Model Curriculum

QP Name: Programmable Logic Controller (PLC) Programmer and Troubleshooter

QP Code: IAS/Q5604

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	Instrumentation and Automation
Occupation	Installation and Commissioning
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/8212.2002
Minimum Educational Qualification & Experience	Diploma in Electrical/Electronics/ Instrumentation, B.Sc. in Electronic
Pre-Requisite License or Training	NA
Minimum Job Entry Age	19 Years
Last Reviewed On	21/01/2020
Next Review Date	21/01/2025
NSQC Approval Date	
Version	1.0
Model Curriculum Creation Date	21/01/2020
Model Curriculum Valid Up to Date	21/01/2025
Model Curriculum Version	1.0
Minimum Duration of the Course	304 Hours, 0 Minutes
Maximum Duration of the Course	304 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, responsibilities and scope of work of a Programmable Logic Controller (PLC) Programmer and Troubleshooter
- Develop and test PLC program using appropriate software
- Perform on site testing of PLC program
- Identify and resolve errors and issues in the machine and process plant
- Work effectively in a team
- Follow the safety procedures

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
Introduction *Bridge Module*	10:00	05:00	-	04:00	19:00
IAS/N5610 - Develop PLC program using related software **NOS Version No. 1.0** **NSQF Level 4**	**25:00**	**45:00**	-	**06:00**	**76:00**
Developing PLC Program	25:00	45:00	-	06:00	76:00
IAS/N5611 - Test the PLC program using simulators **NOS Version No. 1.0** **NSQF Level 4**	**20:00**	**25:00**	-	**06:00**	**51:00**
Testing the PLC Program	20:00	25:00	-	06:00	51:00

IAS/N5612 - Commission and test the PLC program using trial runs on site **NOS Version No. 1.0** **NSQF Level 4**	**30:00**	**45:00**	-	06:00	**81:00**
Commissioning and Testing the PLC Program Onsite	30:00	45:00	-	06:00	81:00
IAS/N5613 - Troubleshoot faults in the machine or process plant **NOS Version No. 1.0** **NSQF Level 4**	**15:00**	**50:00**	-	**06:00**	**69:00**
Troubleshooting Faults in Machine or Process Plant	15:00	50:00	-	06:00	69:00
IAS/N9001 - Work effectively with teams **NOS Version No. 1.0** **NSQF Level 4**	**06:00**	**11:00**	-	-	**17:00**
Soft Skills and Work Ethics	06:00	11:00	-	-	17:00
IAS/N9002 - Health and safety in workplace **NOS Version No. 1.0** **NSQF Level 4**	**06:00**	**11:00**	-	-	**17:00**
Basic Health and Safety Practices	06:00	11:00	-	-	17:00
Total Duration	**112:00**	**192:00**	-	**28**	**332:00**

Module Details

Introduction

Terminal Outcomes:

- Identify the role, responsibilities and scope of work of a Programmable Logic Controller (PLC) Programmer and Troubleshooter

Duration: *10:00*	**Duration**: *05:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the basic knowledge of computers, operating system and safety procedures • Follow standard operating procedures for developing programs • Identify the basic knowledge of PLC programming software, its installation and debugging required • Identify piping and instrumentation diagram • Describe basic infrastructure processes in the industry • List IEC standards, technical information and relevant documents pertaining to PLC programming • Identify the testing process and testing parameters • Follow means of proper communication with technicians	• Illustrate using computers for basic software required for the role • Illustrate using PLC programming software, its installation and debugging
Classroom Aids:	
Laptop, white board marker, projector	
Tools, Equipment and Other Requirements	
Basic hand tools, digital, multimeter	

Developing PLC Program

Terminal Outcomes:

- Develop and test PLC program using appropriate software

Duration: *25:00*	**Duration**: *45:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the customer requirement and surveying on site location • Identify the modules and layout requirement • Assimilate information pertaining to pre-requisites, communication protocol and program blocks, contacts in the field and different types of blocks • Prepare a list of requirement from the customer to be communicated to the control panel makers • Ensure customer satisfaction and prepare optimum plan for target visits	• Prepare the dimensions and layout of the control panel • Illustrate mounting components and examine the drawings as per the layout • Demonstrate providing relevant instructions to the fabrication team • Develop the process logic using pre-defined software
Classroom Aids:	
Laptop, white board marker, projector	
Tools, Equipment and Other Requirements	
Digital multimeter, micrologic PLC with 120 or 240v AC power supply control panel enclosure and mounting accessories, relays, indicating lamp, different types of push button and selectors witch, analog input output expandable, RS232 serial port cab for communication, RS logix 500 programming language, RS linux, communication software	

Testing the PLC Program

Terminal Outcomes:

- Perform on site testing of PLC program

Duration: *20:00*	**Duration**: *25:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Comply with the procedure for downloading program into PLC software • Identify requirements for testing • Explain the various testing procedures • Identify all hardware related errors • Ensure the completion of the factory acceptance test	• Perform activation of inputs to test the software • Demonstrate modification of the logic in case of any errors • Illustrate activating various connections for simulators • Perform testing of program using hardware simulators • Illustrate examining the hardware for errors • Develop programming logic to avoid non functionality of hardware
Classroom Aids:	
Laptop, white board marker, projector	
Tools, Equipment and Other Requirements	
Digital multimeter, micrologic PLC with 120 or 240v AC power supply control panel enclosure and mounting accessories, relays, indicating lamp, different types of push button and selectors witch, analog input output expandable, RS232 serial port cab for communication, RS logix 500 programming language, RS linux, communication software	

Commissioning and Testing the PLC Program

Terminal Outcomes:

- Perform commissioning and testing of PLC program

Duration: *30:00*	**Duration**: *45:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the tools and resources required for installation of control panel • Create a checklist of parameters for inspection such as wiring, cable numbering, etc. • Obtain permission from customer for downloading the PLC and transfer the program • Check the PLC program by activating sensors, switches, push buttons etc. • Identify ways to achieve productivity and quality as per standard operating procedures	• Demonstrate the use of tools for installation of control panel • Inspect the wiring, cable numbering, power supply, IO and continuity test report Perform activation of sensors, limit switches, PLC outputs etc. • Demonstrate downloading and transferring the program • Perform trial runs of the program to identify errors • Demonstrate revising the logic in case of any errors
Classroom Aids:	
Laptop, white board marker, projector	
Tools, Equipment and Other Requirements	
Digital multimeter, micrologic 1200 model, PLC with 120 or 240 v, AC power supply, control panel enclosure and mounting accessories, relays, indicating lamp, different types of push button and selector switch, analog input output expandable, RS232 serial port cab for communication, RS logix 500 programming language, RS linux, communication software	

Troubleshooting Faults in Machine or Process Plant

Terminal Outcomes:

- Identify and resolve errors and issues in the machine and process plant

Duration: *15:00*	**Duration**: *50:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Identify the problem in the machine • Interpret the control drawing of the machine/ plant • Check for correct installation process and availability of module, equipment and electrical components • Prepare flowchart to resolve errors	• Demonstrate testing the various modules • Inspect earthing issues, communication cable faults, and connected devices • Demonstrate inspecting the machine, equipment and electrical components • Demonstrate resolving errors as per the flowchart • Perform necessary procedures for replacement of defective items
Classroom Aids:	
Laptop, white board marker, projector	
Tools, Equipment and Other Requirements	
Digital multimeter, micrologic 1200 model, PLC with 120 or 240 v, AC power supply, control panel enclosure and mounting accessories, relays, indicating lamp, different types of push button and selector switch, analog input output expandable, RS232 serial port cab for communication, RS logix 500 programming language, RS linux, communication software	

Soft Skills and Work Ethics

Terminal Outcomes:

- Work effectively at the workplace

Duration: *06:00*	**Duration**: *11:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of working towards team objectives and goals • Identify the code of conduct towards team members w.r.t. their culture, preferences, roles and responsibilities • Identify the importance of effective communication and interpersonal skills • Identify the common reasons for interpersonal conflicts and ways of managing them effectively • Identify the importance of standard operating procedures of the company w.r.t. privacy, confidentiality and security • Identify the issues with process flow improvements, quality of output, product defects received from previous process, repairs and maintenance of tools and machinery and handle them • Identify the need for implementing standards, guidelines and practices pertaining to gender sensitivity, including work ethics and workplace etiquettes • Identify the need for implementing standards, guidelines and practices pertaining to sensitivity towards Persons with Disabilities (PwD) • Explain the specific ways to help persons with disability overcome the challenges • List organisational guidelines for dress code, time schedules, language and other soft skill aspects	• Apply team building skills and assist colleagues to maximise effectiveness and efficiency in carrying out tasks • Apply appropriate communication skills and etiquettes while interacting with others • Demonstrate use of inclusive language irrespective of disability and the gender of the person • Demonstrate active listening skills while communicating • Illustrate how to interact with supervisor to receive instructions and report problems that need escalation • Demonstrate ideal workplace ethics while interacting with colleagues • Demonstrate working effectively with colleagues by assisting them whenever required • Illustrate appropriate behaviour towards all genders and differently abled people
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.	

Basic Health and Safety Practices

Terminal Outcomes:

- Apply health and safety practices at the workplace

Duration: *06:00*	**Duration**: *11:00*
Theory – Key Learning Outcomes	**Practical – Key Learning Outcomes**
• Explain the importance of health and safety guidelines • List the components of a basic first-aid kit, safety tools and equipment • Identify the practices for maintaining safe and secure workplace • List the precautions for handling different types of cables and electrical equipment • List the daily safety instructions and the other recommended safety procedures for work—before starting work, while working, after finishing work • Describe the safety drills and health related activities scheduled in the organisation • Identify the types of fire and use correct fire extinguishers • Identify the general safety procedures and standard 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 and methods of waste disposal • List the different categories of waste for the purpose of segregation	• Apply methods of accident prevention in the work environment • Demonstrate using proper techniques for disposal of hazardous chemicals, tools and materials by following prescribed environmental norms or as per company policy • Report any abnormal situation/behaviour of any equipment/system to relevant authorities • Apply emergency rescue techniques during fire hazard • Apply first aid and bandage to victims • Illustrate the steps to free a person from electrocution, and artificial respiration and the CPR Process • Demonstrate correct use of fire extinguishers at the time of emergency • Illustrate the administration of basic first-aid at the time of emergency • Use defined emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of escape and so on • Use protective equipment suitable to tasks and work conditions • Demonstrate correct posture while sitting, standing, and handling heavy materials • Comply with the procedures for minimising waste and processes specified for disposal of hazardous waste
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

Annexure

Trainer Requirements

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

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "Programmable logic controller (PLC) Programmer and Troubleshooter" mapped to QP "IAS/Q5604" Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: "Trainer", mapped to the Qualification Pack: "MEP/Q2601".Minimum accepted score is 70%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	**Specialization**	**Relevant Industry Experience**		**Training Experience**		**Remarks**
		Years	***Specialization***	***Years***	***Specialization***	
Diploma in Electrical/ Electronics/ Instrumentation, B.Sc. in Electronics	Programming, commissioning and troubleshooting of PLC	2	Programming, commissioning and troubleshooting of PLC	2	Programming, commissioning and troubleshooting of PLC	-

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for Job Role: "Programmable logic controller (PLC) Programmer and Troubleshooter" mapped to QP "IAS/Q5604" Minimum accepted score is 80%	Recommended that the Assessor is certified for the Job Role: "Assessor", mapped to the Qualification Pack: "MEP/Q2601".Minimum accepted score is 70%

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
    - Center 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