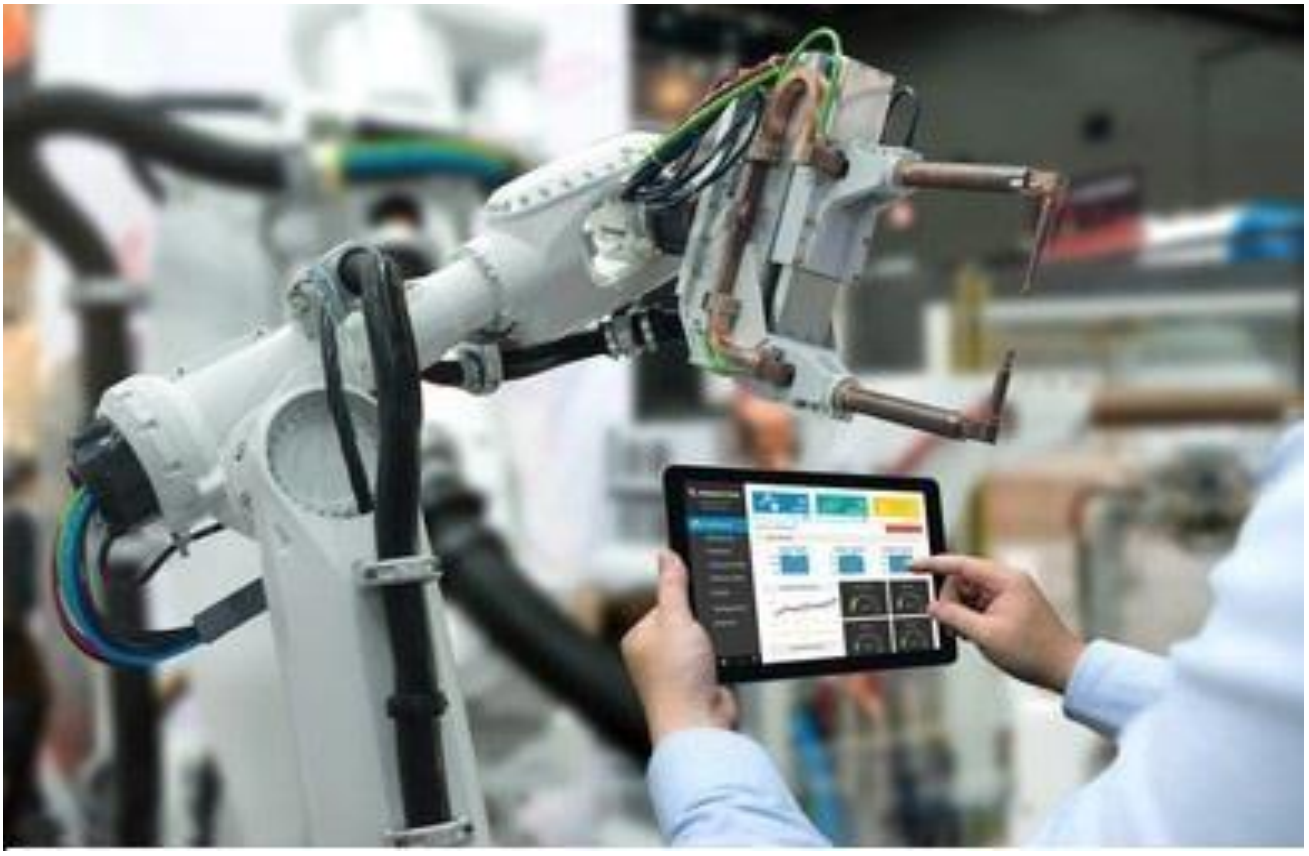

Model Curriculum

QP Name: Automation and Robotics Engineer

QP Code: ASC/Q8303

QP Version: 1.0

NSQF Level: 6

Model Curriculum Version: 1.0

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	Research & Development
Occupation	Automotive Product Development
Country	India
NSQF Level	6
Aligned to NCO/ISCO/ISIC Code	NCO-2015/2144.0804
Minimum Educational Qualification and Experience	3 years Diploma (Mechanical/Automobile/ Electrical / Electronics) from recognized regulatory body with 3 years of relevant experience after class 12th OR B.E./B.Tech (Mechanical/Automobile / Electrical/ Electronics Engineering) with 1 Year of relevant experience, OR M.E./M.Tech (Mechanical/Automobile / Electrical/ Electronics Engineering) OR Certificate-NSQF (Automotive Prototype Manufacturing Lead Technician Level 5) with 3 Years of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	24 years
Last Reviewed On	30/12/2021
Next Review Date	30/12/2024
NSQC Approval Date	30/12/2021
QP Version	1.0
Model Curriculum Creation Date	30/12/2021
Model Curriculum Valid Up to Date	30/12/2024
Model Curriculum Version	1.0
Minimum Duration of the Course	660 Hours 00 Minutes
Maximum Duration of the Course	660 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.

- Perform designing, selection and integration of automation systems
- Perform selection, installation, commissioning and maintenance of industrial Robot
- Perform integration of robots and automation system
- Identify product specifications and requirements for CAD designing.
- Carry out designing of product on CAD software.
- 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					
Module 1: Introduction to the role of an Automation and Robotics Engineer	05:00	00:00			05:00
ASC/N9810: Manage work and resources (Manufacturing) NOS Version No. – 1.0 NSQF Level – 5	**20:00**	**40:00**	-	-	**60:00**
Module 2: Manage work and resources according to safety and conservation standards	20:00	40:00	-	-	60:00
