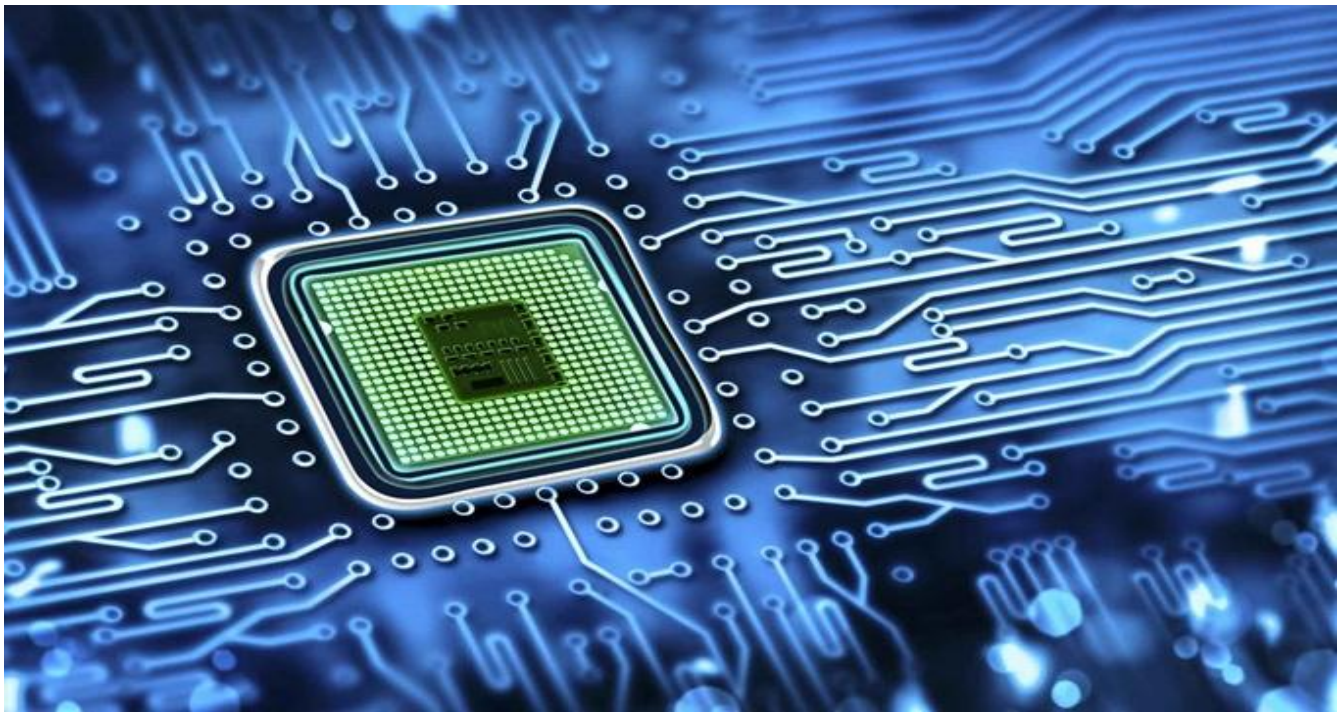

Model Curriculum

QP Name: Embedded Product Design - Technical Lead

QP Code: ELE/Q1403

QP Version: 4.0

NSQF Level: 5.5

Model Curriculum Version: 4.0

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

Table of Contents

Training Parameters

Sector	Electronics
Sub-Sector	Semiconductor & Components
Occupation	Product Design-S&C
Country	India
NSQF Level	5.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2512.0501
Minimum Educational Qualification and Experience	Completed 4 year UG program (Physics/Electronics/Electrical/ Computer Science/Mechanical) with 1.5 years of experience Relevant Experience OR Completed 3 year UG degree (Physics/Electronics/Electrical/ Computer Science/Mechanical) with 1.5 years of experience Relevant Experience OR Completed 3 year diploma after 10th (Electronics/Electrical/ Computer Science/Mechanical) with 3 years of Relevant Experience OR Previous relevant Qualification of NSQF Level (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	600 Hours
Maximum Duration of the Course	600 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:

