QUALIFICATION FILE

Embedded System Developer (A-Level 'Embedded System Design')

☒ Short Term Training (STT) ☐ Long Term Training (LTT) ☐ Apprenticeship

☐ Upskilling ☐ Dual/Flexi Qualification ☐ For ToT ☐ For ToA

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

NCrF/NSQF Level: 5

Submitted By:

NATIONAL INSTITUTE OF ELECTRONICS AND INFORMATION TECHNOLOGY (NIELIT)

NIELIT Bhawan
Plot No. 3, PSP Pocket, Sector-8,
Dwarka, New Delhi-110077

Table of Contents

Section 1: Basic Details

1.	**Qualification Name**	**Embedded System Developer (A-Level 'Embedded System Design')**	
2.	**Sector/s**	**Electronics**	
3.	**Type of Qualification: ☒ New ☐ Revised ☐ Has Electives/Options ☐OEM**	**NQR Code & version of existing/previous qualification: NA**	**Qualification Name of existing/previous version: NA**
4.	**a. OEM Name** **b. Qualification Name** (*Wherever applicable)*	**-**	
5.	**National Qualification Register (NQR) Code &Version** (*Will be issued after NSQC approval)*	QG-05-EH-02592-2024-V1-NIELIT	**6. NCrF/NSQF Level:** *5*
7.	**Award (Certificate/Diploma/Advanced Diploma/ Any Other** *(Wherever applicable specify multiple entry/exits also & provide details in annexure)*	Certificate	
8.	**Brief Description of the Qualification**	**Nature:** ❖ A Level in System Design offers practical training in integrating multiple disciplines like engineering and computer science to design and develop complex systems. It emphasizes hands-on experience and industry-relevant skills to prepare students for roles in system analysis, design, and implementation. **Purpose:** The purpose of a Level in System Design is to equip students with the practical skills and theoretical knowledge necessary to tackle real-world challenges in designing and implementing complex systems. It aims to prepare graduates for careers in various industries by providing specialized training in system analysis, design, and integration.	
9.	**Eligibility Criteria for Entry for Student/Trainee/Learner/Employee**	**a. Entry Qualification & Relevant Experience:**	

S. No.	Academic/Skill Qualification (with Specialization - if applicable)	Required Experience (with Specialization - if applicable)
1.	Completed UG Diploma in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	NA
2.	Completed 3 Years of Diploma in Electronics and Communication Engineering/ Electrical	1.5

	Engineering/CS/IT and allied branches after class 10th	
3.	Completed 2nd Year of Diploma in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches after class 12th	NA
4.	Acquired NSQF Level 4.5 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	1.5 Years
5.	Acquired NSQF Level 4 in Electronics and Communication Engineering/ Electrical Engineering/CS/IT and allied branches	3 Years

b. Age: 18 Years

10.	**Credits Assigned to this Qualification, Subject to Assessment** *(as per National Credit Framework (NCrF))*	26 Credits	**11. Common Cost Norm Category (I/II/III)** *(wherever applicable)***:** Category I (Electronics System Design)
12.	**Any Licensing requirements for Undertaking Training on This Qualification** *(wherever applicable)*	NA	
13.	**Training Duration by Modes of Training Delivery** *(Specify **Total Duration** as per selected training delivery modes and as per requirement of the qualification)*	**☒Offline ☐ Online ☐ Blended**	
14.	**Aligned to NCO/ISCO Code/s** *(if no code is available mention the same)*	*NCO-2015/2512.0501(Embedded Software Engineer)*	
15.	**Progression path after attaining the qualification** *(Please show Professional and Academic progression)*	*Academic:* *Advance courses in Embedded Hardware, Software and Firmware design and development.* *Professional:* *Embedded Software Engineer*	

Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	ES (Hours)	Total (Hours)
Classroom (Offline)	**250**	**350**	**90**	**90**	**780**

Training shall be conducted in any of the 3 modes depending on the regional need.

