QUALIFICATION FILE-Standalone NOS

Essentials of Supply Chain and Materials Management for Semiconductor Fab

☐ 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">Essentials of Supply Chain and Materials Management for Semiconductor Fab</td></tr>
<tr><td>2.</td><td>Sector</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-03736-2025-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 Standalone NOS provides understanding of supply chain and materials management specific to the semiconductor fabrication industry. It covers the end-to-end process of managing materials, inventory, and supply chain operations within a semiconductor fab, ensuring efficiency, cost-effectiveness, and high product quality.</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>Required 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>
<tr><td>8.</td><td>Credits Assigned to this NOS-Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</td><td>2 Credits</td><td>9. Common Cost Norm Category (I/II/III) (wherever applicable): Category-I</td></tr>
</table>

<table>
<tr><td>10.</td><td>Any Licensing Requirements for Undertaking Training on This Qualification (wherever applicable)</td><td>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>☒Offline ☐Online ☐Blended

<table><tr><th>Training Delivery Modes</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>Total (Hours)</th></tr><tr><td>Classroom (offline)</td><td>18</td><td>42</td><td>60</td></tr></table></td></tr>
<tr><td>12.</td><td>Assessment Criteria</td><td><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>☒ Yes ☐ No
Leprosy Cured Person, Dwarfism, Thalassemia, Hemophilia, Hearing Impairment (Hard of Hearing), Acid Attack Victims.</td></tr>
<tr><td>14.</td><td>Progression Path After Attaining the Qualification, wherever applicable</td><td>MEMS Backend Fabrication Engineer -> Semiconductor Fabrication Engineer</td></tr>
<tr><td>15.</td><td>How participation of women will be encouraged?</td><td>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>Qualification file is available in English and Hindi languages.</td></tr>
<tr><td>17.</td><td>Is similar NOS available on NQR-if yes, justification for this qualification</td><td>☐ Yes ☒ No URLs of similar Qualifications:</td></tr>
</table>

18.	**Name and Contact Details Submitting / Awarding Body SPOC** *(In case of CS or MS, provide details of both Lead AB & Supporting ABs)*	**Name:** Sh. Saurabh Kesari **Email:** saurabhk@nielit.gov.in **Contact No.:** 0240-2982021 **Website:** https://www.nielit.gov.in **Name:** Sh. Shashank Kumar Singh **Email:** shashank@nielit.gov.in **Contact No.:** 0240-2982021 **Website:** https://www.nielit.gov.in **Name:** Sh. Ravi Ranjan Kumar **Email:** raviranjan@nielit.gov.in **Contact No.:** 0240-2982021 **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 3 years of relevant experience in the field of Semiconductor Manufacturing / Semiconductor Fabrication and Packaging/VLSI Design.
3.	**Tools and Equipment Required for Training**	☒Yes ☐No *Available at Annexure-II*
4.	**In Case of Revised Qualification, Details of Any Upskilling Required for Trainer**	NA

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)*	The assessor carries out theory online assessments through the remote proctoring methodology. Theory examination would be conducted online, and the paper comprise of 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 *(details to be provided in Annexure-if it is different for Assessment)*

Section 4: Evidence of the Need for the Standalone NOS

1.	Government /Industry initiatives/ requirement (Yes/No): Yes
2.	Number of Industry validation 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 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:** 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 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:** Detailed Assessment Criteria	Available at Annexure-VII: Assessment Criteria

	(Mandatory)	
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 *(Mandatory – Public view)*	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	Understanding of supply chain fundamentals, including demand forecasting, inventory management, and procurement.	Provides foundational knowledge for managing semiconductor supply chains, ensuring efficiency and cost-effectiveness.	4.5
Professional and Technical Skills/ Expertise/ Professional Knowledge	Ability to optimize inventory levels and implement effective procurement strategies for semiconductor fabs.	Equips learners with skills to manage supply chain processes tailored to the semiconductor industry.	4.5
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	Preparedness for roles like Supply Chain Analyst, Procurement Specialist, or Material Manager in semiconductor fabs.	Aligns job readiness with industry needs, emphasizing analytical thinking and decision-making skills.	4.5
Broad Learning Outcomes/Core Skill and Responsibility	Accountability for ensuring smooth material flow, minimizing delays, and optimizing overall supply chain performance	Prepares learners to take ownership of critical tasks, ensuring continuity and efficiency in semiconductor fabs.	4.5

