Mechatronics Designer and System Integrator

QP Code: ELE/Q7107

Version: 1.0

NSQF Level: 6

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Contents

ELE/Q7107: Mechatronics Designer and System Integrator

Brief Job Description

A Mechatronic Designer and System Integrator is responsible for the designing of controlled motion systems through the integration of functional elements from a multitude of disciplines. The individual works in all aspects of the development of smart machine manufacturing from design to testing in industries such as robotics, human-machine interaction, medical and assistive technology, etc.

Personal Attributes

The individual must have attention to detail and problem-solving skills. The person must be able to work collaboratively with a diversity of professionals to deliver projects successfully.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ELE/N7112: Integrate PLC with the SCADA system

2. ELE/N7113: Analyse motion control

3. ELE/N7114: Design the panels using AutoCAD electrical toolset

4. ELE/N7115: Carry out process instrumentation

5. ELE/N7116: Set up advanced automation in mechatronics

6. ELE/N9905: Work effectively at the workplace

7. ELE/N1002: Apply health and safety practices at the workplace

Qualification Pack (QP) Parameters

Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
Country	India
NSQF Level	6
Credits	NA

Aligned to NCO/ISCO/ISIC Code	NCO-2015/NA
Minimum Educational Qualification & Experience	Diploma ((after 10th (Electrical or Electronics or Mechanical Engineering) with 5 Years of Relevant experience) OR (3 Years Diploma after 12 (Electrical or Electronics or Mechanical Engineering) with 3 Years of Relevant experience)) OR B.E./B.Tech ((Degree in Electrical or Electronics or Mechanical Engineering) with 02 Year of relevant Experience) OR (M.E/M.Tech in Electrical or Electronics or Mechanical Engineering)) OR Certificate-NSQF (Level-5 in Building Management System Service Engineer) with 2 Years of experience in the relevant field
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	24/02/2022
Next Review Date	02/06/2025
Deactivation Date	31/07/2024
NSQC Approval Date	24/02/2022
Version	1.0
Reference code on NQR	2022/EHW/ESSC/05392
NQR Version	1.0

ELE/N7112: Integrate PLC with the SCADA system

Description

This OS unit is about performing integration of Programmable Logical Controller (PLC) with Supervisory Control and Data Acquisition (SCADA) system.

Scope

The scope covers the following :

- Carry out the programming of PLC
- Set up the SCADA software

Elements and Performance Criteria

Carry out the programming of PLC

To be competent, the user/individual on the job must be able to:

PC1. select an appropriate type of input or output module for the selected PLC system

PC2. create a new application using PLC to refer to the location in a memory called as address

PC3. use the relevant programming language

PC4. set the basic programming instructions

PC5. set the advanced PLC programming instructions

PC6. examine the monitoring system and enumerate the upload and download function of the programming

PC7. position the cursor of the Ladder diagram for forcing the Internetwork Operating System (IOS)

PC8. detect the fault, troubleshoot it and carry out the required documentation

PC9. set up communication with the SCADA software

PC10. follow the block diagram, input and output modules interfaces of PLC

PC11. examine the belt conveyor control with PLC programming

PC12. perform servo motor control for linear applications using PLC programming

Set up the SCADA software

To be competent, the user/individual on the job must be able to:

PC13. create new SCADA for temperature control and water level control application

PC14. attach the controls to graphic objects

PC15. design different diagram in the SCADA software

PC16. use the relevant tools and controls in the SCADA software

PC17. evaluate the real-time signals and identify the historical trends in the field

PC18. incorporate the real data and scripts application in the SCADA software

PC19. extract the real-time data in the prescribed format

PC20. use the Dynamic Data Exchange (DDE) communications appropriately

PC21. detect data fault and troubleshoot them using the SCADA software

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the basics of digital electronics
KU2. the fundamentals of PLC
KU3. the PLC hardware and architecture
KU4. the source and sink concepts
KU5. the process of wiring different field devices to PLC
KU6. use of PLC programming software
KU7. the process of creating a new application and addressing it in PLC
KU8. different programming languages and basic programming instructions
KU9. the advance instructions such as upload/ download/ monitoring forcing of IOs
KU10. the process of detecting faults in the PLC system and SCADA software, troubleshooting them and carrying out the necessary documentation
KU11. how to communicate with the SCADA software
KU12. use of real-time applications
KU13. how to create a new SCADA project
KU14. the process of creating and editing elementary graphic display
KU15. how to attach controls to graphic objects
KU16. how to analyse real-time and historical trends
KU17. the use of alarms and events
KU18. the application of scripts
KU19. the process of Net DDE Communication