(Refer Blended Learning Annexure-v for details)

16.	**Other Indian languages in which the Qualification & Model Curriculum are being submitted**	Qualification file available in English & Hindi Language.	
17.	**Is similar Qualification(s) available on NQR-if yes, justification for this qualification**	☐ **Yes** ☒ **No URLs of similar Qualifications:**	
18.	**Is the Job Role Amenable to Persons with Disability**	☒ **Yes** ☐ **No** **If "Yes", specify applicable type of Disability:** a. Locomotor Disability ● Leprosy Cured Person ● Dwarfism ● Muscular Dystrophy ● iv. Acid Attack Victims b. Visual Impairment ● Low Vision	
19.	**How Participation of Women will be Encouraged**	Through funding from the Government under various schemes and projects.	
20.	**Are Greening/ Environment Sustainability Aspects Covered** *(Specify the NOS/Module which covers it)*	☐ **Yes** ☒ **No**	
21.	**Is Qualification Suitable to be Offered in Schools/Colleges**	**Schools** ☐ **Yes** ☒ **No** **Colleges** ☒ **Yes** ☐ **No**	
22.	**Name and Contact Details of Submitting / Awarding Body SPOC***(In case of CS or MS, provide details of both Lead AB & Supporting ABs)*	**Name:** Rajesh M **Email:** rajesh.m@nielit.gov.in **Website:** https://nielit.gov.in/ **Name:** Anirban Jyoti Hati **Email:** anirban@nielit.gov.in **Website:** https://nielit.gov.in/ **Name:** Ankit Kumar **Email:** ankit@nielit.gov.in **Website:** https://nielit.gov.in/	
23.	**Final Approval Date by NSQC: 30.05.2024**	**24. Validity Duration: 3 Years**	**25. Next Review Date: 30.05.2027**

Section 2: Module Summary

Mandatory NOS/s of Qualifications

- Embedded System Design & C- Programming
- Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming
- Sensor data acquisition and actuation in embedded systems
- Linux Internals
- RTOS for Embedded Application
- Embedded Communication Protocols (UART, SPI, I2C, CAN, USB)
- Wireless Sensor networks
- Linux Device Driver Development
- Internet of Things
- AI for Embedded Application.

***Th**.-Theory **Pr.**-Practical OJT-On the Job **Man.**-Mandatory Training Rec.-Recommended Proj.-Project*

S. No	NOS/Module Name	Core/ Non-Core	NOS Code	NCrF/ NSQF Level	Credits as per NCrF	Training Duration (Hours)			Assessment Marks					
						Theory	Practical	Total	Theory	Practical	Proj.	Viva	Total	Weightage (%) *(if applicable)*
1.	*NOS1:* Embedded System Design & C- Programming	Core	NIE/ELE /N0206	4	2	25	35	60	100	80	-	20	200	9.3
2.	*NOS2:* Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	Core	NIE/ELE /N0207	4	2	25	35	60	100	80	-	20	200	9.3
3.	*NOS3:* Sensor data acquisition and actuation in embedded systems	Core	NIE/ELE /N0208	4	2	25	35	60	100	80	-	20	200	9.3
4.	NOS4: Linux Internals	Core	NIE/ELE /N0209	4	2	25	35	60	100	80	-	20	200	9.3
5.	NOS5: RTOS for Embedded Application	Core	NIE/ELE /N0210	5	2	25	35	60	100	80	-	20	200	9.3
6.	NOS6: Embedded Communication Protocols (UART, SPI, I2C, CAN, USB)	Core	NIE/ELE /N0211	5	2	25	35	60	100	80	-	20	200	9.3

S. No	NOS/Module Name	Core/ Non-Core	NOS Code	NCrF/ NSQF Level	Credits as per NCrF	Training Duration (Hours)			Assessment Marks					
						Theory	Practical	Total	Theory	Practical	Proj.	Viva	Total	Weightage (%) *(if applicable)*
7.	NOS7: Wireless Sensor networks	Core	NIE/ELE/N0212	5	2	25	35	60	100	80	-	20	200	9.3
8.	NOS 8: Linux Device Driver Development	Core	NIE/ELE/N0213	5	2	25	35	60	100	80	-	20	200	9.3
9.	NOS 9: Internet of Things	Core	NIE/ELE/N0214	5	2	25	35	60	100	80	-	20	200	9.3
10.	NOS 10: AI for Embedded Application	Core	NIE/ELE/N0215	5	2	25	35	60	100	80	-	20	200	9.3
11.	NOS 11: Employability Skill	Non-Core	DGT/VSQ/N0103	5	3	0	0	90	-	-	-	-	50	2
12.	OJT/Project	Core	-	5	3	0	0	90	-	-	80	20	100	5
Duration (in Hours) / Total Marks					**26**	**250**	**350**	**780**	**1000**	**800**	**80**	**220**	**2150**	**100**

