Model Curriculum

QP Name: HMI/SCADA Programmer and Troubleshooter

QP Code: IAS/Q5606

QP Version: 1.0

NSQF Level: 4

Model Curriculum Version: 1.0

Instrumentation Automation Surveillance & Communication Sector Skill Council
201-202 STBP NSIC Complex (Gate No. 02), Okhla Industrial Area, New Delhi-110020

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Training Parameters

Sector	Instrumentation Automation Surveillance and Communication
Sub-Sector	Automation
Occupation	Installation and Commissioning
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification & Experience	Diploma in Electrical/Electronics/Instrumentation, B.Sc. in Electronics
Pre-Requisite License or Training	Not Applicable
Minimum Job Entry Age	21 Years
Last Reviewed On	05/02/2020
Next Review Date	05/02/2024
NSQC Approval Date	
Version	1.0
Model Curriculum Creation Date	05/02/2020
Model Curriculum Valid Up to Date	05/02/2024
Model Curriculum Version	1.0
Minimum Duration of the Course	240 Hours, 0 Minutes
Maximum Duration of the Course	240 Hours, 0 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 the role and responsibilities of a Human-Machine Interface/Supervisory control and data acquisition (HMI/SCADA) Programmer and Troubleshooter.
- Demonstrate how to develop an HMI/SCADA project.
- Perform testing and commissioning of the sample HMI/SCADA project.
- Demonstrate how to troubleshoot errors in a project during runtime.
- Work effectively and efficiently in a team.
- Comply with the health and safety procedures at workplace.

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	**16:00**	**08:00**	**00:00**	**00:00**	**24:00**
Module 1 – Introduction to the Role and Responsibilities of an HMI/SCADA Programmer and Troubleshooter	16:00	08:00	00:00	00:00	24:00
IAS/N5617 - Develop HMI/SCADA project **NOS Version No. 1.0** **NSQF Level 4**	**24:00**	**56:00**	**00:00**	**08:00**	**80:00**
Module 2 – Develop an HMI/SCADA project	24:00	56:00	00:00	08:00	80:00
IAS/N5618 - Commission, test and troubleshoot the HMI/SCADA project on-site **NOS Version No. 1.0** **NSQF Level 4**	**32:00**	**64:00**	**00:00**	**08:00**	**96:00**
Module 3 – Commission, test and troubleshoot the project on-site	32:00	64:00	00:00	08:00	96:00
IAS/N9001 - Work effectively with teams **NOS Version No. 1.0**	08:00	08:00	**00:00**	**00:00**	16:00

NSQF Level 4					
Module 4 – Soft Skills and Work Ethics	08:00	08:00	00:00	00:00	16:00
IAS/N9002 - Maintain health and safety at workplace **NOS Version No. 1.0** **NSQF Level 4**	**08:00**	**08:00**	**00:00**	**00:00**	**16:00**
Module 5 – Basic Health and Safety Practices	08:00	08:00	00:00	00:00	12:00
Module 6 – Self Development Practices	04:00	04:00	00:00	00:00	04:00
Total Duration	**88:00**	**144:00**	**00:00**	**00:00**	**232:00**

Module Details

Module 1: Introduction to the Role and Responsibilities of an HMI/SCADA Programmer and Troubleshooter

Bridge Module

Terminal Outcomes:

- Identify the role and responsibilities of an HMI/SCADA Programmer and Troubleshooter.

Duration: *16:00*	**Duration**: *08:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Define various concepts of HMI and SCADA programming. • Describe the role and responsibilities of HMI/SCADA programmer and troubleshooter. • Explain the basic concepts of, electronics, wiring and instrumentation. • List the segments of HMI/SCADA by type and application. • Explain the basics of industrial and infrastructure processes involved in HMI/SCADA programming and troubleshooting. • Describe the various regulations standards operating procedures (SOPs), and guidelines for developing HMI/SCADA programmes.	• Employ various techniques for using appropriate operating system and other hardware/software specific to HMI/SCADA projects. • Demonstrate use of HMI/SCADA programming software including how to install and debug it.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	
Laptop, white board marker, projector, basic hand tools, piping and instrumentation diagram (P&ID)	

Module 2: Develop HMI/SCADA project

Mapped to NOS IAS/N5617

Terminal Outcomes:

- Explain how to develop HMI/SCADA project as per specifications.

