QUALIFICATION FILE–Standalone NOS

Fundamentals of Cleanroom Operations and Safety

☐ 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: 4.5

Submitted By:

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Section 1: Basic Details

<table>
<tr><td>1.</td><td>NOS-Qualification Name</td><td colspan="2">Fundamentals of Cleanroom Operations and Safety</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</td><td>NQR Code & version of the existing /previous qualification: NA</td><td>Qualification Name of the existing/previous version: NA</td></tr>
<tr><td>4.</td><td>National Qualification Register (NQR) Code & Version</td><td>NG-4.5-EH-03728-2025-V1-NIELIT</td><td>5. NCrF/NSQF Level: 4.5</td></tr>
<tr><td>6.</td><td>Brief Description of the Standalone NOS</td><td colspan="2">This qualification focuses on equipping individuals with the essential knowledge and skills required to operate in and maintain cleanroom environments effectively. Participants will gain foundational knowledge of cleanroom designs, contamination control, safety standards, and best practices. They will also learn how to handle hazardous materials, perform environmental monitoring, and adhere to cleanroom certification standards, making them suitable for roles in manufacturing, pharmaceuticals, and other industries relying on cleanroom technology.</td></tr>
<tr><td>7.</td><td>Eligibility Criteria for Entry for a 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>Relevant Experience (with Specialization - if applicable)</th></tr>
<tr><td>1</td><td>3-Years Diploma in Electronics and Communication Engineering/ Electrical Engineering/ allied branches after class 10th</td><td>NA</td></tr>
<tr><td>2</td><td>3rd year of 3-Years Diploma in Electronics and Communication Engineering/ Electrical Engineering/ allied branches after class 10th</td><td>NA</td></tr>
<tr><td>3</td><td>1st year of UG in Electronics Engineering/Physics/ allied fields</td><td>NA</td></tr>
<tr><td>4</td><td>12th Pass</td><td>1.5-year experience in ESDM Sector</td></tr>
<tr><td>5</td><td>10th pass plus 2-year NTC in relevant field of Electronics Sector</td><td>1.5-year experience in ESDM Sector</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>8.</td><td>Credits Assigned to this NOS-Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</td><td>1 Credit</td><td>9. Common Cost Norm Category (I/II/III) (wherever applicable): Category-I</td></tr>
<tr><td>10.</td><td>Any Licensing Requirements for Undertaking Training on This Qualification (wherever applicable)</td><td colspan="2">NA</td></tr>
<tr><td>11.</td><td>Training Duration by Modes of Training Delivery
(Specify Total Duration as per selected training delivery modes and as per requirement of the qualification)</td><td colspan="2">☒Offline ☐ Online ☐ Blended
<table>
<tr><th>Training Delivery Mode</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>Total (Hours)</th></tr>
<tr><td>Classroom (offline)</td><td>12</td><td>18</td><td>30</td></tr>
</table></td></tr>
<tr><td>12.</td><td>Assessment Criteria</td><td colspan="2">
<table>
<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>
<tr><td>100</td><td>60</td><td>20</td><td>20</td><td>200</td><td>50</td></tr>
</table>
The centralized online assessment is conducted by the Examination Wing, NIELIT Headquarters.
*Assessment strategy shall be as per NIELIT Norms prevailing at times.</td></tr>
<tr><td>13.</td><td>Is the NOS Amenable to Persons with Disability</td><td colspan="2">☒ Yes ☐ No
a. Locomotor Disability: Leprosy Cured Person, Dwarfism, Muscular Dystrophy and Acid Attack Victims
b. Visual Impairment: Low Vision</td></tr>
<tr><td>14.</td><td>Progression Path After Attaining the Qualification, wherever applicable</td><td colspan="2">MEMS Backend Fabrication Engineer -> Semiconductor Fabrication Engineer</td></tr>
<tr><td>15.</td><td>How will the participation of women be encouraged?</td><td colspan="2">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.</td></tr>
<tr><td>16.</td><td>Other Indian languages in which the Qualification & Model Curriculum are being submitted</td><td colspan="2">Qualification files available in English & Hindi Language.</td></tr>
</table>

17.	**Is similar NOS available on NQR-if yes, justification for this qualification**	**☐Yes ☒ No**	
18.	**Name and Contact Details Submitting / Awarding Body SPOC** *(In the case of CS or MS, provide details of both Lead AB & Supporting ABs)*	**Name:** Sh. Sreejeesh SG **Email:** sreejeesh@nielit.gov.in **Contact No.:** 9447769756 **Website:** https://www.nielit.gov.in **Name:** Sh. Nandakumar R **Email:** nanda@nielit.gov.in **Contact No.:** 9995427802 **Website:** https://www.nielit.gov.in	
19.	**Final Approval Date by NSQC: 18.02.2025**	**20. Validity Duration: 3 years**	**21. Next Review Date: 18.02.2028**