Assessment Components	NOS Included	Duration* (in mins)	Marks
Theory Paper 1 – Embedded System Design & C- Programming	1	90	100
Theory Paper 2 – Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	2	90	100
Theory Paper 3– Sensor data acquisition and actuation in embedded systems	3	90	100
Theory Paper 4 – Linux Internals	4	90	100
Theory Paper 5– RTOS for Embedded Application	5	90	100
Theory Paper 6– Embedded Communication Protocols (UART, SPI, I2C, CAN, USB)	6	90	100

Theory Paper 7– Wireless Sensor networks	7	90	100
Theory Paper 8 – Linux Device Driver Development	8	90	100
Theory Paper 9– Internet of Things	9	90	100
Theory Paper 10 – AI for Embedded Application	10	90	100
Practical Paper 1– Embedded System Design & C- Programming	1	180	100
Practical Paper 2– Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	2	180	100
Practical Paper 3– Sensor data acquisition and actuation in embedded systems	3	180	100
Practical Paper 4 – Linux Internals	4	180	100
Practical Paper 5– RTOS for Embedded Application	5	180	100
Practical Paper 6– Embedded Communication Protocols (UART, SPI, I2C, CAN, USB)	6	180	100
Practical Paper 7– Wireless Sensor networks	7	180	100
Practical Paper 8 – Linux Device Driver Development	8	180	100
Practical Paper 9– Internet of Things	9	180	100
Practical Paper 10 – AI for Embedded Application	10	180	100
Employability Skills	11		50
OJT/Project	1,2,3,4,5,6,7,8, 9,10		100
		Grand Total	**2150**

*** Assessment Strategy shall be as per NIELIT Norms prevailing at times.**

Minimum Pass Percentage – The pass percentage is 50% in each assessment component (as mentioned in the above table) with the aggregate pass percentage be 50%

Section 3: Training Related

1.	**Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	B.E./B. Tech in Electronics/ Electronics & Communication/ Electrical/ Electrical and Electronics/Instrumentation/ Electronics & Instrumentation / Instrumentation & Control /Biomedical /Computer Science/Information Technology Minimum 2 year of experience in the field of Embedded Systems Development
2.	**Master Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	B.E./B. Tech in Electronics/ Electronics & Communication/ Electrical/ Electrical and Electronics/Instrumentation/ Electronics & Instrumentation / Instrumentation & Control /Biomedical /Computer Science/Information Technology Minimum 3 years of experience in the field of Embedded Real Time systems
3.	**Tools and Equipment Required for Training**	☒Yes ☐No (*If "Yes", details to be provided in Annexure)* *Details available in Annexure II*
4.	**In Case of Revised Qualification, Details of Any Upskilling Required for Trainer**	Nil

Section 4: Assessment Related

1.	**Assessor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	B.Tech or Equivalent as per NCrF + 3 years relevant experience
2.	**Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	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.	**Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	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.	**Assessment Mode** *(Specify the assessment mode)*	Online for Theory Online/ Offline/ Blended for other assessment components depending on the region where the assessment is conducted

5.	**Tools and Equipment Required for Assessment**	☒ Same as for training ☒ Yes ☐ No *(details to be provided in Annexure-if it is different for Assessment)*

Section 5: Evidence of the need for the Qualification

Provide Annexure/Supporting documents name.

1.	**Latest Skill Gap Study (not older than 2 years) (Yes/No):** Yes, Available in Annexure-C: Evidence of Need
2.	**Latest Market Research Reports or any other source (not older than 2 years) (Yes/No):** Yes, Available at Annexure-C: Evidence of Need
3.	**Government /Industry initiatives/ requirement (Yes/No):** Yes, Available at Annexure-C: Evidence of Need
4.	**Number of Industry validation provided:** 8
5.	**Estimated no. of persons to be trained and employed:** 500 persons per year shall be trained.
6.	**Evidence of Concurrence/Consultation with Line Ministry/State Departments:** 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.

Section 6: Annexure & Supporting Documents Checklist

Specify Annexure Name / Supporting document file name

1.	**Annexure:** NCrF/NSQF level justification based on NCrF level/NSQF descriptors *(Mandatory)*	Available at Annexure-I: Evidence of Level
2.	**Annexure:** List of tools and equipment relevant for qualification *(Mandatory, except in case of online course)*	*Available at Annexure-II: Tools and Equipment*
3.	**Annexure:** Detailed Assessment Criteria *(Mandatory)*	*Available at Annexure-VI: Detailed Assessment Criteria*
4.	**Annexure:** Assessment Strategy *(Mandatory)*	*Available at Annexure-VII: Detailed Assessment Strategy*
5.	**Annexure:** Blended Learning *(Mandatory, in case selected Mode of delivery is "Blended Learning")*	*Available at Annexure-V: Blended Learning*
6.	**Annexure:** Multiple Entry-Exit Details *(Mandatory, in case qualification has multiple Entry-Exit)*	*NA*
7.	**Annexure:** Acronym and Glossary *(Optional)*	*Available at Annexure-IX: Acronym and Glossary*
8.	**Supporting Document:** Model Curriculum *(Mandatory – Public view)*	*Available at Annexure-A: a. Model Curriculum*

