



# Model Curriculum

**QP Name: Motor and Controller Design Engineer**

**QP Code: ELE/Q6702**

**QP Version: 2.0**

**NSQF Level: 5**

**Model Curriculum Version: 2.0**

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## Training Parameters

<b>Sector</b>	Electronics
<b>Sub-Sector</b>	E-Mobility & Battery
<b>Occupation</b>	Product Design & Development-EM&B
<b>Country</b>	India
<b>NSQF Level</b>	5
<b>Aligned to NCO/ISCO/ISIC Code</b>	NCO - 2015/2144.0800
<b>Minimum Educational Qualification and Experience</b>	B.E./B.Tech (Degree in Electrical or Electronics Engineering) OR Diploma (after 10th Electrical or Electronics Engineering) with 2 Years of experience OR Certificate-NSQF (Level-4 in the domain of EV / Electrical / Mechanical /Automobile (Battery System Assembly Operator) with 3 Years of experience
<b>Pre-Requisite License or Training</b>	NA
<b>Minimum Job Entry Age</b>	21 Years
<b>Last Reviewed On</b>	30/12/2021
<b>Next Review Date</b>	30/12/2026
<b>NSQC Approval Date</b>	30/12/20216
<b>QP Version</b>	2.0
<b>Model Curriculum Creation Date</b>	30/12/2021
<b>Model Curriculum Valid Up to Date</b>	30/12/202
<b>Model Curriculum Version</b>	2.0
<b>Maximum Duration of the Course</b>	600 Hours

## Program Overview

This section summarizes the end objectives of the program along with its duration.

### Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills:

- State the role and responsibilities of a Motor & Control Design Engineer
- State the specifications of the Motor and Transmission Control System
- Demonstrate the process of designing the Motor & Transmission Control System as per the Standard Operating Procedure (SOP)
- Explain the process of evaluating the design against various parameters such as safety, performance and cost
- List the design areas where testing is essential
- Explain the importance of complying with the globally accepted regulatory standards while testing
- Explain the process of developing test plans for batteries at the component and system level
- Demonstrate the process of carrying out various tests on the Motor & Transmission Control System
- Explain the importance and process of revising the design based on the test results
- Explain the importance of following inclusive practices for all genders and PwD at work
- Demonstrate the use of relevant health and safety equipment at work

### Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

NOS and Module Details	Theory Duration	Practical Duration	On-the-Job Training Duration (Mandatory)	On-the-Job Training Duration (Recommended)	Total Duration
<b>Bridge Module</b>	<b>24:00</b>	<b>06:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 1: Introduction and orientation to the role of a Motor and Controller Design Engineer	24:00	06:00	00:00	00:00	30:00
<b>ELE/N6703 Design the Motor and Transmission Control System</b>	<b>30:00</b>	<b>90:00</b>	<b>60:00</b>	<b>00:00</b>	<b>180:00</b>
Module 2: Designing the Motor and Transmission Control system	30:00	90:00	60:00	00:00	180:00
<b>ELE/N6704 - Inspect, test and implement the Motor and Transmission Control System</b>	<b>60:00</b>	<b>90:00</b>	<b>90:00</b>	<b>00:00</b>	<b>240:00</b>

Module 3: Testing and implementing the design	60:00	90:00	90:00	00:00	240:00
<b>ELE/N9905 Work effectively at the workplace</b>	<b>15:00</b>	<b>15:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 4: Soft Skills and Work Ethics	15:00	15:00	00:00	00:00	30:00
<b>ELE/N1002 Apply health and safety practices at workplace</b>	<b>15:00</b>	<b>15:00</b>	<b>00:00</b>	<b>00:00</b>	<b>30:00</b>
Module 5: Basic Health and Safety Practice	15:00	15:00	00:00	00:00	30:00
<b>DGT/VSQ/N0103 – Employability Skills (90 Hours)</b>	<b>36:00</b>	<b>54:00</b>	<b>00:00</b>	<b>00:00</b>	<b>90:00</b>
Module 6: Employability Skills (90 Hours)	36:00	54:00	00:00	00:00	90:00
<b>Total Duration</b>	<b>180:00</b>	<b>270:00</b>	<b>150:00</b>	<b>00:00</b>	<b>600:00</b>

# Module Details

## Module 1: Introduction and orientation to the role of a Motor and Controller Design Engineer

### Terminal Outcomes:

- Describe the role and responsibilities of a Motor and Controller Design Engineer.

