Qualification Pack

Motor and Controller Design Engineer

QP Code: ELE/Q6702

Version: 1.0

NSQF Level: 5

Electronics Sector Skills Council of India || 155, 2nd Floor, ESC House Okhla Industrial Area-Phase 3
New Delhi- 110020 || email:standards@essc-india.org

Contents

ELE/Q6702: Motor and Controller Design Engineer

Brief Job Description

The Motor and Controller Design Engineer is responsible for designing motor, controller and power transmission control system for electric vehicles. The job covers activities like designing the control system, thorough testing and validation of the design.

Personal Attributes

The individual must have attention to details, logical thinking, and ability to execute the project as per requirement. This job requires the individual to work collaboratively with diverse teams. The individual should be able to hold interest in technology changes: demonstrate strong technical expertise

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. ELE/N6703: Design the Motor and Transmission Control system
2. ELE/N6704: Inspect, test and implement the Motor and Transmission Control system
3. ELE/N9905: Work effectively at the workplace
4. ELE/N1002: Apply health and safety practices at the workplace

Qualification Pack (QP) Parameters

Sector	Electronics
Sub-Sector	E-Mobility and Battery
Occupation	Product Design & Development-EM&B
Country	India
NSQF Level	5
Credits	NA
Aligned to NCO/ISCO/ISIC Code	NCO-2016/NIL

Minimum Educational Qualification & Experience	B.E./B.Tech (Degree in Electrical or Electronics Engineering) OR Diploma (Electrical or Electronics Engineering) with 3 Years of experience in the relevant field OR Certificate-NSQF (Level-4 in the domain of EV / Electrical / Mechanical / Automobile (Motor & Controller Repairing Technician))
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	30/12/2021
Next Review Date	30/12/2026
Deactivation Date	31/07/2024
NSQC Approval Date	30/12/2021
Version	1.0
Reference code on NQR	2021/EHW/ESSC/04788
NQR Version	1.0

ELE/N6703: Design the Motor and Transmission Control system

Description

This OS unit is about designing the motor, motor controller and power transmission system.

Scope

The scope covers the following :

- Determining specifications of the Motor and Transmission Control system
- Designing the Motor and Motor Controller
- Designing the Transmission and Transmission Control system

Elements and Performance Criteria

Determining specifications of the Motor and Transmission Control system

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

PC1. interpret Electric Vehicle level specifications set out by the Customer / Management

PC2. translate EV specifications into Motor and Transmission Control system level specifications

PC3. list various design options / specifications available at each component level of the Motor and Transmission Control system

PC4. evaluate each design option based on parameters such as safety, performance and cost

PC5. select a proper battery to generate sufficient electrical power for movement of the vehicle

PC6. select specification of the motor for powering the electric vehicle

PC7. select specification of the motor controller for controlling energy flow from the motor

PC8. select specification of the gears, clutch and differentials, necessary for transmitting power to the wheels

PC9. select specification of Transmission Control system

PC10. administer that the project is within the stipulated time and budget

Designing the Motor and Motor Controller

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

PC11. employ cross-functional partners to integrate Motor and Transmission into the final system

PC12. develop designing, building, and testing code to satisfy design requirements

PC13. design motor of the electric vehicle for converting electrical energy into mechanical energy

PC14. design mounting arrangement for different types of motors for two, three and four-wheeler

PC15. design controller of the motor for controlling movement of the motor

Designing the Transmission and Transmission Control system

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

PC16. design power transmission system for controlled transmission of power from the battery to wheel

PC17. design differential for controlling movement of the rear wheels

PC18. design system for transmitting power to one or more differentials

PC19. design system for gear reduction so that the wheels can rotate at different speed

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. types of documentation in organization and importance of the same
KU2. basic electrical and electronics system knowledge, concepts of AC & DC
KU3. operating principle of an electric vehicle
KU4. principles, categories, types and applications of power transmission system
KU5. importance of various design parameters such as cost, space, technology, safety, functional requirements, performance requirements, etc.
KU6. traditional designing methods and present technology advancements
KU7. safety and environmental standards during designing
KU8. functionalities of various transmission system components such as gear, clutch and differentials
KU9. functionalities of various types of motors such as mid-drive motor and hub mounted motors
KU10. application of various types of motors in different types of electric vehicles
KU11. functionalities of various types of motor controllers used in electric vehicles
KU12. mechanisms of power transmission from battery to motor and then to power transmission systems
KU13. torque and how that influence selection of motors
KU14. basic procedures of power conversion and equipment/ gadgets required