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records
GS2. read the relevant literature to get the latest updates about the field of work
GS3. communicate politely and professionally
GS4. listen attentively to understand the information being shared
GS5. take quick decisions to deal with work emergencies or accidents
GS6. identify possible disruptions to work and take appropriate preventive measures
GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Carry out the programming of PLC	**15**	**25**	**-**	**8**
PC1. select an appropriate type of input or output module for the selected PLC system	-	-	-	-
PC2. create a new application using PLC to refer to the location in a memory called as address	-	-	-	-
PC3. use the relevant programming language	-	-	-	-
PC4. set the basic programming instructions	-	-	-	-
PC5. set the advanced PLC programming instructions	-	-	-	-
PC6. examine the monitoring system and enumerate the upload and download function of the programming	-	-	-	-
PC7. position the cursor of the Ladder diagram for forcing the Internetwork Operating System (IOS)	-	-	-	-
PC8. detect the fault, troubleshoot it and carry out the required documentation	-	-	-	-
PC9. set up communication with the SCADA software	-	-	-	-
PC10. follow the block diagram, input and output modules interfaces of PLC	-	-	-	-
PC11. examine the belt conveyor control with PLC programming	-	-	-	-
PC12. perform servo motor control for linear applications using PLC programming	-	-	-	-
Set up the SCADA software	**15**	**30**	**-**	**7**
PC13. create new SCADA for temperature control and water level control application	-	-	-	-
PC14. attach the controls to graphic objects	-	-	-	-
PC15. design different diagram in the SCADA software	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC16. use the relevant tools and controls in the SCADA software	-	-	-	-
PC17. evaluate the real-time signals and identify the historical trends in the field	-	-	-	-
PC18. incorporate the real data and scripts application in the SCADA software	-	-	-	-
PC19. extract the real-time data in the prescribed format	-	-	-	-
PC20. use the Dynamic Data Exchange (DDE) communications appropriately	-	-	-	-
PC21. detect data fault and troubleshoot them using the SCADA software	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7112
NOS Name	Integrate PLC with the SCADA system
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7113: Analyse motion control

Description

This OS unit is about analysing motion control to ensure the correct functioning of various components in the integrated SCADA system.

Scope

The scope covers the following :

- Analyse drives and motors

Elements and Performance Criteria

Analyse drives and motors

To be competent, the user/individual on the job must be able to:

PC1. design the motor circuit and interlocking circuit

PC2. carry out basic parameter programming to operate the motor

PC3. perform drives selection for various processes

PC4. design the control panel

PC5. carry out interfacing of the motor to the PLC and SCADA software

PC6. detect faults in the real-time monitoring system and carry out troubleshooting

PC7. select and use an appropriate starter in the motor such as the soft or conventional starter

PC8. select and use DC shunt or DC series motor as per the requirement

PC9. assess the characteristics of methods of speed control of DC shunt motor

PC10. store data using memory cells

PC11. encode and decode data using logic gates

PC12. prepare for circuit wiring

PC13. design digital electronic circuits for various applications

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the need for motors and their application in different applications

KU2. the concept, operations and limitations of Alternating Current (AC) and Direct Current (DC) motors

KU3. different starters in motor and their functions in DOL & Star- Delta

KU4. the use of motor starters such as DOL, Star-Delta, Auto Transformer

KU5. the use of motor control and interlocking circuits

KU6. the criteria for drives selection

KU7. the process of parameter programming

KU8. the process of designing a drive control panel

KU9. the communication mechanism between PLC and SCADA software

KU10. how to detect and troubleshoot various faults in motion control

KU11. the advantage of using soft starters over conventional starters

KU12. application of motor in different applications

KU13. different starters in motor and identifying its function in DOL & Star- Delta

KU14. design the motor circuit and interlocking circuit

KU15. basic parameter programming to operate the motor

KU16. how to carry out drives selection for various processes

KU17. the concept and process of designing the control panel

KU18. the process of detecting faults in the real-time monitoring system and carrying out troubleshooting

KU19. how to prepare for residential wiring

KU20. how to design digital electronic circuits

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records

GS2. read the relevant manuals, guides and literature on new developments in the field of work

GS3. communicate politely and professionally

GS4. plan and schedule tasks to ensure timely completion

GS5. evaluate all possible solutions to a problem to select the best one

GS6. coordinate with the coworkers to achieve the work objectives

GS7. identify possible disruptions to work and take appropriate preventive measures

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Analyse drives and motors	**30**	**55**	**-**	**15**
PC1. design the motor circuit and interlocking circuit	-	-	-	-
PC2. carry out basic parameter programming to operate the motor	-	-	-	-
PC3. perform drives selection for various processes	-	-	-	-
PC4. design the control panel	-	-	-	-
PC5. carry out interfacing of the motor to the PLC and SCADA software	-	-	-	-
PC6. detect faults in the real-time monitoring system and carry out troubleshooting	-	-	-	-
PC7. select and use an appropriate starter in the motor such as the soft or conventional starter	-	-	-	-
PC8. select and use DC shunt or DC series motor as per the requirement	-	-	-	-
PC9. assess the characteristics of methods of speed control of DC shunt motor	-	-	-	-
PC10. store data using memory cells	-	-	-	-
PC11. encode and decode data using logic gates	-	-	-	-
PC12. prepare for circuit wiring	-	-	-	-
PC13. design digital electronic circuits for various applications	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7113
NOS Name	Analyse motion control
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7114: Design the panels using AutoCAD electrical toolset

Description

This OS unit is about designing panels using AutoCAD electrical toolset.

