Qualification Pack

# Embedded Full-Stack IoT Analyst

QP Code: ELE/Q1404

Version: 2.0

NSQF Level: 5

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# Contents

# ELE/Q1404: Embedded Full-Stack IoT Analyst

## Brief Job Description

The individual in this job role creates and implements new embedded OS based on system requirements and/or industry specifications. The individual builds and manages OS drivers for any custom hardware and to enhance existing application with new features.

## Personal Attributes

The individual must have attention to details, logical thinking, and ability to execute the project as per clients requirement. This job requires the individual to work collaboratively with diverse teams. The individual should be able to hold interest in technology changes, demonstrate strong technical expertise and possess good oral and written communications skills. The individual should also be comfortable working with deadlines and budgets. The Individual must exhibit good customer service attributescourteous, solution oriented, polite, reliable, good decision-making skills, etc.

## Applicable National Occupational Standards (NOS)

### Compulsory NOS:

1. ELE/N1406: Develop and Test Design for IoT Based System
2. ELE/N1410: Build GUI and Applications in a Framework
3. ELE/N1411: Test and Troubleshoot the Firmware
4. ELE/N9905: Work effectively at the workplace
5. ELE/N1002: Apply health and safety practices at the workplace

## Qualification Pack (QP) Parameters

| | |
|---|---|
| **Sector** | Electronics |
| **Sub-Sector** | Semiconductor & Components |
| **Occupation** | Product Design |
| **Country** | India |
| **NSQF Level** | 5 |
| **Credits** | NA |

| | |
|---|---|
| **Aligned to NCO/ISCO/ISIC Code** | NCO-2015/NIL |
| **Minimum Educational Qualification & Experience** | Diploma ((Electrical or Electronics Engineering) with 2 Years of Relevant experience))<br>OR<br>B.E./B.Tech (Degree in Electrical or Electronics Engineering)<br>OR<br>Certificate-NSQF (Level-4 in Design Engineer) with 2 Years of experience In the relevant field |
| **Minimum Level of Education for Training in School** | |
| **Pre-Requisite License or Training** | NA |
| **Minimum Job Entry Age** | 21 Years |
| **Last Reviewed On** | 27/01/2022 |
| **Next Review Date** | 02/06/2025 |
| **Deactivation Date** | 31/07/2024 |
| **NSQC Approval Date** | 27/01/2022 |
| **Version** | 2.0 |
| **Reference code on NQR** | 2022/EHW/ESSC/05132 |
| **NQR Version** | 1.0 |

# ELE/N1406: Develop and Test Design for IoT Based System

## Description

This OS unit covers the development and testing of a IoT system design based on the work requirements, specifications of key components, dependencies, constraints and other functional parameters.

## Scope

The scope covers the following :

- Prepare the design for IoT based system
- Use appropriate techniques to develop embedded design
- Test and debug the embedded system for proper functionality

## Elements and Performance Criteria

*Prepare the design for IoT based system*

To be competent, the user/individual on the job must be able to:

**PC1.** collate the design and connectivity requirements to establish the inter-operability between various components of the system as per its needs

**PC2.** review the specific needs of the stakeholders of an IoT system and convert them to a requirement specification document

**PC3.** confirm that the software and firmware required are as per the given product specifications and system architecture

**PC4.** monitor feasibility analysis of the proposed embedded product design by evaluating the required parameters such as compatibility of hardware & software, cost, space, technology, safety, functional requirements, performance requirements, etc.

**PC5.** review list handshake protocols between the connected devices in the IoT system

**PC6.** check all the Machine to Machine (M2M) information in a flow chart or a connected diagram that shows all inputs and outputs of the system

**PC7.** check embedded OS, development machines like virtual machines, tools (cross compiler, device drivers), embedded language and GUI language required to develop the new product design

**PC8.** plan to deduce security aspects to be provided in the design at all its stages and comply with globally accepted regulatory standards for technical specifications

**PC9.** monitor proper coding requirements and use licensed software (or open source) as per the requirements

**PC10.** check requirements for continuous integration/continuous development platform and automation test case

**PC11.** test the functional specifications of each component as well as of the system

**PC12.** verify technical evaluation and deployment of the overall IoT solution after discussing with experts and the internal team

**PC13.** ensure the IoT based system as per quality, industry and compliance standards as well as performance and budget requirements

**PC14.** supervise the personnel involved work and develop a work plan with agreed scheduled timelines

**PC15.** test both high-level design document and the detailed low-level design document

**PC16.** monitor specifications of the requirements, variables to be recorded, need for specific connectivity at each interface, security requirements, etc. and confirm the same with the client

*Use appropriate techniques to develop embedded design*

To be competent, the user/individual on the job must be able to:

**PC17.** monitor device drivers for sensors, timers, data communication ports, analog-to-digital and digital-to-analog converters and other embedded product peripherals

**PC18.** check microprocessor/microcontroller software to comply with a specified function and its operating parameters

**PC19.** monitor applications that perform signal processing, data acquisition, event processing, data management and communication functions

**PC20.** verify that systems are using real-time embedded operating systems (OS) such as VxWorks and QNX

**PC21.** ensure proper use of Opensource by understanding General Public License (GPL) detail to use re-usable components in collaboration with legal/IP team

**PC22.** guide intellectual property from unauthorized use by maintaining IP confidentiality rights

**PC23.** check reusable software components, best practices and design standards

*Test and debug the embedded system for proper functionality*

To be competent, the user/individual on the job must be able to:

**PC24.** check the Unit Test Cases (UTCs) by white box testing method

**PC25.** plan to use proper testing methodologies to check that prototype devices are built as per specifications

**PC26.** verify the microprocessor/microcontroller on the board and also all associated peripherals systematically

**PC27.** test the performance of the prototype devices/components against product specifications and regulatory requirements

**PC28.** review codes and UTCs from appropriate people to identify defects

**PC29.** check inputs from concerned people to decide design corrections

**PC30.** monitor bug tracking system to report problems or issues in accordance with the policy and procedure and seek guidance from the team on how to resolve them

**PC31.** verify corrective actions taken for identified defects in the design to submit corrected code to concerned person for approval

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

**KU1.** legislation, standards, policies, rules and procedures followed in the company relevant to employment and performance conditions

**KU2.** health and safety requirements applicable in the work place

**KU3.** sources for information pertaining to employment terms, entitlements, job role and responsibilities

**KU4.** how to engage with experts and vendors for support

**KU5.** documentation and related procedures applicable in the context of the employment and work

**KU6.** escalation matrix and procedures for reporting work and employment related issues

**KU7.** c/c++ development (debug and testing using gnu tools and other common ides like eclipse, microsoft visual studio, etc.) on embedded platforms like arm development studio

**KU8.** scripting languages like python/shell/perl

**KU9.** debugging tools such as jtag and protocol analysers

**KU10.** software version control tools and configuration management tools

**KU11.** device drivers and real-time as well as embedded operating systems like mbedos, rtx kernel, freertos, yocto linux, etc.

