NSDA Reference
To be added by NSDA

QUALIFICATION FILE: 3 D Scanning and CNC Routing Engineer

Name and address of submitting body:

National Institute Of Electronics and Information Technology (NIELIT),

1st Floor, ISTE Complex, 25, Gandhi Mandapam Road, Opposite to Anna Centenary library, Chennai – 600 025.

Ministry of Electronics and Information Technology (MeitY)

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Name and contact details of individual dealing with the submission

Name:	Mr.Ripunjay Singh
Position in the organisation	Scientist/ Engineer 'C'
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List of documents submitted in support of the Qualifications File

1. Detailed Curriculum(Annexure I)
2. Industry Validation (Attached at Annexure II)

QUALIFICATION FILE SUMMARY

Qualification Title	3 D Scanning and CNC Routing Engineer (Level 5)
Qualification Code	**NL/M/L5/C025** **NIELIT/EM/L5/009**
Body/bodies which will assess candidates	**Examination Cell,** National Institute of Electronics and Information Technology 6-CGO Complex, Electronics Niketan Lodhi Road, New Delhi. 110003.
Body/bodies which will award the certificate for the qualification.	National Institute of Electronics and Information Technology 6-CGO Complex, Electronics Niketan Lodhi Road, New Delhi. 110003.
Body which will accredit providers to offer the qualification.	National Institute of Electronics and Information Technology 6-CGO Complex, Electronics Niketan Lodhi Road, New Delhi. 110003.
Occupation(s) to which the qualification gives access	3 D Scanning and CNC Routing Engineer
Proposed level of the qualification in the NSQF.	Level 5
Notional Learning Hours	400 Hours
Entry requirements / recommendations.	Diploma holder or B.Sc. Graduate and not less than 18 years of age.
Progression from the qualification.	**Professional Progression** 3D Scanner Engineer , CNC Engineer ⬇ Senior 3D Scanner Engineer , CNC Engineer ⬇ Manager (3D Scanner / CNC Engineer) **Academic Progression:** Advance Diploma –3 D Scanning and CNC Routing Engineer (NL/M/L5/C025) ↓ ↓ Post Diploma in Electronic Product Design (Level 6) Certificate Course on 3-D printing (L 6)
Planned arrangements for RPL.	It will be incorporated once RPL strategy is finalized.

Formal structure of the qualification

Module Code	Module Name	Mandatory/ Optional	Estimated Size (Learning Hours)	Level
ESDM 101	Introduction to 3 D Scanning	Mandatory	25	5
ESDM 102	Factors in 3 D Scanning		60	
ESDM 103	Applications in 3 D Scanning		100	
ESDM 104	Operation of 3 D Scanners		100	
ESDM 105	CNC Routing		80	
ESDM 106	Case Studies		30	
ESDM 107	Interpersonal and Communication Skills/Reporting		5	

SECTION 1
ASSESSMENT

Name of assessment body:
National Institute of Electronics and Information Technology
6-CGO Complex, Electronics Niketan
Lodhi Road, New Delhi. 110003.

Will the assessment body be responsible for RPL assessment?

Presently only candidates undergoing training shall be assessed. Later on candidates having Experience and knowledge shall be assessed. The information will be provided on finalization of such procedure.

Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, consistent and fair and show that these are in line with the requirements of the NSQF:

Assessment is done by Examination Cell, NIELIT, Chennai.
The emphasis is on practical demonstration of skills & knowledge based on the performance criteria. Each OUTCOME is assessed & marked separately. Student is

required to pass in all OUTCOMEs individually and marks are allotted. Following assessment methodologies are used

A. Written Assessment (Multiple Choice Questions)
B. Practical Assessment (The Practical examination will be based on the modules of Advanced Diploma –3 D Scanning and CNC Routing Engineer course.)
C. Project (The Project is carried out by the student under guidance and support of faculty and management of the respective Institute / Organization)

The assessment results are backed by following evidences.

1. The assessor collects a copy of the attendance for the training done under the scheme. The attendance sheets are signed and stamped by the Examination Superintendent/ Head of Institution.
2. The assessor verifies the authenticity of the candidate by checking the photo ID card/Hall Ticket issued by the institute as well as any one Photo ID card issued by the Central/Government. The same is mentioned in the attendance sheet.
3. The Registration/Examination Division assigns roll number.
4. The assessor takes photograph of all the students along with the assessor standing in the middle and with the centre name/banner at the back as evidence.

