QUALIFICATION FILE – Micro Credentials

Fundamentals of Cleanroom- Semiconductor

OEM Qualification name: Cleanroom Technician - Semiconductor Manufacturing

☒ Public ☐ Private

☒ 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:

Electronics Sector Skills Council of India (ESSCI) 155, 2nd Floor,

ESC House

Okhla Industrial Area - Phase 3, New Delhi – 110020

Tel: 011 – 8447738501

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Section 1: Basic Details

<table>
<tr><td>1.</td><td>Micro Credential-Qualification Name</td><td colspan="2">Fundamentals of Cleanroom SOP in Semiconductor</td></tr>
<tr><td>2.</td><td>Sector/s</td><td colspan="2">Electronics</td></tr>
<tr><td>3.</td><td>National Qualification Register (NQR) Code & Version (Will be issued after NSQC approval.)</td><td>NM-4.5-EH-045012025-V1-ESSCI</td><td>4. NCrF/NSQF Level: 4.5</td></tr>
<tr><td>5.</td><td>Brief Description of the Micro Credential</td><td colspan="2">The “Fundamentals of Cleanroom- Semiconductor” is an upskilling course that equips learners with the overview and knowledge to work effectively in a semiconductor manufacturing cleanroom environment. The curriculum emphasizes overview understanding cleanroom protocols, monitoring equipment, maintaining cleanliness, and ensuring contamination control to meet industry standards.</td></tr>
<tr><td>6.</td><td>Eligibility Criteria for Entry for Students/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>Diploma after 10th in Electronics and Communication Engineering/ Electrical Engineering domain</td><td>6 Months of relevant experience</td></tr>
<tr><td>2.</td><td>12th in Science or Equivalent in science</td><td>1.5 years of relevant experience</td></tr>
<tr><td>3.</td><td>10th or equivalent</td><td>4.5 years of relevant experience</td></tr>
<tr><td>4.</td><td>Previous NSQF qualifications of Level 4</td><td>1.5 years of relevant experience</td></tr>
<tr><td colspan="3"># Relevant Experience in Semiconductor Domain</td></tr>
</table>
b. Age: NA</td></tr>
<tr><td>7.</td><td>Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</td><td>1</td><td>8. Common Cost Norm Category (I/II/III) (wherever applicable): I</td></tr>
<tr><td>9.</td><td>Any Licensing Requirements/ Pre-requisites for Undertaking Training (wherever applicable)</td><td colspan="2">NA</td></tr>
<tr><td>10.</td><td>Expected Outcomes of the Micro Credential</td><td colspan="2">Terminal learning outcomes are:
● Introduction of Cleanroom Protocols and Standards
● Overview of Environmental Monitoring and Control
● Overview of Equipment Operation and Maintenance in Cleanrooms</td></tr>
</table>

		• Brief of Contamination Prevention and Risk Mitigation • Brief of Safety and Emergency Procedures

11.	**Training Duration by Modes of Training Delivery** *(Specify **Total Duration** as per selected training delivery modes and as per requirement of the qualification)*	☐ **Offline Only** ☐ **Online Only** ☒ **Blended** *(Refer Blended Learning Annexure for Details)*

Training Delivery Mode	Theory (Hours)	Practical (Hours)	Total (Hours)
Classroom (offline)	00:00	18:00	30:00
Online	12:00	00:00	

12.	**Assessment Criteria**	

Theory (Marks)	Practical (Marks)	Project (Marks)	Viva (Marks)	Total (Marks)	Passing %age
40	60	00	00	100	70%

13.	**Is the Qualification Amenable to Persons with Disability**	☐ **Yes** ☒ **No If *"Yes", specify applicable type of Disability:***
14.	**How participation of women will be encouraged?**	No gender sensitization
15.	**Other Indian Languages in which the Micro Credential will be implemented.**	Hindi
16.	**Is similar Micro Credential Qualification(s) available on NQR-if yes, justification for this qualification**	☐ **Yes** ☒ **No URLs of similar Qualifications:**
17.	**Name and Contact Details Submitting / Awarding Body SPOC**	**Name:** Mr. Saleem Ahmed **Email:** ceo@essc-india.org **Contact No.:** 011 – 8447738501 **Website:** https://www.essc-india.org/
18.	**NSQC Approval Date:** 07.10.2025	**19. Validity Duration:** 3 Years **20. Next Review Date:** 07.10.2028

