Model Curriculum

NOS Name: Industrial Robotic System Planning

NOS Code: ASC/N8353

NOS Version: 1.0

NSQF Level: 5.5

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	Manufacturing
Occupation	Automotive Product Development
Country	India
NSQF Level	5.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/3139.1400
Minimum Educational Qualification and Experience	Completed 3rd year of UG (In Relevant trade) or Pursuing 3rd year of UG (In Relevant trade) and continuous education or Completed 2nd year diploma after 12th or 12th Grade Pass with 1 year NAC plus 1 year CITS with 1 year of relevant experience or 12th grade pass with 1 year NTC plus 1year NAC/CITS with 2 years of relevant experience or Completed 3-year diploma (after 10th) with 2 Years of relevant experience or 12th Grade pass with 3 Years of relevant experience
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 years
Last Reviewed On	29/09/2023
Next Review Date	29/09/2026
NSQC Approval Date	29/09/2023
QP Version	1.0
Model Curriculum Creation Date	29/09/2023
Model Curriculum Valid Up to Date	29/09/2026
Model Curriculum Version	1.0

Minimum Duration of the Course	60 Hours 00 Minutes
Maximum Duration of the Course	60 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 selection and setup of end-effector and robot
- Perform integration of robots and automation system
- Perform installation of robots and automation system

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
ASC/N8353 – Industrial Robotics System Planning **NOS Version No. – 1.0** **NSQF Level – 5.5**	**15:00**	**45:00**			**60:00**
Module 1: Overview of Robotic System	01:00	01:00			02:00
Module 2: Robot Selection	8:00	22:00			30:00
Module 3: Planning for EOAT and safety mechanism	6:00	22:00			28:00
Total Duration	**15:00**	**45:00**			**60:00**

Module Details

Module 1: Overview of Robotic System

Mapped to ASC/N8353, v1.0

Terminal Outcomes:

- Discuss about role and responsibilities of a Robotics System Integrator/Planner.

Duration: *<01:00>*	**Duration**: *<01:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe robot anatomy • List application areas of Robotics and Automation • Describe objective of Robotic Automation for uninterrupted man less production.	• Show how to select the industrial robot based on applications, robot types and technical parameters.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	

Module 2: Robot selection

Mapped to ASC/N8353, v1.0

Terminal Outcomes:

- select suitable robots and tools, and design efficient robot cells.
- Evaluation of environmental and sustainability factors for robotic planning

Duration: *<8:00>*	**Duration**: *<22:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Demonstrate the ability to clearly define specific automation tasks, identify the industry type, and understand the objectives, goals, and performance requirements of an automation project within an industrial context. • Develop the practical skill of choosing the most suitable robot type, considering factors such as the range of motion and task complexity for specific applications. • Analyze automation tasks and determine the optimal number of axes required for a robot, showcasing proficiency in making informed decisions based on task requirements. • Excel in analyzing the physical characteristics of workpieces, including size, shape, weight, and material, and apply this knowledge to select an appropriate robot. • Demonstrate the capability to calculate the necessary payload capacity and reach for robots to effectively perform	• Develop the ability to conduct thorough industry-specific analysis to clearly define specific automation tasks, associated industry types, and comprehensive project objectives, goals, and performance requirements. • Acquire proficiency in selecting the most suitable robot type for various industrial applications, considering key factors like the range of motion and the complexity of tasks. • Demonstrate the capability to perform task analysis and make informed decisions about the optimal number of axes required for a robot to achieve automation objectives. • Excel in accurately analyzing the physical characteristics of workpieces, including size, shape, weight, and material, and apply this knowledge to select the most appropriate robot. • Develop practical skills in calculating the necessary payload capacity and reach for robots to effectively

tasks, taking into account not only the workpiece weight but also additional loads like tooling and sensors. • Develop proficiency in determining the desired cycle time and speed for automation processes, enabling the selection of robots with the necessary speed and acceleration capabilities for specific applications. • Exhibit the ability to assess and define the required level of precision and repeatability for automation tasks, making informed choices in selecting robots that meet precision requirements. • Develop practical expertise in considering environmental conditions, including temperature, humidity, dust, and potential exposure to chemicals or contaminants when selecting robots and end-of-arm tools (EOAT). • Demonstrate the capability to identify safety requirements and standards applicable to automation tasks, ensuring that chosen robots comply with safety regulations and can be seamlessly integrated into existing safety systems in an industrial context.	complete tasks, taking into consideration not only the workpiece weight but also additional loads like tooling and sensors.
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) EOAT, robotic system, controllers, external I/O device, technical manual and documents	

