QUALIFICATION FILE – Standalone NOS

Advanced Program on Nano Science and Technology

☐ Horizontal/Generic ☒ Vertical/Specialization

☒ Upskilling ☐ Dual/Flexi Qualification ☐ For ToT ☐ For ToA

☐General ☐ Multi-skill (MS) ☐ Cross Sectoral (CS) ☒ Future Skills

NCrF/NSQF Level: 6.5

Submitted By:

Electronics Sector Skills Council of India

Head Office: 155, 2nd Floor, ESC House

Okhla Industrial Area - Phase 3, New Delhi – 110020 Tel: +91 -84477-38-501

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Section 1: Basic Details

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<tr><td>1.</td><td>NOS-Qualification Name</td><td colspan="2">Advanced Program on Nano Science and Technology</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 (Will be issued after NSQC approval.)</td><td>NG-6.5-EH-00198-2023-V1-ESSC & V1.0</td><td>5. NCrF/NSQF Level:6.5</td></tr>
<tr><td>6.</td><td>Brief Description of the Standalone NOS</td><td colspan="2">Personnel working in the High-End research and development (Academic & Industry)/ Faculty in the Nanoelectronics, Microsystems, smart materials technologies, and related areas is responsible for the fabrication and characterization of the micro/ nano scale devices.</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>Pursuing First year of PG Engineering in the relevant field</td><td>NA</td></tr>
<tr><td>2</td><td>M.Sc in relevant field</td><td>NA</td></tr>
</table>
**Basic knowledge of Nano Science required

b. Age <Please specify age only in case of any legal restrictions>: 21+</td></tr>
<tr><td>8.</td><td>Credits Assigned to this NOS-Qualification, Subject to Assessment (as per National Credit Framework (NCrF))</td><td>3</td><td>9. Common Cost Norm Category (I/II/III) (wherever applicable): 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 Only ☐ Online Only ☒ Blended
<table>
<tr><th>Training Delivery Mode</th><th>Theory (Hours)</th><th>Practical (Hours)</th><th>Total (Hours)</th></tr>
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<tr><td>Online</td><td>18</td><td>00</td><td>18</td></tr>
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</table>

<table>
<tr><td>12.</td><td>Assessment Criteria</td><td colspan="2"><table><tr><th>Theory Marks</th><th>Practical Marks</th><th>Project (Marks)</th><th>Viva (Marks)</th><th>Total (Marks)</th><th>Passing %age</th></tr><tr><td>20</td><td>80</td><td></td><td></td><td>100</td><td>70</td></tr></table></td></tr>
<tr><td>13.</td><td>Is the NOS Amenable to Persons with Disability</td><td colspan="2">☐ Yes ☒ No If “Yes”, specify applicable type of Disability:</td></tr>
<tr><td>14.</td><td>Progression Path After Attaining the Qualification, wherever applicable (Please show Professional and Academic progression)</td><td colspan="2">Professional Program on Nano Science and Technology</td></tr>
<tr><td>15.</td><td>How participation of women will be encouraged?</td><td colspan="2">Through higher academic institutions</td></tr>
<tr><td>16.</td><td>Other Indian languages in which the Qualification & Model Curriculum are being submitted</td><td colspan="2">NA</td></tr>
<tr><td>17.</td><td>Is similar NOS available on NQR-if yes, justification for this qualification</td><td colspan="2">☐ Yes ☒ No URLs of similar Qualifications:</td></tr>
<tr><td>18.</td><td>Name and Contact Details Submitting / Awarding Body SPOC
(In case of CS or MS, provide details of both Lead AB & Supporting ABs)</td><td colspan="2">Name: Dr. Abhilasha Gaur
Email: ceo@essc-india.org
Contact No.: +91 -84477-38-501
Website: www.essc-india.org</td></tr>
<tr><td>19.</td><td>Final Approval Date by NSQC: 28.02.2023</td><td>20. Validity Duration:
27.02.2026</td><td>21. Next Review Date:
27.02.2026</td></tr>
</table>

