



# Model Curriculum

**QP Name: Mechatronics Designer and System Integrator**

**QP Code: ELE/Q7107**

**QP Version: 2.0**

**NSQF Level: 6**

**Model Curriculum Version: 2.0**

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## Training Parameters

<b>Sector</b>	Electronics
<b>Sub-Sector</b>	Industrial Automation
<b>Occupation</b>	Engineering – I&A
<b>Country</b>	India
<b>NSQF Level</b>	6
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2015/7412.0101
<b>Minimum Educational Qualification and Experience</b>	<p>12th grade Pass with 4 Years of experience relevant experience</p> <p>OR</p> <p>12th grade pass with 2 year NTC/ CITS/NAC with 2 Years of experience relevant experience</p> <p>OR</p> <p>Completed 2nd year diploma after 12th with 2 Years of experience relevant experience</p> <p>OR</p> <p>Completed 3 year UG degree with 1 Year of experience relevant experience</p> <p>OR</p> <p>Previous relevant Qualification of NSQF Level (5) with 3 Years of experience relevant experience</p>
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	21 Years
<b>Last Reviewed On</b>	24.02.2022
<b>Next Review Date</b>	24.02.2025
<b>NSQC Approval Date</b>	24.02.2022
<b>QP Version</b>	2.0
<b>Model Curriculum Creation Date</b>	24.02.2022

<b>Model Curriculum Valid Up to Date</b>	24.02.2025
<b>Model Curriculum Version</b>	2.0
<b>Maximum Duration of the Course</b>	930 Hours

## 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:

- Demonstrate the process of integrating Programmable Logical Controller (PLC) with the Supervisory Control and Data Acquisition (SCADA) system.
- Describe the process of analysing motion control.
- Demonstrate the process of designing the panels using the AutoCAD electrical toolset.
- Describe the process of carrying out process instrumentation.
- Describe the process of setting up advanced automation in mechatronics.
- Explain the importance of following inclusive practices for all genders and PwD at work.
- Demonstrate the use of relevant health and safety equipment at work.

### 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
<b>Bridge Module</b>	<b>21:00</b>	<b>39:00</b>	<b>00:00</b>	<b>00:00</b>	<b>60:00</b>
Module 1: Introduction and orientation to the role of a Mechatronics Designer and System Integrator	21:00	00:00	00:00	00:00	60:00
<b>ELE/N7112 Integrate PLC with the SCADA system</b>	<b>30:00</b>	<b>60:00</b>	<b>00:00</b>	<b>60:00</b>	<b>150:00</b>
Module 2: Process of integrating Programmable Logical Controller (PLC) with the Supervisory Control and Data Acquisition (SCADA) system	30:00	60:00	00:00	60:00	150:00
<b>ELE/N7113 Analyse motion control</b>	<b>30:00</b>	<b>60:00</b>	<b>00:00</b>	<b>60:00</b>	<b>150:00</b>
Module 3: Process of analysing motion control	30:00	60:00	00:00	60:00	150:00
<b>ELE/N7114 Design the panels using AutoCAD electrical toolset</b>	<b>60:00</b>	<b>60:00</b>	<b>00:00</b>	<b>30:00</b>	<b>150:00</b>

Module 4: Process of designing the panels using AutoCAD electrical toolset	60:00	60:00	00:00	30:00	150:00
<b>ELE/N7115 Carry out process instrumentation</b>	<b>60:00</b>	<b>60:00</b>	<b>00:00</b>	<b>30:00</b>	<b>150:00</b>
Module 5: Process of carrying out process instrumentation	60:00	60:00	00:00	30:00	150:00
<b>ELE/N7116 Set up advanced automation in mechatronics</b>	<b>60:00</b>	<b>60:00</b>	<b>00:00</b>	<b>60:00</b>	<b>180:00</b>
Module 6: Process of setting up advanced automation in mechatronics	60:00	60:00	00:00	60:00	180:00
<b>ELE/N1002 Apply health and safety practices at workplace</b>	<b>15:00</b>	<b>15:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 7: Basic Health and Safety Practice	15:00	15:00	00:00	00:00	30:00
<b>DGT/VSQ/N0102- Employability Skills (60 Hours)</b>	<b>24:00</b>	<b>36:00</b>	<b>00:00</b>	<b>00:00</b>	<b>60:00</b>
Module 8: Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00
<b>Total Duration</b>	<b>300:00</b>	<b>390:00</b>	<b>00:00</b>	<b>240:00</b>	<b>930:00</b>

# Module Details

## Module 1: Introduction and orientation to the role of a Mechatronics Designer and System Integrator

### Terminal Outcomes:

- Describe the job role of a Mechatronics Designer and System Integrator.

