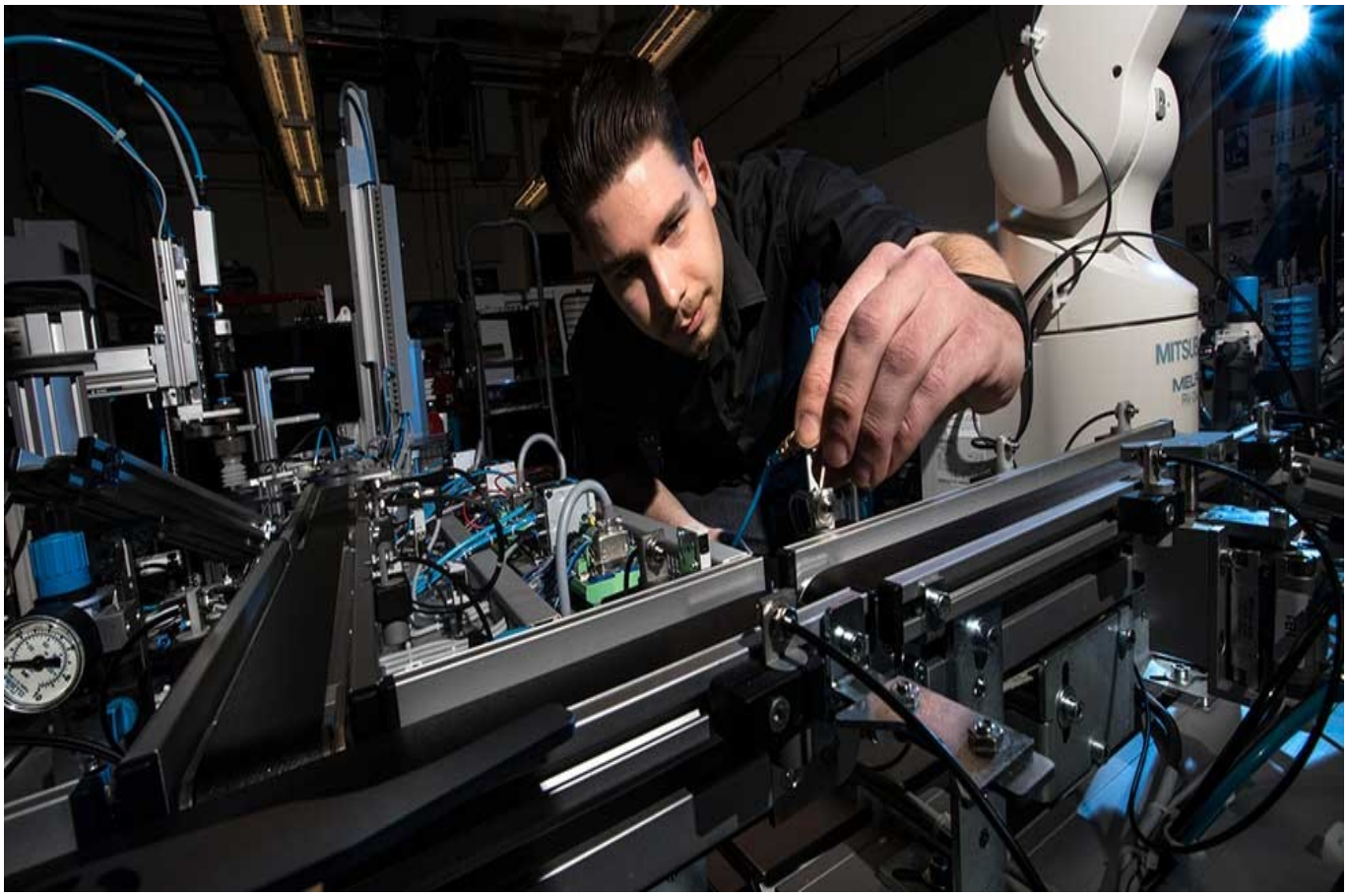
Qualification Pack



Mechatronics Maintenance Specialist

QP Code: ELE/Q7105

Version: 2.0

NSQF Level: 5

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House Okhla Industrial Area-Phase 3
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ELE/Q7105: Mechatronics Maintenance Specialist

Brief Job Description

A Mechatronics Maintenance Specialist is responsible for installing, testing, and using sensors, actuators, and microcontrollers in the mechatronics system. The individual is also responsible for carrying out the repair and maintenance of the mechatronics system.