Section 2: Training Related

1.	**Trainer’s Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Minimum Doctorate with 3 years of experience
2.	**Master Trainer’s Qualification and experience in the relevant sector (in years)** *(as per NCVET guidelines)*	Minimum Doctorate with 7 years of experience
3.	**Tools and Equipment Required for the Training**	☒Yes ☐No *(If “Yes”, details to be provided in Annexure)*
4.	**In Case of Revised NOS, 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)*	Minimum Doctorate with 3 years of experience
2.	**Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines), (wherever applicable)*	Minimum Doctorate with 7 years of experience
3.	**Lead Assessor's/Proctor's Qualification and experience in relevant sector (in years)** *(as per NCVET guidelines)*	Minimum Doctorate with 7 years of experience
4.	**Assessment Mode** *(Specify the assessment mode)*	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 the Need for the Standalone NOS

Provide Annexure/Supporting documents name.

1.	Government /Industry initiatives/ requirement (Yes/No): Yes (Indian Nanoelectronics Users' Programme INUP by MeitY)
2.	Number of Industry validation provided: *2*
3.	Estimated number of people to be trained: *660*
4.	Evidence of Concurrence/Consultation with Line/State Departments (In case of regulated sectors): (Yes/No): *In Progress* If "No", why:

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)*	IISc Bangalore, IIT Bombay and IIT Guwahati, IIT Madras, IIT Delhi and IIT Kharagpur are involved in this along with MeitY
2.	**Annexure:** List of tools and equipment relevant for NOS *(Mandatory, except in case of online course)*	NA
3.	**Annexure:** Performance and Assessment Criteria *(Mandatory)*	*Available*
4.	**Annexure:** Assessment Strategy *(Mandatory)*	*Available*

5.	**Annexure:** Blended Learning *(Mandatory, in case selected Mode of delivery is Blended Learning)*	*Available*
6.	**Annexure:** Acronym and Glossary *(Optional)*	
7.	**Annexure/Supporting Document:** Standalone NOS-Performance Criteria Details Annexure/Document with PC-wise detailing as per NOS format (Mandatory-Public view)	*Available*
8.	**Supporting Document:** Model Curriculum *(Mandatory – Public view)*	*Available*

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	• Knowledge of the nano – technology • Knowledge of company's policy on turnaround time, working hours Achieving productivity, quality and safety standards as per company's policy	The individual at work Planning, Design & Installation modules and sub parts together that form the electronic system of the product.	6.5
Professional and Technical Skills/ Expertise/ Professional Knowledge	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study. • Communicate with the team to understand the work requirement Complete the documentation	A Professional must be able to tackle all the issues related to Nano science and technology	6.5
Employment Readiness & Entrepreneurship	Reasonably good in: • Various processes in nanotechnology/nanoelectronics Overview of ongoing research activities at nanocentres	A professional must have knowledge of various procedures related to nano technology	6.5

Skills & Mind-set/Professional Skill			
Broad Learning Outcomes/Core Skill	Will become professional in: Photovoltaics, Sensors, Quantum Compution etc.	Basic concepts/ understanding of nanotechnology/nanoelectronics/semiconductor Technology	6.5
Responsibility	Responsibility of completing the work assigned and reporting the same as per standards. • Understand the job role and follow the organisational policy • Follow safety regulations at work place Work and interact effectively with colleagues and superiors	Basic concepts/ understanding of nanotechnology/nanoelectronics/semiconductor Technology	6.5

Annexure: Tools and Equipment (lab set-up)

List of Tools and Equipment: Provided by IISc Bangalore

Batch Size: 30 Candidates

S. No.	Tool / Equipment Name	Specification
1.	Transmission Electron Microscope	• Ultra-bright XFEG gun • 4K x 4K CMOS camera • Single tilt and double tilt specimen holders • New computerized 5-axis specimen piezo-stage • Super-X quad EDS detector for super-fast elemental analysis • EDX Solid State Detector • HRTEM and STEM mode • HAADF (High Angle Annular Dark Field Imaging) and triple Dark Field/Bright Field (DF/BF) detectors for simultaneous imaging in STEM mode SAED (Selected Area Electron Diffraction)
2.	Atomic Force Microscope	• Tapping mode, Scan Asyst mode, contact mode for topography – in air and fluid. • Contact mode for Force distance spectroscopy – in air and fluid