Duration: 24:00	Duration: 06:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>Describe the size and scope of the Electronics industry and its sub-sectors</li> <li>Explain the working principle of an Electric Vehicle</li> <li>Explain the application and functions of a Motor and Control System in an Electric vehicle</li> <li>State the role and responsibilities of a Motor and Controller Design Engineer.</li> <li>Discuss various employment opportunities for a Motor and Controller Design Engineer in the Electronics industry</li> <li>Describe various designing and testing processes used in the designing of the Motor &amp; Transmission Control System</li> <li>State the organisational policies on incentives, personnel management, reporting structure, etc.</li> </ul>	<ul style="list-style-type: none"> <li>Overview of the Design for Motor &amp; Controller</li> <li>Overview of the Softwares used in the designing</li> </ul>
<b>Classroom Aids</b>	
Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
NA	

## Module 2: Designing the Motor and Transmission Control system

### Mapped to ELE/N6703

#### Terminal Outcomes:

- State the specifications of the Motor and Transmission Control System
- Demonstrate the process of designing the Motor & Transmission Control System
- Explain the process of evaluating the design against various parameters such as safety, performance and cost

Duration: 30:00	Duration: 90:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the basic principles governing the Alternating Current (AC), Direct Current (DC), electronic circuits, etc.</li> <li>• Explain the principles, categories, and applications of the Motor and Transmission Control System</li> <li>• Explain the applications of Motor and Transmission Control System in an Electric Vehicle</li> <li>• Explain the mechanism of power transmission from battery to motor and then to power transmission systems</li> <li>• State the specifications of various components such as Motor, Energy Controller, Transmission Parts and Control System</li> <li>• Explain the functions of various Motor and Transmission Control System components such as gear, clutch and differentials</li> <li>• Explain the working mechanism of various types of motors such as mid-drive motor and hub-mounted motors</li> <li>• Describe the process of designing a Motor and Transmission Control System</li> <li>• Explain what torque is and how that influences the selection of motors</li> <li>• Explain various safety and environmental standards to be followed during designing a Motor</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the process of designing the motor, controller, mounting arrangements, etc.</li> <li>• Demonstrate the process of designing various components of transmission system such as clutch, gear, differential, transmission control system etc.</li> <li>• Demonstrate the process of testing the performance of the Motor and Transmission Control system against the parameters such as safety, performance and cost</li> </ul>

and Transmission Control System	
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
Machine Tools and Design Software For Designing and Activating The Battery System, Cross Compiler, Circuit Simulator, Device Driver, Laptop and Desktop Computers, Windows, Ios, Linux, Virtual Machines, Organizational Documents.	

## Module 3: Testing and implementing the design

Mapped to ELE/N6704

### Terminal Outcomes:

- List the design areas where testing is essential
- Explain the globally accepted regulatory standards to be adhered to while testing
- Describe the process of developing the test plans for batteries at the component and system level
- Demonstrate the process of performing various tests on the Motor & Transmission Control System
- Explain the importance and process of revising the design based on the test results

Duration: 60:00	Duration: 90:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• Explain the globally accepted regulatory standards for testing</li> <li>• Explain the use of various testing equipment such as Speedometer, Temperature Tester etc.</li> <li>• Describe the process of conducting various tests such as temperature rise test, motor speed test, mechanical balancing test, etc.</li> <li>• Explain the process of testing the speed sensor</li> <li>• Explain how to interpret the experimental data to identify the causes of unbalancing</li> <li>• Describe the process of identifying various causes of unbalancing in the Motor &amp; Transmission Control System such as asymmetric geometry, material inhomogeneity, manufacturing tolerances and elastic deformations of the flexible components during operations</li> <li>• Describe various troubleshooting procedures and standards to follow</li> <li>• Describe the process of performing the routine evaluation of the design against different parameters</li> </ul>	<ul style="list-style-type: none"> <li>• Prepare a sample prototype activation design</li> <li>• Demonstrate the process of carrying out temperature rise test on bushings, instrument transformers, disconnection and other equipment</li> <li>• Demonstrate the process of carrying out the motor speed test</li> <li>• Demonstrate the process of carrying out the mechanical balancing test to identify the reason for unbalancing in the Motor &amp; Transmission Control System</li> </ul>
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	

Tools and Various Testing Equipment Such as Hydrometer, Multimeter, Traffic Generators / Analyzers, Signal Generators / Analyzers, Frequency Counters, Power Supply, PPE, Soldering Equipment, Earthing Equipment Etc. Organizational Documents.

