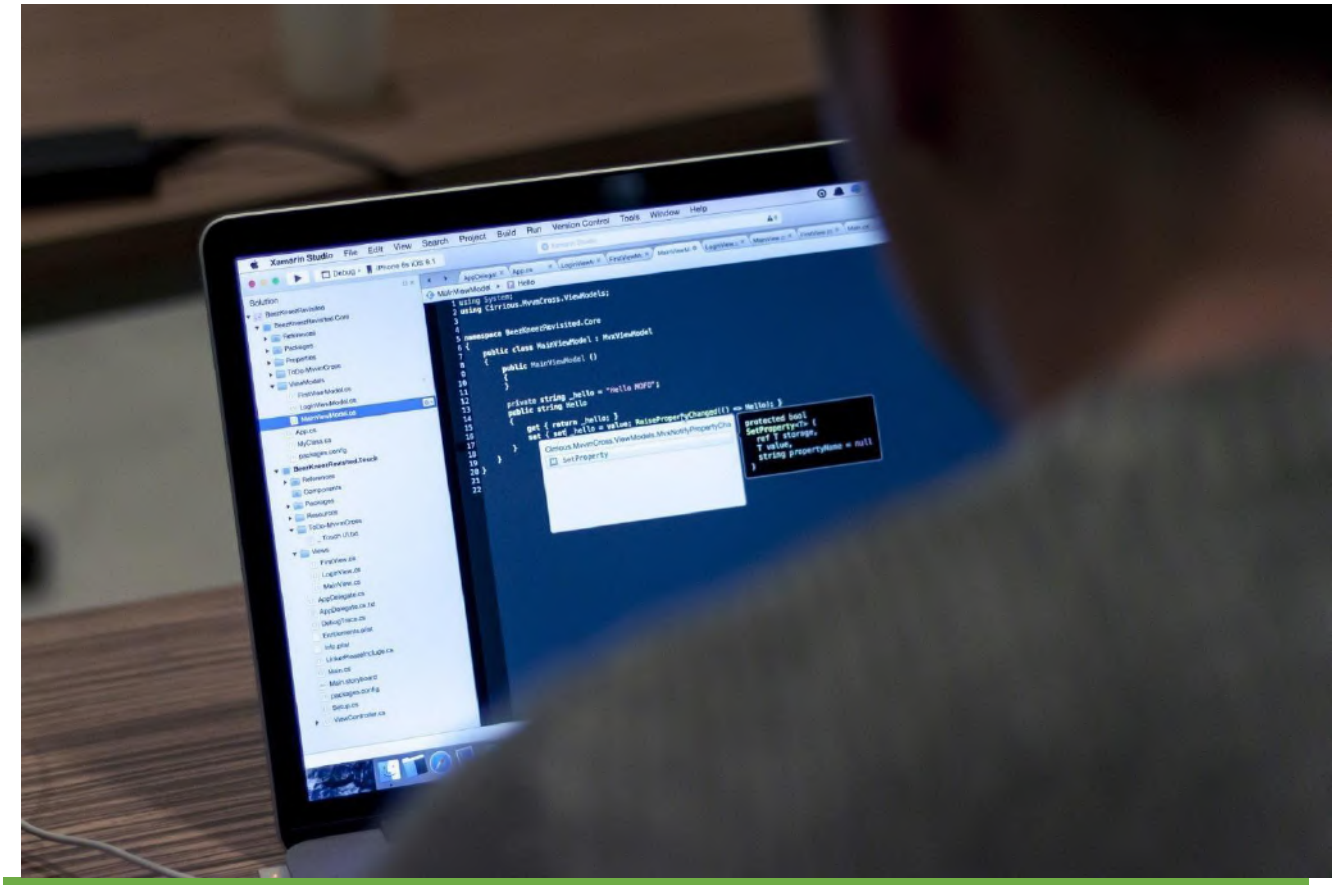

Model Curriculum

QP Name: DCS Programmer and Troubleshooter

QP Code: IAS/Q5605

QP Version: 3.0

NSQF Level: 4

Model Curriculum Version: 2.0

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	• 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	18 Years
Last Reviewed On	20/11/2020
Next Review Date	05/02/2024
NSQC Approval Date	20/11/2020
Version	3.0
Model Curriculum Creation Date	05/02/2020
Model Curriculum Valid Up to Date	05/02/2024
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 DCS Programmer and Troubleshooter.
- Discuss how to develop a DCS program
- Perform on-site testing and commissioning of DCS project.
- Demonstrate how to troubleshoot errors/issues in the machine and process plant.
- Demonstrate testing of hardware components and logic in PLC and install replaced products.
- 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/N5614 - Develop DCS program	**20:00**	**40:00**	**00:00**	**30:00**	**90:00**
Module 1 – Introduction to the Role and Responsibilities of a DCS Programmer and Troubleshooter Bridge Module	10:00	10:00	00:00	00:00	20:00
Module 2 – Develop DCS program	10:00	30:00	00:00	30:00	70:00
IAS/N5615 - Test and commission and troubleshoot DCS project on-site	**70:00**	**80:00**	**00:00**	**30:00**	**90:00**
Module 3 – Test and commission DCS project	30:00	30:00	00:00	30:00	90:00

Module 4 – Troubleshoot DCS project	40:00	50:00	00:00	30:00	120:00
IAS/N9001 - Work effectively with teams	**15:00**	**15:00**	**00:00**	**00:00**	**30:00**
Module 5 – Soft Skills and Work Ethics	15:00	15:00	00:00	00:00	30:00
IAS/N9002 - Maintain health and safety at workplace	**15:00**	**15:00**	**00:00**	**00:00**	**30:00**
Module 6 – Basic Health and Safety Practices	10:00	10:00	00:00	00:00	20:00
Module 7 – 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 8 - Introduction to Employability Skills	01:50	00:00	00:00	00:00	01.50
Module 9 - Constitutional values - Citizenship	01:50	00:00	00:00	00:00	01.50
Module 10 - Becoming a Professional in the 21st Century	02:50	00:00	00:00	00:00	02:50