		● PFQNM – Peak force quantitative nano mechanical mapping for sample surface mechanical properties measurement – in air and fluid ● EFM – Electrostatic force microscopy for qualitative information of electric field gradient ● KPFM – Kelvin probe force microscopy for surface work potential measurement ● PFM – Piezo force microscopy for characterization of piezo electric and ferro electric materials ● MFM – Magnetic force microscopy for mapping the magnetic field distributions on a microscopic scale ● LFM – Lateral force microscopy to investigate surface frictional properties FMM – Force modulation microscopy for sample surface mechanical properties
3.	Multi-technique X-ray Photoelectron Spectroscopy with XPS	● High Energy Resolution and Charge Neutralisation. ● Fast Parallel Imaging ● Multi-point Spectroscopy ● Charge neutralization feature for insulating samples. Quantitative chemical imaging of surface
4.	XRD	● Phase identification of the materials. ● Crystallize Size of the materials. ● Chemical composition of the materials.
5.	Sol3A Class AAA Solar Simulator	● Calibration certificate validating Class AAA performance for all 3 standards: IEC, ASTM and JIS Long-lived, highly reliable instruments designed specifically for • 24/7 production environments ● Non-reflective black finish reduces stray light ● Temperature sensors and interlocks ensure operator safety ● Improved optical design for maximum spatial uniformity ● Improved working distances accommodate larger samples ● Sun light exposure testing and material stability studies for textile, plastics and paints
6.	Raman and MicroPL System	● Raman and Photoluminescence spectroscopy, Resonance Raman, Surface enhanced Raman,

		Raman mapping (material, phase, strain etc), photoluminescence (PL) mapping, IR-PL • Characterization of carbon materials, strain measurements & Raman/PL imaging • Determination of composition and phase, Band gap determination, Material Quality, Impurity levels and defect detection
7.	SEM with EDS	• Ultra high-resolution imaging • Fully integrated EsB detector for compositional information • Low kV BSE imaging at short working distance: WD = 1mm • High efficiency In-lens SE detector for high contrast surface imaging • GEMINI technology with high efficiency In-lens detector for high contrast topographic imaging • Easy operation through Windows XP based SmartSEM control software Local Charge Compensator in ULTRA PLUS for imaging of non-conductive specimen
8.	RCA Cleaning	• RCA chemicals used: DI water, NH4OH, H2O2, HCl, HF c. Piranha chemicals used: H2SO4, H2O2
9.	Oxidation Furnace	• Temperature up to 1150 C – gases H2 and O2 d. Wafer capacity - 25
10.	E-beam Lithography	• Beam energy range : 100 V to 30 kV • Gaussian Beam Laser Interferometer controlled stage with 2nm positioning resolution. • Beam current stability: < 0.5% in 8 hours • Fully automated mix and match operations within selected dies, over entire wafers and masks up to 150 X 150 mm travel range. e. Meteorology: SEM inspection and sample navigation.
11.	Double sided aligner	• Exposure mode: hard, soft and vacuum contact, proximity. • Lamp: 350 W Hg lamps suitable for near UV range • Line width capability (top): upto 0.5µm (bottom): upto 1.5µm