Scope

The scope covers the following :

- Design the panels

Elements and Performance Criteria

Design the panels

To be competent, the user/individual on the job must be able to:

PC1. select the appropriate switch gears and accessories for panel designing

PC2. determine the panel designing requirements and evaluate the real-time application of panels

PC3. use electrical circuits and relevant devices in panel designing

PC4. create, modify and document electrical control systems with AutoCAD Electrical toolset

PC5. follow the recommended safety protocols during panel designing

PC6. analyse the load management system while designing the panel

PC7. determine the need of scheduling the loads for reducing the electric energy consumption and demand under load management

PC8. use the appropriate indicating devices such as ammeter and voltmeter for measuring various parameters in panel design

PC9. correlate the running load, connected load and determine the load factor

PC10. install the electrical protection system

PC11. create the electrical and power circuits using AutoCAD software

PC12. execute the general wiring guidelines during panel designing

PC13. carry out regular maintenance and troubleshooting of control circuits in live panels

PC14. design the power and control diagrams through AutoCAD

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the functions of switch gears and relevant accessories

KU2. the basics of control and power drawings

KU3. applicable protective measures to be taken during panel designing

KU4. the practice of load management i.e. connected load, running load, load factor, etc.

KU5. the use of relevant indicating devices such as Ammeter, Volt Meter, Power Factor (PF) & Kilowatts (KW) Meter for measuring various parameters in the panel design

KU6. the process of preparing general arrangement and busbar sizing diagrams

KU7. the process of preparing power and control circuits

KU8. how to maintain and troubleshoot control circuits in live panels

KU9. the process of designing power and control drawings through AutoCAD

KU10. the function of switch gears and accessories

KU11. the need and application of panel designing

KU12. the function of various devices in designing an electrical circuit

KU13. how to create, modify, and document electrical control systems with AutoCAD Electrical toolset

KU14. the functioning of the load management system in designing the panel

KU15. how to create the electrical and power circuits

KU16. general wiring guidelines and practices

KU17. the process of maintaining and troubleshooting control circuits in live panels

KU18. the process of designing power and control diagrams

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. write work-related notes

GS2. communicate politely and professionally

GS3. read the relevant literature to get the latest updates about the field of work

GS4. plan and prioritise tasks for effective time-management

GS5. identify possible disruptions to work and take appropriate preventive measures

GS6. co-ordinate with the co-workers to achieve the work objectives

GS7. take quick decisions to deal with workplace emergencies or accidents

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Design the panels	**30**	**55**	**-**	**15**
PC1. select the appropriate switch gears and accessories for panel designing	-	-	-	-
PC2. determine the panel designing requirements and evaluate the real-time application of panels	-	-	-	-
PC3. use electrical circuits and relevant devices in panel designing	-	-	-	-
PC4. create, modify and document electrical control systems with AutoCAD Electrical toolset	-	-	-	-
PC5. follow the recommended safety protocols during panel designing	-	-	-	-
PC6. analyse the load management system while designing the panel	-	-	-	-
PC7. determine the need of scheduling the loads for reducing the electric energy consumption and demand under load management	-	-	-	-
PC8. use the appropriate indicating devices such as ammeter and voltmeter for measuring various parameters in panel design	-	-	-	-
PC9. correlate the running load, connected load and determine the load factor	-	-	-	-
PC10. install the electrical protection system	-	-	-	-
PC11. create the electrical and power circuits using AutoCAD software	-	-	-	-
PC12. execute the general wiring guidelines during panel designing	-	-	-	-
PC13. carry out regular maintenance and troubleshooting of control circuits in live panels	-	-	-	-
PC14. design the power and control diagrams through AutoCAD	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7114
NOS Name	Design the panels using AutoCAD electrical toolset
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7115: Carry out process instrumentation

Description

This OS unit is about carrying out process instrumentation.

Scope

The scope covers the following :

- Perform process instrumentation

Elements and Performance Criteria

Perform process instrumentation

To be competent, the user/individual on the job must be able to:

PC1. select the appropriate transmitters or sensors according to the required industrial applications

PC2. detect the position of an object with reference to the fixed point using a position sensor

PC3. identify the change in light intensity using a photo-electric sensor

PC4. detect the presence of nearby objects using a proximity sensor

PC5. measure the flow using the appropriate flow measurement device

PC6. measure the linear, nonlinear, mass or volumetric flow rate of a liquid or gas using a flow sensor

PC7. identify different sensors used in the flow measurements

PC8. select an appropriate pressure measurement device and measure gas pressure

PC9. evaluate the process of pressure measurement using a suitable sensor

PC10. measure the load parameters using load cells

PC11. interconnect different sensors as per the standard procedure

PC12. check different sensors used in load measurement for the correct functioning

PC13. select and use the suitable sensors for level measurement

PC14. use the solenoid valves and control valves as per the requirement

PC15. install and use the smart transmitters appropriately

PC16. use the appropriate technique to protect the power system through instrument transformers such as Current Transformer (CT) and Voltage Transformer (VT)

PC17. install and use the process control and feedback devices in the closed-loop control system

PC18. regulate the temperature, flow, pressure, speed and other process variables by using PID controller

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the basic functions of electrical components

KU2. the function of different types of electrical components, transmitters and sensors used in industrial applications

KU3. different types of position sensors and their applications

KU4. the working principle and selection criteria for a flow measurement device

KU5. the working principle and selection criteria for a pressure measurement device

KU6. the working principle of load cells and the load measurement process

KU7. the working principle and selection criteria for a level measurement device

KU8. the working principle of solenoid valves, control valves, smart transmitters and instrument transformers (CT, VT)

KU9. the functions of closed and open-loop controls

KU10. the process control basics and process controllers (on-off, proportional, PID)

KU11. how to identify the change in light intensity using a photo-electric sensor

KU12. how to estimate the flow measurement, its working principle, types and selection guidelines

