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QP Name: 3D Printing Operator

QP Code: MES/Q0511

QP Version: 1.0

NSQF Level: 4

Model Curriculum Version: 1.0

Media & Entertainment Skills Council, 522-524, DLF Tower-A, Jasola, New Delhi - 110025

Table of Contents

Table of Contents

Table of Contents.....	2
Training Parameters.....	3
Program Overview	4
Training Outcomes	4
Compulsory Modules.....	4
<i>Module 1: Analyse 3D technology for printing.....</i>	<i>5</i>
<i>Module 2: Prepare 3D design, digital models and prototypes</i>	<i>6</i>
<i>Module 3: Data preparation and printing.....</i>	<i>7</i>
<i>Module 4: Operate 3D scanning and printing machinery.....</i>	<i>8</i>
<i>Module 5: Conduct servicing and reaping equipment.....</i>	<i>9</i>
<i>Module 6: Maintain Workplace Health and Safety.....</i>	<i>10</i>
Annexure	11
Trainer Requirements	11
Assessor Requirements	12
Assessment strategy:-	13

Training Parameters

Sector	Media and Entertainment
Sub-Sector	
Occupation	Printing
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2141.2400
Minimum Educational Qualification and Experience	Class 12th pass with six months of relevant experience OR Class 10th pass with two year of relevant experience OR ITI (2 years after 8th) with two year of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	
Next Review Date	30/03/2027
NSQC Approval Date	
QP Version	1.0
Model Curriculum Creation Date	
Model Curriculum Valid Up to Date	30/03/2027
Model Curriculum Version	1.0
Minimum Duration of the Course	510 Hours
Maximum Duration of the Course	510 Hours

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.

- Analyse 3D Technology for printing
- Prepare 3D design, digital models and prototypes
- Prepare data and carry out printing
- Operate 3D scanning and printing machinery
- Conduct servicing and repairing of the equipment
- Maintain workplace health and safety

Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
MES/N2528: Analyse 3D Technology for printing	30:00	30:00			60:00
MES/N0533: Prepare 3D design, digital models and prototypes	30:00	30:00			60:00
MES/N0534: Data preparation and printing	30:00	60:00			90:00
MES/N0536: Conduct servicing and repairing equipment	30:00	30:00			60:00
MES/N0535: Operate 3D scanning and printing machinery	30:00	60:00			90:00
MES/N0104: Maintain Workplace Health & Safety	30:00	60:00			90:00
Total	180:00	270:00	60:00		510:00

Module Details

Module 1: Analyze 3D Technology for printing

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Discuss and demonstrate ways to analyze 3D printing technology
- Create a 3D printed object

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to :
<ul style="list-style-type: none"> • Explain the concept of 3D printing or additive manufacturing • Identify 3D software to be used • Explain the process of slicing • Elaborate different stages of Additive manufacturing process • Describe the working of 3D printer • Discuss how to select appropriate CAD formats 	<ul style="list-style-type: none"> • Demonstrate ways to analyze 3D printing technology • Install 3D software to be used • Show how to do slicing of a 3D model • Demonstrate different stages of Additive manufacturing process • Demonstrate the working of 3D printer • Display how to do Programming of Additive manufacturing Parts • Demonstrate use of correct CAD formats to manufacture a 3D printed part
Classroom Aids:	
Laptop, whiteboard, marker, projector	
Tools, Equipment and Other Requirements	
Related tools, equipment and software	

Module 2: Prepare 3D design, digital models and prototypes

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Define various milestones in AM Development
- Demonstrate ways to use 3D printers to create digital models and prototypes

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to :
<ul style="list-style-type: none"> • Enlist various AM technologies • Classify AM processes • Describe new AM classification scheme • Define various milestones in AM Development • Elaborate about various technologies including Computer-Aided Design Technology - Other Associated Technologies, Lasers, Printing Technologies, Programmable Logic Controllers and do on • Describe various AM types including Vat Photopolymerisation, Material Jetting and Binder Jetting • Elaborate about Material Extrusion, Power bed fusion and Sheet Lamination 	<ul style="list-style-type: none"> • Show ways to select Laser Sintering Polyjet, Materials for Additive Manufacturing & 3D Printing • Demonstrate ways to use layers while doing 3D printing • Demonstrate ways to use 3D printers in the design process to create prototypes • Demonstrate the process of applying various AM type • Demonstrate the process of Material Extrusion, Power bed fusion and Sheet Lamination
Classroom Aids:	
Laptop, whiteboard, marker, projector	
Tools, Equipment and Other Requirements	
Related tools, equipment and software	