<b>Duration: 21:00</b>	<b>Duration: 39:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Describe the size and scope of the Electronics industry and its sub-sectors</li> <li>• Discuss the role and responsibilities of a Mechatronics Designer and System Integrator.</li> <li>• Discuss various employment opportunities for a Mechatronics Designer and System Integrator in the Electronics industry.</li> <li>• State the organisational policies on incentives, personnel management reporting structure, etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Familiarization with the Mechatronics Software</li> <li>• Awareness of Industry 4.0</li> </ul>
<b>Classroom Aids</b>	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
NA	

## Module 2: Process of integrating Programmable Logical Controller (PLC) with the Supervisory Control and Data Acquisition (SCADA) system

### Mapped to ELE/N7112

#### Terminal Outcomes:

- Demonstrate the process of carrying out the programming of PLC.
- Demonstrate the process of setting up the SCADA software.

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the basics of digital electronics.</li> <li>• Explain the fundamentals of PLC.</li> <li>• Explain the PLC hardware and architecture.</li> <li>• Explain the source and sink concepts.</li> <li>• Describe the process of wiring different field devices to PLC.</li> <li>• Explain the use of PLC programming software.</li> <li>• Describe the process of creating a new application and addressing it in PLC.</li> <li>• Explain different programming languages and basic programming instructions.</li> <li>• Explain the advance instructions such as upload/ download/ monitoring forcing of IOs.</li> <li>• Describe the process of detecting faults in the PLC system and SCADA software, troubleshooting them and carrying out the necessary documentation.</li> <li>• Explain how to communicate with the SCADA software.</li> <li>• Explain the use of real-time applications.</li> <li>• Explain how to create a new SCADA project.</li> <li>• Describe the process of creating and editing elementary graphic display.</li> <li>• Explain how to attach controls to</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the process of creating a new application using PLC to refer to the location in a memory called as address.</li> <li>• Demonstrate how to use the relevant programming language.</li> <li>• Demonstrate how to manipulate the basic instruction of programming.</li> <li>• Demonstrate how to discover the advanced instructions of PLC programming.</li> <li>• Demonstrate how to enumerate the upload and download function of the programming.</li> <li>• Demonstrate how to position the cursor of the Ladder diagram for forcing the Internetwork Operating System (IOS)</li> <li>• Demonstrate how to detect the fault, troubleshoot it and carry out the required documentation.</li> <li>• Demonstrate the process of setting up communication with the SCADA software.</li> <li>• Demonstrate the process of performing servo motor control for linear applications using PLC programming.</li> <li>• Demonstrate the process of creating a new SCADA for temperature control and water level control application.</li> <li>• Demonstrate how to attach the controls to graphic objects.</li> <li>• Demonstrate how to design different</li> </ul>



<p>graphic objects.</p> <ul style="list-style-type: none"> <li>• Explain how to analyse real-time and historical trends.</li> <li>• Explain the use of alarms and events.</li> <li>• Describe the application of scripts.</li> <li>• Describe the process of Net DDE Communication.</li> </ul>	<p>diagrams in the SCADA software.</p> <ul style="list-style-type: none"> <li>• Demonstrate the use of the relevant tools and controls in the SCADA software.</li> <li>• Demonstrate how to incorporate the real data and scripts application in the SCADA software.</li> <li>• Demonstrate the process of extracting the real-time data in the prescribed format.</li> <li>• Demonstrate the use of the Dynamic Data Exchange (DDE) communications appropriately.</li> <li>• Demonstrate how to detect data faults and troubleshoot them using the SCADA software.</li> </ul>
<p><b>Classroom Aids</b></p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p>3D printer, Screwdriver, Digital force gauge, Ohmmeter, Flowmeter, Graphing calculator, Vibration isolator, Caliper, PLC, SCADA, Digital Control, Micro-Controllers, Sensor &amp; Actuators</p>	

## Module 3: Process of analysing motion control

### Mapped to ELE/N7113

#### Terminal Outcomes:

- Describe the process of analysing drives and motors.