Personal Attributes

The individual must have attention to detail, problem-solving skills and the ability to work in coordination with others. The individual must be able to work for long durations with concentration.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ELE/N7109: Set up circuits and electrical components in the mechatronics system
2. ELE/N7110: Install, test and use the sensors and actuators in the mechatronics system
3. ELE/N7111: Install, test and use microcontroller in the mechatronics system
4. ELE/N1002: Apply health and safety practices at the workplace
5. DGT/VSQ/N0102: Employability Skills (60 Hours)

Qualification Pack (QP) Parameters

Sector	Electronics
Sub-Sector	
Occupation	Engineering-I&A
Country	India
NSQF Level	5
Credits	20
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7412.0101

Minimum Educational Qualification & Experience	Diploma (after 10 (Electrical/Electronics)) with 1 Year of experience relevant experience OR 12th grade pass with 1 year NTC/ NAC with 1 Year of experience relevant experience OR 12th grade Pass with 2 Years of experience relevant experience OR Previous relevant Qualification of NSQF Level (4) with 3 Years of experience relevant experience OR 10th grade pass with 4 Years of experience relevant experience
Minimum Level of Education for Training in School	10th Class
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	NA
Next Review Date	30/04/2025
NSQC Approval Date	24/02/2022
Version	2.0
Reference code on NQR	QG-05-EH-00427-2023-V1.1-ESSC
NQR Version	1.0

Remarks:

NA

Qualification Pack

ELE/N7109: Set up circuits and electrical components in the mechatronics system

Description

This OS unit is about setting up circuits and electrical components in the mechatronics system.

Scope

The scope covers the following :

- Set up microcontrollers
- Set up circuits, electrical components and pneumatic system

Elements and Performance Criteria

Set up microcontrollers

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

PC1. select an appropriate mechatronics system to solve the given industrial problem(s) and improve productivity

PC2. select the appropriate mechatronics components for the installation of the mechatronics system

PC3. test the mechatronics components to ensure they are functioning correctly

PC4. install the mechatronics control system

PC5. program the microprocessor and microcontroller

PC6. install the hardware interfacing units of microcontrollers

PC7. test the microcontrollers for the correct functioning and carry out troubleshooting for any issues identified

Set up circuits, electrical components and pneumatic system

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

PC8. select the appropriate power converter circuits and electrical drives for installation

PC9. test the electrical components and circuits for correct functioning and compatibility with the mechatronics system

PC10. select the appropriate pneumatic values according to the need

PC11. perform sequence control and use the logic functions for operating the pneumatic system

PC12. use relays in the pneumatic system

PC13. monitor the pneumatic fluid by analysing the speed and pressure control sensors

PC14. carry out troubleshooting for any issues encountered with the pneumatic system

PC15. design the cascade circuits

PC16. use the appropriate techniques for programming PLC with the help of Ladder diagram

PC17. install the pneumatic power system

PC18. follow the relevant case studies for implementing the pneumatic system in the automatic production line

PC19. carry out maintenance of the circuits, electrical components and pneumatic system

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the need and scope of mechatronics system
KU2. mechatronics system and its scope in the automation sector
KU3. the traditional vs. mechatronics approach
KU4. how to interpret the block diagram representation of general mechatronics system showing various components with suitable example
KU5. relevant control systems such as open and closed-loop systems, basic elements of the closed- loop system
KU6. basic circuit concepts
KU7. the semiconductor circuit elements
KU8. different types of circuits used in mechatronic devices
KU9. how to interpret the pneumatic symbols in pneumatic systems
KU10. the function and operation of pneumatic valves
KU11. the logic functions used in the pneumatic system
KU12. the sequence control for operating the pneumatic system
KU13. the function of relays and their working in the pneumatic system
KU14. the need for the proximity sensor and its application in pneumatic cylinder
KU15. speed and pressure control sensor for monitoring the pneumatic fluid
KU16. the design of cascade circuits
KU17. the process of programming PLCs in the Ladder diagram
KU18. the pneumatic systems used in the automatic production line
KU19. the principles of operation, characteristics and applications of power semiconductor devices
KU20. the characteristics of power semiconductor devices and circuits
KU21. the concept of fluid power
KU22. how to carry out repair and maintenance of the circuits, electrical components and pneumatic system

