



# Electronic Hardware Design Engineer

QP Code: ELE/Q6102

Version: 2.0

NSQF Level: 5

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## ELE/Q6102: Electronic Hardware Design Engineer

### Brief Job Description

The individual at work is responsible for undertaking research on new products, work with R&D on developing the schematics, converting them to PCB layout using CAD and other software and generating the Gerber file to pass on to PCB manufacturers.

### Personal Attributes

The job requires the individual to attention to detail, good eyesight, and physically fit with ability to work for long hours on computer.

### Applicable National Occupational Standards (NOS)

#### Compulsory NOS:

1. [ELE/N6102: Develop design for manufacture](#)
2. [ELE/N9905: Work effectively at the workplace](#)
3. [ELE/N1002: Apply health and safety practices at the workplace](#)

### Qualification Pack (QP) Parameters

<b>Sector</b>	Electronics
<b>Sub-Sector</b>	Industrial Automation
<b>Occupation</b>	Designing
<b>Country</b>	India
<b>NSQF Level</b>	5
<b>Credits</b>	NA
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO-2004/NIL

<b>Minimum Educational Qualification &amp; Experience</b>	Diploma (Electrical or Electronics Engineering) with 2 Years of Relevant experience) OR B.E./B.Tech (Degree in Electrical or Electronics Engineering) OR Certificate (NSQF Level-4 in Design Engineer with 2 years of relevant Experience)
<b>Minimum Level of Education for Training in School</b>	Not Applicable
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	18 Years
<b>Last Reviewed On</b>	27/01/2022
<b>Next Review Date</b>	02/06/2025
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<b>NQR Version</b>	1.0

**Remarks:**

NA

## ELE/N6102: ELE/N6102: Develop design for manufacture

### Description

This OS unit is about undertaking research on new products, design and create layout, verify prototype, and approve layout for PCB manufacture

### Scope

The scope covers the following :

- Understand new product specifications
- Design and create layouts
- Test prototype and modify design
- Verify and approve the design
- Achieve productivity and quality standards

### Elements and Performance Criteria

#### *Understand new product specifications*

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

- PC1.** interact with customer and understand the requirement
- PC2.** interact with R&D team in order to confirm understanding on the product's specifications and output
- PC3.** modify the existing products and designs as per market requirement
- PC4.** initiate and coordinate the overall design and development process
- PC5.** maintain and comply with developments in technologies as well as regulations

#### *Design and create layouts*

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

- PC6.** outline layout rules and details to develop design process and analysis
- PC7.** create schematic symbols and layer stack up
- PC8.** develop and finalize schematics along with R&D team
- PC9.** convert the schematic to PCB layout including component symbol, footprint and manufacturing data packages
- PC10.** build circuits according to engineering instructions, technical manuals, knowledge of electronic systems and components
- PC11.** create design blueprints using computer software
- PC12.** provide a detailed layout of complex PCB designs
- PC13.** generate, maintain and manage parts library, i.e., component building and selection
- PC14.** create Gerber artwork file
- PC15.** generate fabrication packages including fabrication drawings, assembly drawings, peer reviews, DFM requests and preliminary RFQs
- PC16.** create netlist and routing rules for manufacturing process
- PC17.** perform high speed bus routing, differential pairs and impedance control routing to meet signal integrity

