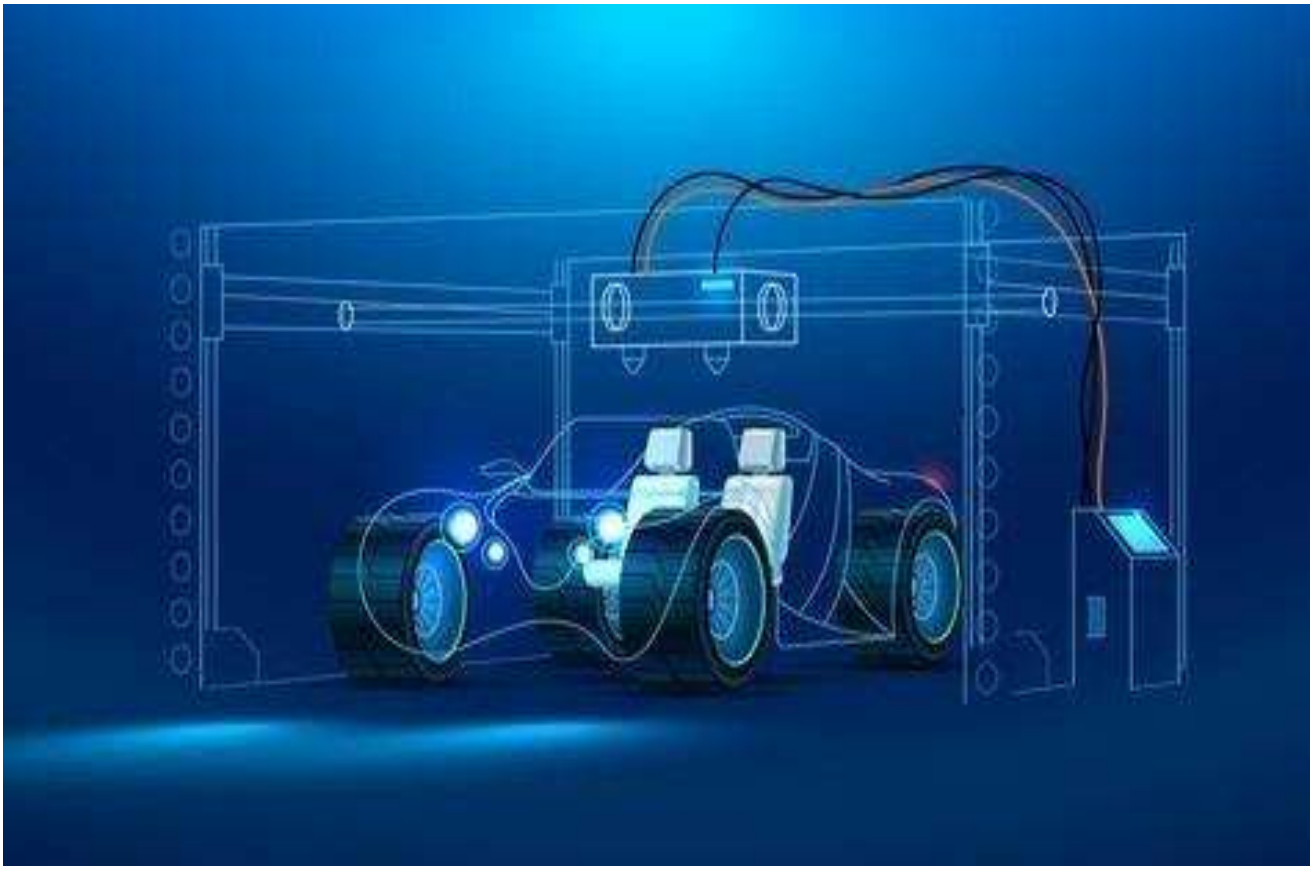

Model Curriculum

QP Name: Automotive Additive Manufacturing Operator

QP Code: ASC/Q6410

QP Version: 4.0

NSQF Level: 3

Model Curriculum Version: 2.0

Automotive Skills Development Council | 153, Gr Floor, Okhla Industrial Area, Phase – III, Leela Building, New Delhi – 110020

Table of Contents

Training Parameters

Sector	Automotive
Sub-Sector	Manufacturing
Occupation	Production Engineering
Country	India
NSQF Level	3
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7412.0101
Minimum Educational Qualification and Experience	5th Class pass with 4 years of relevant experience OR 8th Class Pass with 1 year of relevant experience OR 9th Class pass
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 years
Last Reviewed On	17/11/2022
Next Review Date	17/11/2025
NSQC Approval Date	17/11/2022
QP Version	4.0
Model Curriculum Creation Date	17/11/2022
Model Curriculum Valid Up to Date	17/11/2025
Model Curriculum Version	2.0
Minimum Duration of the Course	390 Hours 00 Minutes
Maximum Duration of the Course	390 Hours 00 Minutes

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.

