



# **NATIONAL COMPETENCY STANDARDS FOR INTERNET OF THINGS (IoT) TECHNICIAN**

**Bhutan Qualifications and Professionals  
Certification Authority, Thimphu, Bhutan  
(February 2023)**



## Table of Contents

Foreword.....	2
Acknowledgement .....	3
Packaging of Qualifications .....	4
Overview of the Unit Competencies .....	5
<b>Annexures:</b>	
1.1 National Competency Standards (NCS) .....	i
1.2 Purpose of National Competency Standards .....	i
1.3 Bhutan Vocational Qualifications Framework (BVQF).....	ii
1.4 BVQF Levels .....	iii
1.5 Coding used for National Competency Standards.....	v
1.6 Assessment Guide.....	v

## FOREWORD

The TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority, Ministry of Education and Skills proudly presents the National Competency Standards (NCS) for IoT Technician as part of TVET reform initiative for improving the quality of Vocational Education and Training System in Bhutan. The standards represent the fruits of hard work and invaluable experiences gained by the department since its establishment in the latter half of 2003. The main aim of developing National Competency Standards is to set up a well-defined nationally recognized Vocational Qualification and Certification system that will help set a benchmark for the Technical Vocational Education and Training (VET) System in our country aligned to international best practices.

National Competency Standards is one of the base pillars in the Bhutan Vocational Qualification Framework (BVQF) and is the first step in its implementation. The standards are developed to ensure that employees or vocational graduates possess and acquire the desired skills, knowledge and attitude required by industries and employers. In order to ensure this close match in supply and demand of skills, knowledge and attitude, standards have been developed in close consultation and partnership with industry experts and trainers from training institutes.

A vocational education and training system based on National Competency Standards shall ensure that training is of a high quality and relevant to the needs of the labour market. As a result, future TVET graduates will be better equipped to meet the need and expectations of industries and employers. This positive impact on the employability of TVET graduates will enhance the reputation of vocational education and training and make it attractive to school leavers.

While acknowledging the existing level of cooperation and collaboration, the authority earnestly requests employers and training providers to extend the fullest support and cooperation in developing or implementing the National Competency Standards. The ultimate objective is to build a competent and productive national workforce that will contribute to the socio-economic development of our country.

We gratefully acknowledge the valuable contributions made by experts from industries during the consultation and validation processes of the standards. We look forward to improved engagement and active participation of the industry and employers in the development of a quality assured demand driven TVET system in the near future.

TVET Quality Council

Bhutan Qualifications and Professionals Certification Authority

## ACKNOWLEDGEMENT

**Development Date** : 16<sup>th</sup> February, 2023

**Date of Review** : 17<sup>th</sup> January, 2026(max. 3 years).

### **Subject experts involved during the consultation workshop:**

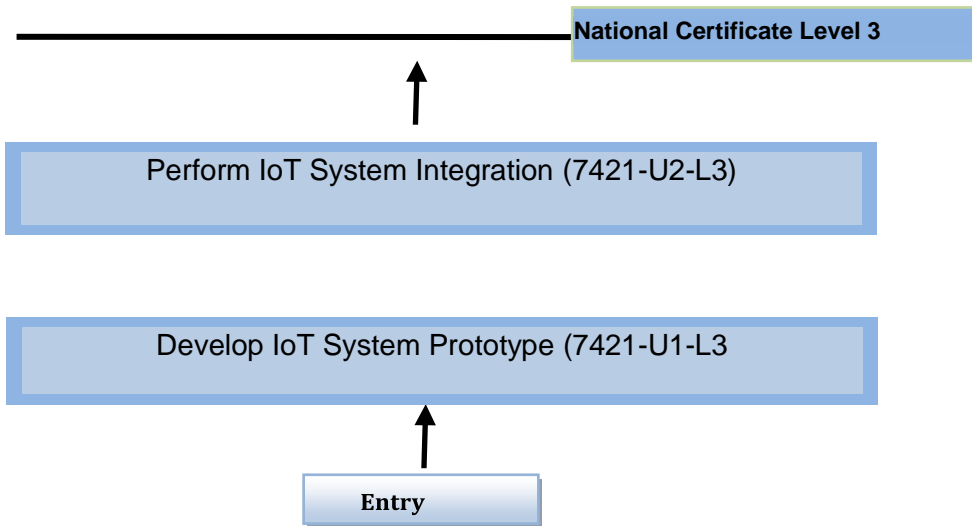
1. Yeshi Jamtsho, Lecturer, CST
2. Kamal Kumar Chapagai, Lecturer, CST
3. Younten Tshering, Lecturer, JNEC
4. Tenzin jamtsho, Engineer, GovTech
5. Tashi Wangchuk, Lecturer, JNEC