Duration: 30:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the need for motors and their application in different applications.</li> <li>• Explain the concept, operations and limitations of Alternating Current (AC) and Direct Current (DC) motors.</li> <li>• Explain different starters in motor and their functions in DOL &amp; Star-Delta.</li> <li>• Explain the use of motor starters such as DOL, Star-Delta, Auto Transformer.</li> <li>• Explain the use of motor control and interlocking circuits.</li> <li>• State the criteria for drives selection.</li> <li>• Explain the communication mechanism between PLC and SCADA software</li> <li>• Explain the advantage of using soft starters over conventional starters.</li> <li>• Explain the application of motor in different applications.</li> <li>• Explain different starters in motor and identify its function in DOL &amp; Star- Delta.</li> <li>• Explain how to design the motor circuit and interlocking circuit.</li> <li>• Explain basic parameter programming to operate the motor.</li> <li>• Explain how to carry out drives selection for various processes.</li> <li>• Describe the concept and process of designing the control panel.</li> <li>• Describe the process of detecting faults in the real-time monitoring system and carrying out Troubleshooting.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to design the motor circuit and interlocking circuit.</li> <li>• Demonstrate the process of carrying out basic parameter programming to operate the motor.</li> <li>• Demonstrate how to perform drives selection for various processes.</li> <li>• Demonstrate the process of designing a drive control panel.</li> <li>• Demonstrate the process of carrying out interfacing of the motor to the PLC and SCADA software.</li> <li>• Demonstrate how to detect faults in the real-time monitoring system and carry out troubleshooting.</li> <li>• Demonstrate the use of the appropriate starter in the motor such as the soft or conventional starter.</li> <li>• Demonstrate the use of DC shunt or DC series motor as per the requirement.</li> <li>• Demonstrate how to store data using memory cells.</li> <li>• Demonstrate the process of encoding and decoding data using logic gates.</li> <li>• Demonstrate how to prepare for circuit wiring.</li> <li>• Demonstrate the process of designing digital electronic circuits for various applications.</li> </ul>

- Explain how to prepare for residential wiring.
- Explain how to design digital electronic circuits.

#### Classroom Aids

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

#### Tools, Equipment and Other Requirements

Memory Cells, Motor, Circuits, Drives, Transformers, Starters

## Module 4: Process of designing the panels using AutoCAD electrical toolset Mapped to ELE/N7114

### Terminal Outcomes:

- Demonstrate the process of designing the panels.

Duration: 60:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the functions of switch gears and relevant accessories.</li> <li>• Explain the basics of control and power drawings.</li> <li>• State the applicable protective measures to be taken during panel designing.</li> <li>• Explain the practice of load management i.e. connected load, running load, load factor, etc.</li> <li>• Explain the use of relevant indicating devices such as Ammeter, Volt Meter, Power Factor (PF) &amp; Kilowatts (KW) Meter for measuring various parameters in the panel design.</li> <li>• Describe the process of preparing general arrangement and busbar sizing diagrams.</li> <li>• Describe the process of preparing power and control circuits.</li> <li>• Explain how to maintain and troubleshoot control circuits in live panels.</li> <li>• Describe the process of designing power and control drawings through AutoCAD.</li> <li>• Explain the function of switch gears and accessories.</li> <li>• Explain the need and application of panel designing.</li> <li>• Explain the function of various devices in designing an electrical circuit.</li> <li>• Explain how to create, modify, and document electrical control systems with AutoCAD Electrical toolset.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the use of electrical circuits and relevant devices in panel designing.</li> <li>• Demonstrate how to create, modify and document electrical control systems with AutoCAD Electrical toolset.</li> <li>• Demonstrate the process of analysing the load management system while designing the panel.</li> <li>• Demonstrate the use of the appropriate indicating devices such as ammeter and voltmeter for measuring various parameters in panel design.</li> <li>• Demonstrate how to correlate the running load, connected load and determine the load factor.</li> <li>• Demonstrate the process of installing the electrical protection system.</li> <li>• Demonstrate how to create the electrical and power circuits using AutoCAD software.</li> <li>• Demonstrate the process of carrying out regular maintenance and troubleshooting of control circuits in live panels.</li> <li>• Demonstrate how to design the power and control diagrams through AutoCAD.</li> </ul>