ASSESSMENT EVIDENCE

Job Role: 3 D Scanning and CNC Routing Engineer

(Detailed Curriculum attached As Annexure-I)

Assessable Outcomes	Assessment criteria for the outcome	Total Mark	Written	Practical	Internal/ Viva-voce
1. Will be able to operate 3D Scanner & CNC.	• Use/Operate 3D scanner & CNC. • 3D scanning of objects, categories, positioning	20	8	10	2
2. Will be able to scan objects & measurement	• Measurement of Arms, process and	60	24	30	6

of various parameters.	calculation. • Functions of Tracked 3D Scanners, structured light 3 D scanners, portable 3 D scanners • Find Factors Affecting 3D Scanning, Atmospheric Conditions, and Reflectance.				
3. Will be able to use 3D scanner for various application like in Aerospace, Automobiles, medical etc.	• Application of 3 D scanning in Aerospace, Automotive • Application of 3D scanning in Cultural Preservation, Consumer Products, Manufacturing and Medical etc. • Interpret the related Case studies.	100	40	50	10
4. Will be able to test effectiveness of 3D scanning & post processing of 3D Scan file.	• Testing, Operation and Working of a 3D Scanner, Major Components in a 3D Scanner • Test the Effectiveness of 3D Scanning • Post-Processing of a 3D Scan File, Meshing,	100	40	50	10

	Stitching • Remove Unnecessary Scan Data, Ensuring Water-tight model, STL Creation				
5. Create design, routing & fabricating the final product.	• Create a design for CNC. • Tool path generation and Conversion to GCode, • Preview design file, Fabricating the final product	80	32	40	8
6. Testing after integration and outcome of various Case Studies in the area of 3D scanning and CNC Technology.	• Test on Design visualization, 3D Gear assembly, Life style goods • Test on Assembly integration, End of arm tools/Exo-Skeleton/Robotic arm • Test on Geneva Mechanism, UAV and others. • Case studies	30	12	15	3
7. Communicate clearly and preparation of job report & report writing.	• Interaction with clients, colleagues. • Speech ability • Technical report Writing and preparation of job report. • Use of	10	4	5	1

	appropriate terminology related to work.				
	Total	400	160	200	40

Means of assessment 1
Proctored online assessments (LAN and Web based), carried out using a variety of question formats applicable for linear / adaptive methodologies; performance criteria being assessed via tests, simulations, and multiple choice questions etc.

Pass Percentage

To qualify for a pass in a module, a candidate must have obtained at least 40% in theory and practical examination. And overall marks for all test should be 50% or above to pass the Examination.

SECTION 2

EVIDENCE OF NEED

What evidence is there that the qualification is needed?
Major 3D Printing / 3D Scanning Cos. in India

Some of the major 3D Printing cos. present in India are listed below:

- Stratasys (USA) – Bangalore
- Objet (Israel) – Bangalore
- EOS (Germany) – Chennai
- Solidscape (USA) – Mumbai
- Melting Mints – Mumbai
- Build Protos – Hyderabad
- Profectus – Hyderabad
- Small Sensations – Ahmedabad
- Nutz&Boltz – New Delhi
- Global 3D – Bangalore
- Fracktal Works – Bangalore
- Design & Prototyping Centre – Hyderabad
- Steinbichler (Germany) – Bangalore
- Faro (USA) – Hyderabad
- Hexagon (USA) – Hyderabad
- Creator Bot – Bangalore
- Fabonix – Bhubaneshwar
- Printzworldwide – Calcutta

- Novabeans – New Delhi

Please note that there are several other small and medium size 3D printing / 3 D Scanning CNC Routingcos. across the country. Only the major names have been showcased here.

Job Description

Persons trained in the digital fabrication (3D Printing, 3D Scanning and CNC) program will have the following new skills which are directly relevant to industry.

- 3D Modeling
- Slicing & Orientation
- Post Processing of 3D Printed models
- 3D Printer machine maintenance
- Design for 3D Printing
- 3D Scan processing
- Estimation and scheduling

Industry Acceptability

The following target segments are addressable immediately over the upcoming years:

No. of SMEs in India, 2012 – 3.2 crore

No. of SMEs in India, 2013 – 4.8 crore

Investment in SMEs in India, 2013 – Rs. 978 crore

Contribution by SMEs to India's GDP, 2013 – Rs. 2000 crore

SMEs in Manufacturing

3 D Scanning CNC Routing is a manufacturing technology that is much faster than all conventional manufacturing technologies. As a result, the immediate market with significant value are the ***manufacturing SMEs*** *as they require 3D Printing and Digital Fabrication technologies to make what they need. Additionally, the* ***Make in India*** *mission has many advantages for manufacturing companies.*

No. of SMEs in Manufacturing in 2013 – 10 lakh (17%)

Estimated no. manufacturing SMEs using 3D Printing by 2018 – 6 lakh

That is a direct job requirement for 6 lakh people.

