



## QUALIFICATION FILE–Standalone NOS

### Fundamentals of Embedded C programming

Horizontal/Generic  Vertical/Specialization

Upskilling  Dual/Flexi Qualification  For ToT  For ToA

General  Multi-skill (MS)  Cross Sectoral (CS)  Future Skills  OEM

NCrF/NSQF Level: 4

Submitted By:

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**Section 1: Basic Details**

1. <b>NOS-Qualification Name</b>	<b>Fundamentals of Embedded C programming</b>																	
2. <b>Sector/s</b>	<b>Electronics</b>																	
3. <b>Type of Qualification</b> <input checked="" type="checkbox"/> <b>New</b> <input type="checkbox"/> <b>Revised</b>	<b>NQR Code &amp; version of the existing /previous qualification: NA</b>		<b>Qualification Name of the existing/previous version: NA</b>															
4. <b>National Qualification Register (NQR) Code &amp; Version</b>	NG-04-EH-02886-2024-V1-NIELIT		<b>5. NCrF/NSQF Level: 4</b>															
6. <b>Brief Description of the Standalone NOS</b>	The course has been developed in consultation with industry experts. It focuses on foundational knowledge and practical skills development, emphasizing real-world applications and industry-relevant practices in embedded systems programming using the C language and it equips the students with a comprehensive Hands-on to embedded systems development, working with ARM Cortex M series Microcontroller architecture and peripheral programming and expertise in Embedded C Programming.																	
7. <b>Eligibility Criteria for Entry for a Student/Trainee/Learner/Employee</b>	<p><b>a. Entry Qualification &amp; Relevant Experience:</b></p> <table border="1"> <thead> <tr> <th><b>S. No.</b></th> <th><b>Academic/Skill Qualification (with Specialization - if applicable)</b></th> <th><b>Relevant Experience (with Specialization - if applicable)</b></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>12th or equivalent in Science with Physics and Maths</td> <td>NA</td> </tr> <tr> <td>2</td> <td>2 Years of 3-Years Diploma in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches after class 10th</td> <td>NA</td> </tr> <tr> <td>3</td> <td>NSQF Level 3.5 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches</td> <td>1.5 Years</td> </tr> <tr> <td>4</td> <td>NSQF Level 3 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches</td> <td>1.5 years</td> </tr> </tbody> </table>			<b>S. No.</b>	<b>Academic/Skill Qualification (with Specialization - if applicable)</b>	<b>Relevant Experience (with Specialization - if applicable)</b>	1	12th or equivalent in Science with Physics and Maths	NA	2	2 Years of 3-Years Diploma in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches after class 10th	NA	3	NSQF Level 3.5 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	1.5 Years	4	NSQF Level 3 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	1.5 years
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4	NSQF Level 3 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	1.5 years																

