# Model Curriculum

**QP Name: Embedded Software Engineer**

**QP Code: ELE/Q1501**

**QP Version: 3.0**

**NSQF Level: 5**

**Model Curriculum Version: 3.0**

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House, Okhla Industrial Area- Phase 3, New Delhi– 110020

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# Training Parameters

| | |
|---|---|
| **Sector** | Electronics |
| **Sub-Sector** | Semiconductor & Components |
| **Occupation** | System Software Development |
| **Country** | India |
| **NSQF Level** | 5 |
| **Aligned to NCO/ISCO/ISIC Code** | NCO-2015/2512.0501 |
| **Minimum Educational Qualification and Experience** | 12th grade pass with 1 year NTC/ NAC with 1 Year of experience relevant experience<br>OR<br>12th grade Pass with 2 Years of experience relevant experience<br>OR<br>10th grade pass with 4 Years of experience relevant experience<br>OR<br>Previous relevant Qualification of NSQF Level (level 4) with 3 Years of experience relevant experience<br>OR<br>Completed 3 years diploma after 10th (Electrical/Electronics) with 1 Year of experience |
| **Pre-Requisite License or Training** | NA |
| **Minimum Job Entry Age** | 21 Years |
| **Last Reviewed On** | 27.01.2022 |
| **Next Review Date** | 27.01.2025 |
| **NSQC Approval Date** | 27.01.2022 |
| **QP Version** | 3.0 |
| **Model Curriculum Creation Date** | 27.01.2022 |
| **Model Curriculum Valid Up to Date** | 27.01.2025 |
| **Model Curriculum Version** | 3.0 |

| | |
|---|---|
| **Maximum Duration of the Course** | 900 Hours |

# Program Overview

This section summarizes the end objectives of the program along with its duration.

## Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills:

- Demonstrate the process of developing embedded system software.
- Explain the importance of following inclusive practices for all genders and PwD at work.
- Demonstrate various practices to be followed to maintain health and safety at work.

## Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

| NOS and Module Details | Theory Duration | Practical Duration | On-the-Job Training Duration (Recommended) | On-the-Job Training Duration (Mandatory) | Total Duration |
|---|---|---|---|---|---|
| **Bridge Module** | **21:00** | **39:00** | **00:00** | **00:00** | **60:00** |
| Module 1: Introduction and orientation to the role of an Embedded Software Engineer | 21:00 | 39:00 | 00:00 | 00:00 | 60:00 |
| **ELE/N1501 Develop embedded software software** | **210:00** | **300:00** | **00:00** | **240:00** | **750:00** |
| Module 2: Soft Skills and Work Ethics | 210:00 | 300:00 | 00:00 | 240:00 | 750:00 |
| **ELE/N1002 Apply health and safety practices at the workplace** | **15:00** | **15:00** | **00:00** | **00:00** | **30:00** |
| Module 3: Basic Health and Safety Practice | 15:00 | 15:00 | 00:00 | 00:00 | 30:00 |
| **DGT/VSQ/N0102- Employability Skills (60 Hours)** | **24:00** | **36:00** | **00:00** | **00:00** | **60:00** |
| Module 4: Employability Skills (60 Hours) | 24:00 | 36:00 | 00:00 | 00:00 | 60:00 |
| **Total Duration** | **270:00** | **390:00** | **00:00** | **240:00** | **900:00** |

# Module Details

## Module 1: Introduction and orientation to the role of an Embedded Software Engineer

***Bridge Module***

**Terminal Outcomes:**

- Discuss the job role of an Embedded Software Engineer.

| **Duration: 21:00** | **Duration: 39:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Describe the size and scope of the electronics industry and its sub-sectors.<br>• Discuss the role and responsibilities of an Embedded Software Engineer.<br>• Describe various employment opportunities for an Embedded Software Engineer. | • Understanding of the Embedded Software<br>• Applications of the Embedded Software<br>• Develop the Quality to statistical and Quantitative Thinking |
| **Classroom Aids** | |
| Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop | |
| **Tools, Equipment and Other Requirements** | |
| NA | |

