QUALIFICATION FILE–Standalone NOS

Fundamentals of Process Technology and Integration in Semiconductor Fabrication

☐ 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

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 Process Technology and Integration in Semiconductor Fabrication</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-04-EH-03727-2025-V1-NIELIT</td><td>5. NCrF/NSQF Level: 4</td></tr>
<tr><td>6.</td><td>Brief Description of the Standalone NOS</td><td colspan="2">The Fundamentals of Process Technology and Integration in Semiconductor Fabrication course will provide significant advantages to the semiconductor industry by ensuring standardized skills and knowledge among the workforce. This alignment with industry requirements ensures the development of expertise in key fabrication processes such as deposition, lithography, etching, doping, and process integration. By equipping professionals with a comprehensive understanding of emerging trends, quality control, and yield management techniques, the course enhances employability and fosters a highly skilled workforce capable of addressing complex fabrication challenges. Through hands-on practical training and exposure to advanced technologies like MEMS and 3D ICs, participants will be prepared to meet industry demands, driving productivity, innovation, and operational efficiency. This initiative supports the semiconductor industry's growth, technological advancements, and global competitiveness.</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>2 Years of 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>12th Pass</td><td>NA</td></tr>
<tr><td>3</td><td>10th pass plus 2-year NTC in Electronics Sector</td><td>NA</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>2 Credits</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>18</td><td>42</td><td>60</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. Nandakumar.R** Email: nanda@nielit.gov.in/ Contact No.: 9995427802 Website: https://www.nielit.gov.in Name: **Sh. Sreejeesh SG** Email: sreejeesh@nielit.gov.in/ Contact No.: 9447769756 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. Or M.Sc. in Physics/Electronics/Material Science and allied branches; with 2 years of relevant experience.
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. Or M.Sc. in Physics/Electronics/Material Science and allied branches with 3 years of relevant experience.
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. Or M.Sc. in Physics/Electronics/Material Science and allied branches with 3 years of relevant experience.
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	- Deep understanding of semiconductor physics, material properties, and fabrication techniques. - Knowledge of theoretical principles such as crystal growth, dopant profiles, and etching mechanisms. - Ability to analyze and apply the theoretical concepts in real-world semiconductor manufacturing processes.	The theoretical knowledge gained aligns with the expectation that individuals apply fundamental scientific concepts to solve real-world problems in semiconductor manufacturing.	4
Professional and Technical Skills/ Expertise/ Professional Knowledge	- Proficiency in handling semiconductor fabrication tools like spin coaters, deposition chambers, etching systems, and ion implanters. - Knowledge of advanced techniques in process integration, device fabrication, and testing. - Ability to analyze and interpret data from metrology tools for performance optimization.	This aligns with where students must apply advanced technical skills in professional settings, demonstrating expertise in using specialized tools and interpreting complex data.	4
Employment Readiness & Entrepreneurship Skills & Mind-set/Professional Skill	- Be employment-ready for roles in semiconductor manufacturing, including cleanroom operations, process optimization, and quality control. - Develop entrepreneurial skills to identify and address process inefficiencies and innovate within the semiconductor industry. - Strong problem-solving abilities to address fabrication challenges.	The course prepares students for employment by equipping them with skills that align with the responsibilities and expectations where they are expected to demonstrate problem-solving abilities and entrepreneurial mindsets in real-world contexts.	4

Broad Learning Outcomes/ Core Skill	- In-depth understanding of semiconductor fabrication processes such as deposition, etching, doping, and photolithography. - Ability to integrate different fabrication processes. - Competence in using various metrology tools to assess quality and performance of devices.	Individuals are expected to apply advanced knowledge of processes and tools to achieve optimal outcomes, and this qualification provides them with the necessary core skills for the semiconductor industry.	4
Responsibility	- Ability to manage semiconductor fabrication processes with high precision. - Ensure safety standards are maintained throughout the production process. - Take responsibility for quality control and optimization in process flows.	The foundational knowledge gained in the course, such as understanding basic semiconductor physics and cleanroom procedures, aligns with the entry-level skills and knowledge.	4