		<b>b. Age:18 years</b>															
8.	<b>Credits Assigned to this NOS-Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</b>	2 Credits	<b>9. Common Cost Norm Category (I/II/III) (wherever applicable):</b> Category I (Electronics System Design)														
10.	<b>Any Licensing Requirements for Undertaking Training on This Qualification (wherever applicable)</b>	NA															
11.	<b>Training Duration by Modes of Training Delivery (Specify Total Duration as per selected training delivery modes and as per requirement of the qualification)</b>	<input checked="" type="checkbox"/> Offline <input type="checkbox"/> Online <input type="checkbox"/> Blended <table border="1" data-bbox="1044 500 2144 627"> <thead> <tr> <th>Training Delivery Mode</th> <th>Theory (Hours)</th> <th>Practical (Hours)</th> <th>Total (Hours)</th> </tr> </thead> <tbody> <tr> <td>Classroom (offline)</td> <td>30</td> <td>30</td> <td>60</td> </tr> </tbody> </table> <p>The mode of delivery shall be based on the regional demand and can be offered in any of the above modes mentioned.</p>				Training Delivery Mode	Theory (Hours)	Practical (Hours)	Total (Hours)	Classroom (offline)	30	30	60				
Training Delivery Mode	Theory (Hours)	Practical (Hours)	Total (Hours)														
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12.	<b>Assessment Criteria</b>	<table border="1" data-bbox="1044 770 2144 960"> <thead> <tr> <th>Theory (Marks)</th> <th>Practical (Marks)</th> <th>Project/ Presentation /Assignment (Marks)</th> <th>Viva/ Internal Assessment (Marks)</th> <th>Total (Marks)</th> <th>Passing %age</th> </tr> </thead> <tbody> <tr> <td>100</td> <td>60</td> <td>20</td> <td>20</td> <td>200</td> <td>50</td> </tr> </tbody> </table> <p>The centralized online assessment is conducted by the Examination Wing, NIELIT Headquarters.</p>				Theory (Marks)	Practical (Marks)	Project/ Presentation /Assignment (Marks)	Viva/ Internal Assessment (Marks)	Total (Marks)	Passing %age	100	60	20	20	200	50
Theory (Marks)	Practical (Marks)	Project/ Presentation /Assignment (Marks)	Viva/ Internal Assessment (Marks)	Total (Marks)	Passing %age												
100	60	20	20	200	50												
13.	<b>Is the NOS Amenable to Persons with Disability</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <b>If "Yes", specify applicable type of Disability:</b> <ul style="list-style-type: none"> <li>a. Locomotor Disability: Leprosy Cured Person, Dwarfism, Muscular Dystrophy and Acid Attack Victims</li> <li>b. Visual Impairment: Low Vision</li> </ul>															
14.	<b>Progression Path After Attaining the Qualification, wherever applicable</b>	Embedded System Developer (A-Level 'Embedded System Design')															

15.	<b>How will the participation of women be encouraged?</b>	Participation by women can be ensured through Government Schemes. Occasionally, exclusive batches for women would be run for the proposed courses. Funding is available for women's participation under other schemes launched by the Government from time to time.
16.	<b>Other Indian languages in which the Qualification &amp; Model Curriculum are being submitted</b>	Qualification files available in English & Hindi Language.
17.	<b>Is similar NOS available on NQR-if yes, justification for this qualification</b>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
18.	<b>Name and Contact Details Submitting / Awarding Body SPOC</b> <i>(In the case of CS or MS, provide details of both Lead AB &amp; Supporting ABs)</i>	<p><b>Name:</b> Rajesh M  <b>Email:</b> rajesh.m@nielit.gov.in  <b>Website:</b> <a href="https://nielit.gov.in/">https://nielit.gov.in/</a></p> <p><b>Name:</b> Prashant Pal  <b>Email:</b> prashantpal@nielit.gov.in  <b>Website:</b> <a href="https://nielit.gov.in/">https://nielit.gov.in/</a></p> <p><b>Name:</b> Anirban Jyoti Hati  <b>Email:</b> anirban@nielit.gov.in  <b>Website:</b> <a href="https://nielit.gov.in/">https://nielit.gov.in/</a></p> <p><b>Name:</b> Ankit Kumar  <b>Email:</b> ankit@nielit.gov.in  <b>Website:</b> <a href="https://nielit.gov.in/">https://nielit.gov.in/</a></p>
19.	<b>Final Approval Date by NSQC:</b> 25.07.2024	<b>20. Validity Duration:</b> 3 years <b>21. Next Review Date:</b> 25.07.2027

## Section 2: Training Related

1.	<b>Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)</b>	B.E./B. Tech in Electronics/ Electronics & Communication/ Electrical/ Electrical and Electronics/Instrumentation/ Electronics & Instrumentation / Instrumentation & Control /Computer Science/Information Technology  Minimum 2 year of experience in the field of Embedded Systems Development
2.	<b>Master Trainer's Qualification and experience in the relevant sector (in years) (as per NCVET guidelines)</b>	B.E./B. Tech in Electronics/ Electronics & Communication/ Electrical/ Electrical and Electronics/Instrumentation/ Electronics & Instrumentation / Instrumentation & Control /Computer Science/Information Technology

