



Model Curriculum

QP Name: Junior Engineer Drone (R & D)

QP Code: ELE/Q6703

QP Version: 1.0

NSQF Level: 5.5

Model Curriculum Version: 1.0

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Training Parameters

Sector	Electronics
Sub-Sector	E – Mobility & Battery
Occupation	Product Design & Development – EM & B
Country	India
NSQF Level	5.5
Aligned to NCO/ISCO/ISIC Code	NCO-2015/8212.0400
Minimum Educational Qualification and Experience	<p>Pursuing 3rd/4th year of Graduation (B.Sc/B.E./B.Tech) in the relevant field</p> <p>OR</p> <p>Diploma (after 10th (Electronics/ Mechanical/Electrical)) with 1 year of relevant experience</p> <p>OR</p> <p>12th grade pass with 1 year NTC/ NAC with 1 year of relevant experience</p> <p>OR</p> <p>12th grade Pass with 2 years of relevant experience</p> <p>OR</p> <p>10th grade Pass with 4 years of relevant experience</p> <p>OR</p> <p>Previous relevant Qualification of NSQF Level (4) with 3 years of relevant experience</p>
Pre-Requisite License or Training	NA
Minimum Job Entry Age	21 Years
Last Reviewed On	NA
Next Review Date	31/01/2027
NSQC Approval Date	31/01/2024
QP Version	1.0
Model Curriculum Creation Date	
Model Curriculum Valid Up to Date	
Model Curriculum Version	1.0
Maximum Duration of the Course	540 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 Specialist
- Demonstrate the basic principles of Electronics and Drones
- Demonstrate the basic flying physics and motions of the drone using a simulator
- Demonstrate the process of inspecting different components of a Drone for testing
- Explain the process of testing a Drone for correct functioning
- Explain the process of manufacturing a prototype
- Explain the process of simulation using the software
- Explain the importance of following the quality and customer service standards
- Explain the importance of following inclusive practices for all genders and PwD at work
- Demonstrate the use of relevant health and safety equipment

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
ELE/N6705 - R & D in the field of Drones & Electronics	30:00	90:00	00:00	00:00	120:00
Module 1: Research in the field of Drones and Electronics	05:00	15:00	00:00	00:00	20:00
Module 2: Study of Block Diagram of a Drone	05:00	15:00	00:00	00:00	20:00
Module 3: Required Constituents/ Tools to assemble a Drone	10:00	30:00	00:00	00:00	40:00
Module 4: Study of Drone Electronics/Circuits	10:00	30:00	00:00	00:00	40:00
ELE/N6706 - Development of Prototype for manufacturing	36:00	114:00	90:00	00:00	240:00
Module 5: Awareness of the software used	12:00	36:00	00:00	00:00	48:00
Module 6: Assembling, Testing and Quality check of the Drone	12:00	39:00	45:00	00:00	96:00
Module 7: Types of Drones and their applications	12:00	39:00	45:00	00:00	96:00
ELE/N7007 - Practical Aspect of Drones and Simulation Techniques	30:00	60:00	30:00	00:00	120:00
Module 8: Principles of Flying and Learning it with Drone Simulator	30:00	60:00	30:00	00:00	120:00
DGT/VSQ/N0102 – Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00

Module 9: Employability Skills (60 Hours)	24:00	36:00	00:00	00:00	60:00
Total Duration	120:00	300:00	120:00	00:00	540:00

Module Details

Module 1: Research in the field of Drones and its components

Mapped to ELE/N6705

Duration: 05:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Describe the size and scope of the electronics industry and its sub-sectors • List various types of Drones and their respective applications • State the role and responsibilities of a Drone Specialist • Discuss various opportunities in the Drone industry • State the organization’s policies on incentives, personnel management reporting structure etc. 	<ul style="list-style-type: none"> • Overview on the types of drones • Awareness about the drone engineering (BOQ)
Classroom Aids	
Training kit - Trainer guide, Presentations, Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
NA	

Module 2: Study of Block Diagram of a Drone

Mapped to ELE/N6705

Duration: 05:00	Duration: 15:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<p>Explain the functional Block Diagram of Drones. Describe functionality of each block and its importance with respect to the operations of the drone.</p>	<p>Practically explain showing the parts forming the functional blocks and their significance in the drone operation.</p>
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Working model of Drone for demonstration.	