KU13. how to measure linear, nonlinear, mass or volumetric flow rate of a liquid or gas using a flow sensor

KU14. different types of sensors used in flow and load measurement

KU15. how to measure pressure by using various pressure measurement devices

KU16. how to measure the load parameters using load cells

KU17. the functions of the smart transmitters

KU18. the technique to be used to protect the power system through instrument transformers (CT, VT)

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. write work-related notes and communications

GS2. read the relevant literature to learn about the latest developments in the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. plan and schedule tasks to ensure timely completion

GS6. evaluate all possible solutions to a problem to select the best one

GS7. coordinate with the coworkers to achieve the work objectives

GS8. identify possible disruptions to work and take appropriate preventive measures

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Perform process instrumentation	**30**	**55**	**-**	**15**
PC1. select the appropriate transmitters or sensors according to the required industrial applications	-	-	-	-
PC2. detect the position of an object with reference to the fixed point using a position sensor	-	-	-	-
PC3. identify the change in light intensity using a photo-electric sensor	-	-	-	-
PC4. detect the presence of nearby objects using a proximity sensor	-	-	-	-
PC5. measure the flow using the appropriate flow measurement device	-	-	-	-
PC6. measure the linear, nonlinear, mass or volumetric flow rate of a liquid or gas using a flow sensor	-	-	-	-
PC7. identify different sensors used in the flow measurements	-	-	-	-
PC8. select an appropriate pressure measurement device and measure gas pressure	-	-	-	-
PC9. evaluate the process of pressure measurement using a suitable sensor	-	-	-	-
PC10. measure the load parameters using load cells	-	-	-	-
PC11. interconnect different sensors as per the standard procedure	-	-	-	-
PC12. check different sensors used in load measurement for the correct functioning	-	-	-	-
PC13. select and use the suitable sensors for level measurement	-	-	-	-
PC14. use the solenoid valves and control valves as per the requirement	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC15. install and use the smart transmitters appropriately	-	-	-	-
PC16. use the appropriate technique to protect the power system through instrument transformers such as Current Transformer (CT) and Voltage Transformer (VT)	-	-	-	-
PC17. install and use the process control and feedback devices in the closed-loop control system	-	-	-	-
PC18. regulate the temperature, flow, pressure, speed and other process variables by using PID controller	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7115
NOS Name	Carry out process instrumentation
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7116: Set up advanced automation in mechatronics

Description

This OS unit is about setting up advanced automation processes in mechatronics which includes setting up Human Machine Interface (HMI), automated material handling system and Internet of things (IoT).

Scope

The scope covers the following :

- Set up HMI
- Automate the material handling system
- Use IoT in mechatronic

Elements and Performance Criteria

Set up HMI

To be competent, the user/individual on the job must be able to:

PC1. determine the application of HMI and relevant measure data to be automated

PC2. input the required information to the interfaces that are used in HMI

PC3. evaluate the real-time lagging data

PC4. design HMI using the knowledge of PLC, SCADA and IoT

PC5. use Software-as-a-Service (SaaS) for distributing data online to cloud computing

PC6. carry out networking and manage all the infrastructure data on a common cloud platform

PC7. perform diagnostic checks to detect faults and troubleshoot them

Automate the material handling system

To be competent, the user/individual on the job must be able to:

PC8. determine the need of using the material handling system according to applicable automation requirements in the industry

PC9. use the mono-rail and rail-guided vehicles and other material transport system for automation

PC10. identify various objects that can be handled through automation using the conveyor system, cranes and hoists on the shop floor

PC11. use the automatic robot working system in the industry, as per the requirement

PC12. perform engineering analysis of automated storage system in the manufacturing sector

PC13. implement the Automated Guidance Vehicle System (AGVS)

PC14. implement industry 4.0 in automated storage and retrieval system to improve the floor space utilisation and data collection

PC15. track tags attached to objects through electromagnetic fields in RFID techniques

PC16. use the carousel storage system

PC17. create and apply barcodes to various applications using the barcode system

PC18. use robotics in the material handling system

Use IoT in mechatronics

To be competent, the user/individual on the job must be able to:

PC19. determine the need for IoT implementation

PC20. modify the automation process by enabling them to transmit data and automate tasks without requiring any manual intervention with the IoT devices

PC21. carry out programming for IoT

PC22. implement different monitoring processes for automation

PC23. use the relevant software platform tools such as intel XDK, Node RED, VISUINO, Fritzing, 123dcircuits

PC24. apply the IoT concept in real-time applications

PC25. interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it

PC26. interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to a smartphone using Bluetooth

PC27. follow the applicable machine integration concepts

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the working of PLC and SCADA with HMI

KU2. the concept of HMI and HMI operations in an automation environment

KU3. the process of creating applications and tags

KU4. the use of different monitoring systems

KU5. the architecture of IoT and applicable trends

KU6. the functioning of relevant material handling systems used in the industry

KU7. the basic knowledge of automated material handling systems and various material transport systems

KU8. the function of a conveyor system and working of cranes and hoists for lifting objects on the shop floor

KU9. the need for conveyor system and rails for automated material handling system

KU10. the working principle of automatic storage and retrieval system

KU11. how to download/upload programs

KU12. how to create alarm messages

KU13. the process of communication with PLC

KU14. the process of detecting faults through diagnostics

KU15. the relevant considerations to be made while selecting a material handling system