		Minimum 3 year of experience in the field of Embedded Real Time systems
3.	<b>Tools and Equipment Required for the Training</b>	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Available at Annexure-II
4.	<b>In Case of Revised NOS, details of Any Upskilling Required for Trainer</b>	Not Applicable

### Section 3: Assessment Related

1.	<b>Assessor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)</b>	B.Tech or Equivalent as per NCrF + 3 years relevant experience
2.	<b>Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines), (wherever applicable)</b>	The assessor carries out theory online assessments through the remote proctoring methodology. Theory examination would be conducted online and the paper comprises MCQ. Conduct of assessment is through trained proctors. Once the test begins, remote proctors have full access to the candidate's video feeds and computer screens. Proctors authenticate the candidate based on registration details, pre-test image captured and I-card in possession of the candidate. Proctors can chat with candidates or give warnings to candidates. Proctors can also take screenshots, terminate a specific user's test session, or re-authenticate candidates based on video feeds.
3.	<b>Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years) (as per NCVET guidelines)</b>	External Examiners/ Observers (Subject matter experts) are deployed including NIELIT scientific officers who are subject experts for evaluation of Practical examination/ internal assessment / Project/ Presentation/ assignment and Major Project (if applicable). Qualification is generally B.Tech
4.	<b>Assessment Mode</b> (Specify the assessment mode)	Centralized online examination will be conducted
5.	<b>Tools and Equipment Required for Assessment</b>	Same as for training <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

#### Section 4: Evidence of the Need for the Standalone NOS

1.	Government /Industry initiatives/ requirement (Yes/No): Yes, Available at Annexure-A: Evidence of Need
2.	Number of Industry validations provided: 10
3.	Estimated number of people to be trained: 500 persons per year shall be trained.
4.	Evidence of Concurrence/Consultation with Line/State Departments (In case of regulated sectors): NIELIT is recognized as AB and AA under Government Category. NIELIT is an HRD arm of MeitY, therefore, the Line Ministry Concurrence is not required.
5.	Latest Skill Gap Study (not older than 2 years) (Yes/No): Yes, Available in Annexure-A: Evidence of Need
6.	Latest Market Research Reports or any other source (not older than 2 years) (Yes/No): Yes, Available at Annexure-A: Evidence of Need

#### Section 5: Annexure & Supporting Documents Check List

Specify Annexure Name / Supporting document file name.

1.	<b>Annexure:</b> NCrF/NSQF level justification based on NCrF/NSQF descriptors ( <i>Mandatory</i> )	Available at Annexure-I: Evidence of Level
2.	<b>Annexure:</b> List of tools and equipment relevant for NOS ( <i>Mandatory, except in case of online course</i> )	Available at Annexure-II: Tools and Equipment
3.	<b>Annexure: Industry Validation</b>	Available at Annexure-III: Industry Validation
4.	<b>Annexure: Training Details</b>	Available at Annexure-IV: Training Details
5.	<b>Annexure:</b> Blended Learning ( <i>Mandatory, in case the selected Mode of delivery is Blended Learning</i> )	Available at Annexure-V: Blended Learning
6.	<b>Annexure/Supporting Document:</b> Standalone NOS- Performance Criteria Details Annexure/Document with PC-wise detailing as per NOS format ( <i>Mandatory- Public view</i> )	Available at Annexure-VI: Standalone NOS- Performance Criteria details
7.	<b>Annexure:</b> Performance and Assessment Criteria ( <i>Mandatory</i> )	Available at Annexure-VII: Detailed Assessment Criteria
8.	<b>Annexure:</b> Assessment Strategy ( <i>Mandatory</i> )	Available at Annexure-VIII: Assessment Strategy