**KU12.** importance of document preparation, referencing and flow chart preparation

**KU13.** use of budget and project management/planning tools like microsoft project and jira

**KU14.** how to read and draw electronic circuits, process and system flowcharts, project schedules, logic diagrams and work breakdown structures

**KU15.** concepts of digital electronics, control engineering and communication protocols

**KU16.** applicable standards , regulations and code compliance norms

**KU17.** how to ensure that the design confirms to safety and environmental standards

**KU18.** types of programming languages and their uses

**KU19.** types of operating systems and their uses

**KU20.** categories of embedded product designs

**KU21.** use of terminology, units, graphical representation and signs and symbols related to embedded product designing

**KU22.** processes involved in embedded product designing

**KU23.** verification or validation processes involved in embedded product designing

**KU24.** precautionary measures used to protect against electrostatic discharge (esd)

**KU25.** standard operating procedures (sop) and their application

**KU26.** documentation process of completed work and reporting process of required information in test reports, report sheets, etc. as per standard organisational policies

## Generic Skills (GS)

User/individual on the job needs to know how to:

**GS1.** procedure involved in preparation of software requirements document and design documents

**GS2.** how to capture complete information as required from stakeholders, experts, vendors, etc. accurately and in the required format

**GS3.** how to prepare report after summarising all the relevant information

**GS4.** use of basic office applications like spread sheet, word processor and presentations

**GS5.** use of organisational software specific to quality function

**GS6.** use of email to communicate within the organisation as per organisational guidelines

**GS7.** learn software development practices/sdlc/agile and select best option for the given iot project

**GS8.** how to read/listen and interpret information correctly from various work instruction documents, manuals, health and safety instructions, memos, etc. applicable to the job in english and/or local language

**GS9.** flowcharts and project management tools

**GS10.** relevant symbols, labels and descriptions on components and equipment while performing early analysis of design

**GS11.** how to gather information in an organised manner such that all relevant information is obtained

**GS12.** use of probing questions to help the stakeholders provide complete information

**GS13.** process of sharing technical information clearly using appropriate language

**GS14.** how to check and clarify task-related information

**GS15.** correct protocols to liaise with appropriate authorities

**GS16.** how to communicate with people in respectful form and manner in line with organisational protocol

**GS17.** how to discuss and take inputs from various stakeholders in order to make critical decisions

**GS18.** how to evaluate various options, their pros and cons, short term and long term implications, cost implications, health and safety implications, etc. before taking a decision

**GS19.** use of additional information which can be added to user tools like raci chart / design thinking to evaluate various solutions and choose the best possible option

**GS20.** limitations and constraints of any component being used in the system

**GS21.** how to plan, prioritise and sequence the activities to be carried out

**GS22.** how to organise and analyse information relevant to work

**GS23.** basic concepts of productivity like time management, efficient resource utilisation and eliminating waste and cost in the design

**GS24.** how to identify problems with work planning, procedures, output and behaviour and their implications

**GS25.** how to prioritise and plan for problem solving

**GS26.** how to communicate problems appropriately to others with recommendations for problem solving

**GS27.** how to identify sources of information and support for problem solving

**GS28.** how to seek assistance and support from other sources to solve problems

**GS29.** how to identify effective resolution techniques, and select and apply them appropriately

**GS30.** how to seek evidence of problem resolution

**GS31.** how to apply logical reasoning to solve current problems or any potential problems related to work by analysing previous experiences

**GS32.** how to analyse trends of previous performances/data to derive best possible approach to impending problems/issues

**GS33.** how to analyse risks to minimise losses or damages

**GS34.** how to complement product research and development with technical inputs deduced from analysis of work data

**GS35.** how to determine the impact of inappropriate selection of work procedures and inputs to overall work outcome

**GS36.** alternative solutions, conclusions or approaches to problems

**GS37.** how to ensure appropriate sizing of system by selecting appropriate components and incorporate appropriate storage as well as electrical and mechanical design within ones scope of work

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Prepare the design for IoT based system* | **23** | **29** | **-** | **5** |
| **PC1.** collate the design and connectivity requirements to establish the inter-operability between various components of the system as per its needs | 2 | 3 | - | 1 |
| **PC2.** review the specific needs of the stakeholders of an IoT system and convert them to a requirement specification document | 1 | 2 | - | - |
| **PC3.** confirm that the software and firmware required are as per the given product specifications and system architecture | 1 | 2 | - | - |
| **PC4.** monitor feasibility analysis of the proposed embedded product design by evaluating the required parameters such as compatibility of hardware & software, cost, space, technology, safety, functional requirements, performance requirements, etc. | 1 | 2 | - | 1 |
| **PC5.** review list handshake protocols between the connected devices in the IoT system | 2 | 2 | - | 1 |
| **PC6.** check all the Machine to Machine (M2M) information in a flow chart or a connected diagram that shows all inputs and outputs of the system | 1 | 2 | - | - |
| **PC7.** check embedded OS, development machines like virtual machines, tools (cross compiler, device drivers), embedded language and GUI language required to develop the new product design | 2 | 2 | - | 1 |
| **PC8.** plan to deduce security aspects to be provided in the design at all its stages and comply with globally accepted regulatory standards for technical specifications | 1 | 1 | - | 1 |
| **PC9.** monitor proper coding requirements and use licensed software (or open source) as per the requirements | 2 | 2 | - | - |
| **PC10.** check requirements for continuous integration/continuous development platform and automation test case | 2 | 2 | - | - |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC11.** test the functional specifications of each component as well as of the system | 1 | 2 | - | - |
| **PC12.** verify technical evaluation and deployment of the overall IoT solution after discussing with experts and the internal team | 2 | 2 | - | - |
| **PC13.** ensure the IoT based system as per quality, industry and compliance standards as well as performance and budget requirements | 2 | 1 | - | - |
| **PC14.** supervise the personnel involved work and develop a work plan with agreed scheduled timelines | 1 | 2 | - | - |
| **PC15.** test both high-level design document and the detailed low-level design document | 1 | 1 | - | - |
| **PC16.** monitor specifications of the requirements, variables to be recorded, need for specific connectivity at each interface, security requirements, etc. and confirm the same with the client | 1 | 1 | - | - |
| *Use appropriate techniques to develop embedded design* | **9** | **10** | **-** | **3** |
| **PC17.** monitor device drivers for sensors, timers, data communication ports, analog-to-digital and digital-to-analog converters and other embedded product peripherals | 2 | 2 | - | 1 |
| **PC18.** check microprocessor/microcontroller software to comply with a specified function and its operating parameters | 2 | 2 | - | 1 |
| **PC19.** monitor applications that perform signal processing, data acquisition, event processing, data management and communication functions | 1 | 2 | - | 1 |
| **PC20.** verify that systems are using real-time embedded operating systems (OS) such as VxWorks and QNX | 1 | 1 | - | - |
| **PC21.** ensure proper use of Opensource by understanding General Public License (GPL) detail to use re-usable components in collaboration with legal/IP team | 1 | 1 | - | - |
| **PC22.** guide intellectual property from unauthorized use by maintaining IP confidentiality rights | 1 | 1 | - | - |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC23.** check reusable software components, best practices and design standards | 1 | 1 | - | - |
| *Test and debug the embedded system for proper functionality* | **8** | **11** | **-** | **2** |
| **PC24.** check the Unit Test Cases (UTCs) by white box testing method | 1 | 2 | - | 1 |
| **PC25.** plan to use proper testing methodologies to check that prototype devices are built as per specifications | 1 | 2 | - | 1 |
| **PC26.** verify the microprocessor/microcontroller on the board and also all associated peripherals systematically | 1 | 1 | - | - |
| **PC27.** test the performance of the prototype devices/components against product specifications and regulatory requirements | 1 | 2 | - | - |
| **PC28.** review codes and UTCs from appropriate people to identify defects | 1 | 1 | - | - |
| **PC29.** check inputs from concerned people to decide design corrections | 1 | 1 | - | - |
| **PC30.** monitor bug tracking system to report problems or issues in accordance with the policy and procedure and seek guidance from the team on how to resolve them | 1 | 1 | - | - |
| **PC31.** verify corrective actions taken for identified defects in the design to submit corrected code to concerned person for approval | 1 | 1 | - | - |
| **NOS Total** | **40** | **50** | **-** | **10** |