Module 3: Planning for EOAT and safety mechanism

Mapped to ASC/N8353, v1.0

Terminal Outcomes:

- Perform preparatory activities for robot EOAT planning
- Demonstrate oSafety mechanism for robotic planning

Duration: *<6:00>*	**Duration**: *<22:00>*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Understand the importance of clearly defining automation process objectives, specific tasks, and EOAT functions in the context of industrial automation. • Comprehend the significance of selecting the appropriate type of EOAT based on workpiece characteristics, including size, shape, weight, material, and variations in geometry. • Gain an understanding of how EOAT design impacts workpiece manipulation and handling, considering factors such as orientation, stacking, delicate handling, and precision requirements. • Familiarize with various types of EOAT options, including grippers (vacuum, magnetic, mechanical), suction cups, specialized tools, and custom-designed attachments, and their suitability for securely and efficiently handling workpieces. • Understand the factors that influence the choice of EOAT material, such as durability, wear resistance, and compatibility with environmental conditions (temperature, humidity, dust, and chemicals). • Comprehend the importance of ensuring compatibility between the selected EOAT and the robot in terms of mounting and communication interfaces for seamless integration into the automation system. • Develop knowledge of identifying potential hazards and risks associated with	• Apply the principles of clearly defining automation process objectives and specific tasks to real-world industrial scenarios, effectively communicating how these aspects impact the design and operation of robotic systems. • Utilize knowledge of workpiece characteristics to practically select the most appropriate type of EOAT, considering factors like size, shape, weight, material, and variations in geometry, for diverse industrial applications. • Demonstrate the ability to design and configure EOAT systems that meet the specific needs of workpiece manipulation and handling, taking into account factors such as orientation, stacking, delicate handling, and precision requirements, while addressing real-world challenges. • Evaluate the practical suitability of various EOAT options, including grippers (vacuum, magnetic, mechanical), suction cups, specialized tools, and custom-designed attachments, and choose the most appropriate option based on the secure and efficient handling of actual workpieces. • Develop hands-on skills in assessing and ensuring compatibility between selected EOAT and robotic systems in terms of mounting and communication interfaces, successfully integrating these components into functional automation systems within an industrial setting.

robotic operations and interaction with humans and other equipment, as well as familiarity with relevant safety regulations and industry standards for robotic systems. • Gain an understanding of safety goal formulation and the role of hazard identification, risk assessment, and safety objectives in selecting appropriate safety measures for the robotic cell. • Learn about the various safeguarding devices used in robotic cells, including safety fences and barriers, safety mats, light curtains, photo sensors, and safety laser scanners, and how to choose the most suitable option based on specific requirements. • Understand the importance of compatibility between the robot and safety interlocks, which ensure that the robot stops when specific conditions are not met, and recognize the significance of an emergency stop system for operator safety. • Gain knowledge of the documentation required for robot and EOAT components, as well as the preparation of a bill of materials for a complete robotic cell.	
Classroom Aids:	
Whiteboard, marker pen, projector	
Tools, Equipment and Other Requirements	
PCs/Laptops, Internet with Wi-Fi (Min2 Mbps Dedicated) EOAT, robotic system, controllers, external I/O device, technical manual and documents	

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/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	2	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	1	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA

Trainer Certification	
Domain Certification	**Platform Certification**
"Industrial Robotic System Planning, ASC/N8353, version 1.0". Minimum accepted score is 80%.	Recommended that the trainer is certified for the job role "Trainer (VET and Skills)", Mapped to Qualification Pack: MEP/Q2601, V2.0" 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/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
B.E/B.Tech	Mechanical/Automobile/ Electrical/ Electronics	6	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
Diploma	Mechanical/Automobile/ Electrical/ Electronics	5	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	3	Mechanical/ Automobile/ Electronics/ Instrumentation	1	Mechanical/ Automobile/ Electronics/ Instrumentation	NA
M.E/M.Tech	Mechanical/Automobile/ Electrical/ Electronics	4	Mechanical/ Automobile/ Electronics/ Instrumentation	0	Mechanical/ Automobile/ Electronics/ Instrumentation	NA

Assessor Certification	
Domain Certification	**Platform Certification**
"Industrial Robotic System Planning, ASC/N8353, version 1.0". Minimum accepted score is 80%.	Recommended that the Accessor is certified for the job role "Assessor (VET and Skills)", Mapped to Qualification Pack: MEP/Q2701, V2.0" 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