Section 2: Training Related

1.	**Trainer's Qualification and experience in relevant sector (in years)** *(as per requirement and NCVET guidelines)*	BE/ BTech (Electrical/ Mechanical/ Electronics) with 1 year industrial and 1 year training experience in the field of Semiconductor Manufacturing domain Or Diploma/ITI (Electrical/ Mechanical/ Electronics) with 2 years industrial and 1 year training experience in the field of Semiconductor Manufacturing domain Or Certified in relevant CITS Trade
2.	**Master Trainer's Qualification and experience in relevant sector (in years)** *(as per requirement and NCVET guidelines)*	BE/ BTech (Electrical/ Mechanical/ Electronics) with 2 years industrial and 1 year's training experience in the field of Semiconductor Manufacturing domain Or Diploma (Electrical/ Mechanical/ Electronics) with 3 years industrial and 1 year's training experience in the field of Semiconductor Manufacturing domain
3.	**Tools and Equipment Required for Training**	☒ **Yes** ☐ **No** *(If "Yes", details to be provided in Annexure)*

Section 3: Assessment Related

1.	**Assessor's Qualification and experience in relevant sector (in years)** *(as per requirement and NCVET guidelines)*	BE/ BTech (Electrical/ Mechanical/ Electronics) with 2 years industrial and 1 years' assessment experience in Semiconductor Manufacturing domain Or Diploma/ITI (Electrical/ Mechanical/ Electronics) with 3 years industrial and 1 years' assessment experience in Semiconductor Manufacturing domain Or Certified in relevant CITS Trade

2.	**Proctor's Qualification and experience in relevant Sector (in years)** *(as per requirement and NCVET guidelines)*	NA
3.	**Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years)** *(as per requirement and NCVET guidelines)*	NA
4.	**Assessment Mode** *(Specify the assessment mode)*	**Mode: ☐ Online Only ☐ Offline Only ☒ Blended**
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 4: Evidence of Need of the Micro Credential

As per the NCVET Guidelines for evidence of need, provide the required Annexure/Supporting documents.

1.	Government /Industry initiatives/ requirement (Yes/No): Yes
2.	Number of Industry validation provided: 1
3.	Estimated number of people to be trained: 500

Section 5: Annexure Check List

Specify Annexure Number and Name.

1.	**Annexure:** NCrF/NSQF level justification based on NCrF Level/NSQF descriptors *(Mandatory)*	*Attached*
2.	**Annexure:** Learning Outcomes and Assessment Criteria *(Mandatory)*	*Attached*
3.	**Annexure:** Assessment Strategy *(Mandatory)*	*Attached*
4.	**Annexure:** List of tools and equipment relevant for qualification *(Mandatory – Except in case of online course)*	*Attached*
5.	**Annexure:** Blended Learning *(Mandatory in case selected mode of delivery is "Blended Learning")*	*Filled*
6.	**Annexure:** Acronym and Glossary *(Optional)*	*Attached*

Annexure: 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	**Demands a wide range of specialized technical skill, clarity of knowledge and practice in a broad range of activities involving standard and non-standard practices.** ● Operate, maintain, and calibrate cleanroom equipment and monitoring instruments. ● Implement cleanroom protocols, gowning procedures, and contamination control measures. ● Analyze environmental deviations and apply corrective and preventive actions. ● Conduct particle count, airflow validation, and surface cleanliness inspections. ● Utilize automated monitoring systems and maintain environmental records. ● Ensure compliance with cleanroom, safety, and environmental standards. ● Implement sustainable practices in cleanroom operations and waste management.	The job role outcomes align with the NCrF/NSQF level descriptors through the development of **cognitive skills** in understanding cleanroom classifications, contamination control protocols, environmental monitoring procedures, and cleanroom operations. It enhances **technical skills** in operating, maintaining, and troubleshooting cleanroom equipment, conducting particle count and cleanliness inspections, and using environmental monitoring tools. Additionally, it develops **process skills** in ensuring adherence to cleanroom standards, implementing safety and hygiene measures, and maintaining accurate documentation and compliance records. The role also emphasizes **responsibility** by ensuring process integrity, maintaining compliance with environmental and occupational safety standards, and contributing to sustainable and efficient cleanroom practices, reflecting competencies expected at this qualification level. **Hence, Level 4.5**	4.5

