Model Curriculum

QP Name: Embedded Software Engineer

QP Code: ELE/Q1501

QP Version: 4.0

NSQF Level: 5

Model Curriculum Version: 4.0

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-S&C
Country	India
NSQF Level	5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2512.0501
Minimum Educational Qualification and Experience	Completed 2nd year of UG (UG Diploma) (Physics/Electronics/ Electrical/Computer Science) with 1.5 years of Relevant Experience Completed 3 year diploma after 10th (Electronics/Electrical/ Computer Science) with 3 Years of Relevant Experience OR Previous relevant Qualification of NSQF Level (4.5) with 1.5 years of Relevant Experience # Relevant Experience in Semiconductor & Components.
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	01.05.2025
Next Review Date	30.04.2028
NSQC Approval Date	08.05.2025
QP Version	4.0
Model Curriculum Creation Date	01.05.2025
Model Curriculum Valid Up to Date	30.04.2028
Model Curriculum Version	4.0
Minimum Duration of the Course	570 Hours
Maximum Duration of the Course	570 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
ELE/N1508: Understanding Project Needs Analysis and System Design using Agile and MBSE	**36:00**	**84:00**	**00:00**	**60:00**	**180:00**
Module 1: Process of Understanding Project Needs Analysis and System Design using Agile and MBSE	36:00	84:00	00:00	60:00	180:00
ELE/N1509: Embedded Software Development with Modular Tools	**60:00**	**45:00**	**00:00**	**60:00**	**165:00**
Module 2: Process of Embedded Software Development with Modular Tools	60:00	45:00	00:00	60:00	165:00
ELE/N1510: Structured Digital Documentation with Quality and Traceability	**60:00**	**45:00**	**00:00**	**60:00**	**165:00**
Module 3: Process of Structured Digital Documentation with Quality and Traceability	60:00	45:00	00:00	60:00	165:00
DGT/VSQ/N0102: Employability Skills (60 Hours)	**24:00**	**36:00**	**00:00**	**00:00**	**60:00**
Module 3: Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00
Total Duration	**180:00**	**210:00**	**00:00**	**180:00**	**570:00**

Module Details

Module 1: Process of Understanding Project Needs Analysis and System Design using Agile and MBSE

Mapped to ELE/N1508

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: 36:00	**Duration: 84:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Learners will understand how to identify, document, and validate stakeholder needs and requirements in the context of a systems project. • Learners will gain theoretical knowledge of Agile frameworks (e.g., Scrum, SAFe) and how iterative, incremental development aligns with system lifecycle processes. • Students will understand the role of MBSE, including SysML (Systems Modeling Language), in enabling the specification, analysis, and design of complex systems. • Learners will explore how Agile and MBSE can be combined to support adaptive system development, reduce risk, and enhance traceability. • Students will be able to explain key phases such as concept definition, architecture design, system realization, validation, and verification in a model-based Agile environment.	• Learners will practice identifying and prioritizing stakeholder needs using interviews, surveys, and use case scenarios. • Students will use MBSE tools (e.g., Cameo Systems Modeler, IBM Rhapsody, or Capella) to create system architecture diagrams, behavior models, and requirement traceability matrices. • Learners will run simulated Agile sprints, maintain product backlogs, and conduct sprint reviews in the context of a system development project. • Learners will develop practical proficiency in creating use case, sequence, activity, and block definition diagrams to communicate design intent. • Students will work in team settings to integrate stakeholder feedback, refine system models, and adapt to changing requirements using Agile principles.
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 suchas code editor, compiler, simulator, debugger, linker, IDE such as Android Studio, Eclipse, Code Blocks, BlueJ, Xcode, Adobe Flash Builder and Visual Studio	

Module 2: Process of Embedded Software Development with Modular Tools

Mapped to ELE/N1509

Terminal Outcomes:

- Understand the development procedure and documentation process.