		f. Alignment accuracy (top): 0.2µm (bottom): 1µm
12.	Laser writer	• Applications: o Mask less lithography o Fabrication of masks • Specifications: o Gray scale (or soft) lithography • Scan modes: o Raster o Vector • Data formats: .CIF
13.	E Beam Evaporator	• Hind Hi Vacuum Systems/ HHV 15K • Materials which can be deposited - Cr, Ni, Ti, Al, Pt, Yb etc.,. g. Base vacuum - 1 X 10^_6 m bar
14.	RTP	• Temperature range: RT to 1100°C • Gas mixing capability with mass flow controllers • Vacuum range: Atmosphere approx to 1 mBar • Substrate temperature : RT to 1100°C (max) h. Chamber base vacuum : Atmosphere approx to 1 mBar
15.	ICPRIE	i. Gases allowed - BCl3, Cl2, PN2, SF6, O2 , Ar etc.
16.	Electroluminescence and photoluminescence	• Source - He-Cd Laser j. Substrate Dimension - 1cm and less not more than 2 cm.
17.	Wire bonder	• Aluminium Wire Bonder k. Gold Wire Bonder
18.	Proxima	• Current versus voltage (IV) measurement • Accurate and precise measurement ranges of 0.1 fA - 1 A and 0.5 µV - 200 V – Spot and • sweep measurement • Capacitance Measurement • Pulsed IV/Fast IV/Transient IV measurement l. EasyEXPERT group+ software
19.	CLEWIN	m. CleWin runs on a PC with Windows 10 or higher. It is compatible with other layout software since it

		uses the standard CIF, GDS-II and OASIS file formats. Furthermore, CleWin can read and write the AutoCAD DXF format. High resolution (Encapsulated) PostScript is available as output format. Bitmap files can be easily imported using the bitmap import utility.
20.	K Layout	n. Version 0.27.13 (Release date: 2022-11-30)

Classroom Aids

The aids required to conduct sessions in the classroom are:

1. White Board
2. Marker
3. Projector
4. Laptop
5. PPT Presentation

Annexure: Industry Validations Summary

S. No	Organization Name	Representative Name	Designation	Contact Address	Contact Phone No	E-mail ID	Linked In Profile *(if available)*
1	Applied Materials	Dr. Ashwini Agrawal	Director	Applied Materials	9910555970	Ashwini_Aggarwal@amat.com	
2	Elbrus Labs	Sh. Hemant Vats	Founder	Elbrus Labs	9911836467	vats.hemant@elbruslabs.com	

Annexure: Training Details

Training Projections:

Year	Estimated Training # of Total Candidates	Estimated training # of Women	Estimated training # of People with Disability
1	100	25	NA
2	220	55	NA
3	340	85	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 NOS	List Recommended Tools – for all Selected Components	Offline: Online Ratio
1	☒Theory/ Lectures - Imparting theoretical and conceptual knowledge	Laptop/ Desktop/ White Board	
2	☐Imparting Soft Skills, Life Skills and Employability Skills /Mentorship to Learners	NA	
3	☒Showing Practical Demonstrations to the learners	Standard	
4	☒Imparting Practical Hands-on Skills/ Lab Work/ workshop/ shop floor training	Standard	
5	☒Tutorials/ Assignments/ Drill/ Practice	Standard	
6	☒Proctored Monitoring/ Assessment/ Evaluation/ Examinations	Classroom/ Blended	
7	☐On the Job Training (OJT)/ Project Work Internship/ Candidate Training	NA	

Annexure: Standalone NOS- Performance Criteria details

1. **Description:** Personnel working in the High-End research and development (Academic & Industry)/ Faculty in the Nanoelectronics, Microsystems, smart materials technologies, and related areas is responsible for the fabrication and characterization of the micro/ nano scale devices.

2. **Scope:**

The scope covers the following:

- Basic concepts of nanotechnology
- Various use cases of nanotechnology
- Introduction to the research infrastructure available at the Nano Centers in the form of lab tours and hands-on training
- Various Fabrication modules such as Wet Etch Bay, Furnaces, Introduction to Thin Films, Lithography, Dry Etch, RCA cleaning, Diffusion, PSG etching, Front/ back Metal Deposition, Photoresist stripping, Forming gas annealing
- Understanding of various Characterization tools, such as, Probe Station, FTIR & Zeta PALS, AFM, LDV, XRD, Raman, SEM, XPS, TEM, Solar Simulator, Quantum Efficiency
- Advanced understanding of various processes and equipment nanotechnology/ nanoelectronics