ASC/N9812 – Interact effectively with team, customers and others NOS Version No. 1.0 NSQF Level 5	**20:00**	**35:00**			**55:00**
Module 3: Communicate effectively and efficiently	20:00	35:00			55:00
ASC/N8305 – Designing, selection and integration of Automation Systems NOS Version No. –1.0 NSQF Level - 6	**30:00**	**90:00**			**120:00**
Module 4: Designing,	30:00	90:00			120:00

selection and integration of Automation Systems					
ASC/N8306 – Selection, Installation, Commissioning and Maintenance of Industrial Robot NOS Version No. –1.0 NSQF Level - 6	**30:00**	**90:00**			**120:00**
Module 5: Selection, Installation, Commissioning and Maintenance of Industrial Robot	30:00	90:00			120:00
ASC/N8307 – Integration of robots and automation system using industrial networking protocols NOS Version No. –1.0 NSQF Level - 6	**30:00**	**90:00**			**120:00**
Module 6: Integration of robots and automation system using industrial networking protocols	30:00	90:00			120:00
ASC/N8308 – Design, operate and maintain 3D printing machine for product generation NOS Version No. –1.0 NSQF Level - 6	**60:00**	**120:00**			**180:00**
Module 7: Design, operate and maintain 3D printing machine for product generation	60:00	120:00			180:00
Total Duration	**195:00**	**465:00**			**660:00**

Module Details

Module 1: Introduction to the role of an Automation and Robotics Engineer

Bridge module

Terminal Outcomes:

- Discuss the role and responsibilities of an Automation and Robotics Engineer.

Duration: *<05:00>*	**Duration**: *<00:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the role and responsibilities of an Automation and Robotics Engineer. • Discuss the job opportunities for an Automation and Robotics Engineer 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: Manage work and resources according to safety and conservation standards

Mapped to ASC/N9810, v1.0

Terminal Outcomes:

- Employ appropriate ways to maintain safe and secure working environment
- Apply material and energy conservation practices at the workplace.