**PC18.** respond to customer's requests and queries as they occur

*Test prototype and modify design*

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

**PC19.** create prototype, hand or machine assembled

**PC20.** verify the design outputs

**PC21.** examine, debug and validate hardware design

**PC22.** analyze and interpret test data against customer's specifications

**PC23.** assist debugging, trouble shooting and correction of latent defects

**PC24.** recommend changes in specifications to simplify assembly and maintenance

**PC25.** edit, develop and implement solutions as per customer specifications

*Verify and approve the design*

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

**PC26.** check drawing plots according to customer's specifications and standards of conformance

**PC27.** review layouts and designs according to engineering specifications using and application software

**PC28.** approve final PCB design for production

**PC29.** create final Gerber file

**PC30.** collaborate with PCB manufacturer and assembly line to finalize PCB manufacturing and assembly processes

**PC31.** create backup copies and file them securely

*Achieve productivity and quality standards*

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

**PC32.** ensure customer's specifications are met

**PC33.** ensure 100% product safety approvals are met

**PC34.** achieve deadlines, schedule, and commitments for assigned projects

**PC35.** collaborate with quality assurance team to ensure quality standards

**PC36.** conform to statutory requirements on environment and criticality knowledge

## **Knowledge and Understanding (KU)**

The individual on the job needs to know and understand:

**KU1.** company's policies on: incentives, delivery and quality standards, personnel management and IPR

**KU2.** work flow involved in assembly process of the company

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

**KU4.** reporting structure

**KU5.** organizational capabilities with respect to input materials and processes

**KU6.** safety and quality standards followed in the organization

**KU7.** electronics and electrical engineering

**KU8.** components values and polarities

**KU9.** CADSTAR, Cadence Or CAD & Allegro, AutoCAD LT, Eagle, Protel, Altium, AutoCAD, Hyperlynx and layout techniques for good signal integrity

- KU10.** Mentor graphics, Valor NPI, DXDesigner and PADs with DXDatabook, CAD packages, CAM350 and other software for schematic capture
- KU11.** other PCB design and layout tools
- KU12.** PCB layout design placement, routing, Gerber verification, building library (footprints, schematic symbols), ERP systems, BOM structures, design for test (DFT) and design for manufacturability (DFM), foot-printing, Net listing, constraint setup
- KU13.** PCB manufacturing process, fabrication drawings and assembly process
- KU14.** modular design techniques, designing for double side and multilayer
- KU15.** design constraints and complete design cycle from understanding customers specifications to production
- KU16.** quality standards associated with PCB design
- KU17.** installing and configuring Operating Systems (Linux, Windows), Storage subsystems
- KU18.** servers, storage hardware, RAID technology, hardware design, testing, verification and validation
- KU19.** debugging, schematics, PCB design, assembly process, wire diagram and interpretation of technical drawings
- KU20.** procedure to make changes to the design
- KU21.** circuit diagrams and wiring
- KU22.** research sources for obtaining technical information
- KU23.** statutory regulations, standards and codes of practice and their implications
- KU24.** importance of keeping designs developed confidential and consequences of breaching IPR clause
- KU25.** IPC standards for printed circuit board

## **Generic Skills (GS)**

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

- GS1.** to read schematics, blueprints, product and customer specifications
- GS2.** to document designs
- GS3.** to read job sheet, process, production schedules, machine operation manuals
- GS4.** to use computer work with designing software
- GS5.** to effectively communicate with external PCB manufacturers
- GS6.** to communicate with in-house assembly team to deliver high quality boards and manufacturability in a timely manner
- GS7.** to communicate with customer in order to resolve any discrepancies in the design for manufacture aspect
- GS8.** to coordinate with various departments such as marketing, sales, production, research and development
- GS9.** to work in teams to devise creative solutions
- GS10.** to plan and organize own tasks
- GS11.** to multi-task, handle additional responsibility, and adapt quickly to changing priorities
- GS12.** to suggest on corrective actions to reduce repetitive errors

- GS13.** to improve work process with less rework within PCB layout function release process for high-volume product manufacturing
- GS14.** to demonstrated leadership in CAD system, library management and design release process for high-volume product manufacturing
- GS15.** to be prompt to resolve problems effectively
- GS16.** to use test and measurement equipment like Oscilloscopes, PCIe/SAS protocol analysers, etc.
- GS17.** to use various design tools, equipment, and computer applications and software
- GS18.** to ensure designs are feasible with knowledge on physics, engineering and mathematics
- GS19.** to have a creative and innovative approach for generating new ideas
- GS20.** to spot process disruptions and delays
- GS21.** to troubleshoot and identify problems
- GS22.** to propose possible solutions



## Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<i>Understand new product specifications</i>	<b>5</b>	<b>15</b>	-	-
<b>PC1.</b> interact with customer and understand the requirement	1	2	-	-
<b>PC2.</b> interact with R&D team in order to confirm understanding on the product's specifications and output	1	4	-	-
<b>PC3.</b> modify the existing products and designs as per market requirement	1	3	-	-
<b>PC4.</b> initiate and coordinate the overall design and development process	1	3	-	-
<b>PC5.</b> maintain and comply with developments in technologies as well as regulations	1	3	-	-
<i>Design and create layouts</i>	<b>10</b>	<b>15</b>	-	-
<b>PC6.</b> outline layout rules and details to develop design process and analysis	1	1	-	-
<b>PC7.</b> create schematic symbols and layer stack up	1	1	-	-
<b>PC8.</b> develop and finalize schematics along with R&D team	-	1	-	-
<b>PC9.</b> convert the schematic to PCB layout including component symbol, footprint and manufacturing data packages	1	1	-	-
<b>PC10.</b> build circuits according to engineering instructions, technical manuals, knowledge of electronic systems and components	1	1	-	-
<b>PC11.</b> create design blueprints using computer software	1	1	-	-
<b>PC12.</b> provide a detailed layout of complex PCB designs	1	1	-	-
<b>PC13.</b> generate, maintain and manage parts library, i.e., component building and selection	1	1	-	-
<b>PC14.</b> create Gerber artwork file	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC15.</b> generate fabrication packages including fabrication drawings, assembly drawings, peer reviews, DFM requests and preliminary RFQs	-	1	-	-
<b>PC16.</b> create netlist and routing rules for manufacturing process	1	1	-	-
<b>PC17.</b> perform high speed bus routing, differential pairs and impedance control routing to meet signal integrity	-	2	-	-
<b>PC18.</b> respond to customer's requests and queries as they occur	1	2	-	-
<i>Test prototype and modify design</i>	<b>10</b>	<b>15</b>	-	-
<b>PC19.</b> create prototype, hand or machine assembled	1	3	-	-
<b>PC20.</b> verify the design outputs	1	2	-	-
<b>PC21.</b> examine, debug and validate hardware design	1	1	-	-
<b>PC22.</b> analyze and interpret test data against customer's specifications	1	1	-	-
<b>PC23.</b> assist debugging, trouble shooting and correction of latent defects	2	1	-	-
<b>PC24.</b> recommend changes in specifications to simplify assembly and maintenance	2	2	-	-
<b>PC25.</b> edit, develop and implement solutions as per customer specifications	2	5	-	-
<i>Verify and approve the design</i>	<b>5</b>	<b>10</b>	-	-
<b>PC26.</b> check drawing plots according to customer's specifications and standards of conformance	1	2	-	-
<b>PC27.</b> review layouts and designs according to engineering specifications using and application software	1	2	-	-
<b>PC28.</b> approve final PCB design for production	1	2	-	-
<b>PC29.</b> create final Gerber file	-	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC30.</b> collaborate with PCB manufacturer and assembly line to finalize PCB manufacturing and assembly processes	1	1	-	-
<b>PC31.</b> create backup copies and file them securely	1	1	-	-
<i>Achieve productivity and quality standards</i>	<b>10</b>	<b>5</b>	-	-
<b>PC32.</b> ensure customer's specifications are met	2	1	-	-
<b>PC33.</b> ensure 100% product safety approvals are met	2	1	-	-
<b>PC34.</b> achieve deadlines, schedule, and commitments for assigned projects	2	1	-	-
<b>PC35.</b> collaborate with quality assurance team to ensure quality standards	2	1	-	-
<b>PC36.</b> conform to statutory requirements on environment and criticality knowledge	2	1	-	-
<b>NOS Total</b>	<b>40</b>	<b>60</b>	-	-

