

NSQF QUALIFICATION FILE**Approved in 20th NSQC Meeting – NCVET-Dated 30 June 2022****CONTACT DETAILS OF THE BODY SUBMITTING THE QUALIFICATION FILE****Karnataka Skill Development Corporation****Name and address of submitting body:****3rd Floor, Koushalya Bhavan, Dairy Circle, Bengaluru, Karnataka 560029****Name and contact details of individual dealing with the submission****Name: Shri Ashwin Danappa Gowda****Position in the organisation: Managing Director****Address if different from above: Same as Above****Tel number(s): 080 -29555084/85, 080 -29522222****E-mail address: md.ksdc@karnataka.gov.in****List of documents submitted in support of the Qualifications File**

- 1. Curriculum**
- 2. Industry validation form**

Model Curriculum to be added which will include the following:

- Indicative list of tools/equipment to conduct the training**
- Trainers qualification**
- Lesson Plan**
- Distribution of training duration into theory/practical/OJT component**

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SUMMARY

| | | |
|---|---|--|
| 1 | Qualification Title | Additive Manufacturing Process Jr. Technician Using Extended Learning Technique |
| 2 | Qualification Code, if any | TBD |
| 3 | NCO code and occupation | 2144.0200 - Designer Machine. 2144.0701 -Prototyping Engineer 2144.0803 - Product Design Engineer 2144.0802 –Modeler 2144.0804 - Prototyping Manager 3115.0301- Executive, Proto Manufacturing 2144.0701 - Prototyping Engineer |
| 4 | Nature and purpose of the qualification (Please specify whether qualification is short term or long term) | <p>This course is designed to provide strong understanding and hands on experience on Additive Manufacturing using latest software & Hardware.</p> <p>The course builds skills in editing of 3d printing model by using 3D modelling software, slicing of model using software, 3D printing of parts with and without support for various industrial applications, post processing of parts and routine maintenance of 3D printer.</p> <p>Application based projects and case studies.</p> <p>This is a short term course.</p> |
| 5 | Body/bodies which will award the qualification | Karnataka Skill Development Corporation |
| 6 | Body which will accredit providers to offer courses leading to the qualification | Karnataka Skill Development Corporation |
| 7 | Whether accreditation/affiliation norms are already in place or not, if applicable (if yes, attach a copy) | No |
| 8 | Occupation(s) to which the qualification gives access | Additive Manufacturing / 3D Printing Operator. |

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| | | | |
|----|--|---|--------------|
| 9 | Job description of the occupation | Additive Manufacturing Process Technician / 3D Printing Operator assists in editing the CAD model to suit the additive manufacturing process. The operator also works with setting up of the machine with proper print parameters to enable the printing process. The person is also responsible for maintaining the equipment and common trouble shooting of the machine | |
| 10 | Licensing requirements | Not Applicable | |
| 11 | Statutory and Regulatory requirement of the relevant sector (documentary evidence to be provided) | Not Applicable | |
| 12 | Level of the qualification in the NSQF | Level 3 | |
| 13 | Anticipated volume of training/learning required to complete the qualification | 270 Hours | |
| 14 | Indicative list of training tools required to deliver this qualification | The list is mentioned in the curriculum attached. | |
| 15 | Entry requirements and/or recommendations and minimum age | 8th Class Pass + ITI (2-Years) (No Experience required) Minimum Age: 15 Years | |
| 16 | Progression from the qualification (Please show Professional and academic progression) | An individual can proceed for from Product Development Technician to Junior Product Development Supervisor to Senior Supervisor. | |
| 17 | International comparability where known (research evidence to be provided) | NA | |
| 18 | Date of planned review of the qualification | 3 years after approval of the Qualification | |
| 19 | Formal structure of the qualification | | |
| | Mandatory components | | |
| | Title of component and identification code/NOSs/Learning outcomes | Estimated size (Learning hours) | Level |