Generic Skills (GS)

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

GS1. write work-related notes and maintain relevant records
GS2. read the relevant literature to get the latest updates about the field of work
GS3. listen attentively to understand the information/ instructions being shared by the speaker
GS4. communicate politely and professionally
GS5. plan and prioritise tasks to ensure timely completion
GS6. evaluate all possible solutions to a problem to select the best one

GS7. co-ordinate with the co-workers to achieve work objectives

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

GS9. take quick decisions to deal with workplace emergencies/ accidents

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Set up microcontrollers	**15**	**35**	**-**	**7**
PC1. select an appropriate mechatronics system to solve the given industrial problem(s) and improve productivity	-	-	-	-
PC2. select the appropriate mechatronics components for the installation of the mechatronics system	-	-	-	-
PC3. test the mechatronics components to ensure they are functioning correctly	-	-	-	-
PC4. install the mechatronics control system	-	-	-	-
PC5. program the microprocessor and microcontroller	-	-	-	-
PC6. install the hardware interfacing units of microcontrollers	-	-	-	-
PC7. test the microcontrollers for the correct functioning and carry out troubleshooting for any issues identified	-	-	-	-
Set up circuits, electrical components and pneumatic system	**15**	**20**	**-**	**8**
PC8. select the appropriate power converter circuits and electrical drives for installation	-	-	-	-
PC9. test the electrical components and circuits for correct functioning and compatibility with the mechatronics system	-	-	-	-
PC10. select the appropriate pneumatic values according to the need	-	-	-	-
PC11. perform sequence control and use the logic functions for operating the pneumatic system	-	-	-	-
PC12. use relays in the pneumatic system	-	-	-	-
PC13. monitor the pneumatic fluid by analysing the speed and pressure control sensors	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. carry out troubleshooting for any issues encountered with the pneumatic system	-	-	-	-
PC15. design the cascade circuits	-	-	-	-
PC16. use the appropriate techniques for programming PLC with the help of Ladder diagram	-	-	-	-
PC17. install the pneumatic power system	-	-	-	-
PC18. follow the relevant case studies for implementing the pneumatic system in the automatic production line	-	-	-	-
PC19. carry out maintenance of the circuits, electrical components and pneumatic system	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7109
NOS Name	Set up circuits and electrical components in the mechatronics system
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7110: Install, test and use the sensors and actuators in the mechatronics system

Description

This OS unit is about installing sensors and actuators in a mechatronics system along with testing and using them.

Scope

The scope covers the following :

- Install, test and use sensors
- Install, test and use actuators

Elements and Performance Criteria

Install, test and use sensors

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

PC1. select the appropriate contact or contactless sensors for installation as appropriate

PC2. install the selected sensors such as potentiometer sensor following the standard procedure

PC3. test the sensors for correct functioning after installation

PC4. check the working of the strain gauge sensor and measure the torque applied by the motor

PC5. determine the measurement of position and displacement using the eddy current sensor

PC6. use the capacitive element by replacing the mechanical buttons

PC7. use the inductive sensor to measure high precision measurements of displacement, distance, oscillation in harsh industrial environments

PC8. check the position of the piston in the cylinder by using the pneumatic sensor

PC9. detect weak infrared irradiation caused by temperature fluctuation by using a pyro-electric sensor

PC10. measure the electrical potential caused by applying mechanical force to a piezoelectric material by using a piezoelectric sensor

PC11. carry out repair and maintenance of sensors

Install, test and use actuators

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

PC12. select the appropriate analogue or digital actuators to install in electrical and hydraulic systems to control various physical quantities