KU16. the use of automated guided vehicle systems

KU17. the functioning of monorails and rail-guided vehicles

KU18. different conveyor systems such as cranes and hoists

KU19. the process of analysing the material transport system

KU20. the process of carrying out engineering analysis of the automated storage system

KU21. the role of automated storage and retrieval system in Industry 4.0

KU22. the working principle of the carousel storage system

KU23. different barcode and RFID techniques

KU24. the use of robotics in material handling system

KU25. the IoT architecture and relevant platforms

KU26. the relevant trends in the adoption of IoT

KU27. the process of basic programming of controllers

KU28. the use of appropriate hardware platforms such as Intel Galileo, Edison, Arduino, Beaglebone, Black & Raspberry Pi

KU29. the use of appropriate software platforms such as Intel XDK, Node-RED, VISUINO, Fritzing, 123dcircuits

KU30. the applicable machine to machine integration concepts

KU31. the basics of Python

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records

GS2. read the relevant literature to get the latest updates about the field of work

GS3. communicate politely and professionally

GS4. listen attentively to understand the information being shared

GS5. take quick decisions to deal with workplace emergencies and accidents

GS6. identify possible disruptions to work and take appropriate preventive measures

GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Set up HMI	**10**	**25**	**-**	**4**
PC1. determine the application of HMI and relevant measure data to be automated	-	-	-	-
PC2. input the required information to the interfaces that are used in HMI	-	-	-	-
PC3. evaluate the real-time lagging data	-	-	-	-
PC4. design HMI using the knowledge of PLC, SCADA and IoT	-	-	-	-
PC5. use Software-as-a-Service (SaaS) for distributing data online to cloud computing	-	-	-	-
PC6. carry out networking and manage all the infrastructure data on a common cloud platform	-	-	-	-
PC7. perform diagnostic checks to detect faults and troubleshoot them	-	-	-	-
Automate the material handling system	**10**	**15**	**-**	**7**
PC8. determine the need of using the material handling system according to applicable automation requirements in the industry	-	-	-	-
PC9. use the mono-rail and rail-guided vehicles and other material transport system for automation	-	-	-	-
PC10. identify various objects that can be handled through automation using the conveyor system, cranes and hoists on the shop floor	-	-	-	-
PC11. use the automatic robot working system in the industry, as per the requirement	-	-	-	-
PC12. perform engineering analysis of automated storage system in the manufacturing sector	-	-	-	-
PC13. implement the Automated Guidance Vehicle System (AGVS)	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. implement industry 4.0 in automated storage and retrieval system to improve the floor space utilisation and data collection	-	-	-	-
PC15. track tags attached to objects through electromagnetic fields in RFID techniques	-	-	-	-
PC16. use the carousel storage system	-	-	-	-
PC17. create and apply barcodes to various applications using the barcode system	-	-	-	-
PC18. use robotics in the material handling system	-	-	-	-
Use IoT in mechatronics	**10**	**15**	**-**	**4**
PC19. determine the need for IoT implementation	-	-	-	-
PC20. modify the automation process by enabling them to transmit data and automate tasks without requiring any manual intervention with the IoT devices	-	-	-	-
PC21. carry out programming for IoT	-	-	-	-
PC22. implement different monitoring processes for automation	-	-	-	-
PC23. use the relevant software platform tools such as intel XDK, Node RED, VISUINO, Fritzing, 123dcircuits	-	-	-	-
PC24. apply the IoT concept in real-time applications	-	-	-	-
PC25. interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it	-	-	-	-
PC26. interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to a smartphone using Bluetooth	-	-	-	-
PC27. follow the applicable machine integration concepts	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7116
NOS Name	Set up advanced automation in mechatronics
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	6
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N9905: Work effectively at the workplace

Description

This unit is about the communicating and managing work effectively at the workplace as well as taking measures to enhance own competence and working in a disciplined and ethical manner.

Scope

The scope covers the following :

- Communicate effectively at the workplace
- Work effectively
- Maintain and enhance professional competence
- Work in a disciplined and ethical manner
- Uphold social diversity at the workplace

Elements and Performance Criteria

Communicate effectively at the workplace

To be competent, the user/individual on the job must be able to:

PC1. exchange information and instruction with colleagues, and seek clarifications and feedback as necessary

PC2. assist colleagues where required

PC3. follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person)

PC4. document and share all relevant information with stakeholders in agreed formats and as per agreed timelines

Work effectively

To be competent, the user/individual on the job must be able to:

PC5. identify and obtain clarity regarding organisational, team and own goals and targets

PC6. prioritise and plan work in order to achieve goals and targets

PC7. monitor own and team performance as per agreed plan

PC8. complete duties accurately, systematically and within required timeframes

PC9. express emotions appropriately at the workplace and manage own response to heightened emotions

PC10. maintain orderliness and cleanliness in the work area

Maintain and enhance professional competence

To be competent, the user/individual on the job must be able to:

PC11. identify own strengths and weaknesses in relation to goals and targets

PC12. adapt self, service, or product to meet success criteria

PC13. seek and select opportunities for continuous professional development

PC14. formulate a professional development plan to enhance capabilities

PC15. build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations

PC16. examine developments and trends in field of work and their potential impact on work

PC17. take feedback from peers, supervisors and clients to improve own performance and practices

Work in a disciplined and ethical manner

To be competent, the user/individual on the job must be able to:

PC18. perform tasks as per workplace standards, organisational policies and legislative requirements

PC19. display appropriate professional appearance at the workplace and adhere to the organisational dress code

PC20. demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc.