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 Facilities

- Cleanroom Environment (Class 100 or Class 1000)
- Cleanroom Attire (Gloves, Masks, Lab Coats, Shoe Covers)
- Cleanroom Consumables (Tweezers, Wafer Handling Tools, Wipes)

Semiconductor Fabrication Tools

- Spin Coater
- Exposure Unit (UV Lithography System)
- Developer Station
- Hot Plates (Soft Bake and Hard Bake)
- Physical Vapor Deposition (PVD) Tools (Sputtering, Evaporation)
- Chemical Vapor Deposition (CVD) Tools (LPCVD, PECVD)
- Atomic Layer Deposition (ALD)
- Wet Benches for Wet Etching
- Reactive Ion Etching (RIE) System
- Inductively Coupled Plasma (ICP) Etching System
- Ion Implanter
- Diffusion Furnace
- Rapid Thermal Annealing (RTA) System

Characterization and Metrology Tools

- Profilometer
- Ellipsometer
- Scanning Electron Microscope (SEM)
- Atomic Force Microscope (AFM)
- Four-Point Probe
- Mask Aligner

Packaging and Advanced Process Tools

- Wire Bonders
- Flip-Chip Bonders
- Die Attach Tools

Software and Computing Tools

- Silvaco TCAD
- Synopsys TCAD
- COMSOL Multiphysics
- Cadence Virtuoso
- Mentor Graphics Calibre
- MATLAB
- Python (NumPy, SciPy, Pandas)

Classroom and General Equipment

- Desktop Computers with Accessories
- LCD Projector
- Pin-up Board
- Whiteboard
- Printers (A4 DeskJet Printer)

Consumables

- Silicon Wafers
- Photoresists (Positive and Negative)
- Process Chemicals (Etchants, Solvents, Cleaning Agents)
- Process Gases (Nitrogen, Argon)

Optional Advanced Tools

- Transmission Electron Microscope (TEM)

- X-ray Diffraction (XRD) System
- Plasma Cleaning System
- Chemical Mechanical Planarization (CMP) Tools

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

This qualification provides a comprehensive understanding of the core and advanced processes used in semiconductor fabrication, including deposition, lithography, etching, doping, and process integration. It combines theoretical knowledge with practical training to equip learners with the skills required for modern semiconductor manufacturing, emphasizing process optimization, quality control, and yield management.

2. Scope

The scope covers the following:

- Training in fundamental and advanced semiconductor fabrication techniques, with hands-on exposure to key processes like deposition, lithography, etching, and doping..
- Building expertise in process integration, quality control, and yield optimization to ensure high-performance semiconductor devices.
- Familiarizing learners with emerging technologies and future trends to prepare them for evolving industry requirements.

3. Elements and Performance Criteria

Elements	Performance Criteria
Introduction to Semiconductor Process Technology	PC1: Semiconductor Fabrication Process Overview: Covers the fundamental steps involved in semiconductor manufacturing, including cleaning, deposition, lithography, and etching. PC2: Integration of Process Technologies: Explains how various fabrication processes are combined and optimized to create complex semiconductor devices. PC3: Practical Equipment Operation and Demonstration: Introduces key fabrication equipment and provides hands-on demonstrations of basic process steps used in semiconductor manufacturing.
Deposition Techniques	PC4: Overview of Deposition Techniques: Explains Physical Vapor Deposition (PVD) methods like sputtering, evaporation, and e-beam, as well as Chemical Vapor Deposition (CVD) techniques such as LPCVD and PECVD. PC5: Applications and Challenges: Discusses the practical uses of deposition processes in semiconductor manufacturing and addresses common challenges encountered during deposition. PC6: Practical Demonstration and Analysis: Includes hands-on experience with PVD and CVD processes, along with techniques for measuring and analyzing film thickness and uniformity.