Duration: *24:00*	**Duration**: *56:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the customer requirements for HMI/SCADA project. • List the equipment used in the automation process and instrumentation used in the factory. • Discuss how to coordinate with the plant engineer regarding plant layout, architecture, input/output list and P&ID. • Describe the benefits of HMI panel and SCADA system. • Identify the type and make of Programmable Logic Controller (PLC) used in the control panel as well as cut-out for HMI panel in the control panel. • List the solutions for distribution of process pictures on HMI/SCADA project. • Discuss various techniques for collecting information pertaining to HMI/SCADA pre-requisites and communication protocol. • Describe the type of communication ports for HMI panel, PLC, compatibility convertor and cable. • Explain the importance for following SOPs for developing HMI/SCADA programs. • List the technical information and relevant documents pertaining to HMI/SCADA project development.	• Demonstrate how to use pre-defined, approved software for developing an HMI/SCADA project. • Develop a sample HMI/SCADA project including input/output (I/O) tags, pictures, objects, value and alarm storage system. • Demonstrate the use of Piping and Instrumentation Diagrams (P&ID) to resolve a set of given issues. • Demonstrate various methods for maintaining the security levels for project users. • Create sample records and reports for an HMI/SCADA project as per the defined templates. • Create a value and alarm storage system and perform backups
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	
Laptop, white board marker, projector, digital multimeter, control panel, programming software communication ports, convertor, communication cable	

Module 3: Commission, test and troubleshoot the HMI/SCADA project

Mapped to NOS IAS/N5618

Terminal Outcomes:

- Demonstrate how to test and commission an HMI/SCADA project on-site.
- Identify and resolve errors in the project during runtime.

Duration: *30:00*	**Duration**: *70:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the approved software and licenses that should be available on plant operator PC. • Identify ways to clean the PC of unnecessary files and viruses. • Explain the debugging process and troubleshooting parameters specific for HMI/SCADA projects.	• Demonstrate how to transfer an HMI project to HMI panel/PC and SCADA to plant PC. • Perform activation of HMI/SCADA project for preliminary testing and check PLC connectivity. • Perform installation and initiation of latest project backup in the PC. • Demonstrate various techniques to test the PLC connection, input output process, picture navigation, animations, etc. and other project activities. • Develop sample objects and pictures to monitor failure of PLC connection as well as performance of PC. • Demonstrate how to use diagnostic programs and antivirus software to monitor faults. • Employ various techniques to check power supply as well as communication cable between PLC and HMI panel/PC. • Perform testing of HMI panel after checking the panel program.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	
Laptop, white board marker, projector, Plant PC, diagnostic software, panels, etc.	

Module 4: Soft Skills and Work Ethics

Mapped to NOS IAS/N9001

Terminal Outcomes:

- Work effectively at the workplace

Duration: *08:00*	**Duration**: *08:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of working towards team objectives and goals. • Discuss the code of conduct towards team members w.r.t. their culture, preferences, roles and responsibilities. • Explain the importance of effective communication and interpersonal skills. • Identify the common reasons for interpersonal conflicts and ways of managing them effectively. • Explain the importance of standard operating procedures of the company w.r.t. privacy, confidentiality and security. • Explain the issues with process flow, repairs and maintenance of tools and machinery and how to handle them. • Identify the need for implementing guidelines and practices pertaining to gender sensitivity at the workplace. • Explain different gender concepts such as gender roles, gender as a social construct, gender power relations etc. • Discuss the provisions of Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013. • Identify the need for implementing guidelines and practices pertaining to sensitivity towards Persons with Disabilities (PwD). • Explain the schemes available for PwD. • Explain the ways to help persons with disability overcome the challenges. • List organisational guidelines for dress code, time schedules, language etc.	• Apply team building skills in a given situation. • Demonstrate active listening skills while communicating. • Demonstrate how to report problems that need escalation. • Demonstrate working effectively with colleagues by assisting them whenever required. • Demonstrate use of appropriate behaviour and language that is respectful of disability and the gender.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	

Tools, Equipment and Other Requirements
Sample of escalation matrix, organisation structure.

