NATIONAL SKILLS QUALIFICATION

LEVEL 3

TITLE:

INTERNET OF THINGS (IoT)

YEAR:

2024

NATIONAL SKILLS QUALIFICATION

NSQ LEVEL 3 - INTERNET OF THINGS

GENERAL INFORMATION

QUALIFICATION PURPOSE

This Qualification is designed to provide learners with the essential skills required to effectively design, develop, implement, manage, and secure IoT systems.

QUALIFICATION OBJECTIVES

The learner should be able to: -

i. Identify the basics of IoT
ii. Use various development boards (e.g., Unity Board, Arduino, ESP32, etc.)
iii. Use Basic electronics for IoT.
iv. Identify basics of embedded programming
v. Work with sensors and actuators
vi. Use Communication protocols
vii. Use IoT networking and communication
viii. Use cloud platforms for IoT projects
ix. Apply IoT security and best practices

Mandatory Units

Unit No	Reference Number	NOS Title	Credit Value	Guided Learning Hours	Remark
1.		Occupational Health and Safety			
2.		Teamwork			
3.		Communication			
4.	ICT/IoT/001	Introduction to IoT	2	20	Level 3
5.	ICT/IoT/002	Basic electronics for IoT	2	20	Level 3
6.	ICT/IoT/003	Introduction to Embedded Programming (C, C++)	4	40	Level 3
7.	ICT/IoT/004	Working with Sensors and Actuators	3	30	Level 3
8.	ICT/IoT/005	Communication Protocols	2	20	Level 3
9.	ICT/IoT/006	IoT Networking	2	20	Level 3
10.	ICT/IoT/007	Cloud platforms for IoT project	2	20	Level 3
11.	ICT/IoT/008	IoT security and best practices	2	20	Level 3

NOTE: *This is a 19 credits unit qualification. To achieve this qualification; Learners are required to achieve 190 guided learning hours. All units are mandatory*

NATIONAL SKILLS QUALIFICATION

LEVEL 3: *Internet of Things*

Unit 1: OCUPATIONAL HEALTH AND SAFETY

Unit Reference Number:

NSQ Level: 3

Credit Value: 1

Guided Learning Hours: 10

Unit Purpose:

To equip learners with the knowledge and skills to implement and maintain safe working practices in the IT environment, ensuring personal and team safety while adhering to industry regulations and standards.

Unit assessment requirements/ evidence requirements:

Assessment must be carried out in real workplace environment in which learning and human development is carried out.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Assignment (ASS), etc.

UNIT 001: Occupational Health and Safety

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand Workplace Health and Safety Regulations	1.1	Explain key OHS legislation and regulations relevant to the IT sector.									
	1.2	Identify the roles and responsibilities of individuals and organizations in maintaining a safe work environment									
	1.3	Describe the process for reporting health and safety risks and incidents.									
LO 2: Identify Workplace Hazards and Implement Control Measures	2.1	Identify common hazards in IT work environments, including electrical, ergonomic, and data-related risks									
	2.2	Assess the severity and likelihood of potential hazards in specific IT tasks.									
	2.3	Implement appropriate control measures, such as safe cabling practices, ergonomic workstation setup, and electrical safety protocols.									
LO 3: Apply Emergency Procedures and First Aid in the Workplace	3.1	Demonstrate the correct procedure for responding to workplace emergencies, such as electrical fires or equipment malfunctions.									
	3.2	Perform basic first aid techniques, including treating minor injuries and using first aid equipment									
	3.3	Communicate and coordinate effectively with emergency services and other relevant personnel during a workplace incident.									

Learner's Signature	Date
Assessor's Signature	Date
IQA's Signature	Date
EQA's Signature	Date

Unit 002: Teamwork

Unit Reference Number:

NSQ Level: 3

Credit Value: 1

Guided Learning Hours: 10

Unit Purpose:

To develop learners' abilities to work effectively within IT teams, fostering collaboration, problem-solving, and the achievement of shared goals.

Unit assessment requirements/ evidence requirements:

Assessment must be carried out in real workplace environment in which learning and human development is carried out.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Assignment (ASS), etc.

