Model Curriculum

QP Name: HMI/SCADA Programmer and Troubleshooter

QP Code: IAS/Q5606

QP Version: 3.0

NSQF Level: 4

Model Curriculum Version: 2.0

IASC Sector Skill Council, B-12, Udhyog Marg, Block B, Sector 1, Noida, Uttar Pradesh 201301

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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	10th + 1 year NTC or 1 year NAC in relevant field OR 10th + 1 year experience in relevant field OR Completed 1st year or pursuing 2nd year of 3 years Engineering Diploma (after 10th) in relevant field OR Previous relevant Qualification of NSQF Level 3 + 1 year experience in relevant field
Pre-Requisite License or Training	Not Applicable
Minimum Job Entry Age	21 Years
Last Reviewed On	20/11/2020
Next Review Date	05/02/2024
NSQC Approval Date	20/22/2020
Version	3.0
Model Curriculum Creation Date	05/02/2020
Model Curriculum Valid Up to Date	21/01/2025
Model Curriculum Version	2.0
Minimum Duration of the Course	420 Hours, 0 Minutes
Maximum Duration of the Course	420 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 (Recommended)	On-the-Job Training Duration (Mandatory)	Total Duration
IAS/N5616 - Develop HMI/SCADA project NOS Version No. 1.0NSQF Level 4	**30:00**	**60:00**	**00:00**	**30:00**	**120:00**
Module 1 – Develop an HMI/SCADA project	30:00	60:00	00:00	30:00	120:00
IAS/N5617 - Commission, test and troubleshoot the HMI/SCADA project on-site NOS Version No. 1.0NSQF Level 4	**30:00**	**60:00**	**00:00**	**30:00**	**120:00**
Module 2 – Commission, test and troubleshoot theproject on-site	30:00	60:00	00:00	30:00	120:00
IAS/N9001 - Work effectively with teams NOS Version No. 1.0	15:00	15:00	**00:00**	**60:00**	90:00

NSQF Level 4					
Module 3 – Soft Skills and Work Ethics	15:00	15:00	00:00	60:00	90:00
IAS/N9002 – Maintain health and safety at workplace NOS Version No. 1.0NSQF Level 4	**15:00**	**15:00**	**00:00**	**00:00**	**30:00**
Module 4 – Basic Health and Safety Practices	10:00	10:00	00:00	00:00	20:00
Module 5 – Self Development Practices	05:00	05:00	00:00	00:00	10:00
Employability Skill 60 Hours Mapped to DGT/VSQ/N0102	**30:00**	**30:00**	**00:00**	**00:00**	**60:00**
Module 6 - Introduction to Employability Skills	01:50	00:00	00:00	00:00	01.50
Module 7 - Constitutional values - Citizenship	01:50	00:00	00:00	00:00	01.50
Module 8 - Becoming a Professional in the 21st Century	02:50	00:00	00:00	00:00	02:50
Module 9 - Basic English Skills	05:00	05:00	00:00	00:00	10:00
Module 10 - Career Development & Goal Setting	01:00	01:00	00:00	00:00	02:00
Module 11 - Communication Skills	02:00	03:00	00:00	00:00	05:00
Module 12 - Diversity & Inclusion	02:50	00:00	00:00	00:00	02:50
Module 13 - Financial and Legal Literacy	02:00	03:00	00:00	00:00	05:00
Module 14 - Essential Digital Skills	04:00	06:00	00:00	00:00	10:00
Module 15 - Entrepreneurship	03:00	04:00	00:00	00:00	07:00
Module 16 - Customer Service	02:00	03:00	00:00	00:00	05:00
Module 17 - Getting ready for apprenticeship & Jobs	03:00	05:00	00:00	00:00	08:00
Total Duration	**120:00**	**180:00**	**00:00**	**120:00**	**420:00**

Module Details

Module 1: Develop HMI/SCADA project
Mapped to NOS IAS/N5616

Terminal Outcomes:

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

Duration: *30:00*	**Duration**: *60:00*
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. - 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 converter and cable. - Explain the importance for following SOPs for developing HMI/SCADA programs. - List the technical information and relevant	- 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. - 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

documents pertaining to HMI/SCADA project development.	