9.	**Supporting Document:** Career Progression *(Mandatory - Public view)*	*Available at Annexure-VIII: Career Progression*
10.	**Supporting Document:** Occupational Map *(Mandatory)*	*Available at Annexure-C: Occupational Map*
11.	**Supporting Document:** Assessment SOP *(Mandatory)*	*Available at Annexure-D: Examination SoP*
12.	**Any other document you wish to submit:**	*NA*

Annexure I: Evidence of Level

NCrF/NSQF Level Descriptors	Key requirements of the job role/ outcome of the qualification	How the job role/ outcomes related to the NCrF/NSQF level descriptor	NCrF/NSQF Level
Professional Theoretical Knowledge	Theoretical and practical knowledge programming and basics of Embedded Systems	Develops wide-ranging specialized theoretical and practical skills in the domain of System Design.	5
Professional and Technical Skills/ Expertise	● Knowledge in developing small scale smart embedded applications. ● Good programming skills	Wide-ranging factual and theoretical knowledge in broad contexts within a field of work or study.	5
Employment Readiness & Entrepreneurship Skills & Mind-set	Having Employability Skills in the domain of Embedded Systems and system design.	Has knowledge and is able to Continuously improve processes which the individual uses for embedded system development.	5
Broad Learning Outcomes	Ability to carry out a specialized job/ work/ tasks in a familiar/ un-familiar, predictable/ un-predictable, routine/ non-routine, Situation of multiple options/ choices.	Good logical and mathematical skill understanding of social political and natural environment and organizing information, communication, and presentation skill.	5
Responsibility	Ability to take responsibility for Delivery and quality of own work and output as also the subordinates.	• Shares responsibility for the group Tasks. • Candidate is a highly skilled master technician • Can perform all non-standard procedures and non-routine tasks with confidence	5

Annexure II: Tools and Equipment (Lab Set-Up)

LIST OF EQUIPMENT (For a batch of 30 students)

Description		Qty	Specifications
1	Classroom	1	30 Sq.m
2	Student Chair	30	
3	Student Table	30	
4	LCD Projector	1	
5	Trainer Chair & Table	1	
6	Pin up Boards	1	
7	White Board	1	
	Computer Lab		
1	Desktop computer with accessories	30	**Hardware Requirements:** ● **Development Board or Evaluation Kit:** ○ ARM Cortex M series development board or any suitable microcontroller evaluation kit with peripherals. ○ Sensors (such as temperature, humidity, accelerometer, etc.) and actuators (LEDs, motors, etc.) for hands-on experiments. ○ Wireless communication modules (for wireless sensor networks), if applicable. ● **PC/Laptop:** ○ Capable of running development environments and simulation software. ○ USB ports for connecting development boards and peripherals. ● **Debugging Tools:** ○ JTAG/SWD debugger for ARM Cortex M series microcontrollers. ○ Oscilloscope and logic analyzer for hardware debugging and analysis. ● **Networking Equipment:**

			○ Routers, switches, and cables for networking experiments. ● **Optional:** ○ Hardware components for IoT applications such as Raspberry Pi, Arduino, sensors, actuators, and IoT development kits. ○ Hardware components for automotive and medical electronics applications. **Software Requirements:** ● **Integrated Development Environment (IDE):** ○ Software tools such as Keil MDK, IAR Embedded Workbench, or Eclipse with GNU ARM toolchain for programming ARM Cortex M series microcontrollers. ○ Code Composer Studio or Arduino IDE for programming microcontrollers and development boards. ● **Simulation Software:** ○ Simulators and emulators for microcontrollers (e.g., Proteus, QEMU) to simulate and debug firmware without hardware. ○ Modeling and simulation tools for wireless sensor networks (e.g., OMNeT++, NS-3). ● **RTOS and Middleware:** ○ RTOS (Real-Time Operating System) such as FreeRTOS, uC/OS-II, or ThreadX. ○ Middleware libraries for communication protocols and device drivers. ● **Linux Environment:** ○ Linux distribution (e.g., Ubuntu, Debian) for NOS 4: Linux Internals and NOS 8: Linux Device Driver Development. ○ Virtualization software (e.g., VirtualBox, VMware) for running Linux on Windows/macOS if needed. ● **Networking Tools:** ○ Wireshark for network protocol analysis. ○ Network simulation software (e.g., Cisco Packet Tracer) for NOS 12: Data Communication and Networking. ● **Optional:** ○ AI/ML frameworks (e.g., TensorFlow Lite, OpenCV) for NOS 11: AI for Embedded Application. ○ Automotive and medical electronics development tools and software suites if covering NOS 12 and NOS 13.