9.	<b>Annexure:</b> Acronym and Glossary (Optional)	Available at Annexure-IX: Acronym and Glossary
10.	<b>Supporting Document:</b> Model Curriculum	Available at Annexure-C: Model Curriculum

### Annexure-I: Evidence of Level

NCrF/NSQF Level Descriptors	Key requirements of the job role/ outcome of the qualification	How the job role/ outcomes relate to the NCrF/NSQF level descriptor	NCrF/NSQF Level
<b>Professional Theoretical Knowledge/Process</b>	<ul style="list-style-type: none"> <li>Acquire theoretical knowledge of the C programming language, focusing on its syntax, basic programming constructs, and usage in embedded systems.</li> <li>Grasp the fundamental concepts and characteristics of embedded systems, including their design, operation, and applications.</li> <li>Learn the theoretical basis for accessing and controlling peripheral registers, which is crucial for direct hardware manipulation and system optimization in embedded applications.</li> </ul>	<ol style="list-style-type: none"> <li>Possesses specialized operational knowledge and understanding of the work.</li> <li>Have complete knowledge of the concept of time required for delivery; and Quality for a range of issues</li> </ol>	4
<b>Professional and Technical Skills/ Expertise/ Professional Knowledge</b>	<ul style="list-style-type: none"> <li>Demonstrate the ability to write, debug, and optimize embedded C code using fundamental constructs such as loops, conditionals, and functions.</li> <li>Efficiently set up and configure integrated development environments (IDEs), toolchains, and hardware platforms for embedded system development.</li> <li>Skillfully manage dynamic memory allocation and deallocation processes to optimize system performance and prevent memory leaks.</li> </ul>	<ol style="list-style-type: none"> <li>Possesses specialized professional and technical skills; displays clarity of professional knowledge and technical skills in a broad range of activities/ tasks.</li> <li>Have knowledge of collecting and interpreting the available information, drawing conclusions &amp; communicating the same</li> </ol>	4

<b>Employment Readiness &amp; Entrepreneurship Skills &amp; Mind-set/Professional Skill</b>	<ul style="list-style-type: none"> <li>Develop strong problem-solving skills to identify and address issues in embedded systems, ensuring reliable performance and client satisfaction.</li> <li>Demonstrate the ability to communicate technical concepts clearly and collaborate effectively with team members, clients, and stakeholders, ensuring successful project delivery and client relations.</li> <li>Focus on delivering solutions that meet client requirements and exceed expectations, fostering long-term relationships and potential business opportunities in the embedded systems industry.</li> </ul>	<ol style="list-style-type: none"> <li>Can explain Entrepreneurial Mindset and describe the importance of it in the context of opportunity curation for future jobs</li> <li>Can comfortably use most of the basic software with proficiency</li> <li>Have the ability to relate to the 5 pillars of Social Emotional Skills and describe the similarities between SES and Emotional Intelligence</li> </ol>	4
<b>Broad Learning Outcomes/ Core Skill</b>	<ul style="list-style-type: none"> <li>Develop strong programming skills in C, focusing on syntax, basic constructs, control flow, and decision-making structures crucial for embedded applications.</li> <li>Acquire the ability to access and control peripheral registers, perform bit-level manipulation, and use bitwise operators effectively for hardware interfacing.</li> <li>Learn to set up and configure development environments for embedded systems, including toolchains and integrated development environments (IDEs).</li> </ul>	<ol style="list-style-type: none"> <li>Developing strong programming skills in C, including syntax, basic constructs, control flow, and decision-making structures, is a fundamental core skill.</li> <li>Acquiring the ability to access and control peripheral registers, perform bit-level manipulation, and use bitwise operators effectively for hardware interfacing is a core skill.</li> </ol>	4