## National Occupational Standards (NOS) Parameters

| | |
|---|---|
| **NOS Code** | ELE/N1406 |
| **NOS Name** | Develop and Test Design for IoT Based System |
| **Sector** | Electronics |
| **Sub-Sector** | Semiconductor & Components |
| **Occupation** | Product Design |
| **NSQF Level** | 5 |
| **Credits** | TBD |
| **Version** | 2.0 |
| **Last Reviewed Date** | 27/01/2022 |
| **Next Review Date** | 03/05/2026 |
| **NSQC Clearance Date** | 03/05/2023 |

# ELE/N1410: Build GUI and Applications in a Framework

## Description

This OS unit covers the building of Graphical User Interface (GUI) and appropriate applications required for a IoT based framework.

## Scope

The scope covers the following :

- Develop application for IoT system
- Develop the appropriate GUI/web UI for the entire IoT system

## Elements and Performance Criteria

*Develop application for IoT system*

To be competent, the user/individual on the job must be able to:

**PC1.** check wireless sensor networks for IoT and select the right platform for development for example arduino, raspberry pi

**PC2.** review IoT application development using embedded OS for example Cotiki OS, mbedOS etc.

**PC3.** verify user flow diagram and design map for the interface

**PC4.** monitor the style of interface and validate the same design of the application to identify wireframe and mockup

**PC5.** ensure lightweight framework, responsive design, event handling, interactivity etc. in GUI designing

**PC6.** test the correct syntax when developing code

**PC7.** monitor programming languages such as Python, C#, C/C++, Java etc. to build programs to communicate to cloud server using various application protocols such as HTTP/CoAP/ MQTT/AMQP

**PC8.** observe a complete IoT application by using appropriate programming language, by interfacing with sensors and actuators using GPIO pins and also interfacing with the camera

**PC9.** plan to select, install and troubleshoot various modules/devices for real applications for smart traffic system, smart parking system, healthcare, wearables, smart lighting, smart homes etc.

*Develop the appropriate GUI/web UI for the entire IoT system*

To be competent, the user/individual on the job must be able to:

**PC10.** verify proper graphical user interface, programming languages and hardware for compatibility between GUI and IoT system to use for the IoT system

**PC11.** check the wireframe design while developing the GUI

**PC12.** verify the front end as per the design configuration and execute functionality to the components on front end

**PC13.** check the program to test the functionality of the GUI

**PC14.** review the syntaxes to remove the faults in the program

**PC15.** verify UI/UX design done up front to ensure ease of use and simplicity of the GUI program

**PC16.** monitor the security aspects for IoT applications and comply with them to publish performance metrics of the application in real time

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

**KU1.** relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions

**KU2.** relevant health and safety requirements applicable in the work place

**KU3.** reporting structure ,inter-department functions, lines and procedures in the work area

**KU4.** how to engage with specialists for support in order to resolve change requests or fixing deviations in design

**KU5.** documentation and related procedures applicable in the context of employment and work

**KU6.** required background in embedded system design concepts using programming languages and understanding advanced topics like memory management, pointers, data structures etc.

**KU7.** basic concepts of gui and iot based application development

**KU8.** basics of os concepts and embedded os concepts and compiler options, to the level to port the embedded design on an arm based platform.

**KU9.** process of analog to digital conversions and vice-versa

**KU10.** how to use and apply sensors like light, sound touch, temperature etc., 16 and 32 bit micro controllers such as arm etc. and microprocessors

**KU11.** basic architecture structure of a micro controller or a microprocessor such as interrupts, cpu, rom, bus control, io ports etc. and interpreting their pin configuration

**KU12.** application of digital signal processing principles

**KU13.** types of wired and wireless standards and a good understanding of their protocols from an osi layer perspective for proper hardware implementation

**KU14.** appropriate use of communication protocols such as uart, spi, rs32 etc.

**KU15.** how to choose microcontroller interface techniques and how to interface them to other devices/boards/modules available commercially (stm32, nxp kinetis, qca 40xx, nordic semi, esp8266 etc)

**KU16.** how to write firmware for input and output devices at a low-level language

**KU17.** ios and android mobile application development

**KU18.** basics of short range communication protocols (bluetooth, zigbee, wi-fi, thread, 6lowpan etc.) and long range protocols including 3g/4g, nb-iot, lora etc. and their applicability in iot

## Generic Skills (GS)

User/individual on the job needs to know how to:

**GS1.** how to fill up appropriate forms, activity logs, attendance sheets as per organizational format in english and/or local language

**GS2.** how to read/listen and interpret information correctly from various work instruction documents, manuals, health and safety instructions, memos, etc. applicable to the job in english and/or local language

**GS3.** how to read relevant symbols, labels or descriptions on components and equipment while performing system operation

**GS4.** how to convey and share technical information clearly using appropriate language

**GS5.** how to check and clarify task-related information

**GS6.** how to liaise with appropriate authorities using correct protocol

**GS7.** how to communicate with people in respectful form and manner in line with organizational protocol

**GS8.** how to seek clarification from immediate supervisor or responsible authority to rectify problems at work when faced with difficult situations

**GS9.** how to identify errors and defects in components as they fail to work in the system and take remedial actions or a work around on the design

**GS10.** how to plan, prioritize and sequence work operations as per job requirements

**GS11.** how to organize and analyse information relevant to work

**GS12.** use of basic concepts of work productivity including efficient resource usage and time management

**GS13.** how to involve the customer at various milestones of the design to keep them abreast on the progress and to seek their approval