Module 11 - Basic English Skills	05:00	05:00	00:00	00:00	10:00
Module 12 - Career Development & Goal Setting	01:00	01:00	00:00	00:00	02:00
Module 13 - Communication Skills	02:00	03:00	00:00	00:00	05:00
Module 14 - Diversity & Inclusion	02:50	00:00	00:00	00:00	02:50
Module 15 - Financial and Legal Literacy	02:00	03:00	00:00	00:00	05:00
Module 16 - Essential Digital Skills	04:00	06:00	00:00	00:00	10:00
Module 17 - Entrepreneurship	03:00	04:00	00:00	00:00	07:00
Module 18 - Customer Service	02:00	03:00	00:00	00:00	05:00
Module 19 - Getting ready for apprenticeship & Jobs	03:00	05:00	00:00	00:00	08:00
Total Duration	**150:00**	**180:00**	**00:00**	**90:00**	**420:00**

Module Details

Module 1: Introduction to the Role and Responsibilities of a DCS Programmer and Troubleshooter

Bridge Module

Terminal Outcomes:

- Identify the role and responsibilities of a DCS Programmer and Troubleshooter

Duration: *10:00*	**Duration**: *10:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain Distributed Control Systems (DCS) programming and its application. • Discuss the workflow process of DCS programming and troubleshooting. • Explain the basic concepts of electronics, wiring and instrumentation. • List the modules, tools/equipment and technologies used in the automation and instrumentation process. • Differentiate between the segments of DCS by component, application and end-use industry. • Explain the basics of industrial and infrastructure processes involved in DCS programming. • Describe the importance of adhering to quality, standards and guidelines.	• Demonstrate how to use appropriate operating system and other hardware/software specific to DCS projects. • Demonstrate various techniques for installation and debugging of DCS control panel and programming software.
Classroom Aids	
White board/ black board marker/chalk, duster, computer or Laptop attached to LCD projector	
Tools, Equipment and Other Requirements	
Software and hardware used in DCS programming	

Module 2: Develop DCS Program

Mapped to NOS IAS/N5614

Terminal Outcomes:

- Demonstrate how to develop the program and project.