Module 5: Basic Health and Safety Practices

Mapped to NOS IAS/N9002

Terminal Outcomes:

- Apply health and safety practices at the workplace.

Duration: *08:00*	**Duration**: *08:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• List the components of a basic first-aid kit. • List the daily safety instructions and the other recommended safety procedures for work. • Identify the types of fire and correct use of fire extinguishers. • Explain the safety procedures for handling tools, equipment and hazardous materials. • Identify the importance of good postures for lifting heavy objects. • Explain the importance of efficient utilisation of material and water. • Identify common practices of conserving electricity. • List the common sources of pollution and ways to minimise it. • Describe the concept of waste management (e.g. methods of waste segregation and disposal etc.). • Explain how to report any issues with any equipment/system to relevant authorities. • Discuss methods of accident prevention at the workplace.	• Demonstrate proper disposal of hazardous chemicals, tools and materials as per prescribed environmental norms/ company policy. • Demonstrate emergency fire rescue techniques. • Display how to administer first aid e.g. bandages, CPR process. • Demonstrate the steps to free a person from electrocution. • Demonstrate correct use of fire extinguishers. • Demonstrate the correct way to evacuate. • Demonstrate use of protective equipment suitable to tasks and work conditions. • Demonstrate the correct posture in different situations.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	
Personal Protection Equipment: safety glasses, head protection, rubber gloves, safety footwear, warning signs and tapes, fire extinguisher and first aid kit	

Module 6: Self Development Practices
Mapped to NOS IAS/N9002

Terminal Outcomes:

- Discuss practices for self-direction learning and skill advancement.

Duration: *04:00*	**Duration**: *04:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of skill advancement and strategies to pursue it. • Discuss how to adapt new technologies in current products/services to succeed in achieving targets effectively. • Analyse the importance of being accountable for timely completion of tasks. • Describe how to express emotions in appropriate ways at workplace especially anger, grief, frustration. • Identify ways to develop critical-thinking and problem-solving skills • Discuss ways for correctly and timely identifying problems, causes and possible solutions.	• Demonstrate how to express emotions in appropriate ways in various mock situations. • Analyse a sample problem and find its cause and possible solutions.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma, B.Sc.	Electrical/ Electronics/ Instrumentation	2	Programming, commissioning and troubleshooting of HMI/SCADA	1		

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "HMI/SCADA Programmer and Troubleshooter" mapped to QP "IAS/Q5606" Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q0102". Minimum accepted score is 80%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma, B.Sc.	Electrical/ Electronics/ Instrumentation	3	programming, commissioning and troubleshooting of HMI/SCADA	-		

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "HMI/SCADA Programmer and Troubleshooter" mapped to QP "IAS/Q5606" Minimum accepted score is 80%	Recommended that the Assessor is certified for the Job Role: "Assessor", mapped to the Qualification Pack: "MEP/Q0104". Minimum accepted score is 80%

Assessment Strategy

1. Assessment System Overview:
    - Batches assigned to the assessment agencies for conducting the assessment on SDSM/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

Reference

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.
CPR	An emergency procedure used to manually restore spontaneous blood circulation and breathing in a person who is under cardiac arrest.

Acronyms and Abbreviations

Term	Description
QP	Qualification Pack
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards
PwD	Persons with Disabilities
P&ID	Piping and instrumentation diagram
HMI	Human-Machine Interface
SCADA	Supervisory control and data acquisition
CPR	Cardiopulmonary resuscitation
PLC	Programmable Logic Controller