## Module 2: Process of developing embedded system software

***Mapped to ELE/N1501***

**Terminal Outcomes:**

- Describe the process of identifying the work requirement.
- Demonstrate the process of identifying the embedded system design specifications.
- Demonstrate the process of developing software for embedded system.
- Explain the importance of completing documentation.

| Duration: 210:00 | Duration: 300:00 |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain the company's policies on incentives, personnel management, documentation, IPR, code of conduct, quality and standards.<br>• Explain the importance of individuals role in the work flow.<br>• Explain the company's reporting structure.<br>• Explain the company's different department and concerned authority need to communicate during the work.<br>• Explain the company's license on IP core library, usage of software and design tools.<br>• Explain the system design modules and concepts of circuit design.<br>• Explain the computer architecture.<br>• Explain the embedded system, designing flow and implementation of embedded system software.<br>• Explain the software fundamentals such as object-oriented design, data structures, algorithm design.<br>• Explain the schematics and data sheets.<br>• Explain how to use and operate ERP system.<br>• Explain how to design, develop, test and debug software components.<br>• Explain how to use software module library and database. | • Demonstrate how to plan the work activities for software development, which is based on the work flow and deliverables.<br>• Demonstrate the process of interacting with the lead engineer and embedded system design engineers to understand the system and software requirements.<br>• Demonstrate how to read and interpret the Business Requirement Specification (BRS) and Software Requirement Specification (SRS) document for interpreting the project specifications, coding, testing and debugging requirements.<br>• Show how to identify the circuit design, functionality and logic involved in the embedded system software.<br>• Demonstrate how to create a software design for the embedded system as per requirement specification and get approval from superior and relevant department on the same.<br>• Demonstrate the process of accessing reusable components, code generation tools and unit testing tools from the company's database.<br>• Demonstrate how to create software modules to meet the requirements of the software.<br>• Demonstrate how to create Unit Test Cases (UTCs) as per the specifications |

| | |
|---|---|
| • Explain how to read and interpret project requirements from Business Requirement Specification (BRS) and Software Requirement Specification (SRS) document.<br>• Explain how to do system testing, product verification and validation.<br>• Explain the software programming languages such as C, C plus plus.<br>• Explin the operating system such as windows, linux.<br>• Explain the system level integration.<br>• Explain the end-product application, i.e. industry for which embedded system is designed. | and requirements.<br>• Demonstrate the process of reviewing the code and UTCs with the support team and lead engineer for any defects.<br>• Show how to rework on the code and UTCs to fix identified defects.<br>• Demonstrate the process of carrying out testing, verification and debugging of software codes for any errors and submit the tested codes and documents for approval as per organisational standards.<br>• Show how to create documents related to design using standard templates and agreed language standards. |
| **Classroom Aids** | |
| Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop | |
| **Tools, Equipment and Other Requirements** | |
| OS like Windows, Linux Software for C, C++, Embedded systems software development tools such as code editor, compiler, simulator, debugger, linker, IDE such as Android Studio, Eclipse, Code Blocks, BlueJ, Xcode, Adobe Flash Builder and Visual Studio | |

## Module 3: Basic Health and Safety Practice

***Mapped to ELE/N1002***

**Terminal Outcomes:**

- Apply health and safety practices at the workplace.