<ul style="list-style-type: none"> <li>• Explain the functioning of the load management system in designing the panel.</li> <li>• Explain how to create the electrical and power circuits.</li> <li>• Explain general wiring guidelines and practices.</li> <li>• Describe the process of maintaining and troubleshooting control circuits in live panels.</li> <li>• Describe the process of designing power and control diagrams.</li> </ul>	
<p><b>Classroom Aids</b></p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p>Volt Meter, Electrical Toolset, Panel, Digital Control, Micro-Controllers, Sensor &amp; Actuators</p>	

## Module 5: Process of carrying out process instrumentation

### Mapped to ELE/N7115

#### Terminal Outcomes:

- Demonstrate the process of performing process instrumentation.

Duration: 60:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the basic functions of electrical components.</li> <li>• Explain the function of different types of electrical components, transmitters and sensors used in industrial applications.</li> <li>• Explain different types of position sensors and their applications.</li> <li>• Explain the working principle and selection criteria for a flow measurement device.</li> <li>• Explain the working principle and selection criteria for a pressure measurement device.</li> <li>• Explain the working principle of load cells and the load measurement process.</li> <li>• Explain the working principle and selection criteria for a level measurement device</li> <li>• Explain the working principle of solenoid valves, control valves, smart transmitters and instrument transformers such as Current Transformer (CT), Voltage Transformer (VT).</li> <li>• Explain the functions of closed and open-loop controls.</li> <li>• Describe the process control basics and process controllers (on-off, proportional, PID).</li> <li>• Explain how to identify the change in light intensity using a photo-electric sensor.</li> <li>• Explain how to estimate the flow measurement, its working principle,</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the use of position sensor, photo-electric sensor and proximity sensor.</li> <li>• Demonstrate the use of the appropriate flow measurement device.</li> <li>• Demonstrate how to measure the linear, nonlinear, mass or volumetric flow rate of a liquid or gas using a flow sensor.</li> <li>• Demonstrate how to evaluate the process of pressure measurement using a suitable sensor.</li> <li>• Demonstrate how to measure the load parameters using load cells.</li> <li>• Demonstrate how to interconnect different sensors as per the standard procedure.</li> <li>• Demonstrate the use of suitable sensors for level measurement.</li> <li>• Demonstrate the use of the solenoid valves and control valves as per the requirement.</li> <li>• Demonstrate the process of installing and using the smart transmitters appropriately.</li> <li>• Demonstrate the process of installing and using the process control and feedback devices in the closed-loop control system.</li> <li>• Demonstrate how to regulate the temperature, flow, pressure, speed and other process variables by using the PID controller.</li> </ul>

<p>types and selection guidelines.</p> <ul style="list-style-type: none"> <li>• Explain how to measure linear, nonlinear, mass or volumetric flow rate of a liquid or gas using a flow sensor.</li> <li>• Explain different types of sensors used in flow and load measurement.</li> <li>• Explain how to measure pressure by using various pressure measurement devices.</li> <li>• Explain how to measure the load parameters using load cells.</li> <li>• Explain the functions of the smart transmitters.</li> <li>• Explain the technique to be used to protect the power system through instrument transformers (CT, VT).</li> </ul>	
<p><b>Classroom Aids</b></p>	
<p>Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop</p>	
<p><b>Tools, Equipment and Other Requirements</b></p>	
<p>Transmitters, Sensors, Measuring Tools, Valves, Transformers, Photo-Electric Sensor.</p>	

## Module 6: Process of setting up advanced automation in mechatronics

### Mapped to ELE/N7116

#### Terminal Outcomes:

- Demonstrate the process of setting up Human Machine Interface (HMI).
- Explain how to automate the material handling system.
- Explain how to use the Internet of Things (IoT) in mechatronic.

