QUALIFICATION FILE

Internet of Things (IoT) Developer

☒ 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: 4.5

Submitted By:

National Institute of Electronics and Information Technology

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Section 1: Basic Details

<table>
<tr><td>1.</td><td>Qualification Name</td><td colspan="2">Internet of Things (IoT) Developer</td></tr>
<tr><td>2.</td><td>Sector/s</td><td colspan="2">Electronics</td></tr>
<tr><td>3.</td><td>Type of Qualification: ☒ New ☐ Revised ☐ Has Electives/Options ☐ OEM</td><td>NQR Code & version of existing/previous qualification: NA</td><td>Qualification Name of existing/previous version: NA</td></tr>
<tr><td>4.</td><td>a. OEM Name
b. Qualification Name
(Wherever applicable)</td><td colspan="2">-</td></tr>
<tr><td>5.</td><td>National Qualification Register (NQR) Code &Version
(Will be issued after NSQC approval)</td><td>QG-4.5-IT-00346-2023-V1-NIELIT</td><td>6. NCrF/NSQF Level: 4.5</td></tr>
<tr><td>7.</td><td>Award (Certificate/Diploma/Advance Diploma/ Any Other (Wherever applicable specify multiple entry/exits also & provide details in annexure)</td><td colspan="2">Certificate</td></tr>
<tr><td>8.</td><td>Brief Description of the Qualification</td><td colspan="2">The Internet of Things (IoT) Developer qualification enable the participants to develop and deploy IoT based products.
After course completion, the trained learner will exhibit the role of Programmer cum Developer to design IoT based software and hardware Industry based solutions.

Hands-on expertise in the areas of Python programming language along with in-depth handling of Raspberry Pi are the takeaways of this course. This course enhances the working of Microcontroller based devices in interdisciplinary areas without degrading their performance.</td></tr>
<tr><td>9.</td><td>Eligibility Criteria for Entry for Student/Trainee/Learner/Employee</td><td colspan="2">a. Entry Qualification & Relevant Experience:
<table>
<tr><th>S. No.</th><th>Academic/Skill Qualification (with Specialization - if applicable)</th><th>Required Experience (with Specialization - if applicable)</th></tr>
<tr><td>1.</td><td>• Completed 1st year of UG
• Pursuing 1st year of UG and continuous education
• Pursuing 3rd year of 3-year diploma after 10th and continuous education</td><td>NA</td></tr>
</table></td></tr>
</table>

		• Completed 3-year diploma after 10	
		2.	• Completed 2nd year of 2-year diploma after 12th • Pursuing 2nd year of 2- year diploma after 12 and continuous education	NA
		3.	Previous relevant Qualification of NSQF Level 4 and with minimum education as 8th Grade pass	1.5 year relevant experience
		b. Age: No Bar		
10.	**Credits Assigned to this Qualification, Subject to Assessment** *(as per National Credit Framework (NCrF))*	18 Credits	**11. Common Cost Norm Category (I/II/III)** *(wherever applicable)***:** Category-II	
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**		

Training Delivery Modes	Theory (Hours)	Practical (Hours)	OJT Mandatory (Hours)	ES	Total (Hours)
Classroom (Offline)	150	240	90	60	540

* The mode of delivery shall be based on the regional demand and can be offered in any of the above modes mentioned.

(Refer Blended Learning Annexure -V for details)

14.	**Aligned to NCO/ISCO Code/s** *(if no code is available mention the same)*	*NCO-2015/2151.9900*
15.	**Progression path after attaining the qualification** *(Please show Professional and Academic progression)*	**Academic:** **Vertical:** Level 5: IoT Data Analyst Level 6: Certificate course on Internet of Things (IoT) Applications **Professional:** IoT Data Analyst ->Team Lead (IoT Analyst)- >IoT Developer->Project Manager (IoT Analyst)