Duration: *<20:00>*	**Duration**: *<40:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss organisational procedures for health, safety and security and individual role and responsibilities related to the same. • List the potential workplace related risks, threats and hazards, their causes and preventions. • List personal protective equipment like safety gloves, glasses, shoes and mask used at the workplace. • List various types of fire extinguisher. • Identify various safety boards/ signs placed on the shop floor. • Explain 5S standards, procedures and policies followed at workplace. • Discuss organisational procedures to deal with emergencies and accidents at the workplace and importance of following them. • State the importance of conducting safety drills or training sessions. • Explain the process of filling daily check sheet for reporting to the concerned authorities about improvements done and risks identified. • Discuss how and when to report about potential hazards identified in the workplace and limits of responsibility for dealing with them. • Outline the importance of keeping workplace, equipment, restrooms etc. clean and sanitised. • Explain the importance of following hygiene and sanitation regulations developed by organisation at the workplace. • Discuss the importance of maintaining the availability of running water, hand wash and alcohol-based sanitizers at the	• Apply appropriate ways to implement safety practices to ensure safety of people at the workplace. • Display the correct way of wearing and disposing PPE. • Demonstrate the use of fire extinguisher. • Demonstrate how to provide first aid procedure in case of emergencies. • Demonstrate how to evacuate the workplace in case of an emergency. • Employ various techniques for checking malfunctions in the machines with the support of maintenance team and as per Standard Operating Procedures (SOP). • Demonstrate to arrange tools/ equipment/ fasteners/ spare parts into proper trays, cabinets, lockers as mentioned in the 5S guidelines/work instructions. • Apply appropriate ways to organise safety drills or training sessions for others on the identified risks and safety practices. • Prepare a report about the health, safety and security breaches. • Apply appropriate ways to check that workplace, equipment, restrooms etc. are cleaned and sanitised. • Role play a situation to brief the team about the hygiene and sanitation regulations developed by organisation. • Demonstrate the correct way of washing hands using soap and water and alcohol-based hand rubs. • Apply appropriate methods to support the employees to cope with stress, anxiety etc. • Demonstrate proper waste collection and disposal mechanism depending upon types of waste.

workplace. • Discuss the significance of conforming to basic hygiene practices such as washing hands, using alcohol based hand sanitizers or soap. • Recall ways of reporting advanced hygiene and sanitation issues to the concerned authorities. • Elucidate various stress and anxiety management techniques. • Discuss the significance of greening. • Classify different categories of waste for the purpose of segregation. • Differentiate between recyclable and non-recyclable waste. • Discuss various methods of waste collection and disposal. • List the various materials used at the workplace. • Explain organisational recommended norms for storage of tools, equipment and material. • Discuss the importance of efficient utilisation of material and water. • Explain basics of electricity and prevalent energy efficient devices. • Explain the processes to optimize usage of material and energy/electricity. • Enlist common practices for conserving electricity at workplace.	• Perform the steps involved in storage of tools, equipment and material after completion of work. • Employ appropriate ways to resolve malfunctioning (fumes/ sparks/ emission/ vibration/ noise) and lapse in maintenance of equipment as per requirements. • Perform the steps to prepare a sample material and energy audit reports. • Employ practices for efficient utilization of material and energy/electricity.
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: Communicate Effectively and Efficiently

Mapped to ASC/N9812, v1.0

Terminal Outcomes:

- Use effective communication and interpersonal skills.
- Apply sensitivity while interacting with different genders and people with disabilities.

Duration: *<20:00>*	**Duration**: *<35:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of complying with organizational requirements to share information with team members. • Discuss the ways to adjust the communication styles to reflect sensitivity towards gender and persons with disability (PwD). • Explain the importance of respecting personal space of colleagues and customers. • Describe the ways to manage and coordinate with team members for work integration. • State the importance of team goals over individual goals, keeping commitment made to team members, and informing them in case of delays. • Discuss the importance of following the organisation's policies and procedures • Discuss the importance of rectifying errors as per feedback and minimizing mistakes. • Discuss gender-based concepts, issues and legislation as well organization standards, guidelines, rights and duties of PwD. • Discuss the importance of PwD and gender sensitization to ensure that team shows sensitivity towards them. • State the importance of following organizational standards and guidelines related to PwD. • Recall the rights and duties at workplace with respect to PwD. • Outline organisation policies and procedures pertaining to written and verbal communication.	• Employ different means and methods of communication depending upon the requirement to interact with the team members. • Employ appropriate ways to maintain good relationships with team members and superiors. • Apply appropriate techniques to resolve conflicts and manage team members for smooth workflow. • Conduct training sessions to train the team members on proper reporting of completed work and receiving feedback. • Employ suitable ways to escalate problems to superiors as and when required. • Prepare a sample report on the progress and team performance . • Role play a situation on how to offer help to people with disability (PwD) if required at work.
Classroom Aids:	
Whiteboard/blackboard, marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	

Module 4: Designing, selection and integration of Automation Systems

Mapped to ASC/N8305, v1.0

Terminal Outcomes:

- Perform the steps of preparing the project design.
- Demonstrate organisational procedure of selection and integration of new automotive system and conducting trial run for any issues.

