



QUALIFICATION FILE – Micro Credentials

Basics of Semiconductor Manufacturing Process

OEM Qualification name: Semiconductor Manufacturing Technician

☒ 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

Contents

Basics of Semiconductor Manufacturing Process.....	1
OEM Qualification name: Semiconductor Manufacturing Technician	1
NCrF/NSQF Level: 4.5.....	1
Submitted By:	1
Electronics Sector Skills Council of India (ESSCI) 155, 2nd Floor, ESC House Okhla Industrial Area - Phase 3, New Delhi – 110020	1
Tel: 011 – 8447738501	1
Section 1: Basic Details	3
Section 2: Training Related.....	5
Section 3: Assessment Related.....	5
Section 4: Evidence of Need of the Micro Credential	6
Annexure: Evidence of Level	7
Annexure: Learning Outcomes and Assessment Criteria	11
Annexure: Assessment Strategy	12
Annexure: Tools and Equipment	14
Annexure: Industry Validations Summary	16
Annexure: Training Details	16
Annexure: Blended Learning	16
Annexure: Acronym and Glossary	18

Section 1: Basic Details

1.	Micro Credential-Qualification Name	Basics of Semiconductor Manufacturing Process		
2.	Sector/s	Electronics		
3.	National Qualification Register (NQR) Code & Version (Will be issued after NSQC approval.)	NM-4.5-EH-045002025-V1-ESSCI	4. NCrF/NSQF Level: 4.5	
5.	Brief Description of the Micro Credential	The “Basics of Semiconductor Manufacturing Process” is an upskilling course that offers foundational skills in semiconductor manufacturing, focusing on equipment such as valves, actuators, chillers, sensors, and environmental control systems critical to the manufacturing process. Learners will gain overview of operation, maintenance, safety protocols, and quality standards, preparing them for technical roles in the semiconductor industry.		
6.	Eligibility Criteria for Entry for Students/Trainee/Learner/Employee	a. Entry Qualification & Relevant Experience		
		S. No.	Academic/Skill Qualification (with specialization- if applicable)	Relevant Experience (with specialization- if applicable)
		1.	Diploma after 10 th in Electronics and Communication Engineering/ Electrical Engineering	6 months of relevant experience
		2.	12 th in science or equivalent in science	1.5 Years of relevant experience
		3.	10 th or equivalent	4.5 years of relevant experience
		4.	Previous NSQF qualifications of Level 4	1.5 years of relevant experience
		Relevant experience – In Semiconductor Domain		
		b. Age: NA		
7.	Credits Assigned to this Qualification, Subject to Assessment (as per National Credit Framework (NCrF))	1	8. Common Cost Norm Category (I/II/III) (wherever applicable): I	
9.	Any Licensing Requirements/ Pre-requisites for Undertaking Training (wherever applicable)	NA		

10.	Expected Outcomes of the Micro Credential	Terminal learning outcomes are: - Understand semiconductor materials, fabrication processes, and cleanroom protocols. - Overview of how to operate, maintain, and troubleshoot semiconductor manufacturing equipment efficiently. - Introduction to Monitor process parameters, ensure quality control, and follow safety regulations. - Overview of Implement sustainable practices, minimize waste, and optimize resource utilization.					
11.	Training Duration by Modes of Training Delivery (<i>Specify Total Duration as per selected training delivery modes and as per requirement of the qualification</i>)	☐ Offline Only ☐ Online Only ☒ Blended					
		Training Delivery Mode	Theory (Hours)	Practical (Hours)	Total (Hours)		
		Classroom (offline)	00:00	18:00	30:00		
		Online	12:00	00:00			
		(Refer Blended Learning Annexure for Details)					
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.	NA					
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 Website: https://www.essc-india.org/ Contact No.: 011 – 8447738501					
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) <i>(as per requirement and NCVET guidelines)</i>	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) <i>(as per requirement and NCVET guidelines)</i>	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 <i>(If "Yes", details to be provided in Annexure)</i>