Duration: 60:00	Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the working of PLC and SCADA with HMI.</li> <li>• Explain the concept of HMI and HMI operations in an automation environment.</li> <li>• Describe the process of creating applications and tags.</li> <li>• Explain the use of different monitoring systems.</li> <li>• Explain the architecture of IoT and applicable trends.</li> <li>• Explain the functioning of relevant material handling systems used in the industry.</li> <li>• Explain the basic knowledge of automated material handling systems and various material transport systems.</li> <li>• Explain the function of a conveyor system and the working of cranes and hoists for lifting objects on the shop floor.</li> <li>• Explain the need for a conveyor system and rails for an automated material handling system.</li> <li>• Explain the working principle of automatic storage and retrieval system.</li> <li>• Explain how to download/upload programs.</li> <li>• Explain how to create alarm messages.</li> <li>• Describe the process of</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate how to evaluate the real-time lagging data.</li> <li>• Demonstrate the process of applying the knowledge of PLC, SCADA and IoT in designing HMI.</li> <li>• Demonstrate the use of Software-as-a-Service (SaaS) for distributing data online to cloud computing.</li> <li>• Demonstrate the process of carrying out networking and managing all the infrastructure data on a common cloud platform.</li> <li>• Demonstrate the process of performing diagnostic checks to detect faults and troubleshoot them.</li> <li>• Demonstrate the use of the mono-rail and rail-guided vehicles and other material transport systems for automation.</li> <li>• Demonstrate the use of the conveyor system, cranes and hoists on the shop floor.</li> <li>• Demonstrate the process of applying the automatic robot working system in the industry.</li> <li>• Demonstrate the process of performing engineering analysis of automated storage systems in the manufacturing sector.</li> <li>• Demonstrate how to implement the Automated Guidance Vehicle System (AGVS).</li> <li>• Demonstrate how to implement industry 4.0 in automated storage and retrieval system to improve floor</li> </ul>



<p>communication with PLC.</p> <ul style="list-style-type: none"> <li>• Describe the process of detecting faults through diagnostics.</li> <li>• State the relevant considerations to be made while selecting a material handling system.</li> <li>• Explain the use of automated guided vehicle systems.</li> <li>• Explain the functioning of monorails and rail-guided vehicles.</li> <li>• Explain different conveyor systems such as cranes and hoists.</li> <li>• Describe the process of analysing the material transport system.</li> <li>• Describe the process of carrying out engineering analysis of the automated storage system.</li> <li>• Explain the role of automated storage and retrieval system in Industry 4.0.</li> <li>• State the working principle of the carousel storage system.</li> <li>• Explain different barcode and RFID techniques.</li> <li>• Explain the use of robotics in material handling systems.</li> <li>• Explain the IoT architecture and relevant platforms.</li> <li>• State the relevant trends in the adoption of IoT.</li> <li>• Describe the process of basic programming of controllers.</li> <li>• Explain the use of appropriate hardware platforms such as Intel Galileo, Edison, Arduino, Beaglebone, Black &amp; Raspberry Pi.</li> <li>• Explain the use of appropriate software platforms such as Intel XDK, Node-RED, VISUINO, Fritzing, 123dcircuits.</li> <li>• Explain the applicable machine to machine integration concepts.</li> <li>• Explain the basics of Python.</li> </ul>	<p>space utilisation and data collection.</p> <ul style="list-style-type: none"> <li>• Demonstrate how to track tags attached to objects through electromagnetic fields in RFID techniques.</li> <li>• Demonstrate how to use the carousel storage system.</li> <li>• Demonstrate the process of creating and applying barcodes to various applications using the barcode system.</li> <li>• Demonstrate the use of robotics in the material handling system.</li> <li>• Demonstrate how to modify the automation process by enabling them to transmit data and automate tasks without requiring any manual intervention with the IoT devices.</li> <li>• Demonstrate the process of carrying out programming for IoT.</li> <li>• Demonstrate how to implement different monitoring processes for automation.</li> <li>• Demonstrate the use of the relevant software platform tools such as intel XDK, Node-RED, VISUINO, Fritzing, 123dcircuits.</li> <li>• Demonstrate the process of applying the IoT concept in real-time applications.</li> <li>• Demonstrate how to interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.</li> <li>• Demonstrate how to interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to a smartphone using Bluetooth.</li> </ul>
<p><b>Classroom Aids</b></p>	

Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop

**Tools, Equipment and Other Requirements**

Screwdriver, Digital force gauge, Ohmmeter, Flowmeter, Graphing calculator, Vibration isolator, Caliper, PLC, SCADA, Digital Control, Micro-Controllers, Sensor & Actuators, RFID

## Module 7: Basic Health and Safety Practice

### Mapped to ELE/N1002

#### Terminal Outcomes:

- Apply health and safety practices at the workplace.