**GS14.** how to identify problems with work planning, procedures, output and behaviour and their implications

**GS15.** how to prioritize and plan for problem solving

**GS16.** how to communicate problems appropriately to others

**GS17.** how to identify sources of information and support for problem solving

**GS18.** how to seek assistance and support from other sources to solve problems

**GS19.** how to identify effective resolution techniques

**GS20.** how to select and apply resolution techniques

**GS21.** how to seek evidence for problem resolution

**GS22.** how to apply logical reasoning to solve problems related to work based on previous experiences

**GS23.** how to determine the impact of selection of inappropriate work procedures and inputs on overall work outcome

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Develop application for IoT system* | **24** | **29** | **-** | **6** |
| **PC1.** check wireless sensor networks for IoT and select the right platform for development for example arduino, raspberry pi | 3 | 4 | - | 1 |
| **PC2.** review IoT application development using embedded OS for example Cotiki OS, mbedOS etc. | 3 | 4 | - | 1 |
| **PC3.** verify user flow diagram and design map for the interface | 2 | 3 | - | 1 |
| **PC4.** monitor the style of interface and validate the same design of the application to identify wireframe and mockup | 3 | 2 | - | - |
| **PC5.** ensure lightweight framework, responsive design, event handling, interactivity etc. in GUI designing | 2 | 4 | - | 1 |
| **PC6.** test the correct syntax when developing code | 3 | 3 | - | 1 |
| **PC7.** monitor programming languages such as Python, C#, C/C++, Java etc. to build programs to communicate to cloud server using various application protocols such as HTTP/CoAP/ MQTT/AMQP | 2 | 3 | - | 1 |
| **PC8.** observe a complete IoT application by using appropriate programming language, by interfacing with sensors and actuators using GPIO pins and also interfacing with the camera | 3 | 3 | - | - |
| **PC9.** plan to select, install and troubleshoot various modules/devices for real applications for smart traffic system, smart parking system, healthcare, wearables, smart lighting, smart homes etc. | 3 | 3 | - | - |
| *Develop the appropriate GUI/web UI for the entire IoT system* | **16** | **21** | **-** | **4** |
| **PC10.** verify proper graphical user interface, programming languages and hardware for compatibility between GUI and IoT system to use for the IoT system | 3 | 3 | - | 1 |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC11.** check the wireframe design while developing the GUI | 2 | 2 | - | - |
| **PC12.** verify the front end as per the design configuration and execute functionality to the components on front end | 3 | 3 | - | 1 |
| **PC13.** check the program to test the functionality of the GUI | 2 | 4 | - | 1 |
| **PC14.** review the syntaxes to remove the faults in the program | 2 | 2 | - | 1 |
| **PC15.** verify UI/UX design done up front to ensure ease of use and simplicity of the GUI program | 2 | 3 | - | - |
| **PC16.** monitor the security aspects for IoT applications and comply with them to publish performance metrics of the application in real time | 2 | 4 | - | - |
| **NOS Total** | **40** | **50** | **-** | **10** |

## National Occupational Standards (NOS) Parameters

| | |
|---|---|
| **NOS Code** | ELE/N1410 |
| **NOS Name** | Build GUI and Applications in a Framework |
| **Sector** | Electronics |
| **Sub-Sector** | Semiconductor & Components |
| **Occupation** | Product Design |
| **NSQF Level** | 5 |
| **Credits** | TBD |
| **Version** | 2.0 |
| **Last Reviewed Date** | 27/01/2022 |
| **Next Review Date** | 03/05/2026 |
| **NSQC Clearance Date** | 03/05/2023 |

# ELE/N1411: Test and Troubleshoot the Firmware

## Description

This unit covers the testing of the functioning of the prototype developed for a IoT based system and rectifying malfunctions, if any.

## Scope

The scope covers the following :

- Test the software solutions for embedded IoT products
- Testing and rectify malfunctions in the IoT prototype
- Validate and configure the entire embedded IoT system

## Elements and Performance Criteria

*Test the software solutions for embedded IoT products*

To be competent, the user/individual on the job must be able to:

**PC1.** verify testing procedures to analyse code

**PC2.** manage the key features of the programming language used to develop and test solutions.

**PC3.** check the embedded code to determine root cause of defects and implement corrective action

**PC4.** check problems and bugs in code by applying debugging techniques such as Break-points, to ensure specifications are met

**PC5.** test the compiled code into the memory of the embedded product

**PC6.** check the embedded product to see if it is working as per the functional and performance requirements

**PC7.** verify program using debug tools such as JTAG, GDB etc.

**PC8.** test the functional correctness for industry standard interfaces using protocol analyzers

*Testing and rectify malfunctions in the IoT prototype*

To be competent, the user/individual on the job must be able to:

**PC9.** monitor the malfunctions in constructed prototype devices/components using appropriate software, hardware and testing methods

**PC10.** verify the bugs in tracking systems and automat test plans

**PC11.** ensure unit failures and develop corrective actions to verify interoperability testing with other elements in the IoT network

**PC12.** verify the test/QA team to fix identified problems and compliance with quality standards

**PC13.** suggest correct techniques to rectify malfunctions as per standard operating system to the specifications or to the final design

**PC14.** test the prototype devices/components using approved procedures and ensure that operational requirements are met

**PC15.** monitor the completed new product design work appropriately and submit to relevant authority/person for approval

*Validate and configure the entire embedded IoT system*

To be competent, the user/individual on the job must be able to:

**PC16.** review and interpret test results against specifications and check for compliance

**PC17.** review root cause analysis to identify the cause of the problem, if test results are in disagreement with specifications, then check, troubleshoot and correct any defects in the design

**PC18.** test the system to various intended applications by selecting the different combinations possible

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

**KU1.** relevant legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions

**KU2.** relevant health and safety requirements applicable in the work place

**KU3.** reporting structure ,inter-department functions, lines and procedures in the work area

**KU4.** how to engage with specialists for support and correct any deviations to the design specifications

**KU5.** how to interpret and follow different design specifications, including high level design (hld) and low level design

**KU6.** the syntax and semantics of the c language for embedded programming

**KU7.** basic tools of editor, compiler and configuration management

**KU8.** the process for converting technical specifications into code

**KU9.** basics of software configuration management tools

**KU10.** how to write software code that is efficient, readable and maintainable

**KU11.** the range of code generation tools and unit testing tools used to develop software code

**KU12.** how to use coding tools

**KU13.** how to create, review and execute (unit test cases) utcs

**KU14.** how to determine whether components are suitable for re-use

**KU15.** use of different sources of information for help to write software code

**KU16.** use of different types of problems and defects that may occur and how these may be resolved

**KU17.** how recording corrective actions for problems and defects can improve future designs

**KU18.** how to test and debug new software code

**KU19.** use of defect tracking tools

**KU20.** software and hardware used to test malfunctions

**KU21.** types of tools, hardware and software and testing devices used

**KU22.** approved techniques used to check defects/malfunctions

**KU23.** application of debugging and methods used

**KU24.** software debugging tools; emulators, debuggers, etc., design constraints and complete design cycle from understanding customers specifications to production