### **Field experts involved during the Consultation workshop:**

#### **Development group (Facilitator):**

1. Karma Loday, Specialist, TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority, Thimphu
2. Rinzin Namgay, Engineer, TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority, Thimphu
3. Chogay lhendup, Sr,Program officer, TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority, Thimphu

## PACKAGING OF QUALIFICATIONS



## OVERVIEW OF UNIT COMPETENCIES

### National Certificate - Level 3

UNIT TITLE	ELEMENTS OF COMPETENCE
Develop IoT System Prototype	<ol style="list-style-type: none"><li>1. Identify the area of IoT application</li><li>2. Identify the components of IoT</li><li>3. Design the circuit diagram</li></ol>
Perform IoT System Integration	<ol style="list-style-type: none"><li>1. Assemble the IoT components</li><li>2. Perform programming</li><li>3. Test the IoT system</li></ol>

<b>UNIT TITLE</b> :	<b>Develop IoT System Prototype</b>
<b>DESCRIPTOR</b>	This unit covers the competencies required to develop the IoT system prototype.
<b>CODE</b> :	<b>7421-U1-L3</b>
<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Identify the area of IoT application	<p>1.1 Identify the area (problem definition) as per the job requirement following standard procedures</p> <p>1.2 Conduct <b>feasibility</b> study of <b>application</b> as per the job requirement following standard procedures.</p> <p>1.3 Provide recommendations based on the feasibility studies to the clients following standard procedures.</p>
2. Identify the components of IoT	<p>2.1 Identify different types of <b>input devices</b> as per the application following standard procedures</p> <p>2.2 Identify different types of <b>output devices</b> as per the application following standard procedures</p> <p>2.3 Identify appropriate microcontrollers or development board as per the application following standard procedures</p>



<p>3. Design the circuit diagram</p>	<p>3.1 Identify the simulation tools as per the application requirement following standard procedures</p> <p>3.2 Create circuit design as per the application requirement following standard procedures</p> <p>3.3 Draw the circuit on simulation software as per the application requirement following standard procedures</p> <p>3.4 Perform simulation as per the application requirement following standard procedures</p>
--------------------------------------	--

## RANGE STATEMENT

### Input devices may include but not limited to:

- Sensors
- Transducers

### Output devices may include but not limited to:

- LED
- LCD
- Buzzers

### Feasibility may include but not limited to:

- Technical
- Economic feasibility

### IoT Application may include but not limited to:

- Smart greenhouse
- Room temperature automation
- Streetlight control
- Room light automation
- Water level control in storage tank

### Critical aspects:

- Demonstrate safe working practices at all times in accordance with OHS regulations.
- Draw correct circuit diagram

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• Occupational Health and Safety (OHS) Regulations</li> <li>• First Aid</li> <li>• Basic working principle of controllers</li> <li>• Types of sensors and electronics components</li> <li>• IoT Architecture</li> <li>• Basic Networking concepts</li> <li>• E-waste management</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Negotiation</li> <li>• Communication skills</li> <li>• Problem solving</li> <li>• Analytical Skills</li> <li>• Time Management</li> </ul>