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

List of Tools and Equipment

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

Tools, Equipment and Other Requirements:

Materials Management Tools
- Inventory Management Software (e.g., SAP, Oracle ERP)
- Material Requirements Planning (MRP) Tools
- Barcode Scanners and Label Printers

Procurement and Supplier Management Tools
- Supplier Relationship Management (SRM) Software
- Procurement Platforms (e.g., Ariba, Coupa)
- Cost Analysis Tools

Logistics and Transportation Tools
- Warehouse Management Systems (WMS)
- Automated Guided Vehicles (AGVs) for Material Handling
- Cold Chain Logistics Equipment (Refrigerated Containers, Temperature Monitors)

Demand Forecasting and Production Planning Tools
- Data Analytics Software (e.g., Tableau, Power BI)
- Forecasting Tools (e.g., SAS, Python Libraries)

- Production Planning Software

Quality Management Tools

- Quality Management Systems (QMS) Software
- Lean and Six Sigma Toolkits
- Risk Analysis Software

Emerging Technologies

- IoT Sensors for Real-Time Tracking
- AI and Machine Learning Platforms for Optimization
- Sustainability Tracking Tools

General Tools

- Desktop Computers with Supply Chain Software
- Projectors and Whiteboards for Training and Collaboration

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 & Employment 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 next 3 years.

Annexure-V: Blended Learning

Blended Learning Estimated Ratio & Recommended Tools: NA

Annexure VI: Performance Criteria details

1. **Description:**
   The purpose is to train the students in Supply Chain and Materials Management for Semiconductor Fab so as to upskill them and increase their employability in the field of Electronics. The participants will get initial exposure for developing Supply Chain and Materials Management for Semiconductor Fab.

2. **Scope:**
   The scope covers the following:

   - Focus on understanding supply chain dynamics and materials management specific to semiconductor fabrication, including procurement, logistics, and inventory control.
   - Develop skills in optimizing material flow, minimizing waste, and ensuring timely availability of critical resources for semiconductor manufacturing.

3. Elements and Performance Criteria

To be competent, the user/individual on the job must be able to:

Elements	Performance Criteria
Introduction to Supply Chain and Materials Management	**PC1.** Explain key stages of semiconductor manufacturing, including front-end and back-end operations. **PC2.** Evaluate strategies like Just-In-Time (JIT) and Vendor Managed Inventory (VMI) for optimizing resource availability. **PC3.** Discuss emerging trends such as digitalization, sustainability, and geopolitical impacts.
Materials Management and Inventory Control	**PC4**. Explain the function and significance of each material type in supporting production and maintenance activities. **PC5.** Utilize Material Requirements Planning (MRP) systems to forecast demand, schedule purchases, and avoid shortages or overstock. **PC6.** Describe procedures for maintaining material traceability and conducting root cause analysis for material-related issues.
Procurement and Supplier Management	**PC7.** Conduct supplier qualification assessments based on technical capabilities, compliance standards, and risk factors. **PC8**.Analyze and resolve conflicts or performance issues with suppliers through structured communication and feedback mechanisms.
Logistics and Transportation Management	**PC9.** Explain common logistics challenges specific to semiconductor manufacturing, such as contamination risk, long lead times, and global coordination. **PC10.** Demonstrate understanding of cold chain logistics requirements for temperature-sensitive materials (e.g., photoresists, chemicals).
Demand Forecasting and Production Planning	**PC11.** Evaluate forecasting accuracy and adjust models based on historical data, market trends, and customer input. **PC12.** Use data analytics tools to support planning decisions and improve forecast reliability.
Quality Management and Compliance	**PC13.** Demonstrate understanding of quality assurance practices throughout the semiconductor supply chain, from raw materials to final delivery. **PC14**. Interpret and apply industry standards and compliance requirements (e.g., ISO 9001, JEDEC standards) in quality systems.
Emerging Trends and Technologies	**PC15.** Identify key technologies such as IoT, digital twins, and simulation tools and their roles in enhancing scalability and decision-making. **PC16.** Analyze use cases of blockchain for enhancing transparency, traceability, and trust in the global supply chain.