Lithography and Patterning	PC7: Photolithography Fundamentals and Process Steps: Covers the basics of photolithography, including light sources, masks, photoresists, and key steps like spin coating, exposure, development, and hard bake. PC8: Advanced Techniques and Applications: Introduces advanced lithography methods and their applications in semiconductor device fabrication. PC9: Practical Lithography Experience: Provides hands-on practice with the lithography process, including spin coating, development, mask alignment, and pattern transfer exercises.
Etching Techniques	PC10: Etching Fundamentals: Introduces wet and dry etching techniques, including plasma-based methods like Reactive Ion Etching (RIE) and Inductively Coupled Plasma (ICP), and explains isotropic versus anisotropic etching. PC11: Practical Etching Processes: Provides hands-on experience with both wet and dry etching methods used in semiconductor fabrication. PC12: Etch Profile Analysis and Optimization: Focuses on analyzing etch profiles and optimizing process parameters for improved results.
Doping and Diffusion Processes	PC13: Doping Fundamentals and Techniques: Explains the basics of semiconductor doping, focusing on ion implantation and diffusion methods. PC14: Dopant Profiles, Activation, and Applications: Covers how dopant profiles are formed, the role of activation and annealing, and their importance in device fabrication. PC15: Practical Demonstration and Analysis: Includes hands-on demonstration of ion implantation and annealing, along with analysis of doping profiles and results.
Integration of Process Technologies	PC16: Process Integration Concepts and Challenges: Explains the fundamentals of process integration, including flow design, optimization, and overcoming challenges when combining different technologies. PC17: Case Studies and Practical Applications: Provides real-world examples of successful process integration in semiconductor manufacturing. PC18: Quality Control and Yield Optimization: Covers practical procedures for quality control, inspections, and techniques for analyzing and optimizing yield.
Quality Control and Yield Management	PC19: Quality Control Principles and Yield Management: Explains the fundamentals of quality control in semiconductor fabrication and the basics of yield and its management. PC20: Statistical Process Control (SPC):Introduces the use of statistical methods to monitor and control fabrication processes for consistent quality. PC21: Practical Quality and Yield Optimization: Covers hands-on quality control procedures, inspections, and techniques for analyzing and optimizing yield.
Advanced Process Technologies	PC22: Overview of Emerging Technologies: Introduces advanced semiconductor technologies such as MEMS, 3D ICs, and new materials. PC23: Integration Challenges and Future Trends: Discusses the difficulties in integrating these technologies and highlights anticipated future developments. PC24: Practical Exploration and Evaluation: Provides hands-on experience with advanced process technologies and methods for evaluating device integration and performance.

4. Knowledge and Understanding (KU):

The individual on the job needs to know and understand:

KU1: The fundamental steps and underlying principles of semiconductor fabrication processes, including cleaning, deposition (PVD and CVD), photolithography, etching, and doping.

KU2. How to integrate and optimize various process technologies to manufacture complex semiconductor devices, along with the challenges and solutions involved in process integration.

KU3. The principles and practices of quality control, yield management, and the use of statistical process control (SPC) to monitor, analyze, and optimize fabrication processes.

KU4. The importance of advanced and emerging semiconductor technologies such as MEMS, 3D ICs, and advanced materials, as well as the challenges and methods for evaluating and integrating these technologies.

5. Generic Skills (GS):

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

GS1. Operate and maintain semiconductor fabrication equipment safely and efficiently, following standard operating procedures for processes such as deposition, lithography, etching, and doping.

GS2. Accurately perform hands-on process steps, including equipment setup, material handling, process monitoring, and troubleshooting during semiconductor manufacturing.

GS3. Measure, analyze, and interpret process parameters and results, such as film thickness, etch profiles, doping concentrations, and yield data, using appropriate tools and techniques.

GS4. Communicate effectively with team members, document process observations, follow quality control protocols, and adapt to new technologies and process improvements in a dynamic work environment.