Module 3: Required Constituents/ Tools to assemble a Drone

Mapped to ELE/N6705

Duration: 10:00	Duration: 30:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain from block diagram to actual constituents that go into making of a Drone. • Describe in brief, significance, positioning of each constituent. • Explain the working of tools needed to assemble and make a drone. • Describe the functionality of each part of the Drone. 	<ul style="list-style-type: none"> • Practically explain showing the parts forming the functional blocks and their significance in the drone operation. • Demonstration of using tools needed for drone assembly.
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Working model of Drone for demonstration of Block diagram, Tools needed for Drone assembly	

Module 4: Study of Drone Electronics/ Circuits

Mapped to ELE/N6705

Duration: 10:00	Duration: 30:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Overview of basic electronic components such as a resistor, capacitor, transistor, coil, motors, sensors etc. • Brushed and Brushless Motors • Factors in selection of motors in drones • Electronic Speed Control (ESC) • Calibrate and mount Electronic Speed Controllers (ESCs) • Explain Transmitters & Receivers and communication modules used in drones • Drone batteries and their types, pros and cons • Explain different sensors used in drones • Distinguish between different flight controllers and compare them • Explain Payloads in drones such as Cameras, Load Grippers etc. • Drone weight and payload weight • Explain payload weight distribution for a set of conditions • Payload based controller calibration 	<ul style="list-style-type: none"> • Demonstrate basic electronic components • Demonstrate different Drone motors • Demonstrate ESC, Trans-receivers etc. • Demonstrate Flight controllers • Demonstrate payload mechanisms • Demonstrate different payload effects on drone flight • Demonstrate effect of imbalanced payload conditions
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Working model of Drone, Electronic constituents of Drone such as Motors, ESC, Flight controllers, Trans-receivers, different payload mechanisms for demonstration	

Module 5: Awareness of the software used

Mapped to ELE/N6706

Mandatory Duration: 12:00	Recommended Duration: 36:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Overview of the various software • Overview of the simulation system • Overview of the Operating System • Overview of the hardware of the prototype 	<ul style="list-style-type: none"> • Overview of the various software • Hands-on on the various software used for the designing and prototyping • Development of prototype for the simulation • Software testing of the prototype • Knowledge of various bugs • Commissioning of the prototype for the simulation
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Hardware for the system, Software Library as per the application	

Module 6: Assembling, Testing and Quality check of the Drone

Mapped to ELE/N6706

Mandatory Duration: 12:00	Recommended Duration: 39:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> ● On the basis of previous module knowledge gained in module 6 and 7 of electronics & aerodynamics(mechanical) of drones <ul style="list-style-type: none"> ○ And from the drone components (Bill of materials) ○ With the help of tools studied previously ● Assemble different types of Drones from their components and sub-assemblies ● To study the assembly procedures for at least 2 different types of drones ● To study configurations and setting of drones to make them operational with desired functionality ● To study the methods to carry out testing of drone sub-assemblies and also fully assembled drone with/without payload ● Performing the necessary pre-dispatch Quality Checks on the Assembled / Manufactured drone. 	<ul style="list-style-type: none"> ● Practicing actual assembly and manufacturing of the drone ● Identifying BOM of components and assemble the drone from drawing supplied with drone kits ● Carry out configuration and settings for the drone. Charging the drone batteries ● Repeat for at least 2 types of drones ● Carry out testing and Quality Check / Assurance of the drone without payload and then with rated payload ● Deploy the drone
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Full CKD (Complete Knock-Down) components for at least 2 different types of Drones. Full tool set – Soldering Iron, Screwdriver, Torque Screwdriver, Nut Driver, Safety Knife, Pliers, Wire Strippers, Wire Cutters, Glue Gun, Tweezers, Multi-meter, Heat Gun, Desk Light and Magnifier, Digital Weighing Scale, Wattmeter and Clamp Meter, Motor Thrust Stand, Servo Tester, Connectors etc.	

Module 7: Types of Drones and Their Applications

Mapped to ELE/N6706

Terminal Outcomes:

- State the different types of Drones and their applications

Duration: 12:00	Duration: 39:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Explain the fundamental concept of a Drone • Explain types of Drones based on Wing Geometry – Fixed Wing, Multi-rotor etc. • Describe the applications of different types of Drones. • Describe the rationale behind having different Drone types for different applications. • Types of Fixed Wing drones, make, parts, terminology • Operations & Maneuver of fixed wing drones • Applications of Fixed Wing drones • Introduction to Multi-rotor drones. • Advantages and disadvantages of Fixed Wing drones over Multi-rotor drones 	<ul style="list-style-type: none"> • Demonstrate different types of Drones in physical form or • Demonstrate the Types of Drones through videos and simulator
Classroom Aids	
Drone videos, Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Different Types of drones in physical form, drone simulator	