4. Knowledge and Understanding (KU):

The individual on the job needs to know and understand:

KU1: Understand the unique requirements and complexities of supply chain and materials management specific to semiconductor fabs, including procurement, inventory control, and logistics operations.

KU2: Learn the knowledge of inventory management strategies (e.g., Just-in-Time, safety stock) and procurement processes, including supplier evaluation, cost optimization, and material requirements planning (MRP).

KU3: Learn the principles of logistics network design, transportation management, warehouse automation, and demand forecasting techniques critical for efficient production planning and supply chain balance.

5. Generic Skills (GS):

The user/individual on the job needs to know how to:

GS1: Develop the ability to identify potential manufacturability issues in semiconductor designs and apply critical thinking to find effective solutions, optimizing designs for higher yield and cost efficiency.

GS2: Improve their skills in effectively communicating technical information, collaborating with cross-functional teams (e.g., design, manufacturing, and testing), and presenting findings or design optimizations clearly.

GS3: Enhance attention to detail, ensuring that every aspect of the semiconductor design process from layout to material selection is carefully considered for manufacturability, quality, and process compatibility.

Annexure VII: Assessment Criteria

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

Elements	Performance Criteria	Theory Marks	Practical Marks	Project/ Presentation /Assignment Marks	Viva/ Internal Assessment Marks
Introduction to Supply Chain and Materials Management	**PC1.** Explain key stages of semiconductor manufacturing, including front-end and back-end operations. **PC2.** Evaluate strategies like Just-In-Time (JIT) and Vendor Managed Inventory (VMI) for optimizing resource availability. **PC3.** Discuss emerging trends such as digitalization, sustainability, and geopolitical impacts.	**15**	**9**	**-**	**-**
Materials Management and Inventory Control	**PC4**. Explain the function and significance of each material type in supporting production and maintenance activities. **PC5.** Utilize Material Requirements Planning (MRP) systems to forecast demand, schedule purchases, and avoid shortages or overstock. **PC6.** Describe procedures for maintaining material traceability and conducting root cause analysis for material-related issues.	**15**	**9**	**-**	**-**
Procurement and Supplier Management	**PC7.** Conduct supplier qualification assessments based on technical capabilities, compliance standards, and risk factors. **PC8**.Analyze and resolve conflicts or performance issues with suppliers through structured communication and feedback mechanisms.	**14**	**8**	**-**	**-**
Logistics and Transportation Management	**PC9.** Explain common logistics challenges specific to semiconductor manufacturing, such as contamination risk, long lead times, and global coordination. **PC10.** Demonstrate understanding of cold chain logistics requirements for temperature-sensitive materials (e.g., photoresists, chemicals).	**15**	**9**	**-**	**-**

Demand Forecasting and Production Planning	**PC11.** Evaluate forecasting accuracy and adjust models based on historical data, market trends, and customer input. **PC12.** Use data analytics tools to support planning decisions and improve forecast reliability.	**15**	**9**	**-**	**-**
Quality Management and Compliance	**PC13.** Demonstrate understanding of quality assurance practices throughout the semiconductor supply chain, from raw materials to final delivery. **PC14**. Interpret and apply industry standards and compliance requirements (e.g., ISO 9001, JEDEC standards) in quality systems.	**13**	**8**	**-**	**-**
Emerging Trends and Technologies	**PC15.** Identify key technologies such as IoT, digital twins, and simulation tools and their roles in enhancing scalability and decision-making. **PC16.** Analyze use cases of blockchain for enhancing transparency, traceability, and trust in the global supply chain.	**13**	**8**	**-**	**-**
Project/ Presentation /Assignment	**Include all Elements**	**-**	**-**	**20**	**-**
Viva/ Internal Assessment	**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.