Duration: 15:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Discuss job-site hazards, risks and accidents.</li> <li>• Explain the organizational safety procedures for maintaining electrical safety, handling tools and hazardous materials.</li> <li>• Elaborate on electronic waste disposal procedures.</li> <li>• Describe the process of disposal of hazardous waste</li> <li>• List the name and location of concerned people, documents and equipment for maintaining health and safety in the workplace.</li> <li>• Describe how to interpret warning signs while accessing sensitive work areas.</li> <li>• Explain the importance of good housekeeping.</li> <li>• Describe the importance of maintaining appropriate postures while lifting heavy objects.</li> <li>• List the types of fire and fire extinguishers.</li> <li>• Explain the importance of efficient utilisation of water, electricity and other resources.</li> <li>• List the common sources of pollution and ways to minimize it.</li> <li>• Describe the concept of waste management and methods of disposing hazardous waste.</li> <li>• Explain various warning and safety signs.</li> <li>• Describe different ways of preventing accidents at the workplace.</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the use of protective equipment suitable as per tasks and work conditions.</li> <li>• Prepare a report to inform the relevant authorities about any abnormal situation/behaviour of any equipment/system.</li> <li>• Administer first aid in case of a minor accident.</li> <li>• Demonstrate the steps to free a person from electrocution safely.</li> <li>• Administer Cardiopulmonary Resuscitation (CPR).</li> <li>• Demonstrate the application of defined emergency procedures such as raising alarm, safe/efficient, evacuation, moving injured people, etc.</li> <li>• Prepare a sample incident report.</li> <li>• Use a fire extinguisher in case of a fire incident.</li> <li>• Demonstrate the correct method of lifting and handling heavy objects.</li> </ul>

<b>Classroom Aids</b>
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop
<b>Tools, Equipment and Other Requirements</b>
Personal Protection Equipment: Safety Glasses, Head Protection, Rubber Gloves, Safety Footwear, Warning Signs And Tapes, Fire Extinguisher, First Aid Kit, Fire Extinguishers And Warning Signs.

## Module 8: Employability Skills (60 Hours) Mapped to DGT/VSQ/N0102

### Terminal Outcomes:

- Discuss about Employability Skills in meeting the job requirements
- Describe opportunities as an entrepreneur.
- Describe ways of preparing for apprenticeship & Jobs appropriately.

<b>Duration: 24:00</b>	<b>Duration: 36:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen</li> <li>• Discuss 21<sup>st</sup> century skills</li> <li>• Explain use of basic English phrases and sentences.</li> <li>• Demonstrate how to communicate in a well-behaved manner</li> <li>• Demonstrate how to work with others</li> <li>• Demonstrate how to operate digital devices</li> <li>• Discuss the significance of Internet and Computer/ Laptops</li> <li>• Discuss the need for identifying business opportunities</li> <li>• Discuss about types of customers.</li> <li>• Discuss on creation of biodata</li> <li>• Discuss about apprenticeship and opportunities related to it.</li> </ul>	<ul style="list-style-type: none"> <li>• List different learning and employability related GOI and private portals and their usage</li> <li>• Show how to practice different environmentally sustainable practices.</li> <li>• Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc.</li> <li>• Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone</li> <li>• Demonstrate how to communicate in a well-mannered way with others.</li> <li>• Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette</li> <li>• Utilize virtual collaboration tools to work effectively</li> <li>• Demonstrate how to maintain hygiene and dressing appropriately.</li> <li>• Perform a mock interview</li> </ul>
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board OR Computer Lab	