Duration: *10:00*	**Duration**: *30:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe how to use the piping and instrumentation diagram for DCS projects. • Explain how to identify specifications and requirements for panel designing. • Discuss the total load to be calculated for implementation of DCS project. • List the number and type of field equipment used in the DCS control panel. • Describe information pertaining to specific software, programming languages and protocol, and communication port needed for DCS project development. • Explain the execution of the basic program, special programming and communication program blocks. • Discuss how to configure the DCS software for various specifications such as input/output (IOs) parameters and hardware details of controller, remote, PC operator stations, etc. • Describe the standard operating procedures (SOP), IEC standards, technical information and relevant documents, regulations, etc. for developing programs.	• Create a list of customer requirements for DCS control panel, automation needed and information about equipment/instrument used in the plant. • Demonstrate various ways of interpreting the wiring diagrams between PLC modules and the equipment/components. • Demonstrate how to work with the main power supply unit, signal modules and numbered terminal base. • Demonstrate the techniques to check the wiring of signal modules with other components, especially for special modules and ferrule numbers. • Inspect the panel by performing Factory Acceptance Test (FAT). • Demonstrate how to set up parameters in signal modules and remote devices. • Develop the process logic using pre-defined approved software, as per sample inputs and processes. • Create the operator station (HMI) project, pictures, graphic objects, animations, archive system and security levels.
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, relays, indicating lamp, different types of push button and selector switch, communication software, communication port, wiring diagrams	

Module 3: Test and Commission and troubleshoot DCS Project on Site

Mapped to NOS IAS/N5615

Terminal Outcomes:

- Perform on-site testing and commissioning of DCS project.

Duration: *30:00*	**Duration**: *30:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Describe the testing process and parameters. • Explain the procedure for downloadingfree program into the controller and ensuring the compilation is error free. • Discuss the architecture of the Supervisory control and data acquisition (SCADA) system and transfer process of a SCADA project to a configured server/client. • Explain how to execute the program. • Explain all hardware, software related errors and their cause.	• Demonstrate how to use diagnostic software to perform checks/tests. • Perform activation of inputs to test the software and modify the logic in case ofany error. • Demonstrate the techniques to check input/output, hardware and activation of the SCADA project. • Develop an SOP for SCADA operation for training the operators. • Create backup of the DCS project. • Develop programming logic to avoid non functionality of hardware. • Demonstrate how to configure an error handling program by creating faults. • Perform site acceptance test (SAT). • Demonstrate how to run error handling program to monitor hardware/software related errors.
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, software, hardware, client PC, server PC	

Module 4: Troubleshoot DCS project On-site

Mapped to NOS IAS/N5616

Terminal Outcomes:

- Identify and resolve errors/issues in the machine and process plant.
- Demonstrate testing of hardware components and logic in PLC.
- Explain how to install products to be replaced.

Duration: *40:00*	**Duration**: *50:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain how identify problems in the machine. • Describe the techniques to check forcorrect installation and availability of modules, equipment and electrical components. • Explain how to interpret the DCS Software status and proper functionality.	• Prepare a flowchart to resolve sample errors. • Demonstrate how to test the various equipment of the DCS panel. • Demonstrate how to rectify the program/module faults and replace the defective products. • Demonstrate how to create various records for documenting parameters observed for the connected load. • Perform installation, testing and start-up of plant on-site. • Demonstrate how to maintain troubleshooting backups and reports with respective remedies.
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, flowchart, panel, software, PC stations, hand tools, back ups	

Module 5: 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 problemsthat 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 6: 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 conservingelectricity. • List the common sources of pollution and ways 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/ company policy. • Demonstrate emergency fire rescue techniques. • Display how to administer first aid e.g. bandages, CPR process. • Demonstrate the steps to free a personfrom 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 indifferent 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 7: Self Development Practices

Mapped to NOS IAS/N9002

Terminal Outcomes:

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

Duration: *06:00*	**Duration**: *06:00*
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 8: 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 9: 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 10: 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, Behaviour 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 11: 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 12: 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 13: 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 14: 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 15: 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 16: 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 17: 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 18: Customer Service

Mapped to NOS 60 Hours (Version No. 1)

Key Learning Outcomes:

- Describe the significance of analyzing 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 19: 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***	
Diploma	(Electrical/ Electronics/ Instrumentation or similar trades)	2	(Electrical/ Electronics/ Instrumentation or similar trades)	1		
B.Sc. (Electronics)	Electronics	2	Electronics	1		

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "DCS Programmer and Troubleshooter" mapped to QP "IAS/Q5605" 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	(Electrical/ Electronics/ Instrumentation or similar trades)	3	(Electrical/ Electronics/ Instrumentation or similar trades)			
B.Sc. (Electronics)	Electronics	3	Electronics			

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "DCS Programmer and Troubleshooter" mapped to QP "IAS/Q5605" 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 center 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 bloodcirculation 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
DCS	Distributed Control Systems
SOP	standard operating procedures
IEC standards	The International Electrotechnical Commission standards
CPR	Cardiopulmonary resuscitation
SCADA	Supervisory control and data acquisition