Section 3: Assessment Related

1.	Assessor's Qualification and experience in relevant sector (in years) <i>(as per requirement and NCVET guidelines)</i>	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) <i>(as per requirement and NCVET guidelines)</i>	NA
3.	Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years) <i>(as per requirement and NCVET guidelines)</i>	NA
4.	Assessment Mode <i>(Specify the assessment mode)</i>	Mode: ☐ Online Only ☐ Offline Only ☒ Blended
5.	Tools and Equipment Required for Assessment	☒ Same as for training ☐ Yes ☐ No <i>(details to be provided in Annexure-if it is different for Assessment)</i>

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 <i>(Mandatory)</i>	Attached
2.	Annexure: Learning Outcomes and Assessment Criteria <i>(Mandatory)</i>	Attached
3.	Annexure: Assessment Strategy <i>(Mandatory)</i>	Attached
4.	Annexure: List of tools and equipment relevant for qualification <i>(Mandatory – Except in case of online course)</i>	Attached
5.	Annexure: Blended Learning <i>(Mandatory in case selected mode of delivery is "Blended Learning")</i>	Filled
6.	Annexure: Acronym and Glossary <i>(Optional)</i>	Attached

MCr Name: Basics of Semiconductor Manufacturing Process

OEM Qualification Name: Semiconductor Manufacturing Technician

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 activity involving standard and non-standard practices. • Operate, maintain, and calibrate semiconductor fabrication equipment. • Implement cleanroom protocols and contamination control measures. • Analyze process deviations and apply corrective actions. • Conduct wafer inspections using microscopy and defect analysis tools. • Integrate automated systems and apply statistical process control (SPC). • Ensure compliance with quality, safety, and environmental standards. • Implement sustainable practices in semiconductor manufacturing	The job role outcomes align with the NCrF/NSQF level descriptors through the development of cognitive skills in understanding semiconductor manufacturing processes, equipment operation, and cleanroom protocols. It enhances technical skills in operating, maintaining, and troubleshooting semiconductor fabrication tools, conducting defect analysis, and applying Statistical Process Control (SPC). Additionally, it develops process skills in ensuring quality control, implementing safety measures, and integrating automation in semiconductor production. The role also emphasizes responsibility by ensuring process efficiency, maintaining compliance with environmental and occupational safety standards, and contributing to sustainable manufacturing 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 semiconductor manufacturing	This course provides essential skills in semiconductor manufacturing , including	4.5

	and process control. • Cognitive skills: Understanding semiconductor fabrication processes, cleanroom protocols, and quality control standards. • Technical skills: Operating, maintaining, and troubleshooting semiconductor fabrication equipment, conducting defect analysis, and applying Statistical Process Control (SPC). • Process skills: Implementing safety measures, ensuring process optimization, and integrating automation in semiconductor production. • Responsibility: Maintaining compliance with environmental and occupational safety standards, ensuring process efficiency, and contributing to sustainable semiconductor manufacturing practices.	operating and maintaining fabrication equipment, implementing cleanroom protocols, conducting defect analysis, and applying Statistical Process Control (SPC) to ensure quality and efficiency. It also covers safety compliance, automation integration, and sustainable manufacturing practices, preparing candidates for semiconductor industry challenges. Hence, Level 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 semiconductor manufacturing. • Develop problem-solving and analytical skills in semiconductor fabrication. • Gain hands-on experience in operating and maintaining semiconductor equipment.	Hence Level 4.5	4.5

	Learn quality control, process optimization, and safety compliance techniques. Cultivate innovation and entrepreneurial thinking in sustainable semiconductor manufacturing.		
Broad Learning Outcomes/Core Skill	- Develop understanding of semiconductor fabrication processes and cleanroom protocols. - Gain proficiency in operating, maintaining, and troubleshooting semiconductor manufacturing equipment. - Learn defect detection, quality control techniques, and Statistical Process Control (SPC). - Apply safety, environmental, and regulatory compliance measures in semiconductor production.	Hence Level 4.5	4.5