Duration: *<30:00>*	**Duration**: *<90:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the information obtained from the project design related to the mechanical drawings and layout diagram. • Classify automation elements as power and safety elements. • List types of control system used in the automation system. • Discuss the selection criteria of automation elements in align with electrical, mechanical and environmental parameters. • Discuss core and auxiliary support process required during automation process. • List the steps to be performed for installation and integration of the automation system. • Describe procedure of programming of PLC and simulation tools from different makers along with integration of automation elements. • Describe various assembly methods need to perform for assembly process. • Describe various system monitoring controls process, alarm and maintenance of automation system. • List the steps to be performed for starting and analysing the functioning of the automation system with the existing manufacturing process. • Describe need of maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance. • List the steps to be performed for conducting the trials of automation system with the existing or new manufacturing process. • Describe APQP procedures, TGW TGR and knowledge management protocol.	• Employ appropriate ways to design / interpret the project design from the mechanical drawings and layout diagram. • Demonstrate Standard operation procedures recommended by manufacturer for using equipment / machinery. • Perform steps to prepare design of electrical wiring, schematic diagram and project documentation. • Perform steps to prepare the e-plan consists of layout, mechanical drawings and project execution phases. • Show how to select the automation elements in align with electrical, mechanical and environmental parameters. • Perform steps to plan and administer automation project as per the e-plan. • Apply appropriate ways to mount and place the electrical and mechanical components safely as per design. • Show how to route electrical wires and make wiring connections etc. as per the wiring diagram. • Apply appropriate ways to assemble the system components as per the mechanical drawings. • Apply appropriate ways to check functionality of installed automation components. • Demonstrate various integration activities like programming, wiring with external elements etc. as per design document. • Show how to develop HMI screen for system monitoring controls. • Show how to set necessary parameters and drive conveyor motor with VFD. • Show how to start the automation system,

• Discuss the records and documents needed to be prepared such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development.	look for any warnings/errors in it. • Apply appropriate ways to rectify the warnings/errors in the automation system. • Demonstrate all necessary tests and procedures to make the automation system fully functional. • Show how to dry-run the automation system with the existing manufacturing process. • Perform steps to prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the automation system. • Apply appropriate ways to generate the fallback action plan for failures of critical activities. • Employ practices to identify and arrange the critical spares with the help of supplier, maintenance team. • Show how to develop the maintenance manual with the help of supplier and maintenance team. • Employ appropriate ways for conducting the trials of automation system as per the e-plan to align it with existing or new manufacturing process. • Show how to handover the system to production team & train them on it as per SOP.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) 18 documents of PPAP, Design records, Design Records, Authorized Engineering Change Documents, Customer Engineering Approval, Design Failure Modes and Effects Analysis (DFMEA), applied in special situations, Process Flow Diagram, Process Failure Modes and Effects Analysis (PFMEA) Control Plan, Part Submission Warrant (PSW), Engineering Change Documents Dimensional Results, PLC Simulator, Hydraulic, Pneumatic, Electronic Control Systems Simulator, Internet of Things study material and IOT communication devices, Manufacturing Execution system, manufacturing operation management system. Hydraulics and pneumatics systems simulator, PLC Simulator with required software, Air Cylinders, valves, connector/tubing simulators, Pick and place robots assembly Electronics sensor like proximity, optical, magnetic sensors.	

Module 5: Selection, installation, commissioning and maintenance of industrial robot

Mapped to ASC/N8306, v1.0

Terminal Outcomes:

- Perform preparatory activities like robot selection, preparation of mounting design, etc.
- Demonstrate organisational procedure of selection, installation, commissioning and maintenance of industrial robot.

