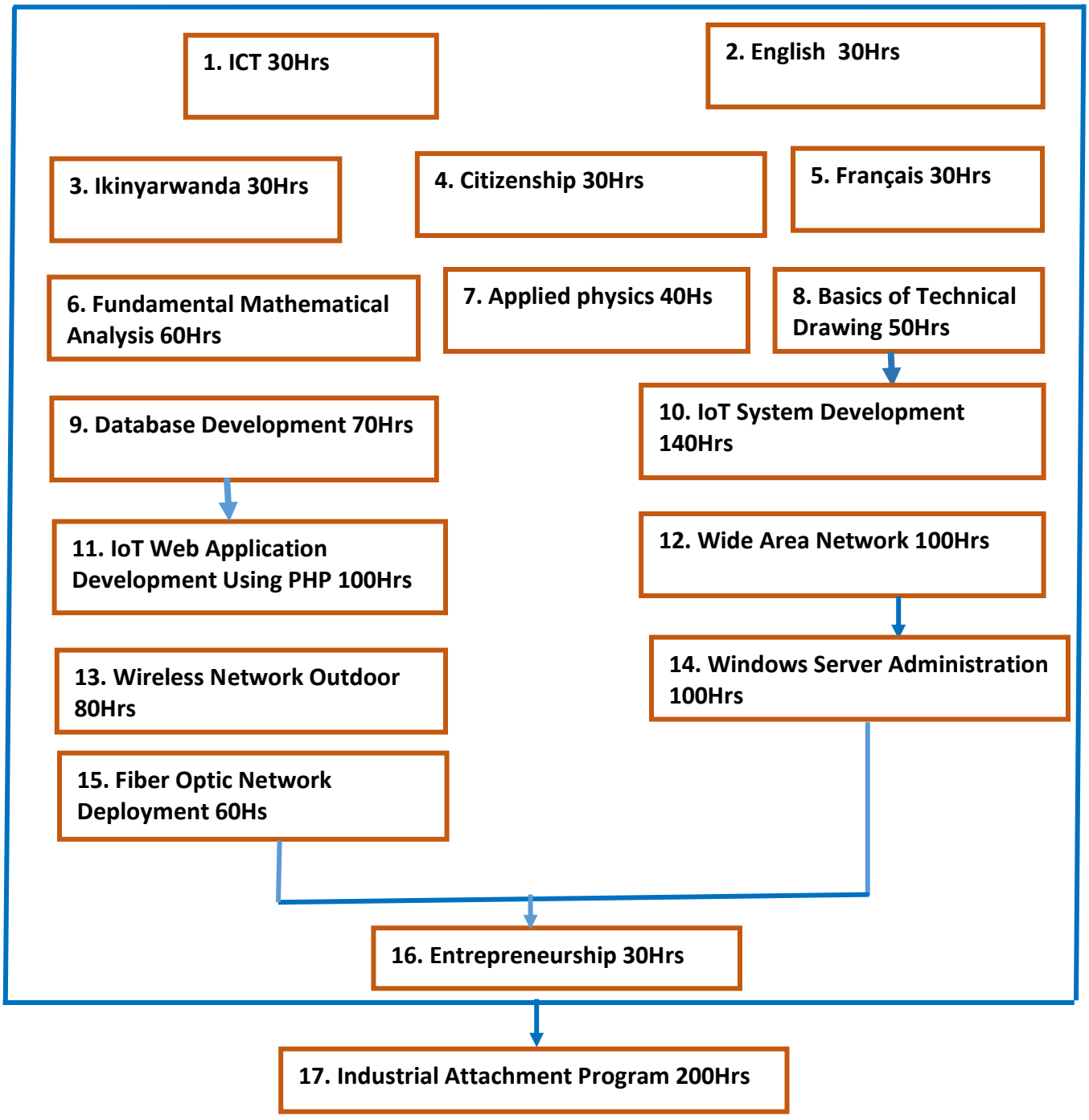



Figure 1 Flowchart

# 4. ASSESSMENT GUIDELINES

## 4.1 Assessment Methodology

To assess knowledge, practical, and application skills through a jury system 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. The portfolio output (formative assessment) will be considered only as enough for complementary and general modules. 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). Each assessment has its own rule for passing to be declared competent.

### Formative Assessment

This is applied on all types of modules (e.g. Complementary, General and Specific modules)

A trainee to be competent for a Specific module must have at least 70%.

A trainee to be eligible to undertake integrated assessment of specific modules must have at least 50% as passing line for general and complementary modules.

Each trainee should be competent on all formative assessments to be declared competent on that module

All formative assessment should be declared competent before taking the summative/integrated assessment

## Summative/Integrated Assessment

All Summative/Integrated assessment should match with the content of the module in the curriculum.

Summative/Integrated Assessment is always 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 to the components of a task.

During Summative/Integrated assessment, assessor panel members should be three (3).

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

The Passing Line for the modules is:

50 % for general and complementary modules
70 % for specific modules

<table>
<tr><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>Group project and presentation</td><td>20%</td></tr>
<tr><td>Individual project /Work</td><td>50%</td></tr>
<tr><td colspan="2"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
<tr><td colspan="4">Total</td><td>100%</td></tr>
</table>

Summative assessment is always conducted at the completion of module delivery. It should be practical through an integrated situation for specific modules and in any other forms of assessment for complementary and general modules.