Responsibility	Responsibility of completing the work assigned and reporting the same as per standards. • Operate and maintain semiconductor fabrication equipment as per SOPs. • Ensure adherence to cleanroom protocols and quality control standards. • Demonstrate accountability in troubleshooting process deviations and defects. • Uphold safety, environmental, and regulatory compliance in semiconductor manufacturing.	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
	Semiconductor Fundamentals and Overview of Equipment Operations	12	18	-	-
1	PC 1: Describe the properties of semiconductor materials such as electrical conductivity, bandgap, and temperature sensitivity.	2	3	-	-
2	PC 2: Explain the manufacturing processes used in semiconductor fabrication including doping, oxidation, etching, and photolithography.	2	3	-	-
3	PC 3: Identify different types of semiconductor equipment used in fabrication, testing, and packaging.	2	3	-	-
4	PC 4: Describe the functions of various semiconductor equipment in the production and testing process.	2	3	-	-
5	PC 5: Operate valves, flow controllers, actuators, chillers, anti-static devices and sensors used in semiconductor manufacturing.	2	3	-	-
6	PC 6: Perform routine maintenance on semiconductor equipment according to SOPs.	2	3	-	-
	Introduction of Process Control, Safety, and Quality Assurance in Semiconductor Manufacturing	14	24	-	-
7	PC 7: Monitor critical process parameters, including temperature and humidity, within cleanroom environments.	4	6	-	-
8	PC 8: Identify and address deviations in environmental controls.	4	6	-	-
9	PC 9: Follow safety protocols when handling semiconductor equipment and chemicals.	3	6	-	-
10	PC 10: Conduct quality checks on wafers to ensure adherence to specifications.	3	6	-	-
	Overview of Sustainable Practices in Semiconductor Manufacturing	14	18	-	-
11	PC 11: Follow energy-efficient operational practices to minimize power consumption in semiconductor manufacturing.	3	3	-	-
12	PC 12: Implement waste segregation, recycling, and disposal procedures as per industry guidelines.	3	3	-	-
13	PC 13: Monitor and optimize the use of water and chemicals to reduce environmental impact.	3	4	-	-
14	PC 14: Comply with environmental regulations and sustainability standards during manufacturing processes.	3	4	-	-
15	PC 15: Assist in the adoption of eco-friendly materials and processes to reduce carbon footprint.	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	Semiconductor process flow charts	Printed process flow charts	30 copies
3	Cleanroom gloves and masks	Disposable cleanroom PPE	30 sets
4	Microscopes for wafer inspection	For wafer inspection	5 units
5	Workbenches with ESD protection	With ESD protection	5 units
6	Basic hand tools (tweezers, cutters, pliers)	Tweezers, cutters, pliers set	30 sets
7	Maintenance toolkits (screwdrivers, hex keys, torque wrenches)	Includes screwdrivers, hex keys, torque wrenches	10 sets
8	Oscilloscope	For signal analysis	2 units
9	Multimeter	Digital multimeter	5 units
10	Temperature and humidity sensors	Temperature and humidity sensors	5 units
11	Valves Regulators, Air Preparation, Pneumatic components, fittings, chillers, ionizers, high vacuum components	SMC make	1 unit each
12	Chemical fume hoods	For chemical ventilation	As per lab size
13	Gas detection meters	For detecting hazardous gases	2 units
14	Chemical storage cabinets	For chemical storage	2 units
15	ESD protection wrist straps	Anti-static wrist straps	30 pcs
16	Fire extinguishers	CO2 and dry chemical extinguishers	2 units each
17	First aid kits	Basic first aid supplies	3 sets
18	UV lighting setup	UV lighting	As per lab size
19	Safety data sheets (SDS) for chemicals	MSDS and SDS sheets	30 copies

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		+919560857975	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.