**KU25.** installing and configuring procedure of operating systems (linux, windows), storage subsystems

**KU26.** research sources for obtaining technical information

**KU27.** statutory regulations, standards and codes of practice and their implications

**KU28.** importance of keeping designs developed confidential and consequences of breaching ipr clause

**KU29.** use of unit test coverage mechanisms

## Generic Skills (GS)

User/individual on the job needs to know how to:

**GS1.** how to fill up appropriate forms, activity logs, attendance sheets as per organizational format in english and/or local language

**GS2.** how to write electronic mail communications with clients/contractors/staffs regarding the scope of work

**GS3.** how to read/listen and interpret information correctly from various work instruction documents, manuals, health and safety instructions, memos, etc. applicable to the job in english and/or local language

**GS4.** how to read relevant symbols, labels or descriptions on components and equipment while designing an iot system

**GS5.** how to read product and customer specifications

**GS6.** how to read and comprehend possible design errors through calculations and analysis

**GS7.** methods of conveying and sharing technical information clearly using appropriate language

**GS8.** process of checking and clarifying task-related information

**GS9.** how to liaise with appropriate authorities using correct protocol

**GS10.** methods of communication with people in respectful form and manner in line with organizational protocol

**GS11.** how to communicate with customer in order to resolve any discrepancies in the design

**GS12.** how to coordinate with various departments such as marketing, sales, production, research and development

**GS13.** how to work in teams to devise creative solutions

**GS14.** how to plan and organize own tasks

**GS15.** how to multi-task, handle additional responsibility and adapt quickly to changing priorities

**GS16.** how to seek clarification from immediate supervisor or responsible authority to rectify problems at work when faced with difficult situations

**GS17.** how to identify faults and defects in components and follow appropriate procedures to document them

**GS18.** how to prepare/modify work plan to overcome unforeseen difficulties or developments that could hamper work outcome

**GS19.** how to refer complex problems/issues to relevant authority as per laid down escalation protocol for situations beyond ones scope of work

**GS20.** how to plan, prioritize and sequence work operations as per requirement

**GS21.** methods to organize and analyse information relevant to work

**GS22.** basic concepts of work productivity including efficient resource usage and time management

**GS23.** how to test and debug an iot system to meet customers requirement

**GS24.** how to focus on customers requirement

**GS25.** how to maintain professional relationship with clients

**GS26.** how to provide client with appropriate information and services

**GS27.** methods to troubleshoot and identify problems with work planning, procedures, output and behaviour and their implications

**GS28.** how to prioritize and plan for problem solving

**GS29.** how to communicate problems appropriately to others

**GS30.** how to identify sources of information and support for problem solving

**GS31.** how to seek assistance and support from other sources to solve problems

**GS32.** how to identify effective resolution techniques and propose potential solutions

**GS33.** how to select and apply resolution techniques

**GS34.** how to seek evidence for problem resolution

**GS35.** how to apply logical reasoning to solve problems or any potential problems related to work by analysing previous experiences

**GS36.** how to analyse trends of previous performances/data to derive best possible approach to impending problems/issues

**GS37.** how to analyse risks to minimize losses or damages

**GS38.** how to complement product research and development with technical inputs deduced from analysis of work data

**GS39.** how to determine the impact of inappropriate selection of work procedures and inputs to overall work outcome

**GS40.** how to apply logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems

**GS41.** how to spot process and system disruptions and delays

**GS42.** how to have a creative and innovative approach for generating new ideas

**GS43.** how to demonstrate leadership in embedded system, library management and design release process for product design

**GS44.** how to ensure designs are feasible with knowledge on physics, engineering and mathematics

**GS45.** how to suggest on corrective actions to reduce repetitive errors

**GS46.** how to use test and measurement equipment like oscilloscopes, pcie/ protocol analysers, etc.

**GS47.** how to use various design tools, equipment, and computer applications and software

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Test the software solutions for embedded IoT products* | **18** | **25** | **-** | **5** |
| **PC1.** verify testing procedures to analyse code | 3 | 4 | - | 1 |
| **PC2.** manage the key features of the programming language used to develop and test solutions. | 2 | 3 | - | 1 |
| **PC3.** check the embedded code to determine root cause of defects and implement corrective action | 3 | 3 | - | 1 |
| **PC4.** check problems and bugs in code by applying debugging techniques such as Break-points, to ensure specifications are met | 2 | 3 | - | - |
| **PC5.** test the compiled code into the memory of the embedded product | 2 | 4 | - | - |
| **PC6.** check the embedded product to see if it is working as per the functional and performance requirements | 2 | 3 | - | 1 |
| **PC7.** verify program using debug tools such as JTAG, GDB etc. | 2 | 2 | - | 1 |
| **PC8.** test the functional correctness for industry standard interfaces using protocol analyzers | 2 | 3 | - | - |
| *Testing and rectify malfunctions in the IoT prototype* | **17** | **19** | **-** | **3** |
| **PC9.** monitor the malfunctions in constructed prototype devices/components using appropriate software, hardware and testing methods | 2 | 2 | - | - |
| **PC10.** verify the bugs in tracking systems and automat test plans | 2 | 3 | - | 1 |
| **PC11.** ensure unit failures and develop corrective actions to verify interoperability testing with other elements in the IoT network | 3 | 3 | - | - |
| **PC12.** verify the test/QA team to fix identified problems and compliance with quality standards | 2 | 3 | - | 1 |
| **PC13.** suggest correct techniques to rectify malfunctions as per standard operating system to the specifications or to the final design | 3 | 3 | - | 1 |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC14.** test the prototype devices/components using approved procedures and ensure that operational requirements are met | 2 | 3 | - | - |
| **PC15.** monitor the completed new product design work appropriately and submit to relevant authority/person for approval | 3 | 2 | - | - |
| *Validate and configure the entire embedded IoT system* | **5** | **6** | **-** | **2** |
| **PC16.** review and interpret test results against specifications and check for compliance | 2 | 2 | - | 1 |
| **PC17.** review root cause analysis to identify the cause of the problem, if test results are in disagreement with specifications, then check, troubleshoot and correct any defects in the design | 1 | 2 | - | 1 |
| **PC18.** test the system to various intended applications by selecting the different combinations possible | 2 | 2 | - | - |
| **NOS Total** | **40** | **50** | **-** | **10** |

## National Occupational Standards (NOS) Parameters

| | |
|---|---|
| **NOS Code** | ELE/N1411 |
| **NOS Name** | Test and Troubleshoot the Firmware |
| **Sector** | Electronics |
| **Sub-Sector** | Semiconductor & Components |
| **Occupation** | Product Design |
| **NSQF Level** | 5 |
| **Credits** | TBD |
| **Version** | 2.0 |
| **Last Reviewed Date** | 27/01/2022 |
| **Next Review Date** | 03/05/2026 |
| **NSQC Clearance Date** | 03/05/2023 |

# ELE/N9905: Work effectively at the workplace

## Description

This unit is about the communicating and managing work effectively at the workplace as well as taking measures to enhance own competence and working in a disciplined and ethical manner.