- Describe the process of designing embedded electronic products.
- Demonstrate the process of developing and testing software solutions for embedded products.
- Describe the process of testing and rectifying malfunctions in the prototype of the embedded product.
- Demonstrate the process of testing and rectifying malfunctions in the prototype of the embedded product.
- Explain the importance of working effectively at the workplace.
- 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/N1432: Create Designs for Embedded Electronic product	**60:00**	**60:00**	**00:00**	**60:00**	**180:00**
Module 1: Process of Creating the designs for Embedded Electronic product	60:00	60:00	00:00	60:00	180:00
ELE/N1433: Develop, Debug, and Verify Software for Embedded Products	**30:00**	**90:00**	**00:00**	**60:00**	**180:00**
Module 2: Process of Developing , Debugging, and Verify Software for Embedded Products	30:00	90:00	00:00	60:00	180:00
ELE/N1434: Perform testing and rectify malfunctions in the prototype of the embedded product	**66:00**	**54:00**	**00:00**	**60:00**	**180:00**
Module 3: Process of performing testing and rectify malfunctions in the prototype of the embedded product	66:00	54:00	00:00	60:00	180:00
DGT/VSQ/N0102- Employability Skills (60Hours)	**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	**180:00**	**240:00**	**00:00**	**180:00**	**600:00**

Module Details

Module 1: Process of Creating the designs for Embedded Electronic product

Mapped to ELE/N1432

Terminal Outcomes:

- Describe the process of preparing and developing the design for embedded products.
- Describe the process of using the appropriate design techniques.
- Demonstrate the process of performing post design activities.

Duration: 60:00	Duration: 60:00
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Interpret the design requirement and prepare a detail list of requirement-specification including software, hardware and firmware as per given specifications and system architecture • Evaluate the feasibility of the design and prepare a feasibility report of the new product design • Analyse datasheets of components such as ageing, caveats, constraints like temperature/ pressure affecting normal operational characteristics of the product • List proper software for designing and testing as per the company standards and requirement • Apply the processes and approved techniques involved in embedded product designing as per stipulated quality standards and compliances • Evaluate the design to ensure thatthe product complies with relevant safety standards, performance and budget requirements • Evaluate supplier/vendor documentation and apply provided suggested courses of action for all hardware-related components • Identify the issues with relevant policy and procedure and report them to appropriate authority	• Use tools and hardware such asComputer, cross compiler, circuit simulator, device driver, PCB design software/ component library, microprocessor/ microcontroller andother peripherals • Use testing devices such as oscilloscopes, multi meters, JTAG, Traffic generators/analyzers, signal generators/analyzers, frequencycounters, power supply • Use operating system and language required for developing the new product design and calibrate them • Develop a work plan and create a design document both high-level andlow-level • Use unit-test cases (UTCs) to test the product according to white box testing method • Assess that the prototype devices or circuits are built as per required specifications and conduct performance test • Compare the code with the design document to ensure that it maps to the requirements • Prepare a document containing hardware specifications, design documentation, hardware-related detailed design documentation, BOMs and Parts Lists, verification tests and reports • Comply with IP confidentiality rights and configuration management of

	hardware items
Classroom Aids	
Training kit (Trainer guide, Presentations). Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Computer, cross compiler, circuit simulator, device driver PCB design software/ component library, microprocessor/ microcontroller and other peripherals, PCB designing software/ spice, Laptop and desktop computers with C, C++, embedded C, PYTHON installed, Windows, iOS, Linux,virtual machines, Embedded device with RTOS, Symbian, Android or Linux, Oscilloscopes, multi meters, JTAG, Traffic generators/analyzers, signal, generators/ analyzers, frequency counters, power supply, Sample BOM	

Module 2: Process of Developing, Debugging, and Verify Software for Embedded Products

Mapped to ELE/N1433

Terminal Outcomes:

- Demonstrate the process of preparing for embedded product software development based on design documents.
- Demonstrate the process of developing software solutions for embedded products.
- Demonstrate the process of testing the software solutions for embedded products.

Duration: 30:00	**Duration: 90:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify extent of code development work required and plan activities accordingly to meet scheduled timelines • Identify and use software configuration management tools, editor and compiler • List the range of code generation tools and unit testing tools used to develop software code • Identify the components which are suitable for re-use and also different sources of information for writing software code • Apply the principles of embedded software programming and real-time programming, best practices for embedded programming and current practice in the infrastructure design of software code • Identify the syntax and semantics of the C language for embedded programming, how to access memory-mapped peripherals using C, how to write interrupt handlers in C • List software requirements specifications including functionality, performance and design constraints • Implement the key features of the programming language such as use of registers, addressing modes, assembler instructions, subroutines and flags and so on • Evaluate the working of the product	• Use appropriate development kit, software and microprocessor ormicro controller based on specified requirements and performance standard • Write efficient, readable and maintainable software code using coding tools, considering purpose of the software solution, type of architecture, potential challenges and how to deal with them • Test the program by compiling and running the programs to check working of basic input/ output functions, memory organization, peripheral operations (e.g., timers, data ports, etc.) and interrupt operation • Apply the process for converting technical specifications into code • Select embedded product development board and compiler/ development environment for the microcontroller/ processor to be programmed • Create and modify code using embedded product peripherals such as timers, data communication ports and so on • Develop microprocessor/ microcontroller software to comply with a specified function and operating parameters • Use digital signal processors and field

