



Model Curriculum

MCr Name: Fundamentals of Wet Process Operations in Solar Cell Manufacturing

OEM Name: Fundamentals of Wet Process Operations in Solar Cell Manufacturing

MCr Code: ELE/MCr-0009

MCr Version: 1.0

NSQF Level: 4.5

Model Curriculum Version: 1.0

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Training Parameters

Sector	Electronics
Sub-Sector	Solar & LED
Occupation	Manufacturing & Quality -S & L
Country	India
NSQF Level	4.5
Aligned to NCO/ISCO/ISIC Code	NCO-xxxx/xxxxxxx
Minimum Educational Qualification and Experience	1. Diploma after 10th in Electronics / Electrical / Mechanical Engineering with 6 Months of relevant experience required 2. 12th or Equivalent with 1.5 years of relevant experience 3. 10th or equivalent with 4.5 years of relevant experience 4. Previous NSQF qualifications of Level 4 with 1.5 years of relevant experience *Relevant Experience in Solar & LED Domain
Pre-Requisite License or Training	NA
Minimum Job Entry Age	NA
Last Reviewed On	08.07.2026
Next Review Date	08.07.2029
NSQC Approval Date	08.07.2026
MCR Version	1.0
Model Curriculum Creation Date	08.07.2026
Model Curriculum Valid Up to Date	08.07.2029
Model Curriculum Version	1.0
Minimum Duration of the Course	30 Hrs.
Maximum Duration of the Course	30 Hrs.

Program Overview

This section summarizes the end objectives of the program along with its duration.

Training Outcomes:

At the end of the program, the learner should have acquired the listed knowledge and skills:

Compulsory:

- Basic lecture introduces different aspects of Wet Process Operations in Solar Cell Manufacturing Equipment and exposure to the current activities at a particular.

Compulsory Modules:

The table lists the modules and their duration corresponding to the Compulsory MCr of the QF.

MCr and Module Details	Theory / Demonstration Duration (In Hours)	Practical/OJ T Duration (In Hours)	On-the-Job Training Duration (in hours) (Mandatory)	On-the-Job Training Duration (in hours) (Recommended)	Total Duration (In Hours)
ELE/MCr-0009	12:00	18:00	00:00	00:00	30:00
Module 1 Wet Process Operations in Solar Cell Manufacturing	12:00	18:00	00:00	00:00	30:00
Total Duration	12:00	18:00	00:00	00:00	30:00

Module Details

Module 1: Wet Process Operations in Solar Cell Manufacturing

Mapped to ELE/MCr-0009

Terminal Outcomes:

Upon completion of the module on Wet Process Operations in Solar Cell Manufacturing, students will:

- Understand the principles of vacuum technology and their application in semiconductor manufacturing processes.
- Operate and monitor vacuum systems and related instruments to maintain required process conditions.
- Perform preventive maintenance of vacuum equipment to ensure reliable and efficient operation.
- Identify and troubleshoot common vacuum system malfunctions and restore normal system performance.
- Apply safety practices and ensure environmental compliance during vacuum system operation and maintenance.

Duration: 12:00 hrs

Theory - Key Learning Outcomes

- Explain vacuum concepts, pressure units, and operating ranges used in semiconductor manufacturing.
- Identify different types of vacuum pumps and their specific applications.
- Describe the role of vacuum systems in maintaining process stability and product quality.
- Understand standard operating procedures for vacuum system operation and monitoring.
- Explain the importance of preventive maintenance, calibration, and system reliability.
- Understand common vacuum system faults and appropriate corrective approaches.
- Explain safety requirements and environmental regulations related to vacuum systems.

Duration: 18:00 hrs

Practical - Key Learning Outcomes

- Operate vacuum systems in accordance with SOPs and process requirements.
- Monitor and record vacuum parameters such as pressure, flow, and temperature.
- Identify deviations in vacuum performance and take timely corrective action.
- Perform routine inspection, cleaning, and basic maintenance of vacuum equipment.
- Replace consumables such as filters, seals, and lubricants correctly.
- Calibrate vacuum gauges and sensors using standard procedures.
- Diagnose vacuum system issues and carry out basic troubleshooting and repairs.
- Verify system functionality after maintenance or fault correction.

- Follow safety practices and ensure proper disposal of waste materials during operations.

Classroom Aids: (If Offline mode)

- Whiteboard and Markers
- Chart paper and sketch pens
- LCD Projector and Laptop for presentations

Tools, Equipment and Other Requirements

Labs equipped with the following:

- Wet Chemical Processing Bench, Chemical Tank, Wafers, Hot Plate / Chemical Heater, Chemical Mixing Tank, pH Meter, Temperature Sensors / Thermometer, I Water System (Demo / Lab Scale), Wafer Rinsing Station, Drying Station / Spin Dryer (Demo), Pneumatic Valves, pump & Tubing's, Flow Meters, Digital Weighing Balance, Measuring Cylinders & Beakers, Chemical Storage Cabinets, Hand Tool Kit, Multimeter Wafer Inspection Microscope, Cleaning Accessories, Personal Protective Equipment (PPE), Emergency Eye Wash & Safety Shower, Fire Extinguisher, First Aid Kit, Waste Chemical Containers

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate Science & Engineering	Electrical/ Mechanical/ Electronics	1	Solar & LED	1	Solar & LED	
Diploma/ITI	Electrical/ Mechanical/ Electronics	2	Solar & LED	1	Solar & LED	

Trainer Certification	
Domain Certification	Platform Certification
“Fundamentals of Wet Process Operations in Solar Cell Manufacturing, ELE/MCr-0009, version 1.0”. Minimum accepted score is 80%.	Recommended that the Trainer is certified for the Fundamentals of Wet Process Operations in Solar Cell Manufacturing “Trainer (VET and Skills)” , mapped to the Qualification Pack: “MEP/Q2601, V2.0”, with minimum score of 80%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduate Science & Engineering	Electrical/ Mechanical/ Electronics	2	Solar & LED	1	Solar & LED	
Diploma/ITI	Electrical/ Mechanical/ Electronics	3	Solar & LED	1	Solar & LED	

Assessor Certification	
Domain Certification	Platform Certification
“Fundamentals of Wet Process Operations in Solar Cell Manufacturing, ELE/MCr-0009, version 1.0”. Minimum accepted score is 80%.	Recommended that the Assessor is certified for the Fundamentals of Wet Process Operations in Solar Cell Manufacturing “Assessor (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2701, V2.0”, with minimum score of 80%

Assessment Strategy

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 MCr 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

References

Glossary

Term	Description
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical/OJT application).
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module . A set of terminal outcomes help to achieve the training outcome.
National Occupational Standard	National Occupational Standard specify the standard of performance an individual must achieve when carrying out a function in the workplace
Persons with Disability	Persons with Disability are those who have long-term physical, mental, intellectual, or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others

Acronyms and Abbreviations

Term	Description
QF	Qualification File
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards
SSC	Skill Sectors Councils
NASSCOM	National Association of Software & Service Companies
NCO	National Classification of Occupations
ISO	International Organization for Standardization
SLA	Service Level Agreement
IT	Information Technology
CRM	Customer Relationship Management
PC	Performance Criteria
PwD	Persons with Disability
SOP	Standard Operating Procedure