Generic Skills (GS)

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

GS1. read and interpret engineering and tool drawings
GS2. prepare summary report with all relevant information
GS3. gather customer requirements and feedback
GS4. translate feedbacks into product requirement document
GS5. share technical information clearly using appropriate language
GS6. evaluate various options, their pros and cons, short term and long-term implications, cost implications, health and safety implications, etc. before taking a decision
GS7. analyze risks to minimize losses or damages
GS8. build and mentor a team
GS9. refer manuals, health and safety instructions, memos, reports, job cards, etc.
GS10. envisage design goals, develop strategies and take action to achieve them
GS11. communicate effectively orally and in writing

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Determining specifications of the Motor and Transmission Control system	**20**	**43**	**-**	**-**
PC1. interpret Electric Vehicle level specifications set out by the Customer / Management	2	4	-	-
PC2. translate EV specifications into Motor and Transmission Control system level specifications	2	4	-	-
PC3. list various design options / specifications available at each component level of the Motor and Transmission Control system	2	4	-	-
PC4. evaluate each design option based on parameters such as safety, performance and cost	2	4	-	-
PC5. select a proper battery to generate sufficient electrical power for movement of the vehicle	2	4	-	-
PC6. select specification of the motor for powering the electric vehicle	2	4	-	-
PC7. select specification of the motor controller for controlling energy flow from the motor	2	4	-	-
PC8. select specification of the gears, clutch and differentials, necessary for transmitting power to the wheels	2	5	-	-
PC9. select specification of Transmission Control system	2	5	-	-
PC10. administer that the project is within the stipulated time and budget	2	5	-	-
Designing the Motor and Motor Controller	**5**	**15**	**-**	**-**
PC11. employ cross-functional partners to integrate Motor and Transmission into the final system	1	3	-	-
PC12. develop designing, building, and testing code to satisfy design requirements	1	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. design motor of the electric vehicle for converting electrical energy into mechanical energy	1	3	-	-
PC14. design mounting arrangement for different types of motors for two, three and four-wheeler	1	3	-	-
PC15. design controller of the motor for controlling movement of the motor	1	3	-	-
Designing the Transmission and Transmission Control system	**5**	**12**	**-**	**-**
PC16. design power transmission system for controlled transmission of power from the battery to wheel	2	3	-	-
PC17. design differential for controlling movement of the rear wheels	1	3	-	-
PC18. design system for transmitting power to one or more differentials	1	3	-	-
PC19. design system for gear reduction so that the wheels can rotate at different speed	1	3	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N6703
NOS Name	Design the Motor and Transmission Control system
Sector	Electronics
Sub-Sector	E-Mobility and Battery
Occupation	Product Design & Development-EM&B
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2026
NSQC Clearance Date	30/12/2021

ELE/N6704: Inspect, test and implement the Motor and Transmission Control system

Description

This OS unit is about effective testing of the design. The testing is conducted in multiple stages before and after the manufacturing. This unit focuses on the design tests conducted before manufacturing.

Scope

The scope covers the following :

- Testing and validation of the design
- Performing temperature rise test
- Performing motor speed test
- Performing mechanical balancing test

Elements and Performance Criteria

Testing and validation of the design

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

PC1. identify design areas where checking and testing is essential

PC2. use simple instructions which can be understood by the stakeholders

PC3. perform routine evaluation of the design for different parameters

PC4. test the entire designs of the power transmission system as per design specifications

PC5. create prototype design of the activation, which can be validated, if necessary

PC6. comply with globally accepted regulatory standards for technical specifications while testing

PC7. create logbook to maintain test records

Performing temperature rise test

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

PC8. use temperature tester with multi-channel temperature monitoring, measuring & recording functions

PC9. inspect that the components and assemblies do not get overheated during operation

PC10. perform temperature rise testing to ensure temperature do not exceed specified limits

PC11. perform the test on bushings, instrument transformers, disconnections and other equipment