Duration: *<30:00>*	**Duration**: *<90:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Discuss the information obtained from the project document related to the robots and automation system requirements. • Describe the selection criteria of industrial robot based on applications, robot types and technical parameters. • Describe types of end effector and their selection criteria. • List the steps to be performed for selection, installation and commissioning of the industrial robot. • List the steps to be performed for starting and analysing the functioning of the robot. • Describe setting like robot jogging, mastering and axis limits in a standalone environment and their impact on robot functioning. • List the steps to be performed for robot integration with automation elements. • List various automation elements like proximity sensors, motor conveyor with VFD, pneumatic fixtures, indexing table etc. • Describe need of maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance. • List the steps to be performed for conducting the trials of robot with the existing or new manufacturing process. • Describe various backup processes like teach pendant programs, parameters, mastering data. • Discuss the records and documents needed to be prepared such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development.	• Employ appropriate ways to design / interpret the project document from the information related to robots and automation system requirements. • Demonstrate Standard operation procedures recommended by manufacturer for using equipment / machinery. • Show how to select the suitable end effector like grippers, handling device, spot, sealer and spray gun for the robot. • Perform steps to prepare the suitable mounting design like floor, ceiling, pedestal etc. as per e-plan, layout diagram and robot manual. • Show how to position the robot and controller on the designated installation area. • Show how to connect all cables, wire harness, safety peripherals, tooling etc. as per e-plan, layout diagram and robot manual. • Apply appropriate ways to check functionality of safety elements, safety peripherals and teach pendant controls before commissioning process. • Show how to start the robot, look for any warnings/errors in it. • Apply appropriate ways to rectify the warnings/errors in the robot. • Show how to set the initial settings like robot jogging, mastering and axis limits in a standalone environment and program the robot as per the path required for using point to point control system. • Apply appropriate ways to integrate the robot with automation elements as per design document.

	• Perform steps to prepare maintenance schedule and checklist for conducting the preventive, predictive and breakdown maintenance of the robot. • Apply appropriate ways to generate the fallback action plan for failures of critical activities. • Employ practices to identify and arrange the critical spares with the help of supplier, maintenance team. • Show how to develop the maintenance manual with the help of supplier and maintenance team. • Employ appropriate ways for conducting the trials of robot as per the e-plan to align it with existing or new manufacturing process. • Show how to fine tune the robot program with required cycle time. • Demonstrate various backup processes like teach pendant programs, parameters, mastering data using different backup devices. • Show how to handover the system to production team & train them on it as per SOP.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) 18 documents of PPAP, Design records, Design Records, Authorized Engineering Change Documents, Customer Engineering Approval, Design Failure Modes and Effects Analysis (DFMEA), applied in special situations, Process Flow Diagram, Process Failure Modes and Effects Analysis (PFMEA) Control Plan, Part Submission Warrant (PSW), Engineering Change Documents Dimensional Results, PLC Simulator, Hydraulic, Pneumatic, Electronic Control Systems Simulator, Internet of Things study material and IOT communication devices, Manufacturing Execution system, manufacturing operation management system. Hydraulics and pneumatics systems simulator, PLC Simulator with required software, Air Cylinders, valves, connector/tubing simulators, Pick and place robots assembly Electronics sensor like proximity, optical, magnetic sensors.	

Module 6: Integration of robots and automation system using industrial networking protocols

Mapped to ASC/N8307, v1.0

Terminal Outcomes:

- Perform steps for installing the elements industrial network architecture and protocols in the system.
- Demonstrate organisational procedure of integrating robots and automation system using industrial networking protocols