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ELE/N6102
<b>NOS Name</b>	ELE/N6102: Develop design for manufacture
<b>Sector</b>	Electronics
<b>Sub-Sector</b>	Industrial Automation
<b>Occupation</b>	Designing
<b>NSQF Level</b>	5
<b>Credits</b>	TBD
<b>Version</b>	4.0
<b>Last Reviewed Date</b>	27/01/2022
<b>Next Review Date</b>	02/06/2025
<b>NSQC Clearance Date</b>	27/01/2022

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

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC14.</b> formulate a professional development plan to enhance capabilities	2	1	-	-
<b>PC15.</b> build or contribute to the organizational knowledge base of cases, clients, issues, solutions, and innovations	1	1	-	-
<b>PC16.</b> examine developments and trends in field of work and their potential impact on work	1	1	-	-
<b>PC17.</b> take feedback from peers, supervisors and clients to improve own performance and practices	1	1	-	-
<i>Work in a disciplined and ethical manner</i>	<b>11</b>	<b>16</b>	-	-
<b>PC18.</b> perform tasks as per workplace standards, organisational policies and legislative requirements	2	2	-	-
<b>PC19.</b> display appropriate professional appearance at the workplace and adhere to the organisational dress code	1	2	-	-
<b>PC20.</b> 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	-	-
<b>PC21.</b> 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	-	-
<b>PC22.</b> protect the rights of the client and organisation when delivering services	1	2	-	-
<b>PC23.</b> ensure services are delivered equally to all clients regardless of personal and cultural beliefs	1	2	-	-
<b>PC24.</b> operate within an agreed ethical code of practice and report unethical conduct to the appropriate authorities	2	2	-	-
<b>PC25.</b> follow organisational guidelines and legal requirements on disclosure and confidentiality	1	2	-	-
<i>Uphold social diversity at the workplace</i>	<b>10</b>	<b>11</b>	-	-

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

## National Occupational Standards (NOS) Parameters

<b>NOS Code</b>	ELE/N9905
<b>NOS Name</b>	Work effectively at the workplace
<b>Sector</b>	Electronics
<b>Sub-Sector</b>	Generic
<b>Occupation</b>	Generic - Organizational Behaviour
<b>NSQF Level</b>	4
<b>Credits</b>	TBD
<b>Version</b>	2.0
<b>Last Reviewed Date</b>	24/02/2022
<b>Next Review Date</b>	30/12/2026
<b>NSQC Clearance Date</b>	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 I
- 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 handling 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
<i>Deal with workplace hazards</i>	<b>20</b>	<b>31</b>	-	-
<b>PC1.</b> identify job-site hazards and possible causes of accident in the workplace	2	3	-	-
<b>PC2.</b> 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	-	-
<b>PC3.</b> 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	-	-
<b>PC4.</b> follow standard safety procedures while handling tool/ ,equipment, hazardous substances and while working in hazardous environments	3	4	-	-
<b>PC5.</b> 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	-	-
<b>PC6.</b> avoid damage of components due to negligence in electrostatic discharge (ESD) procedures	2	3	-	-
<b>PC7.</b> 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	-	-
<b>PC8.</b> maintain appropriate posture while handling heavy objects	1	3	-	-
<b>PC9.</b> apply good housekeeping practices at all times	2	3	-	-
<i>Apply fire safety practices</i>	<b>4</b>	<b>9</b>	-	-
<b>PC10.</b> take preventive measures to prevent fire hazards	2	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
<b>PC11.</b> <ul style="list-style-type: none"> <li>• use appropriate fire extinguishers for different types of fires</li> <li>• 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 I</li> </ul>	1	3	-	-
<b>PC12.</b> exhibit rescue and first-aid techniques in case of fire or electrocution	1	3	-	-
<i>Follow emergencies, rescue and first-aid procedures</i>	<b>6</b>	<b>13</b>	-	-
<b>PC13.</b> administer appropriate first aid to victims in case of bleeding, burns, choking, electric shock, poisoning etc.	1	3	-	-
<b>PC14.</b> administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock,	1	2	-	-
<b>PC15.</b> 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	-	-
<b>PC16.</b> use correct method to move injured people and others during an emergency	2	4	-	-
<i>Effective waste management/recycling practices</i>	<b>5</b>	<b>12</b>	-	-
<b>PC17.</b> identify recyclable and non-recyclable, and hazardous waste generated	1	3	-	-
<b>PC18.</b> segregate waste into different categories	1	2	-	-
<b>PC19.</b> ensure disposal of non-recyclable waste appropriately	1	2	-	-
<b>PC20.</b> deposit non-recyclable and reusable material at identified location	1	3	-	-
<b>PC21.</b> 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