UNIT 002: Teamwork

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Understand the Roles and Responsibilities within a Team	1.1	Identify the different roles and functions within an IT team (e.g., network engineers, system administrators, software developers).									
	1.2	Describe the key responsibilities and contributions of each team member.									
	1.3	Recognize the importance of each role in achieving the team's objectives.									
LO 2: Foster Positive Working Relationships within a Team	2.1	Demonstrate techniques for effective interpersonal communication and conflict resolution in a team environment.									
	2.2	Show the ability to provide constructive feedback and actively listen to others' contributions									
	2.3	Promote inclusivity and collaboration among team members to ensure participation and engagement from all.									
LO 3: Contribute to Team Problem-Solving and Decision-Making	3.1	Participate in group discussions to identify and analyse IT-related problems.									
	3.2	Suggest innovative solutions and support team decision-making processes.									
	3.3	Evaluate the effectiveness of team decisions and propose improvements where necessary.									

Learner's Signature	Date
Assessor's Signature	Date
IQA's Signature	Date
EQA's Signature	Date

Unit 003: Communication

Unit Reference Number:

NSQ Level: 3

Credit Value: 1

Guided Learning Hours: 10

Unit Purpose:

To enhance learners' communication skills, enabling them to convey technical information effectively and collaborate with both technical and non-technical stakeholders.

Unit assessment requirements/ evidence requirements:

Assessment must be carried out in real workplace environment in which learning and human development is carried out.

Assessment methods to be used include:

1. Direct Observation/oral questions (DO)
2. Question and Answer (QA)
3. Witness Testimony (WT)
4. Assignment (ASS), etc.

UNIT 003: Communication

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Communicate Technical Information Clearly and Accurately	1.1	Explain IT concepts, procedures, and solutions in a manner appropriate to the audience, whether technical or non-technical.									
	1.2	Use industry-standard terminology correctly when describing technical processes									
	1.3	Adapt communication methods to suit the context, such as written reports, emails, or verbal presentations.									
LO 2: Utilize Digital Communication Tools Effectively	2.1	Demonstrate proficiency in using digital tools for communication, such as email, messaging platforms, and collaboration software (e.g., Slack, Teams).									
	2.2	Adhere to best practices for professional digital communication, including email etiquette and secure file sharing.									
	2.3	Use collaborative tools to share and receive feedback on documents, code, or project updates.									
LO 3: Listen and Respond Appropriately in a Professional Context	3.1	Demonstrate active listening skills during team discussions or client meetings.									
	3.2	Respond to questions, concerns, and feedback clearly and effectively.									
	3.3	Clarify misunderstandings and summarize discussions to ensure mutual understanding.									
Learner's Signature					Date						
Assessor's Signature					Date						
IQA's Signature					Date						
EQA's Signature					Date						

Unit 4: INTRODUCTION TO IoT

Unit Reference Number: ICT/IOT/001

NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Purpose: This unit will equip learners with fundamentals of IoT for specific IoT technologies and applications.

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. Scenario-based questions
3. True/False Matching questions
4. Periodic checks within the course as (Quizzes)

UNIT 04: INTRODUCTION TO IoT

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know IoT and its importance in today's technology landscape	1.1	Define Internet of Things (IoT)									
	1.2	Explain Importance of IoT in industries such as healthcare, manufacturing, smart cities, etc.									
	1.3	Identify components of IoT ecosystem: Devices, communication, and cloud									
LO 2: Know Key IoT Terms and Concepts	2.1	Explain basic IoT concepts, such as machine-to-machine communication and data acquisition									
	2.2	Use terms like "edge computing," "smart devices," and "big data" in context									
	2.3	Identify different IoT platforms available e.g., Microsoft Azure, Google Cloud, etc									
LO 3: Know development boards	3.1	Discuss Unity Board (Arduino-compatible) as a development board									
	3.2	State Features and technical specifications									
	3.3	Explain the differences and similarities between the Unity Board (Arduino Compatible) and other Development Boards.									
LO 4: Get Started with an IDE	4.1	Set up the Integrated Development Environment (IDE installation)									
	4.2	Configure the Unity Board in an IDE									
	4.3	Upload a code (Hello World)									

Unit 5: BASIC ELECTRONICS FOR IoT

Unit Reference Number: ICT/IOT/002

NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Objective: This unit ensures that students are equipped with the foundational knowledge of electronics for IoT.