PC21. identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution

PC22. protect the rights of the client and organisation when delivering services

PC23. ensure services are delivered equally to all clients regardless of personal and cultural beliefs

PC24. operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities

PC25. follow organisational guidelines and legal requirements on disclosure and confidentiality

Uphold social diversity at the workplace

To be competent, the user/individual on the job must be able to:

PC26. recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes

PC27. identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace

PC28. use inclusive or neutral language and gestures in all interactions

PC29. respect the personal and professional space of others

PC30. access grievance redressal mechanisms as per legislations

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation's policies on dress code, workplace timings, workplace behaviour, performance management, incentives, delivery standards, information security, etc.

KU2. organizational hierarchy and escalation matrix

KU3. importance of the individual's role in the workflow

KU4. organisational norms on health, safety and sustainability

KU5. work area inspection procedures and practices

KU6. professional etiquette and grooming

KU7. communication etiquette across communicative mediums (online, digital, and in-person) including strategies/methods for sharing information, documentation, and providing and receiving feedback

KU8. importance of self-evaluations and developing a continuous learning and professional development plan

KU9. developments and trends impacting professional practice

KU10. importance of taking and using feedback from colleagues and clients to identify and introduce improvements in work performance

KU11. professional ethics and workplace norms on reporting and/or penalizing unethical behaviour and practices.

KU12. guidelines and legal requirements on disclosure, confidentiality, and conflicts of interest

KU13. strategies for collaboration with colleagues and clients.

KU14. professional responses and strategies against inappropriate language or behaviour toward self and others

KU15. Implicit bias (based on gender, disability, class, caste, colour, race, culture, religion, etc.) and its consequences in the workplace

KU16. organizational guidelines, prevalent legislations and accessibility norms and processes to support PwDs at the workplace

KU17. strategies for time, effort and resource allocation towards the goals.

KU18. basic concepts of work productivity including waste reduction, efficient material usage and optimization of time

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. complete documentation and forms such as work orders, invoices maintenance records activity logs, attendance sheets as per organizational format in English and/or local language

GS2. write basic accident or incident report accurately in an appropriate format

GS3. read warnings, instructions and other text material on product labels, components, etc. and relevant signages, warnings, labels or descriptions on equipment, etc. while carrying out work activities

GS4. convey and share technical information clearly using appropriate language

GS5. clarify task-related information

GS6. liaise with authorities and supervisors as per organizational protocol

GS7. listen, speak, and write in an inclusive, respectful manner in line with organizational protocol

GS8. seek clarification from immediate supervisor or responsible authority or exercise most appropriate solutions to safety breaches at work

GS9. report to the supervisor and when to deal with a colleague depending on the type of concern

GS10. deliver product to next work process on time

GS11. improve work process and report potential areas of delays and disruptions

GS12. communicate problems appropriately to others

GS13. identify symptoms of the fault to the cause of the problem and resolve, otherwise seek assistance and support from other sources to solve the problem

GS14. anticipate and avoid hazards that may occur during repairs because of tools, materials used or repair processes

GS15. complete tasks efficiently and accurately within stipulated time

GS16. appreciate and respect social diversity in all professional settings

GS17. develop awareness and accountability for perspectives on gender, disabilities, and socio-cultural issues leading to discrimination, bias, or harassment at the workplace

GS18. maintain positive and effective relationships with colleagues and customers

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Communicate effectively at the workplace	**5**	**13**	**-**	**-**
PC1. exchange information and instruction with colleagues, and seek clarifications and feedback as necessary	1	3	-	-
PC2. assist colleagues where required	1	3	-	-
PC3. follow business communication etiquette in all interactions and communicative formats (online, digital, and in-person)	1	4	-	-
PC4. document and share all relevant information with stakeholders in agreed formats and as per agreed timelines	2	3	-	-
Work effectively	**6**	**13**	**-**	**-**
PC5. identify and obtain clarity regarding organisational, team and own goals and targets	1	2	-	-
PC6. prioritise and plan work in order to achieve goals and targets	1	2	-	-
PC7. monitor own and team performance as per agreed plan	1	2	-	-
PC8. complete duties accurately, systematically and within required timeframes	1	2	-	-
PC9. express emotions appropriately at the workplace and manage own response to heightened emotions	1	2	-	-
PC10. maintain orderliness and cleanliness in the work area	1	3	-	-
Maintain and enhance professional competence	**8**	**7**	**-**	**-**
PC11. identify own strengths and weaknesses in relation to goals and targets	1	1	-	-
PC12. adapt self, service, or product to meet success criteria	1	1	-	-
PC13. seek and select opportunities for continuous professional development	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. formulate a professional development plan to enhance capabilities	2	1	-	-
PC15. build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations	1	1	-	-
PC16. examine developments and trends in field of work and their potential impact on work	1	1	-	-
PC17. take feedback from peers, supervisors and clients to improve own performance and practices	1	1	-	-
Work in a disciplined and ethical manner	**11**	**16**	**-**	**-**
PC18. perform tasks as per workplace standards, organisational policies and legislative requirements	2	2	-	-
PC19. display appropriate professional appearance at the workplace and adhere to the organisational dress code	1	2	-	-
PC20. demonstrate responsible and disciplined behaviour at the workplace such as punctuality; completing tasks as per given time and standards; demonstrating professional behaviour at all times, adopting environment- friendly practices, etc.	1	2	-	-
PC21. identify the cause of conflict and options for resolution with peers or escalate grievances and problems to appropriate authority as per procedure for conflict resolution	2	2	-	-
PC22. protect the rights of the client and organisation when delivering services	1	2	-	-
PC23. ensure services are delivered equally to all clients regardless of personal and cultural beliefs	1	2	-	-
PC24. operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities	2	2	-	-
PC25. follow organisational guidelines and legal requirements on disclosure and confidentiality	1	2	-	-
Uphold social diversity at the workplace	**10**	**11**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC26. recognize and evaluate biased practices against underrepresented groups like women and persons with disabilities, in workplace systems and processes	2	2	-	-
PC27. identify and report discrimination and harassment based on gender, disability, or cultural difference at the workplace	2	2	-	-
PC28. use inclusive or neutral language and gestures in all interactions	2	2	-	-
PC29. respect the personal and professional space of others	2	2	-	-
PC30. access grievance redressal mechanisms as per legislations	2	3	-	-
NOS Total	**40**	**60**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N9905
NOS Name	Work effectively at the workplace
Sector	Electronics
Sub-Sector	Generic
Occupation	Generic - Organizational Behaviour
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	24/02/2022
Next Review Date	30/12/2026
NSQC Clearance Date	30/12/2021