<b>NOS Code</b>	ELE/N1002
<b>NOS Name</b>	Apply health and safety practices at the workplace
<b>Sector</b>	Electronics
<b>Sub-Sector</b>	Generic
<b>Occupation</b>	Generic - Health Safety
<b>NSQF Level</b>	4
<b>Credits</b>	TBD
<b>Version</b>	3.0
<b>Last Reviewed Date</b>	24/02/2022
<b>Next Review Date</b>	24/02/2025
<b>NSQC Clearance Date</b>	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 proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on 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 theory part for each candidate at each examination/training centre (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training centre based on this criterion.
6. To pass the Qualification Pack, 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/N6102.ELE/N6102: Develop design for manufacture	40	60	-	-	100	50
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
<b>Total</b>	<b>115</b>	<b>185</b>	<b>-</b>	<b>-</b>	<b>300</b>	<b>100</b>

**Acronyms**

<b>NOS</b>	National Occupational Standard(s)
<b>NSQF</b>	National Skills Qualifications Framework
<b>QP</b>	Qualifications Pack
<b>TVET</b>	Technical and Vocational Education and Training
<b>NOS</b>	National Occupational Standard(s)
<b>NSQF</b>	National Skills Qualifications Framework
<b>QP</b>	Qualifications Pack
<b>TVET</b>	Technical and Vocational Education and Training
<b>IPR</b>	Intellectual Property Rights

## Glossary

<b>Sector</b>	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.
<b>Sub-sector</b>	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
<b>Occupation</b>	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
<b>Job role</b>	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
<b>Occupational Standards (OS)</b>	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.
<b>Performance Criteria (PC)</b>	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
<b>National Occupational Standards (NOS)</b>	NOS are occupational standards which apply uniquely in the Indian context.
<b>Qualifications Pack (QP)</b>	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.
<b>Unit Code</b>	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
<b>Unit Title</b>	Unit title gives a clear overall statement about what the incumbent should be able to do.
<b>Description</b>	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.
<b>Scope</b>	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.
<b>Knowledge and Understanding (KU)</b>	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.

<b>Organisational Context</b>	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.
<b>Technical Knowledge</b>	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
<b>Core Skills/ Generic Skills (GS)</b>	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.
<b>Electives</b>	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.
<b>Options</b>	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.
<b>Sector</b>	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.
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<b>Performance Criteria (PC)</b>	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
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<b>Unit Code</b>	Unit code is a unique identifier for an Occupational Standard, which is denoted by an N
<b>Unit Title</b>	Unit title gives a clear overall statement about what the incumbent should be able to do.
<b>Description</b>	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.
<b>Scope</b>	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.
<b>Knowledge and Understanding (K)</b>	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.
<b>Organisational Context</b>	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.
<b>Technical Knowledge</b>	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
<b>Core Skills/ Generic Skills (G)</b>	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today world. These skills are typically needed in any work environment in today 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.
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