Module 3: Data preparation and printing

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Carry out the process of printing
- Prepare relevant data required for the process of printing

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to :
<ul style="list-style-type: none"> • Enlist various slicing tools • Elaborate about Finite Element Analysis • Discuss various uses of AM • Describe the processes of Functional Testing, Rapid Tooling • Outline on Manufacturing, Tissue Engineering and Organ Printing • Identify opportunities to apply 3D printing Technology • Identify Entrepreneurial opportunities in 3D Printing 	<ul style="list-style-type: none"> • Demonstrate ways to use various slicing tools • Prepare STLs for 3D Printing • Prepare CAD Models with STL file • Show how to process Simulations Using Finite Element Analysis • Demonstrate the use of AM to Support Medical Applications, Surgical and Diagnostic Aids, Prosthetics Development • Demonstrate ways to ensure that 3D printing has been successfully completed

Classroom Aids:
Laptop, whiteboard, marker, projector
Tools, Equipment and Other Requirements
Relevant tools, equipment and software

Module 4: Operate 3D scanning and printing machinery

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Demonstrate ways to operate 3D scanning
- Develop a prototype/end use product

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to :
<ul style="list-style-type: none"> • Describe the processes of contact and non-contact 3D scanning • Define various instruments used to check the components for functionality and conformance • Elaborate different measurement to be performed to check the components for functionality and conformance • Explain Additive Manufacturing (AM) Technology • Elaborate about emerging trends in Additive Manufacturing 	<ul style="list-style-type: none"> • Demonstrate ways to scan the content • Show how to create and plot assembly and detail views of simple geometrical solid with Dimension, Tolerance & Annotation in 3D Modelling • Perform different measurement with desired accuracy to check the components for functionality and conformance to defined standard using different instruments • Demonstrate the use of various instruments such as Vernier Caliper, Vernier height gauge, Micrometer, depth gauge, Bevel protector, sine bar and dial test indicator • Develop a prototype/ end use product • Create a simple fixture for functional requirement. • Show how to apply process algorithm

Classroom Aids:
Laptop, whiteboard, marker, projector
Tools, Equipment and Other Requirements
Relevant tools, equipment and software

Module 5: Conduct servicing and repairing equipment

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Demonstrate ways to conduct service and repairing of various components of 3D printer and other equipment.

Duration: 30:00	Duration: 30:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to :
<ul style="list-style-type: none"> • Explain the importance of lubricating 3D printer on a daily basis • Discuss why the dust accumulates on 3D printer and why is it necessary to remove it regularly • Describe the relevance of maintaining and replacing bowden tube • Recall the need of cleaning and replacing nozzle often • 	<ul style="list-style-type: none"> • Demonstrate ways to keep 3D printer well lubricated • Show how to dust the printer and its components • Display how to clear any dust and debris from the extruder feeder wheels • Perform a check on nuts and bolts • Demonstrate the process of removing loose bits of 3D printing debris • Demonstrate ways to look for overheated and deformed 3D printed parts • Showcase how to maintain and replace bowden tube • Demonstrate how to tighten up belts on 3D printer • Show how to clean and replace nozzle

Classroom Aids:
Laptop, whiteboard, marker, projector
Tools, Equipment and Other Requirements
Relevant tools, equipment

Module 6: Maintain Workplace Health and Safety

Terminal Outcomes: After the successful completion of this module, the Participant will be able to:

- Discuss the health, safety and security risks prevalent in the workplace and report health and safety issues to the person responsible for health and safety and the resources available.
- Comply with procedures in the event of an emergency
- Discuss the various safety precautions to be taken.