ELE/N1002: Apply health and safety practices at the workplace

Description

This OS unit is about knowledge and practices relating to health, safety and security that candidates need to use in the workplace.

Scope

The scope covers the following :

- Deal with workplace hazards
- Apply fire safety practices
- Follow emergencies, rescue and first-aid procedures
- Effective waste management/recycling practices

Elements and Performance Criteria

Deal with workplace hazards

To be competent, the user/individual on the job must be able to:

PC1. identify job-site hazards and possible causes of accident in the workplace

PC2. perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc.

PC3. use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards

PC4. follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments

PC5. dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques

PC6. avoid damage of components due to negligence in electrostatic discharge (ESD) procedures

PC7. locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans)

PC8. maintain appropriate posture while handling heavy objects

PC9. apply good housekeeping practices at all times

Apply fire safety practices

To be competent, the user/individual on the job must be able to:

PC10. take preventive measures to prevent fire hazards

PC11. • use appropriate fire extinguishers for different types of fires
• Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l

PC12. exhibit rescue and first-aid techniques in case of fire or electrocution

Follow emergencies, rescue and first-aid procedures

To be competent, the user/individual on the job must be able to:

PC13. administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.

PC14. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,

PC15. participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work

PC16. use correct method to move injured people and others during an emergency

Effective waste management/recycling practices

To be competent, the user/individual on the job must be able to:

PC17. identify recyclable and non-recyclable, and hazardous waste generated

PC18. segregate waste into different categories

PC19. ensure disposal of non-recyclable waste appropriately

PC20. deposit non-recyclable and reusable material at identified location

PC21. follow processes specified for disposal of hazardous waste

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. importance of working in clean and safe work environment following safety practices and procedures

KU2. health and safety roles and responsibilities of relevant personnel within and outside the organisation

KU3. key internal and external sources of health and safety information

KU4. basic knowledge of electronic devices and related health risks

KU5. meaning of hazards and risks

KU6. various types of health and safety hazards commonly present in the work environment such as physical hazards, electrical hazards, chemical hazards, fire hazards, equipment related hazards, health hazards, etc.

KU7. methods of accident prevention

KU8. importance of using protective clothing/equipment while working

KU9. general principles for identifying and controlling health and safety risks

KU10. main hazards and preventive as well as control measures while working with different types of equipment

KU11. importance of carrying out electrical and non-electrical isolation to prevent hazards from loss of machine/system/process control

KU12. main hazards and preventive as well as control measures when working with electrical systems or using electrical equipment

KU13. forms and classifications of hazardous substances

KU14. safe working practices while working at various hazardous sites

KU15. prevention and control measures to reduce risks from exposure to hazardous substances

KU16. health effects associated with exposure to noise and vibration and the appropriate control measures

KU17. precautionary activities to prevent the fire accident

KU18. various causes of fire such as heating of metal, spontaneous ignition, sparking, electrical eating, loose fires (smoking, welding, etc.) chemical fires etc.

KU19. techniques of using the different fire extinguishers

KU20. different methods and material to extinguish fires

KU21. different materials used for extinguishing fire such as sand, water, foam, CO2, dry powder

KU22. rescue techniques used during a fire hazard

KU23. various types of safety signs and their meaning

KU24. basic first aid treatment relevant to the common work place injuries e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries

KU25. contents of written accident report

KU26. potential injuries and ill health associated with incorrect handing of tools and equipment

KU27. safe lifting and carrying practices

KU28. potential impact to a person who is moved incorrectly

KU29. personal safety, health and dignity issues relating to the movement of a person by others

KU30. ESD measures and 5S

KU31. efficient utilization and management of material and water

KU32. ways to recognize common electrical problems and practices of conserving electricity

KU33. usage of different colours of dustbins, categorization of waste into dry, wet, recyclable, nonrecyclable and items of single-use plastics