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. Scenario-based questions
3. Drag-and-Drop or Matching exercises
4. Diagram-based Questions (Quizzes)
5. Practical assessment (*where possible*)

UNIT 06: BASIC ELECTRONICS FOR IoT

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know Sensors and Actuators	1.1	Identify sensors (temperature, humidity, light, motion, etc.)									
	1.2	Identify actuators (LEDs, buzzers, relays, motors)									
	1.3	Explain how sensors and actuators interact with the development boards (Unity Board, Arduino, ESP32 etc)									
LO 2: Learn Wiring and Connections	2.1	Do Basic Breadboarding									
	2.2	Use Common electronic components (resistors, capacitors, transistors)									
	2.3	Connect sensors and actuators to the Unity Board (Arduino-compatible)									
LO 3: Know Basic Circuit Design and Simulation	3.1	Do basic Circuit Analysis									
	3.2	Use Proteus etc for circuit simulation									
	3.3	Design simple IoT circuits (LED control, buzzer alarm)									

Unit 7: INTRODUCTION TO EMBEDDED PROGRAMMING (C, C++)

Unit Reference Number: ICT/IOT/003
NSQ Level: 3

Credit Value: 4

Guided Learning Hours: 40

Unit Purpose: This unit equips learners with fundamental concepts and principles of embedded programming using an IDE and integration with electronics.

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. Scenario-based questions
3. Hands-on tasks

UNIT 07: INTRODUCTION TO EMBEDDED PROGRAMMING (C, C++)

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know Programming Basics	1.1	Explain C/C++ application in embedded systems									
	1.2	Explain the structure/**algorithm** of an embedded program (Arduino IDE etc)									
	1.3	Discuss data types, variables, and operators									
LO 2: Read Digital Input/Output signals	2.1	Identify digital pins on the Unity Board (Arduino-compatible)									
	2.2	Control LEDs with digital output									
	2.3	Read button presses (digital input)									
LO 3: Read Analog Input/Output Signals	3.1	Identify analog pins on the Unity Board (Arduino-compatible)									
	3.2	Read data from analog sensors (e.g., potentiometer, temperature sensor)									
	3.3	Do PWM and analogWrite (LED brightness control)									

Unit 8: WORKING WITH SENSORS AND ACTUATORS

Unit Reference Number: ICT/IOT/004

NSQ Level: 3

Credit Value: 3

Guided Learning Hours: 30

Unit Purpose: This unit equip learners with the knowledge and skills necessary to design and implement IoT systems that effectively collect and process sensor data and control actuators.

Assessment methods to be used include:

1) Multiple-choice questions (MCQ's)
2) Scenario-based questions
3) Drag-and-Drop or Matching exercises
4) Diagram-based Questions (Quizzes)
5) Practical assessment (*where possible*)

UNIT 08: WORKING WITH SENSORS AND ACTUATORS

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: **Be able to** Read Data from Sensors	1.1	Interface with temperature sensors (DS1820, DHT11/22 etc.)									
	1.2	Work with light sensors (APDS9960, LDR etc.)									
	1.3	Use motion sensors (RADAR, PIR etc.)									
LO 2: Be able to Control Actuators	2.1	Control a DC motor with Unity Board (Arduino-compatible)									
	2.2	Perform Servo, stepper, DC motors control									
	2.3	Perform Relay operation to control external devices									
LO 3: Design a Project: Smart Lighting System	3.1	Define the project objective, (like remote controlled, motion detection, etc.)									
	3.2	Determine the functional and non-functional requirements for the project									
	3.3	Implement a system that adjusts lighting based on environmental conditions (light sensor + LED)									

Unit 9: COMMUNICATION PROTOCOLS

Unit Reference Number: ICT/IOT/005

NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Purpose: The primary goal of this unit on communication protocol is to equip students with the knowledge and skills necessary to effectively ensure smooth communication between a microcontroller and sensors.

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. Scenario-based questions
3. Drag-and-Drop or Matching exercises
4. Diagram-based Questions (Quizzes)
5. Practical assessment (*where possible*)

UNIT 09: COMMUNICATION PROTOCOLS

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know Communication Protocols	1.1	Identify types of communication protocols (I2C, SPI, UART)									
	1.2	Explain protocol characteristics and Use cases									
	1.3	Configure basic communication using protocols like MQTT, HTTP, or CoAP in a simulated or real-world environment									
LO 2: Know Serial Communication	2.1	Explain serial communication (UART)									
	2.2	Send and receive data using the serial monitor									
	2.3	Configure UART, I2C, and SPI settings such as baud rate, address setting, and data format in microcontroller environments (e.g., Arduino, Raspberry Pi).									
LO 3: Understand I2C and SPI Communication	3.1	Explains how data transmission occurs in I2C									
	3.2	Interface I2C devices (e.g., LCD display, sensor modules)									
	3.3	Use SPI communication									

Unit 10: IoT NETWORKING

Unit Reference Number: ICT/IOT/006

NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Purpose: This unit aims to equip students with skills that ensure the reliability and efficiency of interconnected devices in collecting and transmitting data.