| Duration: 15:00 | Duration: 15:00 |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Discuss job-site hazards, risks and accidents.<br>• Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials.<br>• Elaborate on electronic waste disposal procedures.<br>• Describe the process of disposal of hazardous waste<br>• List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace.<br>• Describe how to interpret warning signs while accessing sensitive work areas.<br>• Explain the importance of good housekeeping.<br>• Describe the importance of maintaining appropriate postures while lifting heavy objects.<br>• List the types of fire and fire extinguishers.<br>• Explain the importance of efficient utilisation of water, electricity and other resources.<br>• List the common sources of pollution and ways to minimize it.<br>• Describe the concept of waste management and methods of disposing hazardous waste.<br>• Explain various warning and safety signs.<br>• Describe different ways of preventing accidents at the workplace. | • Demonstrate the use of protective equipment suitable as per tasks and work conditions.<br>• Prepare a report to inform the relevant authorities about any abnormal situation/behaviour of any equipment/system.<br>• Administer first aid in case of a minor accident.<br>• Demonstrate the steps to free a person from electrocution safely.<br>• Administer Cardiopulmonary Resuscitation (CPR).<br>• Demonstrate the application of defined emergency procedures such as raising alarm, safe/efficient, evacuation, moving injured people, etc.<br>• Prepare a sample incident report.<br>• Use a fire extinguisher in case of a fire incident.<br>• Demonstrate the correct method of lifting and handling heavy objects. |

| Classroom Aids |
| --- |
| Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop |
| **Tools, Equipment and Other Requirements** |
| Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs and Tapes, Fire Extinguisher, First Aid Kit, Fire Extinguishers and Warning Signs. |

## Module 4: Employability Skills (60 Hours)

### Mapped to DGT/VSQ/N0102

**Terminal Outcomes:**

- Discuss about Employability Skills in meeting the job requirements
- Describe opportunities as an entrepreneur.
- Describe ways of preparing for apprenticeship & Jobs appropriately.

| Duration: 24:00 | Duration: 36:00 |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen<br>• Discuss 21st century skills<br>• Explain use of basic English phrases and sentences.<br>• Demonstrate how to communicate in a well-behaved manner<br>• Demonstrate how to work with others<br>• Demonstrate how to operate digital devices<br>• Discuss the significance of Internet and Computer/ Laptops<br>• Discuss the need for identifying business opportunities<br>• Discuss about types of customers.<br>• Discuss on creation of biodata<br>• Discuss about apprenticeship and opportunities related to it. | • List different learning and employability related GOI and private portals and their usage<br>• Show how to practice different environmentally sustainable practices.<br>• Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc.<br>• Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone<br>• Demonstrate how to communicate in a well-mannered way with others.<br>• Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette<br>• Utilize virtual collaboration tools to work effectively<br>• Demonstrate how to maintain hygiene and dressing appropriately.<br>• Perform a mock interview |
| **Classroom Aids** | |
| Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop | |
| **Tools, Equipment and Other Requirements** | |
| Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board<br>OR<br>Computer Lab | |

## Module 5: On-the-Job Training

***Mapped to Embedded Software Engineer***

| Mandatory Duration: 240:00 | Recommended Duration: 00:00 |
|---|---|
| **Location: On Site** | |

**Terminal Outcomes**

1. Interacting with the lead engineer for understanding the work schedules, shifts and delivery dates.
2. Complying with organization's policies, procedures and guidelines when developing embedded system software codes.
3. Interacting with the lead engineer and embedded system design engineers.
4. Creating a software design for the embedded system.
5. Creating the software modules to meet the requirements of the software.
6. Testing, verification and debugging of software codes for any errors and submitting the tested codes and documents for approval.
7. Creating documents related to design using standard templates and agreed language standards.
8. Communicating effectively at the workplace.
9. Applying health and safety practices at the workplace.

# Annexure

## Trainer Requirements

| Trainer Prerequisites | | | | | | |
|---|---|---|---|---|---|---|
| **Minimum Educational Qualification** | **Specialization** | **Relevant Industry Experience** | | **Training Experience** | | **Remarks** |
| | | ***Years*** | ***Specialization*** | ***Years*** | ***Specialization*** | |
| Diploma/ ITI/Degree/ Certified in relevant CITS Trade | Electrical/ Electronics/ Mechanical Engineering | 2 | System Software Development (Embedded Software) | 1 | Electronics | |

| Trainer Certification | |
|---|---|
| **Domain Certification** | **Platform Certification** |
| "**Embedded Software Engineer**", "ELE/Q1501, v3.0", Minimum accepted score is 80% | Recommended that the Trainer is certified for the **Embedded Software Engineer** "Trainer (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2601, V2.0", with minimum score of 80% |