KU34. organization's procedure for minimizing waste

KU35. waste management and methods of waste disposal

KU36. common sources of pollution and ways to minimize it

KU37. names, contact information and location of people responsible for health and safety in the workplace

KU38. location of documents and equipment for health and safety compliance/practices in the workplace

KU39. safety notices, signs and instructions at workplace

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. interpret general health and safety guidelines labels, charts, signages

GS2. read operation manuals

GS3. write health and safety compliance report

GS4. write an accident/incident report in local language or English

GS5. provide an emergency or safety incident brief to seniors or relevant authorities in a calm, clear and to-the-point manner

GS6. communicate general health and safety guidelines to colleagues/co-workers

GS7. communicate appropriately with co-workers in order to clarify instructions and other issues

GS8. act in case of any potential hazards observed in the work place

GS9. plan and organize their own work schedule, work area, tools, equipment in compliance with organizational policies for health, safety and security

GS10. take adequate measures to ensure the safety of clients and visitors at the workplace

GS11. identify immediate or temporary solutions to resolve delays

GS12. evaluate the work area for health and safety risks or hazards

GS13. use cause and effect relations to anticipate potential issues, problems and their solution in the work area related to safety

GS14. recognise emergency and potential emergency situations

GS15. protect self and others from a health and safety risk or hazard

GS16. communicate and collaborate to incorporate sustainable practices (greening) in workplace processes

GS17. record data on waste disposal at workplace

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Deal with workplace hazards	**20**	**31**	**-**	**-**
PC1. identify job-site hazards and possible causes of accident in the workplace	2	3	-	-
PC2. perform work complying to organizational safe working practices and observing hazard signs displayed on containers, equipment and in various work areas such as inside buildings, in open areas and public spaces, etc.	3	4	-	-
PC3. use appropriate personal protective equipment (PPE) for specific tasks and work conditions, contaminant (concentration w.r.t air) requirements and severity of hazard while conforming to the Indian/International standards	3	4	-	-
PC4. follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments	3	4	-	-
PC5. dispose electronic waste (such as toxins; metals such as lead, cadmium, barium; flame retardant plastics, welding slag etc.) as per industry approved techniques	2	4	-	-
PC6. avoid damage of components due to negligence in electrostatic discharge (ESD) procedures	2	3	-	-
PC7. locate general health and safety equipment in the workplace such as fire extinguishers; first aid equipment; safety instruments, clothing and installations (fire exits, exhaust fans)	2	3	-	-
PC8. maintain appropriate posture while handling heavy objects	1	3	-	-
PC9. apply good housekeeping practices at all times	2	3	-	-
Apply fire safety practices	**4**	**9**	**-**	**-**
PC10. take preventive measures to prevent fire hazards	2	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. • use appropriate fire extinguishers for different types of fires • Types of fires: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids and gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class C: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no l	1	3	-	-
PC12. exhibit rescue and first-aid techniques in case of fire or electrocution	1	3	-	-
Follow emergencies, rescue and first-aid procedures	**6**	**13**	**-**	**-**
PC13. administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.	1	3	-	-
PC14. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,	1	2	-	-
PC15. participate regularly in emergency procedures such as raising alarm, safe/efficient, evacuation, correct means of taking shelter and escaping, correct assembly point, roll call, correct return to work	2	4	-	-
PC16. use correct method to move injured people and others during an emergency	2	4	-	-
Effective waste management/recycling practices	**5**	**12**	**-**	**-**
PC17. identify recyclable and non-recyclable, and hazardous waste generated	1	3	-	-
PC18. segregate waste into different categories	1	2	-	-
PC19. ensure disposal of non-recyclable waste appropriately	1	2	-	-
PC20. deposit non-recyclable and reusable material at identified location	1	3	-	-
PC21. follow processes specified for disposal of hazardous waste	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS Total	**35**	**65**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N1002
NOS Name	Apply health and safety practices at the workplace
Sector	Electronics
Sub-Sector	Generic
Occupation	Generic - Health Safety
NSQF Level	4
Credits	TBD
Version	3.0
Last Reviewed Date	24/02/2022
Next Review Date	24/02/2025
NSQC Clearance Date	24/02/2022

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each

Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down

the proportion of marks for Theory and Skills Practical for each PC.

2. The assessment for the theory part will be based on the knowledge bank of questions created by the SSC.

3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected

elective/optional NOS/set of NOS.

4. Individual assessment agencies will create unique question papers for the theory part for each candidate at

each examination/training center (as per assessment criteria below).

5. Individual assessment agencies will create unique evaluations for skill practical for every student at

each

examination/ training center based on these criteria.

6. To pass the Qualification Pack assessment, every trainee should score a minimum of 70% of % aggregate

marks to successfully clear the assessment.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
ELE/N7112.Integrate PLC with the SCADA system	30	55	-	15	100	20
ELE/N7113.Analyse motion control	30	55	-	15	100	15
ELE/N7114.Design the panels using AutoCAD electrical toolset	30	55	-	15	100	15
ELE/N7115.Carry out process instrumentation	30	55	-	15	100	15
ELE/N7116.Set up advanced automation in mechatronics	30	55	-	15	100	15
ELE/N9905.Work effectively at the workplace	40	60	-	-	100	10
ELE/N1002.Apply health and safety practices at the workplace	35	65	-	-	100	10
Total	**225**	**400**	**-**	**75**	**700**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.

Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.