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**	
18.	**Is the Job Role Amenable to Persons with Disability**	**☒ Yes ☐ No** a. Locomotor Disability i. Leprosy-Cured Person ii. Dwarfism iii. Muscular Dystrophy iv. Acid Attack Victims b. Visual Impairment i. Low Vision	
19.	**How Participation of Women will be Encouraged**	Participation of Women Candidates will be ensured as per Existing government norms. Time to time exclusive batches for women would be run for the proposed course. funding of women batches from IT for masses scheme /other schemes launched by Govt. from time to time	
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: Dr. Sarwan Singh** **Email: sarwan@nielit.gov.in** **Contact No.: 9815621657** **Website: www.nielit.gov.in**	
23.	**Final Approval Date by NSQC: 29.03.2023**	**24. Validity Duration: 3 years**	**25. Next Review Date: 29.03.2026**

Section 2: Module Summary

NOS/s of Qualifications

1. Identification and troubleshooting of Basic Electronics components.
2. Conceptualising IoT Platform - Arduino.
3. Conceptualising IoT based use-cases.
4. Fundamentals of wireless IoT using NodeMCU.
5. Conceptualising Single Board Computer as an IoT Platform - Raspberry Pi.

Mandatory NOS/s:

Specify the training duration and assessment criteria at NOS/ Module level. For further details, refer curriculum document.

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

S. No	NOS/Module Name	Core/ Non-Core	NOS/Module Code & Version (if applicable)	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)			Assessment Marks			
						Th.	Pr.	Total	Th.	Pr.	Total	Weightage (%) *(if applicable)*
1.	NOS1: Identification and troubleshooting of Basic Electronics components	Core	NIE/ELE/N0506	4.5	2	20	40	60	28	14	42	12
2.	NOS 2: Conceptualising IoT Platform - Arduino	Core	NIE/ELE/N0515	4.5	4	45	75	120	67	28	95	27
3.	NOS 3: Conceptualising IoT based use-cases.	Core	NIE/ELE/N0514	4.5	2	20	40	60	29	14	43	12
4.	NOS 4: Fundamentals of wireless IoT using NodeMCU	Core	NIE/ELE/N0504	4.5	3	40	50	90	43	20	63	18
5.	NOS 5: Conceptualising Single Board Computer as an IoT Platform - Raspberry Pi	Core	NIE/ELE/N0505	4.5	2	25	35	60	33	14	47	14
Sub Total (A)						150	240	390	200	90	290	83

S. No	NOS/Module Name	Core/ Non-Core	NOS/Module Code & Version (if applicable)	NCrF/NSQF Level	Credits as per NCrF	Training Duration (Hours)			Assessment Marks			
						Th.	Pr.	Total	Th.	Pr.	Total	Weightage (%) *(if applicable)*
6.	Employability Skills (B)	Core	DGT/VSQ/N0102	4.5	2	60			30			8.5
7.	OJT/Project* (C)	Core	N/A	4.5	3	90			30			8.5
Duration (in Hours) /Total Marks (A+B+C)				**4.5**	**18**	**540**			**350**			**100**

Assessment Components	NOS Included	Duration (in mins)	Marks
Theory 1: IoT Developer Paper-1	NOS 1, NOS 3, NOS 4	90	100
Theory 2: IoT Developer Paper-2	NOS 2, NOS 5	90	100
Practical: IoT Developer	NOS 1, NOS 2, NOS 3, NOS 4, NOS 5	180	90
Employability Skills	Employability Skills	-	30
Project/OJT	Project/OJT	-	30
Total:			**350**

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

Assessment - Minimum Qualifying Percentage

Minimum Pass Percentage – Aggregate at qualification level: 50 % *(Every Trainee should score specified minimum aggregate passing percentage at qualification level to successfully clear the assessment.)*

Section 3: Training Related

1.	**Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	BCA / BSc(IT/CS) / Diploma in CS/IT/EC/EE allied area with 1 year of Experience in training or higher.
2.	**Master Trainer's Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	B-LEVEL / MCA/ B.Tech in CS/IT/EC/EE/ allied areas with an experience of 2 years in training
3.	**Tools and Equipment Required for Training**	☒Yes ☐No (*If "Yes", details to be provided in Annexure)*
4.	**In Case of Revised Qualification, Details of Any Upskilling Required for Trainer**	NA

Section 4: Assessment Related

1.	**Assessor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	B-LEVEL / MCA/ B.Tech in CS/IT/EC/EE/ allied areas with an experience of 2 years in training
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 Practical**

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
2.	**Latest Market Research Reports or any other source (not older than 2 years) (Yes/No):** Yes
3.	**Government /Industry initiatives/ requirement (Yes/No):** Yes
4.	**Number of Industry validation provided:** 7
5.	**Estimated nos. of persons to be trained and employed:**
6.	**Evidence of Concurrence/Consultation with Line Ministry/State Departments:** If "No", why: No. NIELIT is recognized as AB and AA under Government Category. NIELIT is HRD arm of MeitY.