Performing motor speed test

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

PC12. examine the instantaneous speed of the vehicle using speedometer

PC13. perform vehicle speed sensor testing in order to test the speed sensor

Perform mechanical balancing test

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

PC14. inspect the system for vibration caused due to unbalancing after fitting of bearing and spindle

PC15. test to identify reasons for unbalancing

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the company
KU2. reporting structure, inter-department functions, lines and procedures in the work area
KU3. basic principle and working of electronics
KU4. importance of various design parameters such as cost, space, technology, safety, functional requirements, performance requirements, etc.
KU5. protocols & standards of Automotive industry (e.g. CAN, UDS, ISO 26262)
KU6. functionalities of various testing equipment such as speedometer, temperature tester etc.
KU7. procedures to be followed for troubleshooting and standards to follow
KU8. techniques to carry out temperature rise test, motor speed test and mechanical balancing test
KU9. globally accepted regulatory standards for testing
KU10. mechanism to test the speed sensor which includes, turning the ignition switch to the OFF position, disengaging the wiring harness connector and using a digital Volt-Ohmmeter to measure the resistance between sensor terminals
KU11. various causes for unbalancing such as asymmetric geometry, material in homogeneity, manufacturing tolerances and elastic deformations of the flexible components during operations
KU12. mechanism to identify causes of unbalancing from experimental data

Generic Skills (GS)

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

GS1. fill forms, activity logs, attendance sheets appropriately as per organizational format
GS2. communicate technical information clearly using appropriate language
GS3. use simple language to be understood by fellow workers, supervisors and clients while testing
GS4. check and clarify task-related information
GS5. seek clarification from immediate supervisor or responsible authority to rectify problems at work when faced with difficult situations
GS6. review the documentation to identify the faults faced in previous designs
GS7. communicate with cross functional teams on issues
GS8. plan, prioritize and sequence work operations as per job requirements
GS9. organize and analyze information relevant to design and testing
GS10. use basic concepts of work productivity including efficient resource usage and time management
GS11. seek assistance and support from other workers, supervisors and clients to solve problems

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Testing and validation of the design	**10**	**30**	**-**	**-**
PC1. identify design areas where checking and testing is essential	1	4	-	-
PC2. use simple instructions which can be understood by the stakeholders	2	4	-	-
PC3. perform routine evaluation of the design for different parameters	1	4	-	-
PC4. test the entire designs of the power transmission system as per design specifications	1	4	-	-
PC5. create prototype design of the activation, which can be validated, if necessary	2	5	-	-
PC6. comply with globally accepted regulatory standards for technical specifications while testing	2	5	-	-
PC7. create logbook to maintain test records	1	4	-	-
Performing temperature rise test	**10**	**20**	**-**	**-**
PC8. use temperature tester with multi-channel temperature monitoring, measuring & recording functions	2	5	-	-
PC9. inspect that the components and assemblies do not get overheated during operation	3	5	-	-
PC10. perform temperature rise testing to ensure temperature do not exceed specified limits	3	5	-	-
PC11. perform the test on bushings, instrument transformers, disconnections and other equipment	2	5	-	-
Performing motor speed test	**4**	**10**	**-**	**-**
PC12. examine the instantaneous speed of the vehicle using speedometer	2	5	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. perform vehicle speed sensor testing in order to test the speed sensor	2	5	-	-
Perform mechanical balancing test	**6**	**10**	**-**	**-**
PC14. inspect the system for vibration caused due to unbalancing after fitting of bearing and spindle	3	5	-	-
PC15. test to identify reasons for unbalancing	3	5	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	ELE/N6704
NOS Name	Inspect, test and implement the Motor and Transmission Control system
Sector	Electronics
Sub-Sector	E-Mobility and Battery
Occupation	Product Design & Development-EM&B
NSQF Level	5
Credits	TBD
Version	1.0
Last Reviewed Date	30/12/2021
Next Review Date	30/12/2026
NSQC Clearance Date	30/12/2021

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/option 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/N6703.Design the Motor and Transmission Control system	30	70	-	-	100	25
ELE/N6704.Inspect, test and implement the Motor and Transmission Control system	30	70	-	-	100	25
ELE/N9905.Work effectively at the workplace	40	60	-	-	100	25
ELE/N1002.Apply health and safety practices at the workplace	35	65	-	-	100	25
Total	**135**	**265**	**-**	**-**	**400**	**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.