## Assessor Requirements

| Assessor Prerequisites | | | | | | |
|---|---|---|---|---|---|---|
| **Minimum Educational Qualification** | **Specialization** | **Relevant Industry Experience** | | **Training/Assessment Experience** | | **Remarks** |
| | | ***Years*** | ***Specialization*** | ***Years*** | ***Specialization*** | |
| Diploma/ ITI/Degree/ Certified in relevant CITS Trade | Electrical/ Electronics/ Mechanical Engineering | 3 | System Software Development (Embedded Software) | 1 | Electronics | |

| Assessor Certification | |
|---|---|
| **Domain Certification** | **Platform Certification** |
| "**Embedded Software Engineer**", "ELE/Q1501, v3.0", Minimum accepted score is 80% | Recommended that the Assessor is certified for the **Embedded Software Engineer** "Assessor (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2701, V2.0", with minimum score of 80% |

## Assessment Strategy

1. Assessment System Overview:
    - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
    - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
    - The assessment agency deploys the ToA certified Assessor for executing the assessment
    - SSC monitors the assessment process & records
2. Testing Environment

    To ensure a conducive environment for conducting a test, the trainer will:
    - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
    - Check the duration of the training.
    - Check the Assessment Start and End time to be 10 a.m. and 5 p.m. respectively
    - Ensure there are 2 Assessors if the batch size is more than 30.
    - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
    - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
    - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
    - Check the availability of the Lab Equipment for the particular Job Role.
3. Assessment Quality Assurance levels / Framework:
    - Question papers created by the Subject Matter Experts (SME)
    - Question papers created by the SME verified by the other subject Matter Experts
    - Questions are mapped with NOS and PC
    - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
    - The assessor must be ToA certified and the trainer must be ToT Certified
    - The assessment agency must follow the assessment guidelines to conduct the assessment
4. Types of evidence or evidence-gathering protocol:
    - Time-stamped & geotagged reporting of the assessor from assessment location
    - Centre photographs with signboards and scheme-specific branding
    - Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
    - Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos
5. Method of verification or validation:

    To verify the details submitted by the training centre, the assessor will undertake:
    - A surprise visit to the assessment location
    - A random audit of the batch
    - A random audit of any candidate
6. Method for assessment documentation, archiving, and access

    To protect the assessment papers and information, the assessor will ensure:
    - Hard copies of the documents are stored

- Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
- Soft copies of the documents & photographs of the assessment are stored on the Hard drive

# References

## Glossary

| Term | Description |
|---|---|
| **Declarative knowledge** | Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem. |
| **Key Learning** | Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application). |
| **OJT (M)** | On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site |
| **OJT (R)** | On-the-job training (Recommended); trainees are recommended the specified hours of training on site |
| **Procedural Knowledge** | Procedural knowledge addresses how to do something, or how to perform a |
| **Training Outcome** | Training outcome is a statement of what a learner will know, understand and be able to do **upon the completion of the training**. |
| **Terminal Outcome** | Terminal outcome is a statement of what a learner will know, understand and be able to do **upon the completion of a module.** A set of terminal outcomes help to achieve the training outcome. |

## Acronyms and Abbreviations

| Term | Description |
|---|---|
| **ISO** | International Organization for Standardization |
| **NCO** | National Occupational Standards |
| **NOS** | National Skills Qualification Committee |
| **NSQF** | National Skills Qualification Framework |
| **OJT** | On-the-Job Training |
| **OMR** | Optical Mark Recognition |
| **PC** | Performance Criteria |
| **PwD** | Persons with Disabilities |
| **QP** | Qualification Pack |
| **SDMS** | Skill Development & Management System |
| **SIP** | Skill India Portal |
| **SME** | Small and Medium Enterprises |
| **SOP** | Standard Operating Procedure |
| **SSC** | Sector Skill Council |
| **TC** | Trainer Certificate |
| **ToA** | Training of Assessors |
| **ToT** | Training of Trainers |
| **TP** | Training Provider |