- Identify product specifications and requirements for 3D printing.
- Use 3D printing machine for the printing of automotive components.
- Work effectively and efficiently as per schedules and timelines.
- Implement safety practices.
- Use resources optimally to ensure less wastage and maximum conservation.
- Communicate effectively and develop interpersonal skills.

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
Bridge Module	**05:00**	**00:00**			**05:00**
Module 1: Introduction to the role of an Automotive Additive Manufacturing Operator	5:00	0:00			5:00
ASC/N9803 – Organize work and resources (Manufacturing) NOS Version No. – 1.0 NSQF Level – 3	**20:00**	**35:00**			**55:00**
Module 2: Organize work and resources according to safety and conservation standards	20:00	35:00			55:00
DGT/VSQ/N0101 - Employability Skills (30 hours) NOS Version No. – 1.0 NSQF Level – 2	**12:00**	**18:00**			**30:00**
Module 3: Introduction to Employability Skills	0.5:00	0.5:00			1:00
Module 4: Constitutional values - Citizenship	0.5:00	0.5:00			1:00
Module 5: Becoming a Professional in the 21st Century	0.5:00	0.5:00			1:00
Module 6: Basic English Skills	1:00	1:00			2:00
Module 7: Communication Skills	1.5:00	2.5:00			4:00

Module 8: Diversity & Inclusion	0.5:00	0.5:00			1:00
Module 9: Financial and Legal Literacy	1.5:00	2.5:00			4:00
Module 10: Essential Digital Skills	1:00	2:00			3:00
Module 11: Entrepreneurship	2.5:00	4.5:00			7:00
Module 12: Customer Service	1.5:00	2.5:00			4:00
Module 13: Getting ready for apprenticeship & Jobs	1:00	1:00			2:00
ASC/N6427 – Operate and maintain 3D printing machine for product generation **NOS Version No. –1.0** **NSQF Level - 3**	**100:00**	**170:00**	**30:00**		**300:00**
Module 14: Operate and maintain 3D printing machine for product generation	100:00	170:00	30:00		300:00
Total Duration	**137:00**	**223:00**	**30:00**		**390:00**

Module Details

Module 1: Introduction to the role of an Automotive Additive Manufacturing Operator

Bridge module

Terminal Outcomes:

- Discuss the role and responsibilities of an Additive/3D Printing Operator.

Duration: *<05:00>*	**Duration**: *<00:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the role and responsibilities of an Additive/3D Printing Operator. • Discuss the job opportunities for an Additive/3D Printing Operator in the automobile industry. • Explain about Indian automobile manufacturing market. • List various automobile Original Equipment Manufacturers (OEMs) and different products/ models manufactured by them. • Discuss manufacturing and automotive product design standards and procedures followed in the company.	
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 2: Organize work and resources according to safety and conservation standards

Mapped to ASC/N9803, v1.0

Terminal Outcomes:

- Employ appropriate ways to maintain safe and secure working environment.
- Perform work as per the quality standards.
- Apply conservation practices at the workplace.

Duration: *<20:00>*	**Duration**: *<35:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the potential workplace related risks and hazards, their causes and preventions. • Identify PPE to be used at workplace. • Identify various warning signs used at the workplace. • Describe appropriate strategies to deal with emergencies and accidents at the workplace. • Outline the organizational structure to be followed to report about health, safety and security breaches to the concerned authorities. • Discuss the importance of keeping work area clean and tidy. • Discuss the significance of conforming to basic hygiene practices such as washing hands, using alcohol based hand sanitizers or soap. • Discuss organizational hygiene and sanitation guidelines and ways of reporting breaches/gaps if any to the concerned authorities. • Discuss the ways of dealing with stress and anxiety. • Discuss how to complete the given work within the stipulated time period. • Explain how to maintain a proper balance between team and individual goals. • Explain 5S guidelines at workplace. • List the various materials used at the workplace. • Explain organisational recommended procedure for storage of tools, equipment and material after completion of work. • Explain the ways to optimize usage of resources. • Discuss various methods of waste management and its disposal.	• Apply appropriate safety practices to ensure safety of people at the workplace • Display the correct way of wearing and removing PPE such as face masks, hand gloves, face shields, PPE suits, etc. • Demonstrate the use of fire extinguisher. • Apply basic first aid procedure in case of emergencies. • Perform routine cleaning of tools, equipment and machines. • Employ various techniques for checking malfunctions in the equipment as per Standard Operating Procedure (SOP). • Show how to sanitize and disinfect one's work area regularly. • Demonstrate the correct way of washing hands using soap and water. • Demonstrate the correct way of sanitizing hands using alcohol-based hand rubs. • Demonstrate how to evacuate the workplace in case of an emergency. • Demonstrate sorting of materials, tools and equipment and spare parts after completion of work. • Demonstrate the steps involved in storage of tools, equipment and material after completion of work. • Perform basic checks to identify any spills and leaks and that need to be plugged /stopped. • Demonstrate different disposal techniques depending upon types of waste. • Employ different ways to check if equipment/machines are functioning as per requirements and report malfunctioning, if observed. • Employ ways for efficient utilization of