Professional and Technical Skills/ Expertise/ Professional Knowledge	**Factual and theoretical knowledge in broad contexts within cleanroom operations and contamination control.** ● **Cognitive skills:** Understanding cleanroom classifications, contamination sources, environmental monitoring protocols, and standard cleanroom procedures. ● **Technical skills:** Operating, maintaining, and troubleshooting cleanroom equipment; monitoring particle count, pressure differentials, and environmental parameters. ● **Process skills**: Implementing contamination control measures, following safety protocols, and maintaining proper documentation in compliance with cleanroom standards. ● **Responsibility:** Ensuring adherence to hygiene, safety, and environmental regulations; supporting process integrity; and contributing to efficient and compliant cleanroom operations.	This course provides essential skills in **cleanroom operations,** including **operating and maintaining cleanroom equipment, implementing contamination control protocols, and performing environmental monitoring** to ensure product and process integrity. It also covers **safety compliance, documentation practices, and sustainable cleanroom management**, preparing candidates to meet the operational and regulatory demands of the cleanroom environment across industries. **Hence, Level 4.5**	4.5

Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	**A range of cognitive and practical skills required to generate solutions to specific problems in cleanroom operations.** ● Develop problem-solving and analytical skills in cleanroom processes and contamination control. ● Gain hands-on experience in operating, maintaining, and troubleshooting cleanroom equipment. ● Learn environmental monitoring, quality assurance, and safety compliance techniques. ● Cultivate innovation and proactive thinking in maintaining efficient and contamination-free cleanroom environments.	Hence Level 4.5	4.5
Broad Learning Outcomes/Core Skill	● Develop understanding of cleanroom classifications, protocols, and contamination control techniques. ● Gain proficiency in operating, maintaining, and monitoring cleanroom equipment and systems. ● Learn environmental monitoring methods, documentation practices, and compliance with cleanroom	Hence Level 4.5	4.5

	standards. ● Apply safety procedures, hygiene practices, and regulatory compliance in cleanroom operations.		
Responsibility	**Responsibility of completing the work assigned and reporting the same as per standards.** ● Operate and maintain cleanroom equipment as per SOPs. ● Ensure adherence to cleanroom protocols and contamination control standards. ● Demonstrate accountability in identifying and reporting deviations or risks. ● Uphold safety, hygiene, and environmental compliance in cleanroom operations.	Hence Level 4.5	4.5

Annexure: Learning Outcomes and Assessment Criteria

Detailed learning outcomes and assessment criteria for the qualification are as follows:

S. No.	Learning Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Overview of Cleanroom Protocols and Standards	**8**	**12**	**-**	**-**
1	**PC 1:** Describe cleanroom classifications and associated standards (e.g., ISO 14644).	3	4	-	-
2	**PC 2:** Follow gowning procedures to enter cleanrooms.	3	4	-	-
3	**PC 3:** Ensure adherence to personal and workplace hygiene practices.	2	4	-	-
	Introduction of Environmental Monitoring and Control	**8**	**12**		
4	**PC 4:** Measure and monitor particle levels, temperature, and humidity.	3	4		
5	**PC 5:** Calibrate and validate cleanroom monitoring equipment.	3	4		
6	**PC 6:** Identify deviations in environmental parameters and take corrective actions	2	4		
	Brief of Equipment Operation and Maintenance in Cleanrooms	**8**	**12**	**-**	**-**
7	**PC 7:** Operate cleanroom equipment following manufacturer guidelines.	2	4	-	-
8	**PC 8:** Perform routine maintenance of cleanroom systems (e.g., HEPA, ULPA filters, particle counters, Ionizers).	3	4	-	-
9	**PC 9:** Address malfunctions and escalate complex issues to supervisors.	3	4	-	-
	Overview of Contamination Control, Risk Management, and Safety Procedures	**16**	**24**	**-**	**-**
10	**PC 10:** Identify contamination sources and implement mitigation strategies.	3	4	-	-
11	**PC 11:** Conduct routine inspections of cleanroom surfaces and equipment.	3	4	-	-
12	**PC 12:** Ensure proper disposal of waste and consumables.	3	4	-	-
13	**PC 13:** Follow cleanroom safety protocols and emergency procedures.	3	4	-	-
14	**PC 14:** Identify hazards and report incidents promptly.	2	4	-	-
15	**PC 15:** Participate in cleanroom safety drills and training	2	4		
	Total	**40**	**60**		

Annexure: 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.

1. Assessment System Overview:
   - Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
   - Assessment agencies send the assessment confirmation to VTP/TC looping SSC
   - Assessment agency deploys the ToA certified Assessor for executing the assessment
   - SSC monitors the assessment process & records

2. Testing Environment:
   - Confirm that the centre is available at the same address as mentioned on SDMS or SIP
   - Check the duration of the training.
   - Check the Assessment Start and End time to be as 10 a.m. and 5 p.m.
   - If the batch size is more than 30, then there should be 2 Assessors.
   - Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
   - Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
   - Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
   - Check the availability of the Lab Equipment for the particular Job Role.