PC13. install an actuator with the appropriate properties according to the need

PC14. use the appropriate interface circuitry to match the actuator to the system driving it

PC15. test the actuator for correct functioning after installation

PC16. carry out troubleshooting for any issues identified with the installed hydraulic and pneumatic actuator as per the sketches and block diagrams

PC17. debounce the keypads to use the mechanical switches as required

PC18. install and use the vane motor as per the standard procedure
PC19. control high-powered circuit using a lower power signal through electro-mechanical and solid- state relays
PC20. use the stepper motor to convert electrical power into mechanical power
PC21. create analytical design and development solutions for actuators for different applications
PC22. carry out repair and maintenance of actuators

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. use of contact and non-contact type sensors
KU2. the functions and application of Potentiometer Sensors, Strain Gauge Elements, Capacitive Elements, Eddy Current, Inductive Proximity Sensors, Light Sensors, Pressure Sensors, Pneumatic Sensors, Pyro Electrical Sensors, Piezoelectric Sensors etc.
KU3. the criteria for selecting sensors for use
KU4. the classification, need and scope of different types of actuators
KU5. the process of pneumatic actuation, hydraulic actuation and double-acting
KU6. use of different types of motors such as vane motors
KU7. the components of electrical actuation systems such as switching devices, solenoid type devices, drive systems, mechanical switches, keypads, electromechanical and solid-state relays, stepper motors
KU8. the criteria for the selection of different types of actuators
KU9. how to carry out repair and maintenance of sensors and actuators in mechatronics system

Generic Skills (GS)

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

GS1. maintain the record of work-related observations
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 or instructions being given
GS5. coordinate with the coworkers to achieve the work objectives
GS6. plan and schedule tasks to achieve work efficiency
GS7. identify possible disruptions to work and take preventive measures
GS8. evaluate all possible solutions to a problem to select the best one
GS9. take quick decisions to deal with workplace emergencies or accidents

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Install, test and use sensors	**15**	**30**	**-**	**8**
PC1. select the appropriate contact or contactless sensors for installation as appropriate	-	-	-	-
PC2. install the selected sensors such as potentiometer sensor following the standard procedure	-	-	-	-
PC3. test the sensors for correct functioning after installation	-	-	-	-
PC4. check the working of the strain gauge sensor and measure the torque applied by the motor	-	-	-	-
PC5. determine the measurement of position and displacement using the eddy current sensor	-	-	-	-
PC6. use the capacitive element by replacing the mechanical buttons	-	-	-	-
PC7. use the inductive sensor to measure high precision measurements of displacement, distance, oscillation in harsh industrial environments	-	-	-	-
PC8. check the position of the piston in the cylinder by using the pneumatic sensor	-	-	-	-
PC9. detect weak infrared irradiation caused by temperature fluctuation by using a pyro-electric sensor	-	-	-	-
PC10. measure the electrical potential caused by applying mechanical force to a piezoelectric material by using a piezoelectric sensor	-	-	-	-
PC11. carry out repair and maintenance of sensors	-	-	-	-
Install, test and use actuators	**15**	**25**	**-**	**7**
PC12. select the appropriate analogue or digital actuators to install in electrical and hydraulic systems to control various physical quantities	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. install an actuator with the appropriate properties according to the need	-	-	-	-
PC14. use the appropriate interface circuitry to match the actuator to the system driving it	-	-	-	-
PC15. test the actuator for correct functioning after installation	-	-	-	-
PC16. carry out troubleshooting for any issues identified with the installed hydraulic and pneumatic actuator as per the sketches and block diagrams	-	-	-	-
PC17. debounce the keypads to use the mechanical switches as required	-	-	-	-
PC18. install and use the vane motor as per the standard procedure	-	-	-	-
PC19. control high-powered circuit using a lower power signal through electro-mechanical and solid- state relays	-	-	-	-
PC20. use the stepper motor to convert electrical power into mechanical power	-	-	-	-
PC21. create analytical design and development solutions for actuators for different applications	-	-	-	-
PC22. carry out repair and maintenance of actuators	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

Qualification Pack

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7110
NOS Name	Install, test and use the sensors and actuators in the mechatronics system
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

ELE/N7111: Install, test and use microcontroller in the mechatronics system

Description

This OS unit is about carrying out the installation of a microcontroller in the mechatronics system, along with testing and using it.