Section 6: Annexure & Supporting Documents Check List

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-VI : Detailed Assessment Strategy
5.	**Annexure:** Blended Learning *(Mandatory, in case the selected Mode of delivery is "Blended Learning")*	Available at Annexure-V: Blended Learning
6.	**Annexure:** Multiple Entry-Exit Details *(Mandatory, in case*	NA

	qualification has multiple Entry-Exit)	
7.	**Annexure:** Acronym and Glossary *(Optional)*	Available at Annexure-X : Acronym and Glossary
8.	**Supporting Document:** Model Curriculum *(Mandatory – Public view)*	Available at Annexure-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-IX : Occupational Map
11.	**Supporting Document:** Assessment SOP *(Mandatory)*	Available at Annexure-C : 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 relate to the NCrF/NSQF level descriptor	NCrF/NSQF Level
Professional Theoretical Knowledge/Process	1. Gain the understanding and learn the power of embedded system and its ecosystem 2. Students are able to understand the concept of IoT devices and its applications. 3. Students learn the code and build simple IoT applications/use cases	1. Possesses specialized operational knowledge and understanding of the work. 2. Have complete knowledge of the concept of time required for delivery; and Quality for a range of issues	**4.5**
Professional and Technical Skills/ Expertise/ Professional Knowledge	1. Work in embedded C language 2. Read data from sensors and perform operations 3. Display the processed data on LCD output and/or control actuators accordingly. 4. Understand the uses of wireless ecosystem and build applications using wi-fi 5. Work with single board computer – Raspberry Pi	1. Possesses specialized professional and technical skills; displays clarity of professional knowledge and technical skills in a broad range of activities/ tasks. 2. Have knowledge of collecting and interpreting the available information, drawing conclusions & communicating the same	**4.5**
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	1. Introduction to Employability Skills 2. Career Development & Goal Setting 3. Becoming a Professional in the 21st Century 4. Constitutional values - Citizenship 5. Basic English Skills 6. Communication Skills	1. Can explain Entrepreneurial Mindset and describe the importance of it in the context of opportunity curation for future jobs. 2. Can comfortably use most of the basic software with proficiency. 3. Have the ability to relate to the 5 pillars of	**4.5**

	7. Essential Digital Skills 8. Financial and Legal Literacy 9. Customer Service 10. Entrepreneurship 11. Diversity & Inclusion 12. Getting Ready for Apprenticeship & Jobs	Social Emotional Skills and describe the similarities between SES and Emotional Intelligence.	
Broad Learning Outcomes/Core Skill	1. Build and test prototype for IoT based use cases 2. Understanding the use of Single board computer	1. Students are able to code and build IoT based system using sensors and actuators 2. Build applications around single board computer	**4.5**
Responsibility	1. Code embedded programs in C language to interface sensors 2. Read input from sensors and display on LCD output 3. Build system using wi-fi and interface sensors and actuators 4. Interfacing sensors with Raspberry Pi	1. Takes complete responsibility for delivery and quality of own work and output.	**4.5**

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

List of Tools and Equipment

Batch Size:

S. No.	Tool / Equipment Name	Specification	Quantity for specified Batch size
1.	Desktop computer with accessories	Installed with **Arduino IDE**	15
2.	Sensors and actuators (DHT11, ultrasonic sensor, LDR, MQ3, MQ135, water level sensor, soil moisture sensor, Motor driver, Relay, Displays)	As per requirement	
3.	Arduino Uno		15
4.	NodeMCU, HC05, RFID		15
5.	Raspberry Pi 4	Latest Raspberry Pi with at least 2GB RAM	15