<b>UNIT TITLE :</b>	<b>Perform IoT System Integration</b>
<b>DESCRIPTOR:</b>	This unit covers the competencies required to perform IoT system integration.
<b>CODE :</b>	<b>7421-U2-L3</b>
<b>ELEMENTS OF COMPETENCE</b>	<b>PERFORMANCE CRITERIA</b>
1. Assemble the IoT components	<p>1.1 Select the components as per the design following standard procedure</p> <p>1.2 Perform required configuration or settings for the selected components as per the job requirement following standard procedure</p> <p>1.3 Perform circuit connection as per the design following standard procedure</p> <p>1.4 Perform testing of the system as per the design following standard procedure</p>
2. Perform Programming	<p>2.1 Identify the <b>programming languages</b> and platforms as per the job requirement following standard procedure</p> <p>2.2 Write codes as per the application requirement following standard procedure</p> <p>2.3 Interface hardware with programming platforms following standard procedure</p>
3. Test the IoT system	<p>3.1 Perform logical and functional test as per the application requirement following standard procedure</p> <p>3.2 Select the IoT framework as per the application requirement following</p>

	<p>standard procedure</p> <p>3.3 Integrate IoT framework with the system following standard procedure</p> <p>3.4 Perform visualization of sensors' data following standard procedure</p> <p>3.5 Perform troubleshooting of the IoT system as per the job requirement following standard procedures</p>
--	--

<b>RANGE STATEMENT</b>
<p><b>Programming languages may include but not limited to:</b></p> <ul style="list-style-type: none"> <li>• C</li> <li>• Python</li> <li>• C++</li> </ul>

<p><b>Critical aspects:</b></p> <ul style="list-style-type: none"> <li>• Demonstrate safe working practices at all times in accordance with OHS regulations.</li> <li>• Write codes as per the application requirement</li> </ul>
---

<b>UNDERPINNING KNOWLEDGE</b>	<b>UNDERPINNING SKILLS</b>
<ul style="list-style-type: none"> <li>• Ethics and Integrity</li> <li>• Occupational Health &amp; Safety</li> <li>• First Aid</li> <li>• Fundamentals of programming</li> <li>• Data privacy and integrity</li> <li>• IoT Frameworks</li> <li>• Debugging programs</li> <li>• Database concepts</li> <li>• E-waste management</li> </ul>	<ul style="list-style-type: none"> <li>• Team work</li> <li>• Negotiation</li> <li>• Communication skills</li> <li>• Problem solving</li> <li>• Analytical Skills</li> <li>• Time Management</li> </ul>

## **Annexure:**

### **1.1 National Competency Standards (NCS)**

National Competency Standards specify the skill, knowledge and attitudes applied to a particular occupation. Standards also specify the standards or criteria of performance of a competent worker and the various contexts in which work may take place. Standards provide explicit advice to assessors regarding the skill and knowledge to be demonstrated by candidates seeking formal recognition either following training or through work experience.

### **1.2 Purpose of National Competency Standards**

Competency Standards serve a number of purposes including:

- Providing advice to curriculum developers about the skill and knowledge to be included in curriculum.
- Providing specifications to assessment resource developers about the skill, knowledge and attitudes within an occupation to be demonstrated by candidates.
- Providing advice to industry/employers about job functions, which in turn can be used for the development of job descriptions, performance appraisal systems and work flow analysis.

### 1.3 Bhutan Vocational Qualifications Framework (BVQF)

Bhutan Vocational Qualifications Framework is an agreed system of Assessing, Certifying and Monitoring nationally recognized qualifications for all learning in the VET sector against national standards, in training institutions, in the workplace, in schools or anywhere where learning takes place.

#### Components of the Bhutan Vocational Qualification Framework (BVQF)



\* RPL = Recognition of Prior Learning

## 1.4 BVQF Levels

The Bhutan Vocational Qualifications Framework has three levels classified based on the competency of the skilled workers. The three levels are:

- National Certificate Level 3 (NC 3) -Master Craftsman
- National Certificate Level 2 (NC 2) -Craftsman
- National Certificate Level 1 (NC 1) -Semi Skilled Worker

### BVQF Level Descriptors

The qualification levels are decided based on level descriptors. The detail of the qualification level descriptor is as follows:

#### National Certificate Level 1 (Semi skilled)

Carry out processes that:	Learning demand:	Responsibilities Which are applied:
<ul style="list-style-type: none"><li>• Are narrow in range.</li><li>• Are established and familiar.</li><li>• Offer a clear choice of routine responses.</li><li>• Involve some prioritizing of tasks from known solutions.</li></ul>	<ul style="list-style-type: none"><li>• Basic operational knowledge and skill.</li><li>• Utilization of basic available information.</li><li>• Known solutions to familiar problems.</li><li>• Little generation of new ideas.</li></ul>	<ul style="list-style-type: none"><li>• In directed activity.</li><li>• Under general supervision and quality control.</li><li>• With some responsibility for quantity and quality.</li><li>• With no responsibility for guiding others.</li></ul>



## National Certificate Level 2 (Craftsman)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> <li>• Require a range of well-developed skills.</li> <li>• Offer a significant choice of procedures requiring prioritization.</li> <li>• Are employed within a range of familiar context.</li> </ul>	<ul style="list-style-type: none"> <li>• Some relevant theoretical knowledge.</li> <li>• Interpretation of available information.</li> <li>• Discretion and judgment.</li> <li>• A range of known responses to familiar problems</li> </ul>	<ul style="list-style-type: none"> <li>• In directed activity with some autonomy.</li> <li>• Under general supervision and quality checking.</li> <li>• With significant responsibility for the quantity and quality of output.</li> <li>• With some possible responsibility for the output of others.</li> </ul>

## National Certificate Level 3 (Master Craftsman)

Carry out processes that:	Learning demand:	Responsibilities which are applied:
<ul style="list-style-type: none"> <li>• Requires a wide range of technical or scholastic skills.</li> <li>• Offer a considerable choice of procedures requiring prioritization to achieve optimum outcomes.</li> <li>• Are employed in a variety of familiar and unfamiliar contexts.</li> </ul>	<ul style="list-style-type: none"> <li>• A broad knowledge base which incorporates some theoretical concepts.</li> <li>• Analytical interpretation of information.</li> <li>• Informed judgment.</li> <li>• A range of sometimes innovative responses to concrete but often unfamiliar problems.</li> </ul>	<ul style="list-style-type: none"> <li>• In self-directed activity.</li> <li>• Under broad guidance and evaluation.</li> <li>• With complete responsibility for quantity and quality of output.</li> <li>• With possible responsibility for the output of others.</li> </ul>

## **1.5 CODING USED FOR NATIONAL COMPETENCY STANDARDS**

The coding and classification system developed in Bhutan is logical, easy to use, and also aligned with international best practices. The Bhutanese coding and classification system is based on the International Standard Classification of Occupations, 2008 (ISCO-08) developed by the International Labour Organisation (ILO).

The coding of the National Competency Standards forms the basis of the identification code for the Vocational Education and Training Management Information System (VET – MIS) both in terms of economic sector identification and that of the individual standard.

Coding the individual unit competency standard is to identify the level in qualification package to which it belongs.

While packaging, in order to follow a logical order, only competency standards related to each other and following a logical sequence in terms of training delivery, from the simple to the complex, are clustered into a qualification package.

## **1.6 ASSESSMENT GUIDE**

### **Form of assessments**

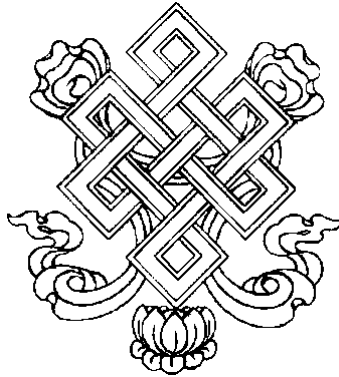
- Continuous assessment together with collected evidence of performance will be used.
- Evidence of the performance shall be based on practical demonstration.
- Knowledge can be assessed through diagrams, in writing or orally (viva- voce).

### **Assessment context**

- Competency may be assessed in the actual work place or in a simulated workplace setting.

### **Assessment condition**

- The candidate shall have access to all required tools, equipment, materials and documents.
- Candidate must complete the assessment in industry accepted time frame.



Department of Occupational Standards  
Ministry of Labour & Human Resources  
Thongsel Lam, Lower Motithang  
P.O. Box 1036, Thimphu Tel:  
02-331611 Fax: 02-326873  
[www.molhr.gov.bt](http://www.molhr.gov.bt)