<b>Responsibility</b>	Ability to manage the system resources in the most effective manner by appropriate planning, estimation, coordination and control of the activities involved in the design & development of any Embedded Applications using 'C' as a Programming Language.	<ol style="list-style-type: none"> <li>1. Takes complete responsibility for delivery and quality of own work and output as also the subordinates.</li> <li>2. Shares responsibility for the group tasks.</li> </ol>	4
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### **Annexure II: Tools and Equipment (lab set-up)**

#### **List of Tools and Equipment**

**Batch Size: 30**

S. No.	Tool / Equipment Name	Specification	Quantity for specified Batch size
1	Classroom	1 (750 Sq. ft to 1000 Sq. ft.)	30
2	Students Chair	30	30
3	Students Table	15 (2 students sharing 1 table)	15
4	Desktop computer with accessories / Laptop	Laptop with minimum specifications: Intel I3 or Celeron processor with at least 8GB RAM, 512GB SSD Hard disk integrated with graphics card, Display size 15.6-inch, Wi-Fi connectivity and Wired Optical Mouse + C compiler, IDE (Integrated Development Environment), embedded system development kit, peripherals for input/output operations.	15
5	Internet Connectivity	Seamless internet connectivity with at least 100 Mbps without firewall	

Classroom Aids for offline and blended mode of training:

The aids required to conduct sessions in the classroom are:

1. LCD Projector/Smart Board

## Annexure III: Industry Validations/ Government Recognition Summary

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID
1	AISECT Ltd.	Teena Panthi	Assistant Manager	AISECT Ltd. 1-1-387, 3rd floor, Flat No. 403/404, GNR Heights, Above SBI,Bakaram Road, Musheerabad, Hyderabad-500020	7879982075	<a href="mailto:teena.panthi@aisect.org">teena.panthi@aisect.org</a>
2	NICE SHIKSHA VIKAS KENDRA	Motilal Ohdar	Secretary	Moti House, (Nice Computer Gali), Prince Chowk, Simdega, Jharkhand	7992489955	<a href="mailto:vtpnice12@gmail.com">vtpnice12@gmail.com</a>
3	Aajivika Global Skill Private Limited	Mukesh Kumar Verma	Director	Beside Vishal Trade, dasmille chowk, Khunti Road Ranchi, Jharkhand-835221	9507952882	<a href="mailto:aajivikaglobal@gmail.com">aajivikaglobal@gmail.com</a>
4	B. G. Infotech	Amal Das	Centre Head	Kakdihi, Mecheda, Purba, Medinipur	9434996748	<a href="mailto:bginfotech2007@gmail.com">bginfotech2007@gmail.com</a>
5	Devendra Nath Institute of Information Mation Technology	Amit Kumar Tripathy	Director	Uska Road, Near Naveen Sabji Mandi, Tetari Bazar, Siddharth Nagar-272207	8765562815	<a href="mailto:aktiob@gmail.com">aktiob@gmail.com</a>
6	Inditech Software Wizard Pvt. Ltd.	Sandip Ghosh	Course Coordinator	Mohiari Chanpiritala, Po: Andul Mouri, PS: Domjur, Distt: Howrah, West Bengal-711302	9230027415	<a href="mailto:swizardrecruitment@gmail.com">swizardrecruitment@gmail.com</a>
7	Prasanthi Polytechnic	D. Prasad	Principal	Duppituru (Vill), Atchutapuram (Md). Visakhapatnam (Dist), Andhra Pradesh-531011	9849952573	<a href="mailto:prasadreddy.1279@gmail.com">prasadreddy.1279@gmail.com</a>
8	JAN SAMRIDHI DUMKA	Gobind Nath Maji	Director	Near Gyan School, Dudhani, Dumka, Jharkhand-814101	8789620133	<a href="mailto:Gobind107@gmail.com">Gobind107@gmail.com</a>