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| | | | |
|--------|--|--|--------------|
| (i) | Comply with workshop health and safety guidelines | 5 | 3 |
| (ii) | Understand need of Additive Manufacturing & Identify process of additive Manufacturing | 15 | 3 |
| (iii) | Select Material & Process for additive Manufacturing. | 20 | 3 |
| (iv) | Ability to build Additive Manufacturing prototypes | 20 | 3 |
| (v) | Understand the concept of Additive manufacturing simulation tool. | 30 | 3 |
| (vi) | Ability to handle 3D printer and advance tools | 30 | 3 |
| (vii) | Assignments to increase the absorbability of the subject | 60 | 3 |
| (viii) | Mini Project to validate the learning outcomes. | 90 | 3 |
| | Sub Total (A) | 270 | 3 |
| | Optional Components | | |
| | Title of component and identification code/NOSs/Learning outcomes | Estimated size (Learning hours) | Level |
| | | | |
| | | | |
| | Sub Total (B) | | |
| | <u>Total (A+B)</u> | 270 | 3 |

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SECTION 1

ASSESSMENT

| | |
|----|---|
| 20 | Body/Bodies which will carry out assessment: Capital Goods Skill Sector Council |
| 21 | How will RPL assessment be managed and who will carry it out? RPL Assessments are carried out according to the norms provided by the Capital Goods Skill Sector Council and managed by KSDC. |
| 22 | Describe the overall assessment strategy and specific arrangements which have been put in place to ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF. Will follow the Assessment criteria set by Capital Goods Skill Sector Council and will ensure that assessment is always valid, reliable and fair and show that these are in line with the requirements of the NSQF. |

Please attach most relevant and recent documents giving further information about assessment and/or RPL.

Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

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ASSESSMENT EVIDENCE

Complete a grid for each component as listed in “Formal structure of the qualification” in the Summary.

NOTE: this grid can be replaced by any part of the qualification documentation which shows the same information – i.e., Learning Outcomes to be assessed, assessment criteria and the means of assessment.

23. Assessment evidences

Title of Component: Additive Manufacturing Process Jr. Technician Using
Extended Learning Technique

| Outcomes to be assessed/NOSs to be assessed | Assessment criteria for the outcome |
|---|--|
| Comply with workshop health and safety guidelines | <ul style="list-style-type: none">• Comply with safety, health, security and environment related regulations/ guidelines as per organizational/ manufacturer’s policy.• Carry out maintenance operations as per the manufacturer and workshop related health and safety guidelines/ standard operating procedures.• Follow safety regulations and procedures with regard to service workshop hazards and risks.• Use appropriate protective clothing/ equipment for specific tasks and work conditions as per service manual.• Record and report details related to operations, incidents or accidents, as applicable. |
| The need of Additive Manufacturing & Identify process of additive Manufacturing | <ul style="list-style-type: none">• Ability to differentiate between additive vs subtractive manufacturing.• Identify the materials used for Additive manufacturing and Business Scenario• List the advantages, limitations and application of additive manufacturing and working principle of additive manufacturing. |
| Select Material & Process for additive Manufacturing. | <ul style="list-style-type: none">• Ability to select the different materials and different types of additive manufacturing methods based on the need.• Understand the various methods such as Powder bed fusion, Vat Photo-polymerization and Directed Energy Deposition and Binder |