## Module 9: On-the-Job Training

### Mapped to Mechatronics Designer and System Integrator

<b>Mandatory Duration: 240:00</b>	<b>Recommended Duration: 00:00</b>
<b>Location: On-Site</b>	
<p><b>Terminal Outcomes</b></p> <ol style="list-style-type: none"> <li>1. Explain the basics of digital electronics.</li> <li>2. Explain the PLC hardware and architecture.</li> <li>3. Explain the process of carrying out the programming of PLC.</li> <li>4. Explain the process of setting up the SCADA software.</li> <li>5. Explain the process of analysing drives and motors.</li> <li>6. Explain the concept, operations and limitations of Alternating Current (AC) and Direct Current (DC) motors.</li> <li>7. Use of relevant indicating devices such as Ammeter, Volt Meter, Power Factor (PF) &amp; Kilowatts (KW) Meter.</li> <li>8. Carry out troubleshooting control circuits in live panels.</li> <li>9. Carry out process instrumentation.</li> <li>10. Set up Human Machine Interface (HMI).</li> <li>11. Use the Internet of Things (IoT) in mechatronic.</li> <li>12. Maintain a healthy, safe and secure working environment.</li> </ol>	

# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E./B.Tech	Electrical/ Electronics Engineering	5	Mechatronics  Designer and System Integrator	2	Electronics	

Trainer Certification	
Domain Certification	Platform Certification
<p><b>“Mechatronics Designer and System Integrator”</b>, “ELE/Q7107, v2.0”, Minimum accepted score is 80%</p>	<p>Recommended that the Trainer is certified for the <b>Mechatronics Designer and System Integrator</b> “Trainer (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2601, V2.0”, with minimum score of 80%</p>

## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
B.E./B.Tech	Electrical/ Electronics Engineering	7	Mechatronics  Designer and System Integrator	2	Electronics	

Assessor Certification	
Domain Certification	Platform Certification
<p><b>“Mechatronics Designer and System Integrator”, “ELE/Q7107, v2.0”,</b> Minimum accepted score is 80%</p>	<p>Recommended that the Assessor is certified for the <b>Mechatronics Designer and System Integrator “Assessor (VET and Skills)”</b>, mapped to the Qualification Pack: <b>“MEP/Q2701, V2.0”</b>, with minimum score of 80%</p>



## 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
- The assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

### 2. Testing Environment

To ensure a conducive environment for conducting a test, the trainer will:

- 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 10 a.m. and 5 p.m.
- Ensure there are 2 assessors if the batch size is more than 30.
- 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 levels 1 to 3 are for the unskilled & semi-skilled individuals, and levels 4 and above are for the skilled, supervisor & higher management
- The assessor must be ToA certified & the trainer must be ToT Certified
- The 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:

To verify the details submitted by the training centre, the assessor will undertake:

- A surprise visit to the assessment location
- A random audit of the batch
- A random audit of any candidate

### 6. Method for assessment documentation, archiving, and access

To protect the assessment papers and information, the assessor will ensure:

- 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 drive

# References

## Glossary

Term	Description
<b>Declarative knowledge</b>	Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood to accomplish a task or to solve a problem.
<b>Key Learning</b>	The key learning outcome is the statement of what a learner needs to know, understand and be able to do 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).
<b>OJT (M)</b>	On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on the site
<b>OJT (R)</b>	On-the-job training (Recommended); trainees are recommended the specified hours of training on the site
<b>Procedural Knowledge</b>	Procedural knowledge addresses how to do something, or how to perform a
<b>Training Outcome</b>	Training outcome is a statement of what a learner will know, understand and be able to do <b>upon the completion of the training.</b>
<b>Terminal Outcome</b>	The terminal outcome is a statement of what a learner will know, understand and be able to do <b>upon the completion of a module.</b> A set of terminal outcomes help to achieve the training outcome.

## Acronyms and Abbreviations

Term	Description
AC	Alternating Current
AGVS	Automated Guidance Vehicle System
CT	Current Transformer
CPR	Cardiopulmonary Resuscitation
DDE	Dynamic Data Exchange
DC	Direct Current
HMI	Human Machine Interface
KW	Kilowatts
NCO	National Occupational Standards
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
PC	Performance Criteria
PF	Power Factor
PLC	Programmable Logical Controller
PwD	Persons with Disabilities
QP	Qualification Pack
SaaS	Software-as-a-Service
SDMS	Skill Development & Management System
SIP	Skill India Portal
SME	Small and Medium Enterprises
SOP	Standard Operating Procedure
SSC	Sector Skill Council
SCADA	Supervisory Control and Data Acquisition
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider
VT	Voltage Transformer