## Module 4: Soft Skills and Work Ethics

### Mapped to ELE/N9905

#### Terminal Outcomes:

- Work effectively at the workplace.
- Demonstrate practices related to gender and PwD sensitization

Duration: 15:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> <li>• State the importance of work ethics and workplace etiquette</li> <li>• State the importance of effective communication and interpersonal skills.</li> <li>• Explain ways to maintain discipline at the workplace.</li> <li>• Discuss the common reasons for interpersonal conflict and ways of managing them effectively.</li> <li>• Discuss the importance of following organisational guidelines for dress code, time schedules, language usage and other behavioural aspects.</li> <li>• Explain the importance of working as per the workflow of the organisation to receive instructions and report problems.</li> <li>• Explain the importance of conveying information/instructions as per defined protocols to the authorised persons/team members.</li> <li>• Explain the common workplace guidelines and legal requirements on non-disclosure and confidentiality of business-sensitive information.</li> <li>• Describe the process of reporting grievances and unethical conduct such as data breaches, sexual harassment at the workplace, etc.</li> <li>• Explain the concept and importance of gender sensitivity and equality.</li> <li>• Discuss ways to create sensitivity for different genders and Persons with Disabilities (PwD).</li> <li>• Discuss ways of dealing with</li> </ul>	<ul style="list-style-type: none"> <li>• Develop a sample plan to achieve organisational goals and targets.</li> <li>• Create a sample feedback form to obtain feedback from customers, colleagues etc.</li> <li>• Roleplay to demonstrate the use of professional language and behaviour that is respectful of PwD and all genders.</li> <li>• Apply organisational protocol on data confidentiality and sharing only with the authorised personnel.</li> </ul>

heightened emotions of self and others.	
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations)	
<b>Tools, Equipment and Other Requirements</b>	
Sample of Escalation Matrix, Organization Structure.	

## Module 5: Basic Health and Safety Practice

### Mapped to ELE/N1002

#### Terminal Outcomes:

- Apply health and safety practices at the workplace.

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

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

## Module 6: Employability Skills (90 Hours)

Mapped to DGT/VSQ/N0103

### Terminal Outcomes:

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

<b>Duration: 36:00</b>	<b>Duration: 54:00</b>
<b>Theory – Key Learning Outcomes</b>	<b>Practical – Key Learning Outcomes</b>
<ul style="list-style-type: none"> <li>• Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen</li> <li>• Discuss 21<sup>st</sup> century skills</li> <li>• Explain use of basic English phrases and sentences.</li> <li>• Demonstrate how to communicate in a well-behaved manner</li> <li>• Demonstrate how to work with others</li> <li>• Demonstrate how to operate digital devices</li> <li>• Discuss the significance of Internet and Computer/ Laptops</li> <li>• Discuss the need for identifying business opportunities</li> <li>• Discuss about types of customers.</li> <li>• Discuss on creation of biodata</li> <li>• Discuss about apprenticeship and opportunities related to it.</li> </ul>	<ul style="list-style-type: none"> <li>• List different learning and employability related GOI and private portals and their usage</li> <li>• Show how to practice different environmentally sustainable practices.</li> <li>• Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc.</li> <li>• Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone</li> <li>• Demonstrate how to communicate in a well -mannered way with others.</li> <li>• Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette</li> <li>• Utilize virtual collaboration tools to work effectively</li> <li>• Demonstrate how to maintain hygiene and dressing appropriately.</li> <li>• Perform a mock interview</li> </ul>
<b>Classroom Aids</b>	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
<b>Tools, Equipment and Other Requirements</b>	
Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board	
OR	
Computer Lab	

## Module 7: On-the-Job Training

### *Mapped to Motor and Controller Design Engineer*

<b>Mandatory Duration: 150:00</b>	<b>Recommended Duration: 00:00</b>
<b>Location: On-Site</b>	
<p><b>Terminal Outcomes</b></p> <ol style="list-style-type: none"> <li>1. Explain the functioning of an Electric Vehicle</li> <li>2. Explain the application of Motor, Power Transmission and Transmission Control in an Electric Vehicle</li> <li>3. Perform the necessary assessment before starting to design</li> <li>4. Design Motor and Transmission Control System considering various parameters such as safety, performance and cost</li> <li>5. Explain the applicable global standards for designing an Motor &amp; Transmission Control System</li> <li>6. Describe the process of testing and validating an Motor &amp; Transmission Control System design</li> <li>7. Interact and coordinate with supervisor and colleagues</li> <li>8. Carry out assigned work within the agreed time limit and as per the agreed quality standards</li> <li>9. Maintain a healthy, safe and secure working environment</li> </ol>	