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| | jetting and material extrusion, Sheet lamination process, working principle and industrial application. | | | | | | | | | | | | | | | | | | |
|--|---|----------------------|-------------|----------------------|-----|------------------------------------|----|-----|--------------------|----|-----|----------------------|----|-----|---------------------------------------|----|-------|--|-----|
| Ability to build Additive Manufacturing prototypes | <ul style="list-style-type: none">• Understanding the relevance of computer aided design software.• Ability to assist in editing and modifying existing 3D model design by using computer aided software.• Perform the tool orientation for computer aided design software's for creating 3D modelling. | | | | | | | | | | | | | | | | | | |
| Understand the concept of Additive manufacturing simulation tool. | <ul style="list-style-type: none">• Ability to assist to understand the slicing software and its basics settings and multi product printing• Assist to optimize the manufacturing time and material uses in slicing software.• Assist to convert the file format STL, OBJ, AMF etc. to G code.• Follow the user manual to troubleshooting and maintenance. | | | | | | | | | | | | | | | | | | |
| Means of assessment 1 | The assessment comprises of <ul style="list-style-type: none">• Theory Examination MCQ, VIVA Voce• Practical assessment Role plays, Demonstration | | | | | | | | | | | | | | | | | | |
| Means of assessment 2 | The marks allotted for the assessments are as below. In total of 100 marks are allotted for the Assessments. | | | | | | | | | | | | | | | | | | |
| <table border="1"><thead><tr><th>SL. No.</th><th>Description</th><th>Marks allotted (100)</th></tr></thead><tbody><tr><td>(a)</td><td>On course assessment (Assignments)</td><td>15</td></tr><tr><td>(b)</td><td>Theory Examination</td><td>20</td></tr><tr><td>(c)</td><td>Practical Assessment</td><td>40</td></tr><tr><td>(d)</td><td>Project work, Presentation, Viva Voce</td><td>25</td></tr><tr><td colspan="2">Total</td><td>100</td></tr></tbody></table> | | SL. No. | Description | Marks allotted (100) | (a) | On course assessment (Assignments) | 15 | (b) | Theory Examination | 20 | (c) | Practical Assessment | 40 | (d) | Project work, Presentation, Viva Voce | 25 | Total | | 100 |
| SL. No. | Description | Marks allotted (100) | | | | | | | | | | | | | | | | | |
| (a) | On course assessment (Assignments) | 15 | | | | | | | | | | | | | | | | | |
| (b) | Theory Examination | 20 | | | | | | | | | | | | | | | | | |
| (c) | Practical Assessment | 40 | | | | | | | | | | | | | | | | | |
| (d) | Project work, Presentation, Viva Voce | 25 | | | | | | | | | | | | | | | | | |
| Total | | 100 | | | | | | | | | | | | | | | | | |
| Pass/Fail | Minimum passing marks for Theory and Practical is 60% provided the candidate is able secure the minimum of attendance 80%. | | | | | | | | | | | | | | | | | | |

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SECTION 2

24. EVIDENCE OF LEVEL

OPTION A

| Title/Name of qualification/component: Additive Manufacturing Process Jr.Technician Using Extended Learning Technique | | | Level: 3 |
|---|--|---|------------|
| NSQF Domain | Outcomes of the Qualification / Component | How the outcomes relate to the NSQF level descriptors | NSQF Level |
| Process | <ul style="list-style-type: none"> Additive Manufacturing operator is expected to assist to find out the customer needs, design & develop the product. Operate the additive manufacturing machine and perform minor repair. Maintain the work area, tools and instruments and ensure good working condition of required tools. | The operator is expected to work under supervision, where the range of activities is limited from editing the CAD data to input to the printer to set the machine parameters to facilitate the printing to carry out mundane tasks such as day to day maintenance to common trouble shooting. | 3 |
| Professional knowledge | <ul style="list-style-type: none"> Additive Manufacturing operator is expected to have basic knowledge of the processes, identifying customer needs, Design the product using computer aided software. Basic Knowledge of Material, machining process, Machining tools, measuring instruments, techniques and methods is expected to ensure the product quality. Generic knowledge of Common Engineering standards, symbols, GD & T to read the Industrial drawing Considering the basic professional knowledge, which Additive | The operator is expected to understand the basics of the additive manufacturing process, decide the type of the process for the particular design. He is expected to give the recommendation on the material selection. He is also expected to read the engineering drawing with proper GD & T. | 3 |

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| | Manufacturing operator to assist in new creation & upgradation in existing product | | |
| Professional skill | <ul style="list-style-type: none"> ● Additive Manufacturing operator to assist in new creation & upgradation in existing product. as per the customer requirements & engineering standards. ● Operates the 3D Printer machine, working on 3D printing slicing software. ● Thus able to design and develop the product to for new creation or to upgrade the existing product. | The jobholder is expected to perform the repetitive tasks such as operation, maintenance and typical trouble shooting of the machine with ease. He is also expected to work on software to edit the existing design, apart from creating the design on his /her own. | 3 |
| Core skill | <ul style="list-style-type: none"> ● Additive Manufacturing operator is expected to create the computer aided design model, assembly of product. ● Create the industry ready drafting drawing, convert the model for 3D printer, Optimize the Additive manufacturing model using slicing software, operate 3D printer machine, Performing the post operation for 3D printed product & ensure the product quality with the help of measuring instruments. ● If any support is needed, the operator needs to follow superior's instructions. ● Expected to be good in communication skills. ● Jobholder is expected to conduct themselves in ways, which show a basic understanding of the social and | The jobholder is expected to understand the customer requirements and translate them into engineering specifications. He is expected to present the design, ideas in a proper communication format. He should possess the additional required skills such as engineering calculations etc. to aid the creation and modification of the design. He is also expected understand the professional environment and work harmoniously in sync with the surroundings. | 3 |