- Advanced understanding of semiconductor technology
- Gaining knowledge on how to submit a good research proposal
- Outcome of a good research proposal can lead to publication in the peer-reviewed journals and filing a patent
- Summarizing a research proposal in a concise form
- Platform to show-case the proposed research work to reviewers and participants
- Technical discussions which will lead to improvise the research problem

3. Elements and Performance Criteria

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

Classroom Lectures:

PC1. Introduction to the research infrastructure
PC2. In-depth information about the equipment and their capabilities
PC3. In-depth information about the labs, equipment and their capabilities
PC5. RCA cleaning
PC5. Research proposal, Feasibility check, Proof of concept/ Innovative idea

Safety:
PC6. Lab safety protocols (Fire, Chemical, Gas and Electrical Safety)

Thin Film Deposition:
PC7. Deposition tools - Oxidation furnace, thermal evaporators, Sputter Systems, Electron Beam Evaporators, Plasma Laser Deposition System, Atomic Layer Deposition Systems, ICPCVD, HWCVD

Lithography:
PC8. Lithography tools - Laser writer, photolithography systems, E-Beam lithography
Etch Process:
PC9. Etch tools - DRIE, STSRIE, Plasma Etcher, Plasma Asher, Forming gas annealing
PC10. Wet Etch Bay

Characterization:
PC11. Electrical Characterization: Probe Station for IV/CV measurements
PC12. Mechanical Characterization: LDV
PC13. Material Characterization: XRD, XPS
PC14. Optical Characterization: FTIR, UV-Vis, Raman, PL, Zeta PALS
PC15. Surface/morphological characterizations - AFM, SEM, FESEM, TEM
PC16. Opto-electronics characterization - Solar Simulator, Quantum Efficiency
PC17. Electro - Magnetic properties: Polytronic Research Electromagnet Model, PPMS, SQUID, Hall measurement system

Packaging:

PC18. Packaging tools - wire bonder, wafer dicer

Implantation:

PC19. Doping tools: PDS, PIII

Hand-on training:

PC20. Processes: Thin Film Deposition, Lithography process, Plasma assisted etching processes, Deep Reactive Ion Etching, Plasma Doping System, X-ray Photoelectron Spectroscopy Analysis, Mask Designing Using Clewin Software, Unique 2D and 3D Zeiss Microscopy Solutions using X-Ray, microscopy, Modeling Microfluidics using COMSOL, Semiconductor Modeling using COMSOL, TCAD

PC21. Devices: MOSCAP devices, Microfuidic devices for healthcare applications, Nanomaterials and devices, Inter-digitated Electrodes for Biosensors, Impedance based biosensor, A MEMS based Explosive Trace Detector

4. Knowledge and Understanding (KU):

The individual on the job needs to know and understand:

KU1. How to fabricate a device in micro nano scale

KU2. How to do the measurement of various characterization tool

KU3. Semiconductor physics

KU4. Details regarding each unit process flow

KU5. Procedure of setting up all process parameters

KU6. Measurements to ensure dimensions are within specification

KU7. Preparation of the full Standard Operating Procedure (SOP)

KU8. Importance of identifying the parameters for the new product verification process

KU9. Run dummy samples/measurements, Calculate Process Capability (CPK), Process Performance (PPK), and other quality parameters

KU10. Process of verifying the real product using various quality and reliability checks

KU 11. The design flow involved in design stages

KU12. End-product application

KU13. How to use CleWin software and KLayout

KU14. Improving the understanding of the possible translation of the chips and prototypes.

KU15. Introduction to the understanding of quantum technologies.

KU16. Improving the understanding of the applications of the basic semiconductor technologies

KU17. Hands on use of the clean room, fabrication, characterization, and testing facilities.

KU18. Understanding concepts, writing, and building a good patent document.

KU19. Understanding concepts, writing, and building a good research proposal.