# Annexure

## Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Mechatronics / Electronics Engineering/ Certified in relevant CITS Trade	Electronics / Mechatronics Engineering	3	Motor and Controller Design Engineer	2	Electronics	

Trainer Certification	
Domain Certification	Platform Certification
“Motor and Controller Design Engineer”, “ELE/Q6702, v2.0”, Minimum accepted score is 80%	Recommended that the Trainer is certified for the <b>Motor &amp; Controller Design Engineer</b> “Trainer (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2601, V2.0”, with minimum score of 80%

## Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
Mechatronics / Electronics Engineering/ Certified in relevant CITS Trade	Electronics / Mechatronics Engineering	5	Mechatronics or Electronics Engineering	2	Electronics	

Assessor Certification	
Domain Certification	Platform Certification
“Motor and Controller Design Engineer”, “ELE/Q6702, v2.0”, Minimum accepted score is 80%	Recommended that the Assessor is certified for the <b>Motor &amp; Controller Design Engineer</b> “Assessor (VET and Skills)”, mapped to the Qualification Pack: “MEP/Q2701, V2.0”, with minimum score of 80%

## Assessment Strategy

### 1. Assessment System Overview:

- Batches assigned to the assessment agencies for conducting the assessment on SDMS/SIP or email
- Assessment agencies send the assessment confirmation to VTP/TC looping SSC
- The assessment agency deploys the ToA certified Assessor for executing the assessment
- SSC monitors the assessment process & records

### 2. Testing Environment

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

- Confirm that the centre is available at the same address as mentioned on SDMS or SIP
- Check the duration of the training.
- Check the Assessment Start and End time to be 10 a.m. and 5 p.m. respectively
- Ensure there are two Assessors if the batch size is more than 30.
- Check that the allotted time to the candidates to complete Theory & Practical Assessment is correct.
- Check the mode of assessment—Online (TAB/Computer) or Offline (OMR/PP).
- Confirm the number of TABs on the ground are correct to execute the Assessment smoothly.
- Check the availability of the Lab Equipment for the particular Job Role.

### 3. Assessment Quality Assurance levels / Framework:

- Question papers created by the Subject Matter Experts (SME)
- Question papers created by the SME verified by the other subject Matter Experts
- Questions are mapped with NOS and PC
- Question papers are prepared considering that levels 1 to 3 are for the unskilled & semi-skilled individuals, and levels 4 and above are for the skilled, supervisor & higher management
- The assessor must be ToA certified & the trainer must be ToT Certified
- The assessment agency must follow the assessment guidelines to conduct the assessment

### 4. Types of evidence or evidence-gathering protocol:

- Time-stamped & geotagged reporting of the assessor from assessment location
- Centre photographs with signboards and scheme-specific branding
- Biometric or manual attendance sheet (stamped by TP) of the trainees during the training period
- Time-stamped & geotagged assessment (Theory + Viva + Practical) photographs & videos

### 5. Method of verification or validation:

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

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

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

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

- Hard copies of the documents are stored

- Soft copies of the documents & photographs of the assessment are uploaded/accessed from Cloud Storage
- Soft copies of the documents & photographs of the assessment are stored in the Hard drive

# References

## Glossary

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

## Acronyms and Abbreviations

Term	Description
DC	Direct Current
EM&B	E-Mobility & Battery
IC	Integrated Circuit
ITI	Industrial Training Institute
MCU	MicroController Unit
NCO	National Occupational Standards
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OJT	On-the-Job Training
OMR	Optical Mark Recognition
PC	Performance Criteria
PwD	Persons with Disabilities
QP	Qualification Pack
SDMS	Skill Development & Management System
SIP	Skill India Portal
SME	Small and Medium Enterprises
SOP	Standard Operating Procedure
SSC	Sector Skill Council
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider
UL	Underwriter Laboratories
VTP	Vocational Training Provider