Duration: *<30:00>*	**Duration**: *<90:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe different layers of network architecture. • Describe functioning of various network devices like routers, network switch, repeaters. • Illustrate design of industrial network between devices based on protocols, topology and device parameters. • Elaborate ways to analyse the installed Machines, automation elements, system and robots into different layers of network architecture like field devices, control devices, network. • Describe types of network protocols, topology and its significance. • Discuss device manufacturer software for network parameter settings and device communication. • Discuss the selection criteria of suitable network protocols like MODBUS,CC-LINK, Profinet, Profibus, OPC UA, MQTT etc. based on control system requirements. • List the steps to be performed for installing network protocols in the system. • Describe network topology like STAR, LINE, RING. • List the steps to be performed for connecting the intelligent devices and system by using suitable network topology like STAR, LINE, RING as per network design document. • Discuss working and integration of different elements using I/O link master to the controller. • Describe data types like machine, process and control data from robot and automation system in the network.	• Employ appropriate ways to design / interpret the network consists of devices, automation system and robots. • Demonstrate Standard operation procedures recommended by manufacturer for using equipment / machinery. • Show how to select the suitable network protocols like MODBUS,CC-LINK, Profinet, Profibus, OPC UA, MQTT etc. based on control system requirements. • Demonstrate organisational procedure installing the network protocols and connecting the intelligent devices in the system. • Show how to connect the automation elements like sensors, control devices to I/O link master. • Apply appropriate ways to install the cable between devices in align with signaling parameters. • Employ appropriate ways to establish the communication between automation system, intelligent devices and robots • Show how to turn on the power of automation devices, system in the network and observe their functioning. • Apply appropriate ways to protect the network from unauthorized access or malicious internet and allow only authorized devices to connect to the network. • Employ appropriate ways for conducting trial run of the systems as per the e-plan to align it with existing or new manufacturing process. • Show how to handover the system to

• Discuss the need of automation elements like sensors, control devices in the system. • Describe signaling parameters like bend radius, signal ground, terminal resistor, cable length etc. and their impact on system functioning. • Describe parameter like baud rate, distance, station ID and station type and how to set them in the system. • Describe ways to provide physical security of the network contains IIOT Edge Devices, IIOT Sensors, Machines, Robots and Automation System. • Explain the organisational specified policies and procedures for conducting trial run of the system/ • List the documents needed to be prepared related to procurement, trial run and modifications done on the system. • Discuss the records and documents needed to be prepared and maintained such as experience under development, TGW /TGR faced during process trials etc. as a reference for future development.	production team & train them on it as per SOP.

Classroom Aids:
Whiteboard, marker pen, projector

Tools, Equipment and Other Requirements
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) 18 documents of PPAP, Design records, Design Records, Authorized Engineering Change Documents, Customer Engineering Approval, Design Failure Modes and Effects Analysis (DFMEA), applied in special situations, Process Flow Diagram, Process Failure Modes and Effects Analysis (PFMEA) Control Plan, Part Submission Warrant (PSW), Engineering Change Documents Dimensional Results, PLC Simulator, Hydraulic, Pneumatic, Electronic Control Systems Simulator, Internet of Things study material and IOT communication devices, Manufacturing Execution system, manufacturing operation management system. Hydraulics and pneumatics systems simulator, PLC Simulator with required software, Air Cylinders, valves, connector/tubing simulators, Pick and place robots assembly Electronics sensor like proximity, optical, magnetic sensors.

Module 7: Design, operate and maintain 3D printing machine for product generation

Mapped to ASC/N8308, 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: *<60:00>*	**Duration**: *<120:00>*
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	• 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

conditions. • 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.	machine operation. • 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/ Electrical/ Electronics/ Automobile/ Instrumentation	4	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	1	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA
B.E/B.Tech	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	5	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	0	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA
M.E/M.Tech	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	3	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	1	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA

Trainer Certification	
Domain Certification	**Platform Certification**
"Automotive Automation and Robotics Engineer, ASC/Q8303, version 1.0". Minimum accepted score is 80%.	"Trainer, MEP/Q2601 v1.0" 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/ Electrical/ Electronics/ Automobile/ Instrumentation	5	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	1	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA
B.E/B.Tech	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	6	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	0	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA
M.E/M.Tech	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	4	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	1	Mechanical/ Electrical/ Electronics/ Automobile/ Instrumentation	NA

Assessor Certification	
Domain Certification	**Platform Certification**
"Automotive Automation and Robotics Engineer, ASC/Q8303, version 1.0". Minimum accepted score is 80%.	"Assessor; MEP/Q2701 v1.0" Minimum accepted score is 80%.

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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