Scope

The scope covers the following :

- Install, test and use microcontroller

Elements and Performance Criteria

Install, test and use microcontroller

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

PC1. select an appropriate microcontroller to install according to the intended application in the mechatronics system

PC2. install the microcontroller as per the standard procedure and link the function of microcontroller structure in hardware interfacing units of the mechatronics system

PC3. test the microcontroller after installation to ensure it functions as expected

PC4. program the microcontroller to execute a specific set of instructions

PC5. test the functioning of the machine using the mechatronics system

PC6. carry out interfacing of Analog-To-Digital (A/D) and Digital-To-Analog (D/A) convertors using the appropriate type of microcontroller

PC7. compose and program stepper motor using the appropriate type of microcontroller

PC8. compose and program Advanced RISC Machine (ARM) and microprocessor with stepper motor

PC9. carry out repair and maintenance of microcontrollers

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. different applications of mechatronic systems

KU2. structure of different types of microcontroller and their PIN configuration

KU3. difference between a microprocessor and microcontroller

KU4. advantages, disadvantages and applications of microcontrollers

KU5. interfacing of D/A converters and A/D converters with microcontroller

KU6. application of temperature control stepper motor control

KU7. the function of microcontroller structure in hardware interfacing units of the mechatronics system

KU8. instruction sets and programming concepts of microprocessor and microcontroller

KU9. programming concepts to interface the hardware units with microprocessor and microcontroller

KU10. the architecture of PIN configuration, ARM Processor

KU11. the criteria for selecting an appropriate microcontroller

KU12. the process of digital to analogue and vice versa conversion in a microcontroller

KU13. the process of controlling the temperature with temperature sensor using microcontroller circuit

KU14. the process of interfacing experiments of A/D and D/A using the appropriate type of microprocessor

KU15. the process of interfacing and programming of Stepper motor using the appropriate type of microcontroller

KU16. the process of interfacing and programming of the ARM processor with Stepper Motor

KU17. how to carry out repair and maintenance of microcontrollers in the mechatronics system

Generic Skills (GS)

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

GS1. read the relevant literature to get the latest updates about the field of work

GS2. communicate politely and professionally

GS3. write work-related notes

GS4. take quick decisions to deal with any disruptions to work

GS5. maintain professional relationships with co-workers and clients

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

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

GS8. apply domain knowledge and experience to improve the quality of work

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Install, test and use microcontroller	**30**	**55**	**-**	**15**
PC1. select an appropriate microcontroller to install according to the intended application in the mechatronics system	-	-	-	-
PC2. install the microcontroller as per the standard procedure and link the function of microcontroller structure in hardware interfacing units of the mechatronics system	-	-	-	-
PC3. test the microcontroller after installation to ensure it functions as expected	-	-	-	-
PC4. program the microcontroller to execute a specific set of instructions	-	-	-	-
PC5. test the functioning of the machine using the mechatronics system	-	-	-	-
PC6. carry out interfacing of Analog-To-Digital (A/D) and Digital-To-Analog (D/A) convertors using the appropriate type of microcontroller	-	-	-	-
PC7. compose and program stepper motor using the appropriate type of microcontroller	-	-	-	-
PC8. compose and program Advanced RISC Machine (ARM) and microprocessor with stepper motor	-	-	-	-
PC9. carry out repair and maintenance of microcontrollers	-	-	-	-
NOS Total	**30**	**55**	**-**	**15**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N7111
NOS Name	Install, test and use microcontroller in the mechatronics system
Sector	Electronics
Sub-Sector	Industrial Automation
Occupation	Engineering-I&A
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	24/02/2022
Next Review Date	03/05/2026
NSQC Clearance Date	03/05/2023

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	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC21. follow processes specified for disposal of hazardous waste	1	2	-	-
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

Qualification Pack

DGT/VSQ/N0102: Employability Skills (60 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

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

PC1. identify employability skills required for jobs in various industries

PC2. identify and explore learning and employability portals

Constitutional values – Citizenship

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

PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.