9	Sidhi Academy	Vinayak	Neha Verma	Director	Shiv Narayan Kunj, B Block, Shivaji Nagar, Hethu, Ranchi, JH-834002	8789837772	<a href="mailto:sidhiacadmey@gmail.com">sidhiacadmey@gmail.com</a>
10	Surekha IT Services	Anjani K		Manager	8-3-191/84/302, Sharan Residency, Vengalrao Nagar, Hyderabad-500038, Telangana	8125134134	<a href="mailto:info@surekhaitservices.com">info@surekhaitservices.com</a>

#### Annexure IV: Training Details

##### Training Projections:

Year	Estimated Training # of Total Candidates	Estimated training# of Women	Estimated training# of People with Disability
2024-25	500	200	20
2025-26	500	200	20
2026-27	1000	200	20

Data to be provided year-wise for the next 3 years.

#### Annexure V: Blended Learning

##### Blended Learning Estimated Ratio & Recommended Tools:

S. No.	Select the Components of the Qualification	List Recommended Tools – for all Selected Components	Offline : Online Ratio
1	Theory/ Lectures - Imparting theoretical and conceptual knowledge	Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	70:30
2	Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners	Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	70:30
3	Showing Practical Demonstrations to the learners	Through Virtual Simulation Software (Proteus- VSM) and Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	70:30
4	Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	Through Virtual Simulation Software (Proteus- VSM) and Online interaction platforms like JitSi Meet, Bharat VC, Google Meet,	70:30

		MS Teams, etc.	
5	Tutorials/ Assignments/ Drill/ Practice	Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	70:30
6	Proctored Monitoring/ Assessment/ Evaluation/ Examinations	NIELIT Remote Proctored Software	Online: 100% Theory Offline: 100% Practical
7	On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training	Simulated Platform	Either 100% online in a virtual environment Or 100% offline in the Industry.

#### Annexure VI: Standalone NOS- Performance Criteria details

##### 1. Description

The Standalone NOS equips the students to explore the characteristics and components of embedded systems, setting up the development environment, and mastering C language syntax and basic programming constructs.

##### 2. Scope

The scope covers the following:

The scope of this course encompasses an in-depth study of embedded systems and their characteristics, focusing on the C programming language tailored for embedded applications. Students will learn to set up the development environment and master C language syntax, variables, data types, control flow, pointers, and memory management techniques. The course also covers input/output operations, bit-level manipulation, peripheral register control, interrupt handling, and timer configurations. This comprehensive approach ensures students gain practical skills and theoretical knowledge essential for embedded systems programming.

### 3. Elements and Performance Criteria

#### *Embedded Systems and C Programming:*

- Comprehend the fundamental characteristics and applications of embedded systems.
- Gain proficiency in the basics of the C programming language tailored for embedded systems.
- Successfully set up and configure an embedded systems development environment, including necessary tools and software.

#### *Programming Constructs and Memory Management:*

- Demonstrate understanding of C language syntax, including variables, data types, operators, and control flow structures.
- Apply pointers in various programming scenarios, understanding their significance in embedded systems.
- Efficiently use dynamic memory allocation and deallocation techniques, and implement memory management strategies for optimal performance in embedded systems.

#### *Peripheral Control and Interrupt Handling:*

- Access and manipulate peripheral registers to control hardware components.
- Implement interrupt handling mechanisms and develop interrupt service routines for responsive embedded applications.
- Configure timers and manage interrupt-based timer operations to achieve precise timing and scheduling in embedded systems.

### 4. Knowledge and Understanding (KU):

The individual on the job needs to know and understand:

#### **Embedded Systems and C Programming:**

- Know the steps and tools required to set up a development environment for embedded systems programming, including IDEs, compilers, and debuggers.

#### **Programming Constructs and Memory Management:**

- Gain in-depth knowledge of variables, data types, operators, control flow structures (if, switch, loops), and their application in embedded systems programming.

#### **Peripheral Control and Interrupt Handling:**

- Learn the configurations and operations of timers in embedded systems, including how to manage interrupts and implement interrupt-based timing mechanisms.