Assessment methods to be used include:

1) Multiple-choice questions (MCQ's)
2) Scenario-based questions
3) Drag-and-Drop or Matching exercises
4) Diagram-based Questions (Quizzes)
5) Practical assessment (*where possible*)

UNIT 10: IoT NETWORKING

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know IoT Networking fundamentals	1.1	Evaluate IoT networking to select most suitable for projects (GSM/GPRS, WiFi, Bluetooth, LoRa, etc.)									
	1.2	Explain IP addresses and network protocols									
	1.3	Comprehend the role of IP (Internet Protocol) addresses, MAC addresses, and subnet masks in device identification and communication									
LO 2: Connect Unity Board(Arduino-compatible) to the Internet	2.1	Use a WiFi module (ESP8266/ESP32) with Unity Board(Arduino-compatible)									
	2.2	Do Basic WiFi configuration and connection									
	2.3	Send data to the cloud using HTTP requests									
LO 3: Design a Project: IoT Temperature Monitor	3.1	Demonstrate ability to plan for IoT temperature monitor project									
	3.2	Define the functional and nonfunctional requirements of the project									
	3.3	Build a temperature monitoring system that sends data to a cloud platform or web server									

Unit 11: CLOUD PLATFORMS FOR IoT PROJECT

Unit Reference Number: ICT/IOT/007

NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Purpose: This unit ensures that students are equipped with skills for transmitting data for cloud storage and visualization.

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. Scenario-based questions
3. Drag-and-Drop or Matching exercises
4. Diagram-based Questions (Quizzes)
5. Practical assessment (*where possible*)

UNIT 07: CLOUD PLATFORMS FOR IoT PROJECT

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know Cloud Platforms	1.1	Explain cloud platforms in IoT									
	1.2	Identify popular cloud platforms (ThingSpeak, Blynk, AWS IoT,Azure etc.)									
	1.3	Distinguish the strength and best fit of the platforms									
LO 2: Learn Data Logging on ThingSpeak	2.1	Set up a ThingSpeak account									
	2.2	Send sensor data to ThingSpeak using HTTP requests									
	2.3	Visual data in real-time using cloud platforms									
LO 3: Design a Project: Smart Home Dashboard	3.1	Demonstrate ability to plan for simple smart home project									
	3.2	Specify function and nonfunctional requirements for the project									
	3.3	Create a dashboard to monitor multiple sensors (temperature, humidity) via ThingSpeak or Blynk									

Unit 12: IoT SECURITY AND BEST PRACTICES

Unit Reference Number: ICT/IOT/008
NSQ Level: 3

Credit Value: 2

Guided Learning Hours: 20

Unit Purpose: This unit ensures that students are equipped with knowledge on the ethics and industry standards for IoT applications

Assessment methods to be used include:

1. Multiple-choice questions (MCQ's)
2. .Scenario-based questions
3. Drag-and-Drop or Matching exercises
4. Diagram-based Questions (Quizzes)
5. Practical assessment (*where possible*)

UNIT 12: IoT SECURITY AND BEST PRACTICES

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
LO 1: Know IoT Security	1.1	Define IoT security and explain why it is critical in the context of connected devices									
	1.2	Describe the unique security challenges faced by IoT devices, including resource constraints, scalability, and heterogeneity									
	1.3	Explain best practices for securing IoT devices									
LO 2: Implement Data Encryption	2.1	Explain and implement data encryption for IoT devices and authentication measures.									
	2.2	Implement secure communication using HTTPS									
	2.3	Configure secure boot settings to ensure only authenticated firmware runs on a device									
	2.4	understand the role of patches in maintaining security									
LO 3: Design and Implement Security Solutions for IoT Systems	3.1	Build a secure IoT system that encrypts sensor data before sending it to the cloud									
	3.2	Integrate security gateways and edge devices to filter data, enforce policies, and reduce exposure to threats									
	3.3	Secure cloud connections using API keys, certificates, and robust authentication methods									
LO 4: Understand Regulatory Compliance and Security Standards in IoT	4.1	Identify relevant security standards and regulations that apply to IoT systems, such as **NDPR/GDPRA** for data privacy and ISO/IEC 27001 for information security management									
	4.2	Demonstrate how to implement best practices aligned with NIST Cyber security Framework in IoT environments									

LEARNING OBJECTIVE (LO) The learner will:		PERFORMANCE CRITERIA The learner can:	Evidence Type					Evidence Ref. Page No.			
	4.3	Develop compliance checklists for IoT devices and systems to ensure adherence to required security standards									

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