PC4. follow environmentally sustainable practices

Becoming a Professional in the 21st Century

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

PC5. recognize the significance of 21st Century Skills for employment

PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

Basic English Skills

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

PC7. use basic English for everyday conversation in different contexts, in person and over the telephone

PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English

PC9. write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

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

PC10. understand the difference between job and career

PC11. prepare a career development plan with short- and long-term goals, based on aptitude

Communication Skills

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

PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings

PC13. work collaboratively with others in a team

Diversity & Inclusion

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

PC14. communicate and behave appropriately with all genders and PwD

PC15. escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

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

PC16. select financial institutions, products and services as per requirement

PC17. carry out offline and online financial transactions, safely and securely

PC18. identify common components of salary and compute income, expenses, taxes, investments etc

PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

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

PC20. operate digital devices and carry out basic internet operations securely and safely

PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively

PC22. use basic features of word processor, spreadsheets, and presentations

Entrepreneurship

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

PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research

PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion

PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

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

PC26. identify different types of customers

PC27. identify and respond to customer requests and needs in a professional manner.

PC28. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

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

PC29. create a professional Curriculum vitae (Résumé)

PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC31. apply to identified job openings using offline /online methods as per requirement

PC32. answer questions politely, with clarity and confidence, during recruitment and selection

PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account and use applications such as word processors, spreadsheets etc.

KU16. how to identify business opportunities

KU17. types and needs of customers

KU18. how to apply for a job and prepare for an interview

KU19. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

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

GS1. read and write different types of documents/instructions/correspondence

GS2. communicate effectively using appropriate language in formal and informal settings

GS3. behave politely and appropriately with all
GS4. how to work in a virtual mode
GS5. perform calculations efficiently
GS6. solve problems effectively
GS7. pay attention to details
GS8. manage time efficiently
GS9. maintain hygiene and sanitization to avoid infection

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	**1**	**1**	**-**	**-**
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
Constitutional values – Citizenship	**1**	**1**	**-**	**-**
PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC4. follow environmentally sustainable practices	-	-	-	-
Becoming a Professional in the 21st Century	**2**	**4**	**-**	**-**
PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
Basic English Skills	**2**	**3**	**-**	**-**
PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
Career Development & Goal Setting	**1**	**2**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. understand the difference between job and career	-	-	-	-
PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
Communication Skills	**2**	**2**	**-**	**-**
PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
PC13. work collaboratively with others in a team	-	-	-	-
Diversity & Inclusion	**1**	**2**	**-**	**-**
PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
Financial and Legal Literacy	**2**	**3**	**-**	**-**
PC16. select financial institutions, products and services as per requirement	-	-	-	-
PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
Essential Digital Skills	**3**	**4**	**-**	**-**
PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Entrepreneurship	**2**	**3**	**-**	**-**
PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
Customer Service	**1**	**2**	**-**	**-**
PC26. identify different types of customers	-	-	-	-
PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
PC28. follow appropriate hygiene and grooming standards	-	-	-	-
Getting ready for apprenticeship & Jobs	**2**	**3**	**-**	**-**
PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0102
NOS Name	Employability Skills (60 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	4
Credits	2
Version	1.0
Last Reviewed Date	18/02/2025
Next Review Date	18/02/2028
NSQC Clearance Date	18/02/2025

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 marsks 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/N7109.Set up circuits and electrical components in the mechatronics system	30	55	-	15	100	25
ELE/N7110.Install, test and use the sensors and actuators in the mechatronics system	30	55	-	15	100	25
ELE/N7111.Install, test and use microcontroller in the mechatronics system	30	55	-	15	100	30
ELE/N1002.Apply health and safety practices at the workplace	35	65	-	-	100	10
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	0	0	50	10
Total	**145**	**260**	**-**	**45**	**450**	**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.