## 5. Generic Skills (GS):

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

### Problem-solving Skills:

- Develop the ability to identify, analyze, and solve problems in embedded systems by using debugging tools and techniques effectively.

### Communication and Collaboration:

- Enhance communication and teamwork skills by collaborating with peers on projects, sharing knowledge, and providing constructive feedback.

### Self-Management and Lifelong Learning:

- Foster adaptability by staying current with new tools, technologies, and methodologies in the rapidly evolving field of embedded systems.

## Annexure VII: Assessment Criteria

Detailed PC-wise assessment criteria and assessment marks for the NOS are as follows:

NOS/Module Name	Assessment Criteria for Performance Criteria	Theory Marks	Practical Marks	Project /Presentation /Assignment Marks	Viva/ Internal Assessment (Marks)
NOS1: Fundamentals of Embedded C programming  NOS Code: NIE/ELE/N0221	<p><i>Embedded Systems and C Programming</i></p> <p>Comprehend the fundamental characteristics and applications of embedded systems.</p> <p>Gain proficiency in the basics of the C programming language tailored for embedded systems.</p> <p>Successfully set up and configure an embedded systems development environment, including necessary tools and software.</p> <p><i>Programming Constructs and Memory Management:</i></p> <p>Demonstrate understanding of C language syntax, including</p>	30  -  -  -  30	20  -  -  -  20	-  -  -  -	6  -  -  -  7

	variables, data types, operators, and control flow structures.	-	-	-	-
	Apply pointers in various programming scenarios, understanding their significance in embedded systems.			-	-
	Efficiently use dynamic memory allocation and deallocation techniques, and implement memory management strategies for optimal performance in embedded systems.	-	-	-	-
	<i>Peripheral Control and Interrupt Handling:</i>	40	20	-	7
	Access and manipulate peripheral registers to control hardware components.	-	-	-	-
	Implement interrupt handling mechanisms and develop interrupt service routines for responsive embedded applications.	-	-	-	-
	Configure timers and manage interrupt-based timer operations to achieve precise timing and scheduling in embedded systems.				
		100	60	20	20
	<b>NOS Total</b>	<b>200</b>			

#### Annexure VIII: Assessment Strategy

This section includes the processes involved in identifying, gathering, and interpreting information to evaluate the Candidate on the required competencies of the program.

Assessment of the qualification evaluates candidates to ascertain that they can integrate knowledge, skills and values for carrying out relevant tasks as per the defined learning outcomes and assessment criteria.

The underlying principle of assessment is fairness and transparency. The evidence of the outcomes and assessment criteria. Competence acquired by the candidate can be obtained by conducting Theory (Online) examination.

#### About Examination Pattern:

1. The question papers for the theory exams are set by the Examination wing (assessor) of NIELIT HQS.
2. The assessor assigns roll number.
3. The assessor carries out theory online assessments. Theory examination would be conducted online and the paper comprise of MCQ
4. Pass percentage would be 50% marks.

5. The examination will be conducted in English language only.

Quality assurance activities: A pool of questions is created by a subject matter expert and moderated by other SME. Test rules are set beforehand. Random set of questions which are according to syllabus appears which may differ from candidate to candidate. Confidentiality and impartiality are maintained during all the examination and evaluation processes

#### Annexure IX: Acronym and Glossary

##### Acronym

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
NCrF	National Credit Framework
NOS	National Occupational Standard(s)
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework

##### Glossary

Term	Description
<b>National Occupational Standards (NOS)</b>	NOS define the measurable performance outcomes required from an individual engaged in a particular task. They list down what an individual performing that task should know and also do.
<b>Qualification</b>	A formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards
<b>Qualification File</b>	A Qualification File is a template designed to capture necessary information of a Qualification from the perspective of NSQF compliance. The Qualification File will be normally submitted by the awarding body for the qualification.
<b>Sector</b>	A grouping of professional activities on the basis of their main economic function, product, service, or technology.