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 Semiconductor Process Technology	PC1: Semiconductor Fabrication Process Overview: Covers the fundamental steps involved in semiconductor manufacturing, including cleaning, deposition, lithography, and etching. PC2: Integration of Process Technologies: Explains how various fabrication processes are combined and optimized to create complex semiconductor devices. PC3: Practical Equipment Operation and Demonstration: Introduces key fabrication equipment and provides hands-on demonstrations of basic process steps used in semiconductor manufacturing.	10	7	-	-
Deposition Techniques	PC4: Overview of Deposition Techniques: Explains Physical Vapor Deposition (PVD) methods like sputtering, evaporation, and e-beam, as well as Chemical Vapor Deposition (CVD) techniques such as LPCVD and PECVD. PC5: Applications and Challenges: Discusses the practical uses of deposition processes in semiconductor manufacturing and addresses common challenges encountered during deposition. PC6: Practical Demonstration and Analysis: Includes hands-on experience with PVD and CVD processes, along with techniques for measuring and analyzing film thickness and uniformity.	15	8	-	-
Lithography and Patterning	PC7: Photolithography Fundamentals and Process Steps: Covers the basics of photolithography, including light sources, masks, photoresists, and key steps like spin coating, exposure, development, and hard bake. PC8: Advanced Techniques and Applications: Introduces advanced lithography methods and their applications in semiconductor device fabrication. PC9: Practical Lithography Experience: Provides hands-on practice with the lithography process, including spin coating, development, mask alignment, and pattern transfer exercises.	15	8	-	-

Etching Techniques	PC10: Etching Fundamentals: Introduces wet and dry etching techniques, including plasma-based methods like Reactive Ion Etching (RIE) and Inductively Coupled Plasma (ICP), and explains isotropic versus anisotropic etching. PC11: Practical Etching Processes: Provides hands-on experience with both wet and dry etching methods used in semiconductor fabrication. PC12: Etch Profile Analysis and Optimization: Focuses on analyzing etch profiles and optimizing process parameters for improved results.	12	8	-	-
Doping and Diffusion Processes	PC13: Doping Fundamentals and Techniques: Explains the basics of semiconductor doping, focusing on ion implantation and diffusion methods. PC14: Dopant Profiles, Activation, and Applications: Covers how dopant profiles are formed, the role of activation and annealing, and their importance in device fabrication. PC15: Practical Demonstration and Analysis: Includes hands-on demonstration of ion implantation and annealing, along with analysis of doping profiles and results.	12	7	-	-
Integration of Process Technologies	PC16: Process Integration Concepts and Challenges: Explains the fundamentals of process integration, including flow design, optimization, and overcoming challenges when combining different technologies. PC17: Case Studies and Practical Applications: Provides real-world examples of successful process integration in semiconductor manufacturing. PC18: Quality Control and Yield Optimization: Covers practical procedures for quality control, inspections, and techniques for analyzing and optimizing yield.	12	8	-	-
Quality Control and Yield Management	PC19: Quality Control Principles and Yield Management: Explains the fundamentals of quality control in semiconductor fabrication and the basics of yield and its management. PC20: Statistical Process Control (SPC):Introduces the use of statistical methods to monitor and control fabrication processes for consistent quality. PC21: Practical Quality and Yield Optimization: Covers hands-on quality control procedures, inspections, and techniques for analyzing and optimizing yield.	12	7	-	-

Advanced Process Technologies	PC22: Overview of Emerging Technologies: Introduces advanced semiconductor technologies such as MEMS, 3D ICs, and new materials. PC23: Integration Challenges and Future Trends: Discusses the difficulties in integrating these technologies and highlights anticipated future developments. PC24: Practical Exploration and Evaluation: Provides hands-on experience with advanced process technologies and methods for evaluating device integration and performance.	12	7	-	-
Project	Include all elements	-	-	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.