The aids required to conduct sessions in the classroom are:

1. Classroom-1, 30 Sq. mtr area, white board, LCD projector-1
2. Study Chair- 30, Study table-15

Annexure III: Industry Validations Summary

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID
1	Jan Samridhi Dumka	Gobind Nath Maji	Secretary	Mahesh Munda Road, Nutandih, Near Sido Kanhu Model School Nutandih, Nala, Jamtara, Jharkhand-815355	8789620133	gobind107@gmail.com
2	Jay Enterprise	Gagandeep Singh	CEO	Plot No 181/31, Industrial Area Phase 1 Chandigarh 160002	6284385976	gagandeepsingh@jenterprise.in
3	Jagan Electronic Circuits	Jagan Singh	Proprietor	Plot no. 539, Industrial Area, Phase 9, SAS Nagar, Mohali, Punjab-160062	9417621856	jaganpcb@gmail.com
4	Ekam Mechatronics Systems	Manjit Singh	Proprietor	Plot no. EL-641-A, Industrial Area, Phase 9, SAS Nagar, Mohali, Punjab	7087296011	mschopra@hotmail.com
5	Fillxpert Technologies Pvt. Ltd.	Ekampreet Kaur	Director	Reg Office: 3174 Sector 46C, Chandigarh 160047	7087273174	Ekam01kaur@gmail.com
6	United Computer	Subhasis Choudhury	Chief Executive	Chotonilpur (Pirtala), P.O. Sripally, Burdwan-713103	9641820965	United-computer97@rediffmail.com
7	Buannel Studio Pvt. Ltd.	Lalrinzuala	CEO	Buannel Studio Pvt. Ltd.	8732856261	pslalrinzuala@gmail.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
2023	1000	100	200	20	10	1
2024	1000	100	200	20	10	1
2025	1000	100	200	20	10	1

Data to be provided year-wise for 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.	60:40
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.	60:40
3	Showing Practical Demonstrations to the learners	Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	60:40
4	Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	NA	100:0
5	Tutorials/ Assignments/ Drill/ Practice	Online interaction platforms like JitSi Meet, Bharat VC, Google Meet, MS Teams, etc.	50:50
6	Proctored Monitoring/ Assessment/ Evaluation/ Examinations	NIELIT Remote Proctored Software	Online: 100% Theory Offline: 100% Practical

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
NOS1: Identification and troubleshooting of Basic Electronics components.	1. Identification of electronics components 2. Understanding the Fundamentals of basic electronics 3. Troubleshooting of electronics components 4. Understanding the operation of measurement devices.	28	14
NOS 2: Conceptualising IoT Platform - Arduino	1. Introduction to microprocessor and micro controller 2. Introduction to Internet of Things(IoT) – applications, protocols, use-cases 3. Introduction to Arduino 4. Embedded C Language 5. Interfacing of sensors and actuators with Arduino Boards	67	28
NOS 3 : Conceptualising IoT based use-cases	1. Smart Street Light control 2. Home automation using Arduino 3. Password enabled Digital Lock using Arduino	29	14
NOS 4 : Fundamentals of wireless IoT using NodeMCU	1. Fundamentals and architecture of wireless IoT 2. TCP/IP modelling for IoT 3. NodeMCU as an IoT Platform 4. Fundamentals of cloud Platforms 5. Implementation of cloud based IoT use cases	43	20
NOS 5: Conceptualising Single Board Computer as an IoT Platform - Raspberry Pi	1. Introduction to Raspberry Pi 2. Basics of Python Programming 3. Interfacing of sensors and actuators with Raspberry Pi 4. Implementation of IoT based use cases using Raspberry Pi	33	14
Employability skill		30	
OJT/Project		30	
Total		**350**	

Annexure VII: Assessment Strategy

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 and practical 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 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: Career Progression:

Academic:

Vertical:

Level 5: IoT Data Analyst

Level 6: Certificate course on Internet of Things (IoT) Applications

Professional:

IoT Data Analyst ->Team Lead (IoT Analyst)- >IoT Developer->Project Manager (IoT Analyst)

Annexure X: 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 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.
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