			○ Security tools and libraries for NOS 14: Embedded Security.
2	Desk jet printer	1	A4

Annexure III: Industry Validations Summary

Provide the summary information of all the industry validations in table. This is not required for OEM qualifications.

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID
1	Aajivika Global Skill Private Limited	Mukesh Kumar Verma	Director	Beside Vishal Trade, dasmile chowk, Khunti Road Ranchi, Jharkhand-835221	9507952882	aajivikaglobal@gmail.com
2	AISECT Ltd.	Teena Panthi	Assistant Manager	AISECT Ltd. 1-1-387, 3rd floor, Flat No. 403/404, GNR Heights, Above SBI,Bakaram Road, Musheerabad, Hydrabad-500020	7879982075	Teena.panthi@aisect.org
3	B. G. Infotech	Amal Das	Centre Head	Kakdihi, Mecheda, Purba, Medinipur	9434996748	Bginfotech2007@gmail.com
4	Devendra Nath Institute of Information Mation Technology (DNIIT)	Amit Kumar Tripathy	Director	Uska Road, Near Naveen Sabji Mandi, Tetari Bazar, Siddharth Nagar-272207	8765562815	aktjob@gmail.com
5	Inditech Software Wizard Pvt. Ltd.	Sandip Ghosh	Course Coordinator	Mohiari Chanpiritala, Po: Andul Mouri, PS: Domjur, Distt: Howrah, West Bengal-711302	9230027415	swizardrecruitment@gmail.com
6	Prasanthi Polytechnic	D. Prasad	Principal	Duppituru (Vill), Atchutapuram (Md). Visakhapatnam (Dist), Andhara Pradesh-531011	9849952573	prasadreddy.1279@gmail.com
7	Sidhi Vinayak Academy	Neha Verma	Director	Shiv Narayan Kunj, B Block, Shivaji Nagar, Hethu, Ranchi, JH-834002	8789837772	sidhiacadmey@gmail.com
8	Surekha IT Services	Anjani K	Manager	8-3-191/84/302, Sharan Residency, Vengalrao Nagar, Hyderabad-500038, Telangana	8125134134	info@surekhaitservices.com

Annexure IV: Training & Employment Details

Training and Employment Projections:

Year	Total Candidates		Women		People with Disability	
	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities	Estimated Training #	Estimated Employment Opportunities
2024	500	200	200	100	25	10
2025	750	350	350	150	50	20
2026	750	350	350	150	50	20

Data to be provided year-wise for next 3 years

Training, Assessment, Certification, and Placement Data for previous versions of qualifications: NA

Languages in which Content is available: English

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 (Proteous- 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 (Proteous- VSM) and Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	70:30
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: Detailed Assessment Criteria

Detailed assessment criteria for each NOS/Module are as follows:

NOS/Module Name	Assessment Criteria for Performance Criteria/Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva
Embedded System Design & C- Programming	Assess students' proficiency in embedded system design through practical programming tasks involving microcontroller peripherals and hardware interfacing using C programming.	50	40	-	10
	Evaluate students' understanding of embedded system concepts and their ability to apply them in real-world scenarios through project-based assessments, focusing on problem-solving skills and code optimization techniques.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Microcontroller - ARM Cortex M series - Architecture, Peripheral Programming	Evaluate students' comprehension of ARM Cortex-M series architecture and their ability to implement efficient peripheral programming through practical assessments and hands-on lab exercises.	50	40	-	10
	Assess students' proficiency in designing and debugging embedded systems using ARM Cortex-M microcontrollers, focusing on their understanding of memory-mapped registers, interrupt handling, and low-power modes.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Sensor data acquisition and actuation in embedded systems	Evaluate students' ability to design and implement sensor data acquisition systems in embedded environments, assessing their understanding of analog and digital sensor interfaces, signal conditioning, and data conversion techniques.	50	40	-	10
	Assess students' proficiency in integrating sensors with embedded systems for real-time data acquisition and actuation, focusing on their ability to select appropriate sensors, calibrate sensor readings, and implement closed-loop control algorithms.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Linux Internals	Assess students' understanding of Linux kernel architecture and internals through examinations covering process management, memory management,	50	40	-	10