## Scope

The scope covers the following :

- Communicate effectively at the workplace
- Work effectively
- Maintain and enhance professional competence
- Work in a disciplined and ethical manner
- Uphold social diversity at the workplace

## Elements and Performance Criteria

*Communicate effectively at the workplace*

To be competent, the user/individual on the job must be able to:

**PC1.** exchange information and instruction with colleagues, and seek clarifications and feedback as necessary

**PC2.** assist colleagues where required

**PC3.** follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person)

**PC4.** document and share all relevant information with stakeholders in agreed formats and as per agreed timelines

*Work effectively*

To be competent, the user/individual on the job must be able to:

**PC5.** identify and obtain clarity regarding organisational, team and own goals and targets

**PC6.** prioritise and plan work in order to achieve goals and targets

**PC7.** monitor own and team performance as per agreed plan

**PC8.** complete duties accurately, systematically and within required timeframes

**PC9.** express emotions appropriately at the workplace and manage own response to heightened emotions

**PC10.** maintain orderliness and cleanliness in the work area

*Maintain and enhance professional competence*

To be competent, the user/individual on the job must be able to:

**PC11.** identify own strengths and weaknesses in relation to goals and targets

**PC12.** adapt self, service, or product to meet success criteria

**PC13.** seek and select opportunities for continuous professional development

**PC14.** formulate a professional development plan to enhance capabilities

**PC15.** build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations

**PC16.** examine developments and trends in field of work and their potential impact on work

**PC17.** take feedback from peers, supervisors and clients to improve own performance and practices

*Work in a disciplined and ethical manner*

To be competent, the user/individual on the job must be able to:

**PC18.** perform tasks as per workplace standards, organisational policies and legislative requirements

**PC19.** display appropriate professional appearance at the workplace and adhere to the organisational dress code

**PC20.** demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc.

**PC21.** identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution

**PC22.** protect the rights of the client and organisation when delivering services

**PC23.** ensure services are delivered equally to all clients regardless of personal and cultural beliefs

**PC24.** operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities

**PC25.** follow organisational guidelines and legal requirements on disclosure and confidentiality

*Uphold social diversity at the workplace*

To be competent, the user/individual on the job must be able to:

**PC26.** recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes

**PC27.** identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace

**PC28.** use inclusive or neutral language and gestures in all interactions

**PC29.** respect the personal and professional space of others

**PC30.** access grievance redressal mechanisms as per legislations

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

**KU1.** organisation's policies on dress code, workplace timings, workplace behaviour, performance management, incentives, delivery standards, information security, etc.

**KU2.** organizational hierarchy and escalation matrix

**KU3.** importance of the individual's role in the workflow

**KU4.** organisational norms on health, safety and sustainability

**KU5.** work area inspection procedures and practices

**KU6.** professional etiquette and grooming

**KU7.** communication etiquette across communicative mediums (online, digital, and in-person) including strategies/methods for sharing information, documentation, and providing and receiving feedback

**KU8.** importance of self-evaluations and developing a continuous learning and professional development plan

**KU9.** developments and trends impacting professional practice

**KU10.** importance of taking and using feedback from colleagues and clients to identify and introduce improvements in work performance

**KU11.** professional ethics and workplace norms on reporting and/or penalizing unethical behaviour and practices.

**KU12.** guidelines and legal requirements on disclosure, confidentiality, and conflicts of interest

**KU13.** strategies for collaboration with colleagues and clients.

**KU14.** professional responses and strategies against inappropriate language or behaviour toward self and others

**KU15.** Implicit bias (based on gender, disability, class, caste, colour, race, culture, religion, etc.) and its consequences in the workplace

**KU16.** organizational guidelines, prevalent legislations and accessibility norms and processes to support PwDs at the workplace

**KU17.** strategies for time, effort and resource allocation towards the goals.

**KU18.** basic concepts of work productivity including waste reduction, efficient material usage and optimization of time

## Generic Skills (GS)

User/individual on the job needs to know how to:

**GS1.** complete documentation and forms such as work orders, invoices maintenance records activity logs, attendance sheets as per organizational format in English and/or local language

**GS2.** write basic accident or incident report accurately in an appropriate format

**GS3.** read warnings, instructions and other text material on product labels, components, etc. and relevant signages, warnings, labels or descriptions on equipment, etc. while carrying out work activities

**GS4.** convey and share technical information clearly using appropriate language

**GS5.** clarify task-related information

**GS6.** liaise with authorities and supervisors as per organizational protocol

**GS7.** listen, speak, and write in an inclusive, respectful manner in line with organizational protocol

**GS8.** seek clarification from immediate supervisor or responsible authority or exercise most appropriate solutions to safety breaches at work

**GS9.** report to the supervisor and when to deal with a colleague depending on the type of concern

**GS10.** deliver product to next work process on time

**GS11.** improve work process and report potential areas of delays and disruptions

**GS12.** communicate problems appropriately to others

**GS13.** identify symptoms of the fault to the cause of the problem and resolve, otherwise seek assistance and support from other sources to solve the problem

**GS14.** anticipate and avoid hazards that may occur during repairs because of tools, materials used or repair processes

**GS15.** complete tasks efficiently and accurately within stipulated time

**GS16.** appreciate and respect social diversity in all professional settings

**GS17.** develop awareness and accountability for perspectives on gender, disabilities, and socio-cultural issues leading to discrimination, bias, or harassment at the workplace