Section 2: 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 and allied branches with 2 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design. Or M.Sc. in Physics/Electronics/Material Science and allied branches; with 2 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design
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 and allied branches with 3 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design. Or M.Sc. in Physics/Electronics/Material Science and allied branches; with 3 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design.
3.	**Tools and Equipment Required for the Training**	☒ Yes ☐No Available at Annexure-II

4.	**In Case of Revised NOS, details of Any Upskilling Required for Trainer**	Not Applicable

Section 3: Assessment Related

1.	**Assessor's Qualification and experience in 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 and allied branches with 3 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design. Or M.Sc. in Physics/Electronics/Material Science and allied branches 3 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design.
2.	**Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines), (wherever applicable)*	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)*	Centralized online examination will be conducted
5.	**Tools and Equipment Required for Assessment**	Same as for training ☒ Yes ☐ No

Section 4: Evidence of the Need for the Standalone NOS

1.	Government /Industry initiatives/ requirement (Yes/No): Yes
2.	Number of Industry validations provided: The course has been developed in collaboration with TATA Electronics to support the development of skilled manpower for the upcoming semiconductor industry.
3.	Estimated number of people to be trained: 500
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.

Section 5: Annexure & Supporting Documents Check List

Specify Annexure Name / Supporting document file name.

1.	**Annexure:** NCrF/NSQF level justification based on NCrF/NSQF descriptors *(Mandatory)*	*Available at* Annexure-I: Evidence of Level
2.	**Annexure:** List of tools and equipment relevant for NOS *(Mandatory, except in case of online course)*	*Available at* Annexure-II: Tools and Equipment
3.	**Annexure:** Industry Validation	*Available at* Annexure-III: Industry Validation
4.	**Annexure:** Training Details	*Available at* Annexure-IV: Training Details
5.	**Annexure:** Blended Learning *(Mandatory, in case the selected Mode of delivery is Blended Learning)*	*Available at* Annexure-V: Blended Learning
6.	**Annexure/Supporting Document:** Standalone NOS-Performance Criteria Details Annexure/Document with PC-wise detailing as per NOS format (Mandatory- Public view)	*Available at* Annexure-VI: Standalone NOS- Performance Criteria details
7.	**Annexure:** Performance and Assessment Criteria *(Mandatory)*	*Available at* Annexure-VII: Detailed Assessment Criteria
8.	**Annexure:** Assessment Strategy *(Mandatory)*	*Available at* Annexure-VIII: Assessment Strategy
9.	**Annexure:** Acronym and Glossary *(Optional)*	*Available at* Annexure-IX: Acronym and Glossary
10.	**Supporting Document:** Model Curriculum	*Available at* Annexure-A: 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
Professional Theoretical Knowledge/Process	• Work in a predictable, routine environment with cleanroom tasks	Operate in controlled environments maintaining contamination-free zones.	4.5
Professional and Technical Skills/ Expertise/ Professional Knowledge	• Knowledge of cleanroom standards, contamination control, safety.	• Understand and follow cleanroom protocols and safety regulations.	4.5
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	• Perform gowning, contamination control, and hazardous material handling.	• Apply practical skills in cleanroom operations and safety measures.	4.5
Broad Learning Outcomes/ Core Skill	• Communication, documentation, and adherence to SOPs.	• Use effective communication and documentation to maintain compliance.	4.5
Responsibility	• Responsible for own work and maintaining cleanroom standards.	• Ensure work meets cleanroom operation requirements independently.	4.5

Annexure II: Tools and Equipment (lab set-up)

Sl. No	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 Board	1	-
7	White Board	1	-
8	Desktop Computer with accessories	30	Processor: Intel Core i5 (sixth generation newer) or equivalent Memory: 16GB RAM, Internal Storage: 500GB
9	Desk jet printer	1	A4

List of Tools and Equipment:

Cleanroom Infrastructure

- Cleanroom Facility (Class 100 or Class 1000)
- Air Filtration System (HEPA and ULPA filters)
- Air Showers
- Sticky Mats

Personal Protective Equipment (PPE)

- Gowns/Lab Coats
- Gloves (Latex, Nitrile)
- Shoe Covers
- Hairnets
- Face Masks or Respirators

Environmental Monitoring Tools

- Particle Counters
- Microbial Air Samplers
- Differential Pressure Gauges
- Thermo hygrometer

Contamination Control Tools

- HEPA Filters
- Cleanroom Wipes
- Disinfectant Sprayers
- Sterile Swabs

Cleaning and Maintenance Equipment

- Cleanroom Vacuum Cleaners
- Mop Systems with Disposable Covers
- Cleaning Chemicals and Disinfectants

Safety and Emergency Response Tools

- Spill Kits
- Eye Wash Stations
- Fire Extinguishers (Clean agent type)
- First Aid Kits

General Tools and Equipment

- Pin-up Boards
- Whiteboards and Markers
- Desktop Computers or Tablets
- LCD Projector

Annexure III: Industry Validations Summary

The course has been developed in collaboration with TATA Electronics to support the development of skilled manpower for the upcoming semiconductor industry.