by loading the compiled code in to product	programmable gate arrays (FGPA) firmware code development • Develop applications for signal processing, data acquisition, event processing and data managementand communication functions • Develop systems using real-time embedded operating systems • Create UTCs, execute them and fixthe issues • Apply the steps for testing such as developing testing procedures, analysing inputs from appropriate people, recording corrective actions for identified defects, submitting tested code for approval • Use defect tracking tools • Apply debugging techniques to fix the identified issue in the embeddedcode using assembler/ simulator software packages, emulators, debuggers and so on
Classroom Aids	
Training kit (Trainer guide, Presentations). Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Computer, cross compiler, circuit simulator, device driver, Laptop and desktop computers with C, C++, embedded C, PYTHON installed, Windows, iOS, Linux, virtual machines, Embedded device with RTOS, Symbian, Android or Linux, Oscilloscopes, multi meters, JTAG, Traffic generators/ analyzers, signal generators/analyzers, frequency counters, power supply	

Module 3: Process of performing testing and rectify malfunctions in the prototype of the embedded product

Mapped to ELE/N1434

Terminal Outcomes:

- Demonstrate the process of testing the prototype of the embedded product.
- Demonstrate the process of rectifying malfunction, if any, in the prototype.

Duration: 66:00	**Duration: 54:00**
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the malfunctions in the prototype devices/ components • List the software and hardware used to test malfunctions • Identify the applications of debugging • Identify and resolve malfunctions as per standard operating system • Evaluate end-of-life and component change notifications and sourcing alternate components	• Use debugging to analyse and resolve malfunctions in the prototype • Apply approved techniques to check defects/ malfunctions • Analyse unit failures and develop corrective actions • Assess the techniques used for electromagnetic interference or compatibility (EMI/ EMC) testing, thermal testing, scale testing, rate test. KPI test etc. • Demonstrate working with the testing/QA team to fix identified problems • Comply with the quality standards defined by the organization • Prepare a document containing the completed new product design work and submit to relevant authority/ person for approval
Classroom Aids	
Training kit (Trainer guide, Presentations)	
Tools, Equipment and Other Requirements	
Computer, cross compiler, circuit simulator, device driver, Laptop and desktop computers with C, C++, embedded C, PYTHON installed, Windows, iOS, Linux, virtual machines, Embedded device with RTOS, Symbian, Android or Linux, Oscilloscopes, multi meters, JTAG, Traffic generators/ analyzers, signal generators/analyzers, frequency counters, power supply	

Module 3: 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 4: On-the-Job Training

Mapped to Embedded Product Design - Technical Lead

Mandatory Duration: 180:00	Recommended Duration: 00:00
Location: On Site	

Terminal Outcomes

1. Explain the process of preparing a feasibility report of the new product design.
2. Use testing devices such as oscilloscopes, multi meters, JTAG, Traffic generators/analyzers,signal generators/analyzers, frequency counters, power supply
3. Analyse datasheets of components such as ageing, caveats, constraints like temperature/ pressure affecting normal operational characteristics of the product
4. Write efficient, readable and maintainable software code using coding tools.
5. Create UTCs, execute them and fix the issues
6. Analyse unit failures and develop corrective actions
7. Create a sample feedback form to obtain feedback from customers, colleagues etc.
8. Administer first aid in case of a minor accident.
9. Demonstrate how to maintain a healthy, safe and secure working environment.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma/ITI/ Degree	Electronics /Electrical /Computer Science /Mechanical	4	Semiconductor, Components Domain	1 year	Electronics & Semiconductors Domain	

Trainer Certification	
Domain Certification	**Platform Certification**
"Embedded Product Design - Technical Lead", "ELE/Q1403,v4.0**",** Minimum accepted score is 80%	Recommended that the Trainer is certified for the "**Embedded Product Design - Technical Lead"** 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	Electronics /Electrical /Computer Science /Mechanical	5	Semiconductor, Components Domain	2 years preferably	Electronics & Semiconductors Domain	

Assessor Certification	
Domain Certification	**Platform Certification**
"Embedded Product Design - Technical Lead", "ELE/Q1403, v4.0**",** Minimum accepted score is 80%	Recommended that the Assessor is certified for the "**Embedded Product Design - Technical Lead**" 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 center 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 center, 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
DC	Direct Current
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