	and file system operations.				
	Evaluate students' practical skills in Linux system administration and debugging by analyzing and troubleshooting real-world scenarios, including kernel module development and system performance optimization.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
RTOS for Embedded Application	Evaluate students' comprehension of real-time operating system (RTOS) concepts through written exams, focusing on task scheduling, synchronization mechanisms, and resource management.	50	40	-	10
	Assess students' ability to develop and debug real-time embedded applications using RTOS by analyzing their project deliverables, including task design, inter-task communication, and meeting real-time deadlines.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Embedded Communication Protocols (UART, SPI, I2C, CAN, USB)	Evaluate students' understanding of various embedded communication protocols (UART, SPI, I2C, CAN, USB) through practical assessments involving protocol configuration, data transfer, and error handling.	50	40	-	10
	Assess students' ability to select and apply appropriate communication protocols for different embedded system requirements, based on their understanding of protocol characteristics and trade-offs.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Wireless Sensor networks	Assess students' comprehension of wireless sensor network (WSN) principles through project-based assessments, evaluating their ability to design, deploy, and optimize WSNs for specific application scenarios.	50	40	-	10
	Knowledge in system-level programming, including operating systems, embedded systems, and device drivers.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Linux Device Driver Development				-	
	Evaluate students' proficiency in Linux device driver development through practical assessments, including designing and implementing device drivers for custom hardware peripherals.	50	40	-	10
	Assess students' understanding of kernel-level programming concepts and Linux kernel APIs through written exams and code review sessions.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Internet of Things	Assess students' ability to design and implement IoT solutions by evaluating their IoT project prototypes, focusing on integration of sensors, proficiency in scripting languages, connectivity modules, and cloud services	50	40	-	10
	Assess students' understanding of embedded product design principles and comprehension of data communication and networking through project-based assessments, evaluating their ability to integrate hardware and software components to meet specific design requirements	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**

AI for Embedded Application	Assess students' understanding and implementation of AI algorithms in embedded systems and embedded application prototypes for automotive applications through project demonstrations and code reviews	50	40	-	10
	Assess students' embedded application prototypes for medical electronics and understanding of embedded system security, considering regulatory compliance, data privacy, and reliability.	50	40	-	10
	Total Marks:	**100**	**80**	-	**20**
Employability Skills	Employability Skills	-	-	-	50
Project / OJT	Project	-	-	100	-
	Grand Total: 2150	**1000**	**800**	**100**	**250**

Annexure VII: 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), Practical assessment, internal assessment, Project/Presentation/ Assignment, Major Project. The emphasis is on the practical demonstration of skills & knowledge gained by the candidate through the training. Each OUTCOME is assessed & marked separately. A candidate is required to pass all OUTCOMES individually based on the passing criteria.

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 the roll number.
3. The assessor carries out theory online assessments through remote proctoring methodology. Theory examination would be conducted online and the paper comprise of MCQ. Conduct of assessment are through trained proctors. Once the test begins, remote proctors have full access to 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.
4. An External Examiner/ Observer may be deployed including NIELIT officials for evaluation of Practical examination/ internal assessment / Project/ Presentation/. Major Project (if applicable) would be evaluated preferably by external/ subject expert including NIELIT officials.

5. Pass percentage would be 50% marks in each component.
6. Candidates may apply for re-examination within the validity of registration (only in the assessment component in which the candidate failed).
7. For re-examination prescribed examination fee is required to be paid by the candidate only for the assessment component in which the candidate wants to reappear.
8. There would be no exemption for any paper/module for candidates having similar qualifications or skills.
9. 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 VIII: Acronym and Glossary

Acronym

Acronym	Description
AA	Assessment Agency
AB	Awarding Body
ISCO	International Standard Classification of Occupations
NCO	National Classification of Occupations
NCrF	National Credit Framework
NOS	National Occupational Standard(s)
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework
OJT	On the Job Training

Glossary

Term	Description
National Occupational Standards (NOS)	NOS defines 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.
Qualification	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
Qualification File	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.
Sector	A grouping of professional activities on the basis of their main economic function, product, service or technology.
Long Term Training	Long-term skilling means any vocational training program undertaken for a year and above. https://ncvet.gov.in/sites/default/files/NCVET.pdf