Other Markets where 3 D Scanning CNC Routing is being adopted

1. Custom gifting/Small Scale Entrepreneurs
2. Medical Devices and Implants

3. Architectural Sector/Civil Construction
4. Education
5. Jewelry
6. Large Scale PSUs/ Research & Development Govt. Labs
7. Consumer/Hobbyist

Justification of Course in ESDM Sector

As shown above, the figure of 6 lakh jobs in this field are encouraging. The manufacturing SMEs are already adopting 3 D Scanning CNC Routing. It would be prudent to begin skilling and enable entrepreneurs and skilled labour in 3 D Scanning CNC Routing in India.

What is the estimated uptake of this qualification and what is the basis of this estimate?

30 students / Batch - 3 Batches / Year tentatively. Hardware and Software availability in NIELIT Chennai/ Accredited Centre.

What steps were taken to ensure that the qualification(s) does/do not duplicate already existing or planned qualifications in the NSQF?

As the understanding and adoption models of Qualification Packs (QPs) evolve in the industry and across its sub-sectors, we foresee consolidation of qualification packs as a natural progression. The Qualification does not exist as per information available in public domain.

What arrangements are in place to monitor and review the qualification(s)? What data will be used and at what point will the qualification(s) be revised or updated?

The Qualification is to be monitored and reviewed every two years.
The following data will be used

1. Results of assessments
2. Employer feedback will be sought post-placement
3. Student feedbacks
4. Workshops and seminar for reviewing the qualifications
5. Industry Requirements
6. Consultation/ Tie-up with Industries or Expert for review of the Curriculum.

SECTION 3
SUMMARY EVIDENCE OF LEVEL

Level of qualification: 5

Summary of Direct Evidence:

Generic NOS is/are linked to the overall authority attached to the job role.

NSQF Domain	Outcomes of the Qualification/Component	How the job role relates to the NSQF Level Descriptors	NSQF Level
Process required	The job holder must be able to Operate 3 D Scanner and CNC, Do post processing of 3D files, Maintain 3 D Scanner and CNC	Job that requires well developed skill, with clear choice of procedures in familiar context.	5
Professional knowledge	An individual on the job needs to know and understand: Principles of 3 D Scanning, Principles of CNC routing, To be able to understand design constraints specific to the company, Scanning tools and Working of CNC	Knowledge of facts, principles, processes and general concepts, in a field of work or study.	5
Professional skill	An individual on the job needs to know and understand: Explain current and emerging 3D Scanning requirement of various Industries, Describe the advantages and limitations of each 3D Scanning technology, Understand CNC routing, Identify opportunities to apply 3D Scanning technology for time and cost savings	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	5
Core skill	An individual on the job should have following: Providing support for production and design team in the Company.	Desired mathematical skill; understanding of social, political; and some skill of	5

	Able to give support and advice whenever necessary to all stakeholders involved. Over the whole product development life cycle, intervene with 3D Scanning and CNC routing technologies to optimize the process, reduce production cost, and ease the prototyping activities	collecting and organizing information, communication.	
Responsibility	The job holder who can efficiently operate 3D Scanner and handle CNC routing	Responsibility for own work and learning and some responsibility to other's works and learning.	5

SECTION 4

EVIDENCE OF RECOGNITION OR PROGRESSION

What steps have been taken in the design of this or other qualifications to ensure that there is a clear path to other qualifications in this sector?

This qualification comprises of much relevant topics in all aspects of the industrial requirement. Hence an incumbent can possibly get higher job roles like 3D Scanner Engineer, CNC EngineerSenior 3D Scanner Engineer, CNC EngineerManager (3D Scanner / CNC Engineer). And ensure that the design of the course will timely be modified as per the industrial demands. Incumbent can go for higher level relevant course.

SECTION 5

EVIDENCE OF INTERNATIONAL COMPARABILITY

***** NIL*****