Annexure IV: Training Details

Training Projections:

Year	Estimated Training # of Total Candidates	Estimated training # of Women	Estimated training # of People with Disability
2025-26	**100**	**50**	**10**
2026-27	**200**	**70**	**15**
2027-28	**200**	**70**	**15**

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

Annexure V: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools: NA

Annexure VI: Standalone NOS- Performance Criteria details

1. Description

The purpose of this qualification is to train individuals in cleanroom operations and safety protocols, enhancing their employability in industries like manufacturing, pharmaceuticals, and semiconductors. The aim is to demystify cleanroom practices and equip the workforce with the confidence to independently apply the knowledge and skills gained. Participants will gain initial exposure to cleanroom environments, contamination control, and certification processes.

2. Scope

The scope covers the following:

- Prepares individuals for roles in cleanroom operations, including positions such as Cleanroom Technician, Contamination Control Assistant, and Cleanroom Supervisor.
- Equips participants with the skills to maintain contamination-free environments, ensuring compliance with cleanroom standards in industries like pharmaceuticals, semiconductors, and manufacturing.
- Extends to opportunities in advanced cleanroom management and certification processes, requiring proficiency in contamination control techniques and environmental monitoring.

3. Elements and Performance Criteria

Elements	Performance Criteria
Introduction to Cleanroom Concepts	PC1. Students can understand the definition and different classifications of cleanroom. PC2. Students can explore the applications of cleanroom in various industries.
Cleanroom Standards and Regulations	PC3. Students can gain an overview of ISO standards, their types, GMP guidelines, and compliance requirements. PC4. Students can understand the use of various classroom types in the context of cleanroom standards.
Sources of Contamination	PC5. Students can identify various sources of contamination such as particulates and microorganisms. PC6. Students can learn methods for controlling contamination in cleanroom environments.
Gowning and Entry/Exit Protocols	PC7. Students can learn the proper procedures for gowning, degowning, and maintaining personal hygiene. PC8. Students can understand how to maintain cleanroom integrity through correct practices.
Cleanroom Equipment and Tools	PC9. Students can understand the basics of cleanroom and various types of internal pressure conditions. PC10. Students can gain hands-on experience with HEPA filters, particle counters, air samplers, and other cleanroom equipment.
Cleaning and Maintenance Practices	PC11. Students can distinguish between process and non-process areas in cleanroom. PC12. Students can learn cleaning techniques, disinfectant selection, and routine maintenance procedures.

Safety and Emergency Procedures	PC13. Students can understand proper chemical handling, risk assessment, and emergency response in cleanroom. PC14. Students can learn HF handling procedures and spill containment techniques to ensure safety and compliance.

4. Knowledge and Understanding (KU):

The individual on the job needs to know and understand:

KU1: the definition, classifications, and industrial applications of cleanrooms.

KU2: ISO standards, GMP guidelines, types of cleanroom environments, and their compliance requirements.

KU3.the sources of contamination and the preventive measures to maintain cleanroom integrity, including gowning procedures and hygiene protocols.

KU4.the operation of cleanroom equipment, cleaning and maintenance techniques, and emergency handling procedures related to chemical spills and hazardous substances.

5. Generic Skills (GS):

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

GS1: Identify cleanroom classifications, interpret ISO and GMP standards, and ensure compliance with industry-specific guidelines and requirements.

GS2: Recognize sources of contamination, implement contamination control methods, and maintain cleanroom integrity through proper gowning, hygiene, and operational practices.

GS3: Operate and maintain cleanroom equipment such as HEPA filters, particle counters, and air samplers, as well as distinguish between process and non-process areas and perform effective cleaning and disinfection.

GS4: Handle chemicals safely, conduct risk assessments, respond to emergencies, and follow procedures for hazardous material handling and spill containment in cleanroom environments.

Annexure VII: Assessment Criteria

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

Elements	Assessment Criteria for Performance Criteria/Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Cleanroom Concepts	Definition, classifications, and applications of cleanroom in various industries	20	7	-	-
Cleanroom Standards and Regulations	Overview of ISO standards and its types, GMP guidelines, and compliance requirements, Brief explanation of various class room use	20	7	-	-
Sources of Contamination	Identifying contamination sources (particulates, microorganisms, etc.) and their control	15	7	-	-
Gowning and Entry/Exit Protocols	Procedures for gowning, degowning, personal hygiene, and maintaining cleanroom integrity	15	7	-	-
Cleanroom Equipment and Tools	Introduction of clean room, various type of inside pressure, Hands-on experience with HEPA filters, particle counters, air samplers, and other cleanroom equipment.	00	20	-	-
Cleaning and Maintenance Practices	Processes area and non process area Cleaning techniques, disinfectant selection, and routine maintenance procedures	15	7	-	-
Safety and Emergency Procedures	Chemical handling, Risk assessment, emergency response, HF handling procedure and spill containment in cleanroom	15	5	-	-
Final Project	Designing a cleanroom operation plan and demonstrating knowledge application in a practical project setting.	-	-	20	-
Viva	Include all Elements	-	-	-	20
Grand Total		**100**	**60**	**20**	**20**

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
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.