• List the different categories of waste for the purpose of segregation • Differentiate between recyclable and non-recyclable waste • State the importance of using appropriate colour dustbins for different types of waste. • Discuss common practices for conserving electricity at workplace. • Discuss the common sources of pollution and ways to minimize it.	material and water.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
• Housekeeping material: Cleaning agents, cleaning cloth, waste container, dust pan and brush set, liquid soap, hand towel, fire extinguisher • Safety gears: Safety shoes, ear plug, goggles, gloves, helmet, first-aid kit	

Module 3: Introduction to Employability Skills

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements

Duration: *<0.5:00>*	**Duration**: *<0.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the importance of Employability Skills in meeting the job requirements	• Demonstrate Employability Skills
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 4: Constitutional values - Citizenship

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Discuss about constitutional values to be followed to become a responsible citizen

Duration: *<0.5:00>*	**Duration**: *<0.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain constitutional values, civic rights, duties, citizenship, responsibility towards society etc. that are required to be followed to become a responsible citizen.	• Show how to practice different environmentally sustainable practices
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 5: Becoming a Professional in the 21st Century

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Demonstrate professional skills required in 21st century

Duration: *<0.5:00>*	**Duration**: *<0.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss 21st century skills.	• Display positive attitude, self -motivation, problem solving, time management skills and continuous learning mindset in different situations.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 6: Basic English Skills

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Practice basic English speaking.

Duration: *<1:00>*	**Duration**: *<1:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss need of basic English skills.	• Use appropriate basic English sentences/phrases while speaking
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 7: Communication Skills

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Practice basic communication skills.

Duration: *<1.5:00>*	**Duration**: *<2.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss need of communication skills • Describe importance of team work	• Demonstrate how to communicate in a well -mannered way with others. • Demonstrate working with others in a team
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 8: Diversity & Inclusion

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Describe PwD and gender sensitisation.

Duration: *<0.5:00>*	**Duration**: *<0.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the significance of reporting sexual harassment issues in time	• Show how to conduct oneself appropriately with all genders and PwD
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 9: Financial and Legal Literacy

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Describe ways of managing expenses, income, and savings.

Duration: *<1.5:00>*	**Duration**: *<2.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the significance of using financial products and services safely and securely. • Explain the importance of managing expenses, income, and savings. • Explain the significance of approaching the concerned authorities in time for any exploitation as per legal rights and laws	• Demonstrate ways of managing expenses, income, and savings.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 10: Essential Digital Skills

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Demonstrate procedure of operating digital devices and associated applications safely.

Duration: *<1:00>*	**Duration**: *<2:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the significance of using internet for browsing, accessing social media platforms, safely and securely	• Show how to operate digital devices and use the associated applications and features, safely and securely
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 11: Entrepreneurship

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Describe opportunities as an entrepreneur.

Duration: *<2.5:00>*	**Duration**: *<4.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the need for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges	• Demonstrate ways for identifying opportunities for potential business, sources for arranging money and potential legal and financial challenges
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 12: Customer Service

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Describe ways of maintaining customer.

Duration: *<1.5:00>*	**Duration**: *<2.5:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Differentiate between types of customers. • Explain the significance of identifying customer needs and addressing them. • Discuss the significance of maintaining hygiene and dressing appropriately.	• Show how to maintain hygiene and dressing appropriately.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 13: Getting ready for apprenticeship & Jobs

Mapped to DGT/VSQ/N0101

Terminal Outcomes:

- Describe ways of preparing for apprenticeship & Jobs appropriately.

Duration: *<1:00>*	**Duration**: *<1:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the significance of dressing up neatly and maintaining hygiene for an interview • Discuss how to search and register for apprenticeship opportunities	• Create a biodata • Use various sources to search and apply for jobs
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 14: Operate and maintain 3D printing machine for product generation

Mapped to ASC/N6427, v1.0

Terminal Outcomes:

- Perform the steps to operate and set up the machine for printing the automotive components.
- Demonstrate post-processing activities like quality check, segregation, storage etc.