3. Assessment Quality Assurance levels / Framework:
   - Question papers created by the Subject Matter Experts (SME)
   - Question papers created by the SME verified by the other subject Matter Experts
   - Questions are mapped with NOS and PC
   - Question papers are prepared considering that level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
   - Assessor must be ToA certified & trainer must be ToT Certified
   - Assessment agency must follow the assessment guidelines to conduct the assessment

4. Types of evidence or evidence-gathering protocol:
   - Time-stamped & geotagged reporting of the assessor from assessment location

- Centre photographs with signboards and scheme specific branding
- Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
- Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

5. Method of verification or validation:
   - Surprise visit to the assessment location
   - Random audit of the batch
   - Random audit of any candidate

6. Method for assessment documentation, archiving, and access
   - Hard copies of the documents are stored
   - Soft copies of the documents & photographs of the assessment are uploaded / accessed from Cloud Storage
   - Soft copies of the documents & photographs of the assessment are stored in the Hard Drives

Annexure: Tools and Equipment

List of Tools and Equipment

Batch Size: 30

S.No	Tool or Equipment Name	Specifications	Quantity (For 30 Candidates)
1	Antistatic Coveralls / Gowns	Cleanroom-compatible, ISO Class 5–8 rated	30 (1 per candidate)
2	Face Masks	3-ply or N95, cleanroom-rated	60 (2 per candidate)
3	Cleanroom Gloves	Nitrile, powder-free, ISO 5–7 compatible	60 pairs (2 per candidate)
4	Shoe Covers / Booties	Cleanroom-rated, anti-slip	60 pairs (2 per candidate)
5	Goggles / Face Shields	Anti-fog, cleanroom-compatible	30
6	Gowning Bench	Stainless steel, non-shedding, 4–6 feet	3 benches (10 per bench)
7	Sticky Mats	24"x36", 30-layer, cleanroom-safe adhesive	6 mats
8	Laminar Flow Benches	Portable or fixed, HEPA-filtered, ISO Class 5 airflow	2–3 for demo use
9	Air Particle Counter	Handheld, 0.3 – 10 micron particle size range	2
10	Surface Particle Testing Kit	Swab kits and contact plates	5 kits (shared)

Classroom Aids:

The aids required to conduct sessions in the classroom are:

1. Whiteboard
2. Projector
3. Computer/Laptop
4. Chairs
5. Tables
6. Whiteboard marke

Annexure: Industry Validations Summary

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID	LinkedIn Profile *(if available)*
1	SMC	Devraj Singh	Head		+91 95608 57975	singh.devraj@smc.com	NA

Annexure: Training Details

Training Projections:

Year	Estimated Training # of Total Candidates	Estimated training # of Women	Estimated training # of People with Disability
1	100	NA	NA
2	200	NA	NA
3	200	NA	NA

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

Annexure: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools:

Refer NCVET "Guidelines for Blended Learning for Vocational Education, Training & Skilling" available on:
https://ncvet.gov.in/sites/default/files/Guidelines%20for%20Blended%20Learning%20for%20Vocational%20Education,%20Training%20&%20Skilling.pdf

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	• Books/ e-books • Presentations • Reference Material • Audio / Video Modules	30:70
2	☒Imparting Soft Skills, Life Skills, and Employability Skills /Mentorship to Learners	• Self-Learning Videos • Broadcasts	30:70

		• Mobile Learning • Curated Digital content	
3	☒Showing Practical Demonstrations to the learners	• Video Content • E-Resource library • AR/ VR/ XR	30:70
4	☒Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	• Training tools (tools list attached) • Video Play • Presentations	30:70
5	☒Tutorials/ Assignments/ Drill/ Practice	• Online Question Bank • Mobile Quick test app • MCQ based tests	30:70
6	☒Proctored Monitoring/ Assessment/ Evaluation/ Examinations	• Assessment engine for Essays • Up-loadable file examinations • Mock test sessions	30:70
7	☒On the Job Training (OJT)/ Project Work Internship/ Apprenticeship Training	• Online tests • Offline assessments	30:70

Annexure: 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
NQR	National Qualification Register
NSQF	National Skills Qualifications Framework
OJT	On the Job Training

Glossary

Term	Description
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 based on their main economic function, product, service or technology.