Duration: 60:00	**Duration: 45:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Learners will comprehend the core components of embedded systems, including microcontrollers, memory types, I/O interfaces, and real-time constraints. • Understand abstraction, encapsulation, reusability, and separation of concerns in the context of embedded software development. • Learn about task scheduling, inter-task communication, priority inversion, and timing analysis in RTOS-based systems. • Acquire knowledge of integrated development environments (IDEs), version control systems (e.g., Git), debuggers, and compilers used in modular embedded development. • Understand safety-critical coding standards code quality metrics, and industry regulations	• Learners will write, compile, and test modular embedded code using functions, drivers, and reusable components. • Gain hands-on experience with microcontroller development kits (e.g., Arduino, or TI Launch Pad) and configure toolchains for cross-compilation. • Practice using tools like oscilloscopes, and logic analyzers for real-time debugging and performance monitoring. • Build multitasking applications using an RTOS, implementing semaphores, message queues, and timers in real-time systems. • Use version control (e.g., Git) and continuous integration pipelines to integrate, test, and validate modular embedded software.
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 3: Process of Structured Digital Documentation with Quality and Traceability

Mapped to ELE/N1510

Terminal Outcomes:

- Understand the development procedure and documentation process.

Duration: 60:00	**Duration: 45:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Learners will understand the role and importance of using approved templates and style guides (e.g., IEEE, ISO, company-specific formats) to ensure consistency and professionalism in technical documentation. • Learners will gain theoretical knowledge of tools and other AI-powered platforms for automating and managing structured documentation. • • Understand the criteria for high-quality documentation, including accuracy, completeness, readability, and the importance of meeting delivery deadlines. • Explore how to publish documentation in agreed digital formats (e.g., PDF, HTML, Markdown) and maintain organized version-controlled repositories. • Learn about documentation compliance frameworks and how modern solutions like Git and block chain technologies can ensure document integrity and traceability.	• Learners will produce professional documents using organization-approved templates and consistent styling in line with recognized documentation standards. • Learners will apply tools to auto-generate code documentation and use **Confluence** to collaboratively author and manage structured documents. • Learners will conduct peer reviews, run documentation quality checklists, and manage submission schedules to meet project or compliance deadlines. • Learners will export documentation into formats like PDF and HTML, and publish them using version-controlled systems such as Git, ensuring accessibility and history tracking. • Learners will simulate or apply block chain or hash-based audit trails to preserve documentation integrity, demonstrate version history, and ensure compliance.
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 • Discuss 21st century skills • Explain use of basic English phrases and sentences. • Demonstrate how to communicate in a well-behaved manner • Demonstrate how to work with others • Demonstrate how to operate digital devices • Discuss the significance of Internet and Computer/ Laptops • Discuss the need for identifying business opportunities • Discuss about types of customers. • Discuss on creation of biodata • Discuss about apprenticeship and opportunities related to it.	• List different learning and employability related GOI and private portals and their usage • Show how to practice different environmentally sustainable practices. • Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc. • Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone • Demonstrate how to communicate in a well-mannered way with others. • Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette • Utilize virtual collaboration tools to work effectively • Demonstrate how to maintain hygiene and dressing appropriately. • 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 OR Computer Lab	

Module 5: On-the-Job Training

Mapped to Embedded Software Engineer

Mandatory Duration: 180:00	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/ Computer Science	2	System Software Development (Embedded Software)	1	Electronics	

Trainer Certification	
Domain Certification	**Platform Certification**
"**Embedded Software Engineer**", "ELE/Q1501, v4.0", Minimum accepted score is 80%	Recommended that the Trainer is certified for the **Embedded Software Engineer** "Trainer (VETand 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/ Computer Science	3	System Software Development (Embedded Software)	1	Electronics	

Assessor Certification	
Domain Certification	**Platform Certification**
"**Embedded Software Engineer**", "ELE/Q1501, v4.0", 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