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| | professional environment of working at workshops and on field visits | | |
| Responsibility | <p>The jobholder is responsible to:</p> <ul style="list-style-type: none"> ● Assist to identify the customer needs. ● Assist to create the 3D model & assemble the product using computer aided design software. ● Assist to create the drafting drawing, maintain the engineering drawing & relevant documents ● Assist to optimize the design for additive manufacturing using slicing software. ● Assist to make set up and operate 3D printer. ● Maintain tools and work area <p>He has the limited Responsibility for own work and majorly function in close supervision. In his routine activity he is responsible for his own work.</p> | <p>The jobholder is expected work in a close supervision of the senior professional. He is expected to consult the senior for critical decisions such as verifying the process parameters on the machine, creating 3D printable design in the software etc. The operator is also expected to display the decisiveness with in the limited range of operation.</p> | 3 |

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SECTION 3

EVIDENCE OF NEED

| | | |
|----|--|--|
| 25 | What evidence is there that the qualification is needed? What is the estimated uptake of this qualification and what is the basis of this estimate? | |
| | Basis | In case of other Awarding Bodies (Institutes under Central Ministries and states departments) |
| | Need of the qualification | <p>One of the key technology emerging as the enabler of the of Industry 4.0 is additive manufacturing process. With the process being matured, this process is poised to become the default manufacturing process in industry 4.0 framework.</p> <p>The global additive manufacturing market size was valued at USD 13.84 billion in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 20.8% from 2022 to 2030. A total of 2.2 million units of 3D printers were shipped globally in 2021 and the unit shipments are expected to reach 21.5 million units by 2030</p> <p>This sector is set for a rapid exponential growth in the coming days. The sector requires highly skilled man power and the qualification meets the requirements of this emerging sector.</p> <p>Hence the qualification has been designed keeping in view to cater to the ever-increasing demand of skilled manpower in consultation with all the stakeholders.</p> |
| | Industry Relevance | <p>The job role for the intended qualification is defined as per the National Classification of Occupations 2015, which emphasizes that candidates can be employed in various domains in industry. The course is designed such that, it will bring industry ready labour, and the demand for such labours are increasing rapidly. The candidates will have acquired adequate knowledge to suit the requirement of the industry. Hence, this justifies the qualification is very much relevant for industry.</p> |
| | Usage of the qualification | <p>The qualification is intended to make the learner a good asset to the industry. The candidate will be skilled to such a level that the operator can work in the industry with a very minimum supervision and he / she is qualified such that the tasks can be taken in number of domains. Some of the areas the trained candidates can be</p> |

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|----|--|---|
| | | accommodated is, Automotive, aerospace & defence, prosthetics, agricultural equipment manufacturing, locomotive etc., in various positions. |
| 26 | Recommendation from the concerned Line Ministry of the Government/Regulatory Body. To be supported by documentary evidences Directorate General of Training | |
| 27 | What steps were taken to ensure that the qualification(s) does (do) not duplicate already existing or planned qualifications in the NSQF? Give justification for presenting a duplicate qualification The AA will ensure the qualifications does not duplicate already existing or planned qualifications in the NSQF. | |
| 28 | 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? Specify the review process here AA will have a robust monitoring mechanism to ensure a standard quality & reliable along with the periodic evaluation system | |

Please attach most relevant and recent documents giving further information about any of the topics above.

Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.