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 2: Commission, test and troubleshoot the HMI/SCADA project
Mapped to NOS IAS/N5617

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**: *60:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
- List the approved software and licenses that should be available on plant operatorPC. - 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 toplant 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 asperformance of PC. - Demonstrate how to use diagnostic programs and antivirus software tomonitor faults. - Employ various techniques to check powersupply 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 3: Soft Skills and Work Ethics
Mapped to NOS IAS/N9001

Terminal Outcomes:

- Work effectively at the workplace

Duration: *15:00*	Duration: *15:00*
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 each 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 behavior 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, organization structure.	

Module 4: Basic Health and Safety Practices
Mapped to NOS IAS/N9002

Terminal Outcomes:

- Apply health and safety practices at the workplace.

Duration: 15:00	Duration: 15:00
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 forwork. - 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 utilization of material and water. - Identify common practices of conserving electricity. - List the common sources of pollution andways to minimize it. - Describe the concept of waste management (e.g. methods of wastesegregation 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/ companypolicy. - Demonstrate emergency fire rescuetechniques. - Display how to administer first aid e.g. bandages, CPR process. - Demonstrate the steps to free a person from electrocution. - Demonstrate correct use of fireextinguishers. - 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 5: Self Development Practices
Mapped to NOS IAS/N9002

Terminal Outcomes:

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

Duration: *06:00*	Duration: *15:00*
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	

Module 6: Introduction to Employability Skills
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Discuss the Employability Skills required for jobs in various industries
- List different learning and employability related GOI and private portals and their usage

Duration:1.5 Hours (1.5 Theory + 0 Practical)

Module 7: Constitutional values - Citizenship
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
- Show how to practice different environmentally sustainable practices

Duration:1.5 Hours (1.5 Theory + 0 Practical)

Module 8: Becoming a Professional in the 21st Century
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Discuss importance of relevant 21st century skills.
- Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.
- Describe the benefits of continuous learning

Duration:2.5 Hours (2.5 Theory + 0 Practical)

Module 9: Basic English Skills
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
- Read and interpret text written in basic English
- Write a short note/paragraph / letter/e -mail using basic English

Duration: 10 Hours (5 Theory + 5 Practical)

Module 10: Career Development and Goal Setting
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Create a career development plan with well-defined short- and long-term goals

Duration: 2 Hours (1 Theory + 1 Practical)

Module 11: Communication skills
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
- Explain the importance of active listening for effective communication
- Discuss the significance of working collaboratively with others in a team

Duration: 5 Hours (2 Theory + 3 Practical)

Module 12: Diversity and Inclusion
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
- Discuss the significance of escalating sexual harassment issues as per POSH

Duration: 2.5 Hours (2.5 Theory+ 0 Practical)

Module 13: Financial and Digital Literacy
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Outline the importance of selecting the right financial institution, product, and service
- Demonstrate how to carry out offline and online financial transactions, safely and securely

Duration: 5 Hours (2 Theory+ 3 Practical)

Module 14: Essential Digital Skills
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Describe the role of digital technology in today's life
- Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
- Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
- Create sample word documents, excel sheets and presentations using basic features
- utilize virtual collaboration tools to work effectively

Duration: 10 Hours (4 Theory+ 6 Practical)

Module 15: Entrepreneurship
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Explain the types of entrepreneurship and enterprises
- Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
- Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement
- Create a sample business plan, for the selected business opportunity

Duration: 7 Hours (3 Theory+ 4 Practical)

Module 16: Customer Service
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Describe the significance of analysing different types and needs of customers
- Explain the significance of identifying customer needs and responding to them in a professional manner.
- Discuss the significance of maintaining hygiene and dressing appropriately

Duration: 5 Hours (2 Theory+ 3 Practical)

Module 17: Getting Ready for Apprenticeship and Jobs
Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:
- Create a professional Curriculum Vitae (CV)
- Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
- Discuss the significance of maintaining hygiene and confidence during an interview
- Perform a mock interview
- List the steps for searching and registering for apprenticeship opportunities

Duration: 8 Hours (3 Theory+ 5 Practical)

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	*Specialization*	*Years*	*Specialization*	
I.T.I	Electrical, Electronics, Instrumentation or similar trades	2		1		
Diploma	Electrical, Electronics, Instrumentation, or similar trades	2		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	
I.T.I	Electrical, Electronics, Instrumentation or similar trades	3		1		
Diploma	Electrical, Electronics, Instrumentation, or similar trades	3		1		

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 tobe 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. Aset 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 completespecified hours of training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended thespecified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform atask. 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, understandand be able to do **upon the completion of the training**.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understandand 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