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:	Practical – Key Learning Outcomes After the successful completion of this module, the Participant will be able to:
<ul style="list-style-type: none"> • Recall health, safety and security- related guidelines and identify the risks involved. • Maintain correct posture while working and maintain and use the first aid kit whenever required. • report health and safety risks/ hazards to concerned personnel • Recall people responsible for health and safety and able to contact in case of emergency • Illustrate security signals and other safety and emergency signals • Explain the process to identify and report risk. • Enumerate and recommend opportunities for improving health, safety, and security to the designated person • Describe how to report any hazards outside the individual’s authority to the relevant person in line with organisational procedures and warn other people who may be affected • complying with procedures in the event of an emergency • Explain the impact of the violation of safety procedures. 	<ul style="list-style-type: none"> • Identify the different types of health and safety hazards in a workplace • Practice safe working practices for own job role • Perform evacuation procedures and other arrangements for handling risks • Perform the reporting of hazard • identify and document potential risks like sitting postures while using the computer, eye fatigue and other hazards in the workplace • Demonstrate the use of Personal Protective Equipment (PPE) appropriately.
Classroom Aids:	
Laptop, whiteboard, marker, projector, Health and Safety Signs and policy	
Tools, Equipment and Other Requirements	
Health and Safety Signs and policy	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduation in relevant field		2	Experience in printing required	1	-	-
		OR				
Masters in relevant field		-	-	-	-	-

Trainer Certification	
Domain Certification	Platform Certification
<p>Certified for Job Role: "3D Printing Operator" mapped to QP: "MES/Q0000", version 1.0. Minimum accepted score as per SSC guidelines is 80%.</p>	<p>Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q2601, v1.0 Trainer" with the scoring of a minimum of 80%.</p>

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
Graduation in relevant field		4	Experience in printing required	2	-	-
OR						
Masters in relevant field		2	Experience in printing required	1	-	-

Assessor Certification	
Domain Certification	Platform Certification
<p>Certified for Job Role: “3D Printing Operator” mapped to QP: “MES/Q0000”, version 1.0. Minimum accepted score as per SSC guidelines is 80%.</p>	<p>Recommended that the Assessor is certified for the Job Role: “Assessor”, mapped to the Qualification Pack: “MEP/Q2701, v1.0 Assessor” with the scoring of a minimum 80%.</p>

Assessment Strategy

This section includes the processes involved in identifying, gathering and interpreting information to evaluate the learner on the required competencies of the program.

Assessment system Overview:-

Assessment will be carried out by MESC affiliated assessment partners. Based on the results of assessment, MESC certifies the learners. Candidates have to pass online theoretical assessment which is approved by MESC. The assessment will have both theory and practical components in 30:70 ratio. While theory assessment is summative and an online written exam; practical will involve demonstrations of applications and presentations of procedures and other components. Practical assessment will also be summative in nature.

Testing Environment:-

Training partner has to share the batch start date and end date, number of trainees and the job role. Assessment is fixed for a day after the end date of training. It could be next day or later. Assessment will be conducted at the training venue. Question bank of theory and practical will be prepared by assessment agency and approved by MESC. From this set of questions, assessment agency will prepare the question paper. Theory testing will include multiple choice questions, pictorial question, etc. which will test the trainee on theoretical knowledge of the subject. The theory and practical assessments will be carried out on same day. If there are candidates in large number, more assessors and venue will be organized on same day of the assessment.

Assessment			
Assessment Type	Formative or Summative	Strategies	Examples
Theory	Summative	Written Examination	Knowledge of facts related to the job role and functions. Understanding of principles and concepts related to the job role and functions
Practical	Summative	Structured tasks	Presentation
Viva	Summative	Questioning and Probing	Mock interview on topics

Assessment Quality Assurance framework

Only certified assessor can be assigned for conducting assessment. Provision of 100 % video recording with clear audio to be maintained and the same is to be submitted to MESC. The training partner will intimate the time of arrival of the assessor and time of leaving the venue.

Methods of Validation:-

Unless the trainee is registered, the person cannot undergo assessment. To further ensure that the person registered is the person appearing for assessment, id verification will be carried out. Aadhar card number is required of registering the candidate for training. This will form the basis of further verification during the assessment. Assessor conducts the assessment in accordance with the assessment guidelines and question bank as per the job role. The assessor carries tablet with the loaded questions. This tablet is geotagged and so it is monitored to check their arrival and completion of assessment. Video of the practical session is prepared and submitted to MESC. Random spot checks/audit is conducted by MESC assigned persons to check the quality of assessment. Assessment agency will be responsible to put details in SIP. MESC will also validate the data and result received from the assessment agency.

Method of assessment documentation and access

The assessment agency will upload the result of assessment in the portal. The data will not be accessible for change by the assessment agency after the upload. The assessment data will be validated by MESC assessment team. After upload, only MESC can access this data. MESC approves the results within a week and uploads it.