**GS18.** maintain positive and effective relationships with colleagues and customers

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Communicate effectively at the workplace* | **5** | **13** | **-** | **-** |
| **PC1.** exchange information and instruction with colleagues, and seek clarifications and feedback as necessary | 1 | 3 | - | - |
| **PC2.** assist colleagues where required | 1 | 3 | - | - |
| **PC3.** follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person) | 1 | 4 | - | - |
| **PC4.** document and share all relevant information with stakeholders in agreed formats and as per agreed timelines | 2 | 3 | - | - |
| *Work effectively* | **6** | **13** | **-** | **-** |
| **PC5.** identify and obtain clarity regarding organisational, team and own goals and targets | 1 | 2 | - | - |
| **PC6.** prioritise and plan work in order to achieve goals and targets | 1 | 2 | - | - |
| **PC7.** monitor own and team performance as per agreed plan | 1 | 2 | - | - |
| **PC8.** complete duties accurately, systematically and within required timeframes | 1 | 2 | - | - |
| **PC9.** express emotions appropriately at the workplace and manage own response to heightened emotions | 1 | 2 | - | - |
| **PC10.** maintain orderliness and cleanliness in the work area | 1 | 3 | - | - |
| *Maintain and enhance professional competence* | **8** | **7** | **-** | **-** |
| **PC11.** identify own strengths and weaknesses in relation to goals and targets | 1 | 1 | - | - |
| **PC12.** adapt self, service, or product to meet success criteria | 1 | 1 | - | - |
| **PC13.** seek and select opportunities for continuous professional development | 1 | 1 | - | - |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC14.** formulate a professional development plan to enhance capabilities | 2 | 1 | - | - |
| **PC15.** build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations | 1 | 1 | - | - |
| **PC16.** examine developments and trends in field of work and their potential impact on work | 1 | 1 | - | - |
| **PC17.** take feedback from peers, supervisors and clients to improve own performance and practices | 1 | 1 | - | - |
| *Work in a disciplined and ethical manner* | **11** | **16** | **-** | **-** |
| **PC18.** perform tasks as per workplace standards, organisational policies and legislative requirements | 2 | 2 | - | - |
| **PC19.** display appropriate professional appearance at the workplace and adhere to the organisational dress code | 1 | 2 | - | - |
| **PC20.** demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc. | 1 | 2 | - | - |
| **PC21.** identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution | 2 | 2 | - | - |
| **PC22.** protect the rights of the client and organisation when delivering services | 1 | 2 | - | - |
| **PC23.** ensure services are delivered equally to all clients regardless of personal and cultural beliefs | 1 | 2 | - | - |
| **PC24.** operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities | 2 | 2 | - | - |
| **PC25.** follow organisational guidelines and legal requirements on disclosure and confidentiality | 1 | 2 | - | - |
| *Uphold social diversity at the workplace* | **10** | **11** | **-** | **-** |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC26.** recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes | 2 | 2 | - | - |
| **PC27.** identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace | 2 | 2 | - | - |
| **PC28.** use inclusive or neutral language and gestures in all interactions | 2 | 2 | - | - |
| **PC29.** respect the personal and professional space of others | 2 | 2 | - | - |
| **PC30.** access grievance redressal mechanisms as per legislations | 2 | 3 | - | - |
| **NOS Total** | **40** | **60** | **-** | **-** |

## National Occupational Standards (NOS) Parameters

| | |
|---|---|
| **NOS Code** | ELE/N9905 |
| **NOS Name** | Work effectively at the workplace |
| **Sector** | Electronics |
| **Sub-Sector** | Generic |
| **Occupation** | Generic - Organizational Behaviour |
| **NSQF Level** | 4 |
| **Credits** | TBD |
| **Version** | 2.0 |
| **Last Reviewed Date** | 24/02/2022 |
| **Next Review Date** | 30/12/2026 |
| **NSQC Clearance Date** | 30/12/2021 |

# ELE/N1002: Apply health and safety practices at the workplace

## Description

This OS unit is about knowledge and practices relating to health, safety and security that candidates need to use in the workplace.

## Scope

The scope covers the following :

- Deal with workplace hazards
- Apply fire safety practices
- Follow emergencies, rescue and first-aid procedures
- Effective waste management/recycling practices

## Elements and Performance Criteria

*Deal with workplace hazards*

To be competent, the user/individual on the job must be able to:

**PC1.** identify job-site hazards and possible causes of accident in the workplace

**PC2.** perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc.

**PC3.** use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards

**PC4.** follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments

**PC5.** dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques

**PC6.** avoid damage of components due to negligence in electrostatic discharge (ESD) procedures

**PC7.** locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans)

**PC8.** maintain appropriate posture while handling heavy objects

**PC9.** apply good housekeeping practices at all times

*Apply fire safety practices*

To be competent, the user/individual on the job must be able to:

**PC10.** take preventive measures to prevent fire hazards

**PC11.** • use appropriate fire extinguishers for different types of fires
• Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l

**PC12.** exhibit rescue and first-aid techniques in case of fire or electrocution

*Follow emergencies, rescue and first-aid procedures*

To be competent, the user/individual on the job must be able to:

**PC13.** administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.

**PC14.** administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,

**PC15.** participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work

**PC16.** use correct method to move injured people and others during an emergency

*Effective waste management/recycling practices*

To be competent, the user/individual on the job must be able to:

**PC17.** identify recyclable and non-recyclable, and hazardous waste generated

**PC18.** segregate waste into different categories

**PC19.** ensure disposal of non-recyclable waste appropriately

**PC20.** deposit non-recyclable and reusable material at identified location

**PC21.** follow processes specified for disposal of hazardous waste

## Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

**KU1.** importance of working in clean and safe work environment following safety practices and procedures

**KU2.** health and safety roles and responsibilities of relevant personnel within and outside the organisation

**KU3.** key internal and external sources of health and safety information

**KU4.** basic knowledge of electronic devices and related health risks

**KU5.** meaning of hazards and risks

**KU6.** various types of health and safety hazards commonly present in the work environment such as physical hazards, electrical hazards, chemical hazards, fire hazards, equipment related hazards, health hazards, etc.

**KU7.** methods of accident prevention

**KU8.** importance of using protective clothing/equipment while working

**KU9.** general principles for identifying and controlling health and safety risks

**KU10.** main hazards and preventive as well as control measures while working with different types of equipment

**KU11.** importance of carrying out electrical and non-electrical isolation to prevent hazards from loss of machine/system/process control

**KU12.** main hazards and preventive as well as control measures when working with electrical systems or using electrical equipment

**KU13.** forms and classifications of hazardous substances

**KU14.** safe working practices while working at various hazardous sites

**KU15.** prevention and control measures to reduce risks from exposure to hazardous substances

**KU16.** health effects associated with exposure to noise and vibration and the appropriate control measures

**KU17.** precautionary activities to prevent the fire accident
**KU18.** various causes of fire such as heating of metal, spontaneous ignition, sparking, electrical eating, loose fires (smoking, welding, etc.) chemical fires etc.
**KU19.** techniques of using the different fire extinguishers
**KU20.** different methods and material to extinguish fires
**KU21.** different materials used for extinguishing fire such as sand, water, foam, CO2, dry powder
**KU22.** rescue techniques used during a fire hazard
**KU23.** various types of safety signs and their meaning
**KU24.** basic first aid treatment relevant to the common work place injuries e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries
**KU25.** contents of written accident report
**KU26.** potential injuries and ill health associated with incorrect handing of tools and equipment
**KU27.** safe lifting and carrying practices
**KU28.** potential impact to a person who is moved incorrectly
**KU29.** personal safety, health and dignity issues relating to the movement of a person by others
**KU30.** ESD measures and 5S
**KU31.** efficient utilization and management of material and water
**KU32.** ways to recognize common electrical problems and practices of conserving electricity
**KU33.** usage of different colours of dustbins, categorization of waste into dry, wet, recyclable, nonrecyclable and items of single-use plastics
**KU34.** organization's procedure for minimizing waste
**KU35.** waste management and methods of waste disposal
**KU36.** common sources of pollution and ways to minimize it
**KU37.** names, contact information and location of people responsible for health and safety in the workplace
**KU38.** location of documents and equipment for health and safety compliance/practices in the workplace
**KU39.** safety notices, signs and instructions at workplace