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SECTION 4

EVIDENCE OF PROGRESSION

29 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?
Show the career map here to reflect the clear progression

Inputs:

Before designing this course, we gathered inputs from various sources

- Study of various reports pertaining to latest trends in technologies and manpower requirement
- Current and future skill needs of Industries
- Interactions and meeting with various industry experts
- Feedbacks from Industries

Analysis:

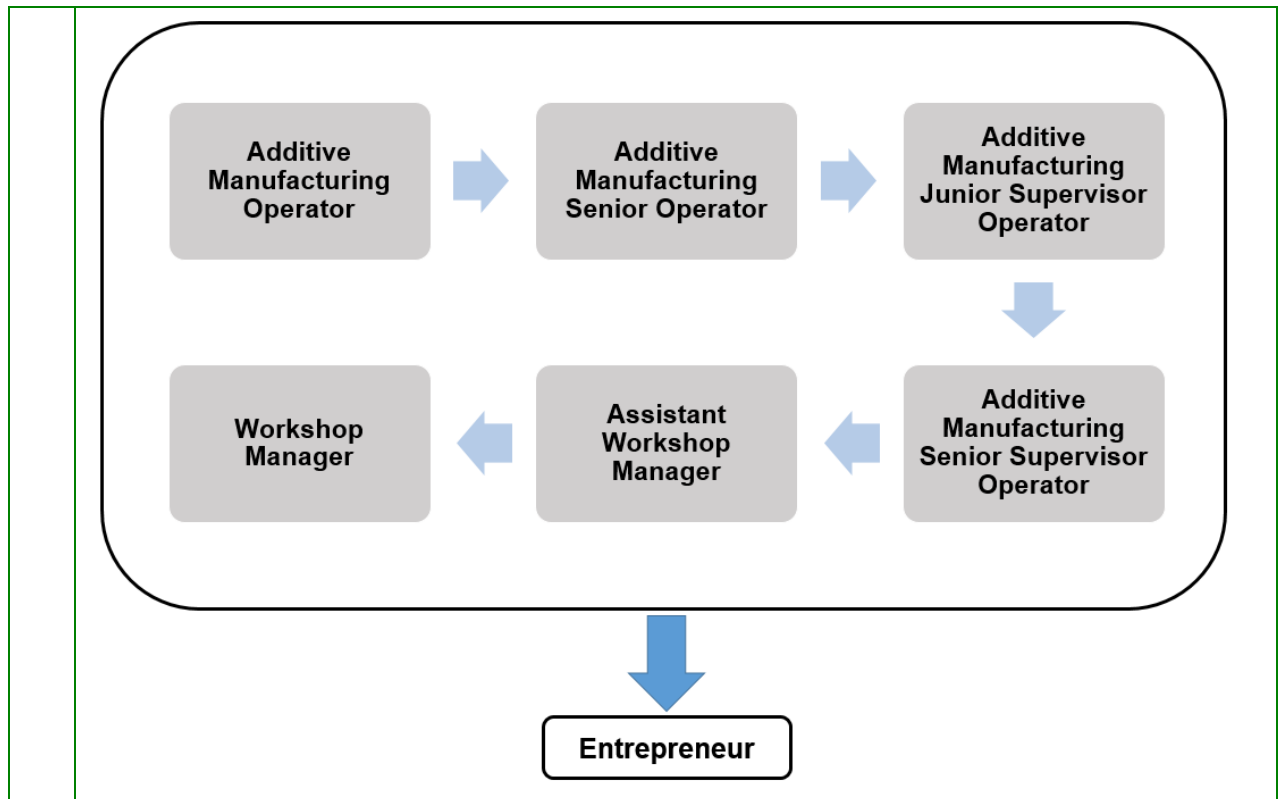
These inputs were analyzed thoroughly by the team of internal experts & need gap was identified.

Outcome:

The topics were selected based on need gap analysis & subsequently syllabus was formulated in prescribed structure. Timings were assigned to various topics to align proposed course with NSQF Level 3.

After successfully completing the course and obtaining requisite certification, the students will become "3D Printer Technician" / "3D Printer Operator" etc. and would find job opportunities in manufacturing roles across manufacturing, agriculture, automotive, defence, etc. industries

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Give the titles and other relevant details of the document(s) here. Include page references showing where to find the relevant information.