5. Generic Skills (GS):

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

GS1. maintain work-related notes and records

GS2. read the relevant literature to get the latest updates about the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. take quick decisions to deal with work emergencies or accidents

GS6. identify possible disruptions to work and take appropriate preventive measures

GS7. evaluate all possible solutions to a problem to select the best one

Annexure: Assessment Criteria

Detailed PC-wise assessment criteria and assessment marks for the NOS are as follows:

S. No.	Assessment Criteria for Performance Criteria	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Classroom Lectures	**4**	**17**		
PC1	Introduction to the research infrastructure	1	3	-	-
PC2	In-depth information about the equipment and their capabilities	1	3	-	-
PC3	In-depth information about the labs, equipment and their capabilities.	1	3	-	-
PC4	RCA cleaning	1	4	-	-
PC5	Research proposal, Feasibility check, Proof of concept/ Innovative idea	0	4	-	-
	Safety	**1**	**3**	-	-
PC6	Lab safety protocols (Fire, Chemical, Gas and Electrical Safety)	1	3	-	-
	Thin Film Deposition	**1**	**4**	-	-
PC7	Deposition tools - Oxidation furnace, thermal evaporators, Sputter Systems, Electron Beam Evaporators, Plasma Laser Deposition System, Atomic Layer Deposition Systems, ICPCVD, HWCVD	1	4	-	-
	Lithography	**1**	**4**	-	-
PC8	Lithography tools - Laser writer, photolithography systems, E-Beam lithography	1	4	-	-
	Etch Process	**2**	**8**	-	-
PC9	Etch tools - DRIE, STSRIE, Plasma Etcher, Plasma Asher, Forming gas annealing	1	4	-	-
PC10	Wet Etch Bay	1	4	-	-
	Characterization	**7**	**28**	-	-
PC11	Electrical Characterization: Probe Station for IV/CV measurements	1	4	-	-
PC12	Mechanical Characterization: LDV	1	4		
PC13	Material Characterization: XRD, XPS	1	4	-	-
PC14	Optical Characterization: FTIR, UV-Vis, Raman, PL, Zeta PALS	1	4	-	-

PC15	Surface/morphological characterizations - AFM, SEM, FESEM, TEM	1	4		
PC16	Opto-electronics characterization - Solar Simulator, Quantum Efficiency	1	4	-	-
PC17	Electro - Magnetic properties: Polytronic Research Electromagnet Model, PPMS, SQUID, Hall measurement system	1	4	-	-
	Packaging	**1**	**4**	-	-
PC18	Packaging tools - wire bonder, wafer dicer	1	4		
	Implantation	**1**	**4**	-	-
PC19	Doping tools: PDS, PIII	1	4	-	-
	Hands – on Training	**2**	**8**	-	-
PC20	Processes: Thin Film Deposition, Lithography process, Plasma assisted etching processes, Deep Reactive Ion Etching, Plasma Doping System, X-ray Photoelectron Spectroscopy Analysis, Mask Designing Using Clewin Software, Unique 2D and 3D Zeiss Microscopy Solutions using X-Ray, microscopy, Modeling Microfluidics using COMSOL, Semiconductor Modeling using COMSOL, TCAD	1	4	-	-
PC21	Devices: MOSCAP devices, Microfuidic devices for healthcare applications, Nanomaterials and devices, Inter-digitated Electrodes for Biosensors, Impedance based biosensor, A MEMS based Explosive Trace Detector	1	4		
Total Marks		**20**	**80**		

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 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:

- Check the Assessment location, date and time
- 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.

3. Assessment Quality Assurance levels/Framework:

- Question bank is created by the Subject Matter Experts (SME) are verified by the other SME
- Questions are mapped to the specified assessment criteria
- Assessor must be ToA certified & trainer must be ToT Certified

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

5. Method of verification or validation:

- Surprise visit to the assessment location

6. Method for assessment documentation, archiving, and access

- Hard copies of the documents are stored

Annexure: 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.