## Generic Skills (GS)

User/individual on the job needs to know how to:

**GS1.** interpret general health and safety guidelines labels, charts, signages
**GS2.** read operation manuals
**GS3.** write health and safety compliance report
**GS4.** write an accident/incident report in local language or English
**GS5.** provide an emergency or safety incident brief to seniors or relevant authorities in a calm, clear and to-the-point manner
**GS6.** communicate general health and safety guidelines to colleagues/co-workers
**GS7.** communicate appropriately with co-workers in order to clarify instructions and other issues
**GS8.** act in case of any potential hazards observed in the work place

**GS9.** plan and organize their own work schedule, work area, tools, equipment in compliance with organizational policies for health, safety and security

**GS10.** take adequate measures to ensure the safety of clients and visitors at the workplace

**GS11.** identify immediate or temporary solutions to resolve delays

**GS12.** evaluate the work area for health and safety risks or hazards

**GS13.** use cause and effect relations to anticipate potential issues, problems and their solution in the work area related to safety

**GS14.** recognise emergency and potential emergency situations

**GS15.** protect self and others from a health and safety risk or hazard

**GS16.** communicate and collaborate to incorporate sustainable practices (greening) in workplace processes

**GS17.** record data on waste disposal at workplace

## Assessment Criteria

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| *Deal with workplace hazards* | **20** | **31** | **-** | **-** |
| **PC1.** identify job-site hazards and possible causes of accident in the workplace | 2 | 3 | - | - |
| **PC2.** perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc. | 3 | 4 | - | - |
| **PC3.** use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards | 3 | 4 | - | - |
| **PC4.** follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments | 3 | 4 | - | - |
| **PC5.** dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques | 2 | 4 | - | - |
| **PC6.** avoid damage of components due to negligence in electrostatic discharge (ESD) procedures | 2 | 3 | - | - |
| **PC7.** locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans) | 2 | 3 | - | - |
| **PC8.** maintain appropriate posture while handling heavy objects | 1 | 3 | - | - |
| **PC9.** apply good housekeeping practices at all times | 2 | 3 | - | - |
| *Apply fire safety practices* | **4** | **9** | **-** | **-** |
| **PC10.** take preventive measures to prevent fire hazards | 2 | 3 | - | - |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **PC11.** • use appropriate fire extinguishers for different types of fires • Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l | 1 | 3 | - | - |
| **PC12.** exhibit rescue and first-aid techniques in case of fire or electrocution | 1 | 3 | - | - |
| *Follow emergencies, rescue and first-aid procedures* | **6** | **13** | **-** | **-** |
| **PC13.** administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc. | 1 | 3 | - | - |
| **PC14.** administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, | 1 | 2 | - | - |
| **PC15.** participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work | 2 | 4 | - | - |
| **PC16.** use correct method to move injured people and others during an emergency | 2 | 4 | - | - |
| *Effective waste management/recycling practices* | **5** | **12** | **-** | **-** |
| **PC17.** identify recyclable and non-recyclable, and hazardous waste generated | 1 | 3 | - | - |
| **PC18.** segregate waste into different categories | 1 | 2 | - | - |
| **PC19.** ensure disposal of non-recyclable waste appropriately | 1 | 2 | - | - |
| **PC20.** deposit non-recyclable and reusable material at identified location | 1 | 3 | - | - |
| **PC21.** follow processes specified for disposal of hazardous waste | 1 | 2 | - | - |

| Assessment Criteria for Outcomes | Theory Marks | Practical Marks | Project Marks | Viva Marks |
|---|---|---|---|---|
| **NOS Total** | **35** | **65** | **-** | **-** |

## National Occupational Standards (NOS) Parameters

| | |
|---|---|
| **NOS Code** | ELE/N1002 |
| **NOS Name** | Apply health and safety practices at the workplace |
| **Sector** | Electronics |
| **Sub-Sector** | Generic |
| **Occupation** | Generic - Health Safety |
| **NSQF Level** | 4 |
| **Credits** | TBD |
| **Version** | 3.0 |
| **Last Reviewed Date** | 24/02/2022 |
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# Assessment Guidelines and Assessment Weightage

## Assessment Guidelines

Minimum 70% marks are required

**Minimum Aggregate Passing % at QP Level : 70**

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

## Assessment Weightage

Compulsory NOS

| National Occupational Standards | Theory Marks | Practical Marks | Project Marks | Viva Marks | Total Marks | Weightage |
|---|---|---|---|---|---|---|
| ELE/N1406.Develop and Test Design for IoT Based System | 40 | 50 | - | 10 | 100 | 30 |
| ELE/N1410.Build GUI and Applications in a Framework | 40 | 50 | - | 10 | 100 | 30 |
| ELE/N1411.Test and Troubleshoot the Firmware | 40 | 50 | - | 10 | 100 | 20 |
| ELE/N9905.Work effectively at the workplace | 40 | 60 | - | - | 100 | 10 |
| ELE/N1002.Apply health and safety practices at the workplace | 35 | 65 | - | - | 100 | 10 |
| **Total** | **195** | **275** | **-** | **30** | **500** | **100** |

## Acronyms

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| **NOS** | National Occupational Standard(s) |
| **NSQF** | National Skills Qualifications Framework |
| **QP** | Qualifications Pack |
| **TVET** | Technical and Vocational Education and Training |

## Glossary

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| **Sector** | Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests. |
| **Sub-sector** | Sub-sector is derived from a further breakdown based on the characteristics and interests of its components. |
| **Occupation** | Occupation is a set of job roles, which perform similar/ related set of functions in an industry. |
| **Job role** | Job role defines a unique set of functions that together form a unique employment opportunity in an organisation. |
| **Occupational Standards (OS)** | OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts. |
| **Performance Criteria (PC)** | Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task. |
| **National Occupational Standards (NOS)** | NOS are occupational standards which apply uniquely in the Indian context. |
| **Qualifications Pack (QP)** | QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code. |
| **Unit Code** | Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N' |
| **Unit Title** | Unit title gives a clear overall statement about what the incumbent should be able to do. |
| **Description** | Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for. |
| **Scope** | Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required. |
| **Knowledge and Understanding (KU)** | Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard. |

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| **Organisational Context** | Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility. |
| **Technical Knowledge** | Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities. |
| **Core Skills/ Generic Skills (GS)** | Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles. |
| **Electives** | Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives. |
| **Options** | Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options. |