Duration: *<100:00>*	**Duration**: *<200:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the information needed to interpret from the instructions received from supervisor related to work to be done and work requirements. • Explain various 3D Printing technologies such as Fused Deposition Modelling, StereoLithography etc. • Identify various symbols and notifications being displayed by the 3D Printing machine. • Describe functionality of the 3D printing machine. • List the machine, support structure, raw material etc. required for work. • List types of materials available for fabrication in various 3D printing technique. • Explain the selection criteria of raw material and 3D printing machine as per the product specifications. • Recall various specifications of machine such as build speed, extrusion speed, nozzle temperature etc. • List machine operating parameters such as room temperature range, air cleanliness. • Explain standard tessellation language (.stl) code file and its selection criteria for machine operation. • List steps for preparing 3D printing machine for operation. • List the steps to be performed for operating the 3D printing machine. • List the steps to be performed for uploading and removing new code files in the machine memory. • Discuss the importance of preserving critical electronic parts/equipment from moisture/ heat/ environmental external conditions.	• Demonstrate how to select the raw material and 3D printing machine for printing the automotive components as per product specifications. • Apply appropriate ways to check the material and 3D printing machine for any issues and required quality standards before use. • Use appropriate resources to obtain information about part orientation, support structure requirement, machine specifications, machine operating parameters etc. as per the work requirement. • Show how to set the 3D printing machine and its parameters as per SOP/WI. • Demonstrate how to clean the 3D printing machine before starting the printing operation by following organisational procedures. • Demonstrate how to connect the data storage devices with the machine. • Role play a situation on how to co- ordinate with the designer for rectifying the errors generated during file uploading and observed during running of process. • Show how to pre-heat the bed of the machine and set the laser or nozzles temperature of the machine to defined values. • Demonstrate organizational specified procedure of starting and operating the 3D printing machine for printing of automotive components. • Show how to stop the machine during an unwanted situation. • Apply appropriate ways to identify and rectify errors in machine during the machine operation.

• Describe post-processing techniques such as removing and cleaning printed parts, inspection, segregation etc. of parts. • Discuss ways for removing the fabricated part from machine and support structures from the part. • Explain methods of inspecting the quality and non-conformities of the part. • Discuss the process of storing of ok parts as per organisational guidelines. • List maintenance activities for a 3D printing machine. • List the steps to be performed for troubleshooting and repairing defects in the machine. • List the steps to be performed for lubricating the 3D printing machine. • Discuss the importance of placing tags on machines for next maintenance cycles. • Summarise the documents, records and information to be maintained related to the maintenance and repairing done.	• Prepare a sample report about the errors identified and rectified in the machine. • Demonstrate how to remove the printed part and support structures from the machine carefully. • Apply appropriate ways to clean the part for getting required surface finish. • Demonstrate how to clean and store the tools, equipment and auxiliaries after completion of work as per organisational guidelines. • Apply appropriate inspection methods for checking the quality and non-conformities of the part. • Demonstrate how to store and preserve the manufactured automotive parts as per organisational guidelines. • Apply appropriate ways to check the critical components of machine as per maintenance checklist or manufacturer guidelines. • Employ appropriate ways for troubleshooting and repairing defects in the machine. • Show how to lubricate the machine by using appropriate lubricant.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
3D Printing machines- Fixed Deposition Modelling Machine, Stereo-Lithography Machine, Metal Sintering Machine & any other type of 3D printing machine with the all the consumables required, Flash Drive (With pre-stored program)	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	2	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electronics	2	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electronics	3	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA

Trainer Certification	
Domain Certification	**Platform Certification**
"Automotive Additive Manufacturing Printing Operator, ASC/Q6410, version 2.0". Minimum accepted score is 80%.	"MEP/Q2601, Trainer (VET and Skills), Version-2" Minimum accepted score is 80%.

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	2	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electronics/ Instrumentation	3	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electronics	3	Mechanical/ Automobile/ Electronics	1	Mechanical/ Automobile/ Electronics	NA
Diploma	Mechanical/Automobile/ Electronics	4	Mechanical/ Automobile/ Electronics	0	Mechanical/ Automobile/ Electronics	NA

Assessor Certification	
Domain Certification	**Platform Certification**
"Automotive Additive Manufacturing Operator, ASC/Q6410, version 2.0". Minimum accepted score is 80%.	"MEP/Q2701, Assessor (VET and Skills), Version-2" Minimum accepted score is 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 NOS 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
Declarative Knowledge	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem.
Key Learning Outcome	Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order 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 application).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective or psychomotor skills.
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.

Acronyms and Abbreviations

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
SOP	Standard Operating Procedure
WI	Work Instructions
PPE	Personal Protective equipment