Module 8: Principles of Flying and Learning it with Drone Simulator

Mapped to ELE/N7007

Mandatory Duration: 30:00	Recommended Duration: 60:00
Theory – Key Learning Outcomes	Practical – Key Learning Outcomes
<ul style="list-style-type: none"> • Understand basic principles of flying like Bernoulli's Principle etc. • Apply principles of flight to Drones. • Understand Longitude/Latitude etc. • Take-off, Flight, Landing, Maneuvers, turns etc. • Multi-rotor configurations, airframe sizes and construction materials • Different propeller designs • Knowledge of the purpose of the different parts of the drones. • Acquire knowledge of thrust to weight ratio of a drone and how the propellers help in controlling the same • Apply concepts of Lift and drag for drone flight using a drone simulator • Understand concept of reverse torque acting on drones. Knowledge of 3-axis drone motions roll, pitch and yaw and impact of propellers on the motion • Knowing controlled roll and pitch angle and its bearing on the flight of the drone • Know sensor interfacing with the drone • Simulate the concept of Pitch, roll, yaw, thrust to weight ratio using Drone simulator • Simulate the concept of Hovering a drone, soft landing, controlled pitch and roll angles with a Drone Simulator • Use of Drones solving day-to-day problems 	<ul style="list-style-type: none"> • Demonstrate airframes and propellers • Demonstrate aerodynamics of motion control • Demonstrate maneuvering in drones using these principles • Simulate full flight sequences on the Drone Simulator for understanding of – <ul style="list-style-type: none"> ○ Set Up – Drone, Site, Coordinates ○ Pre-flight checks, start-up ○ Take-off ○ Fly ○ Approach and soft landing ○ Handle fly-aways and exceptions ○ Yaw, pitch, roll ○ Thrust-to-weight ratio, lift, drag ○ Controlled roll and pitch angles
Classroom Aids	
Whiteboard, Marker, projector, laptop	
Tools, Equipment and Other Requirements	
Drone Simulator capable with all above-mentioned simulation parameters and facilities	

Module 9: Employability Skills (60 Hours) Mapped to DGT/VSQ/N0102

Terminal Outcomes:

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

Duration: 24:00	Duration: 36:00
<p>Theory – Key Learning Outcomes</p> <ul style="list-style-type: none"> • Explain constitutional values, civic rights, responsibility towards society to become a responsible citizen • Discuss 21st century skills • Explain use of basic English phrases and sentences. • Demonstrate how to communicate in a well-behaved manner • Demonstrate how to work with others • Demonstrate how to operate digital devices • Discuss the significance of Internet and Computer/ Laptops • Discuss the need for identifying business opportunities • Discuss about types of customers. • Discuss on creation of biodata • Discuss about apprenticeship and opportunities related to it. 	<p>Practical – Key Learning Outcomes</p> <ul style="list-style-type: none"> • List different learning and employability related GOI and private portals and their usage • Show how to practice different environmentally sustainable practices. • Exhibit 21st century skills like Self-Awareness, Behavior Skills, time management, etc. • Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone • Demonstrate how to communicate in a well -mannered way with others. • Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette • Utilize virtual collaboration tools to work effectively • Demonstrate how to maintain hygiene and dressing appropriately. • Perform a mock interview
Classroom Aids	
Training Kit (Trainer Guide, Presentations). Whiteboard, Marker, Projector, Laptop	
Tools, Equipment and Other Requirements	
Computer, UPS, Scanner, Computer Tables, LCD Projector, Computer Chairs, White Board	
OR	
Computer Lab	

Module 10: On-The-Job Training

Mapped to Junior Engineer Drone (R & D)

Mandatory Duration: 120:00

Recommended Duration: 00:00

Terminal Outcomes

1. Explain the fundamental concept of a Drone
2. Illustrate the preliminary tasks involve in the R & D of a Drone
3. Demonstrate how to perform preliminary checks on a Drone Simulation
4. Demonstrate how to carry out Testing of a Drone prior to deployment
5. Test functioning of the Drone prototype
6. Communicate product and service-related information to the customer
7. Interact and coordinate with supervisor and colleagues
8. Perform assigned work within timelines and with defined quality
9. Demonstrate how to maintain a healthy, safe and secure working environment

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training Experience		Remarks
		Years	Specialization	Years	Specialization	
Diploma / Degree in Electronics (related fields) or Aeronautical Engineering/ Certified in relevant CITS Trade	Should have knowledge of Aerospace engineering/ Electronics Engineering	3	Drones	2	Electronics	

Trainer Certification	
Domain Certification	Platform Certification
“Junior Engineer Drone (R & D)”, “ELE/QXXXX, v1.0”, Minimum accepted score is 80%	Recommended that the Trainer is certified for the Junior Engineer Drone (R & D) “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	
Diploma / Degree in Electronics or Aeronautical Engineering/ Certified in relevant CITS Trade	Should have knowledge of aerospace engineering/ Electronics Engineering	5	Drones	2	Electronics	

Assessor Certification	
Domain Certification	Platform Certification
“Junior Engineer Drone (R & D)”, “ELE/QXXXX, v1.0”, Minimum accepted score is 80%	Recommended that the Assessor is certified for the Junior Engineer Drone (R & D) “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
- 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 are 10 a.m. and 5 p.m. respectively
- Ensure there are 2 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 level 1 to 3 are for the unskilled & semi-skilled individuals, and level 4 and above are for the skilled, supervisor & higher management
- The assessor must be ToA certified & trainer must be ToT Certified
- 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 on the Harddrive

References

Glossary

Term	Description
Declarative knowledge	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.
Key Learning	Key learning outcome is the 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).
OJT (M)	On-the-job training (Mandatory); trainees are mandated to complete specified hours of on-site training
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of on-site training
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a
Training Outcome	Training outcome is a statement of what a learner will know, understand and be able to do upon the completion of the training.
Terminal Outcome	Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome.

Acronyms and Abbreviations

Term	Description
AMC	Annual Maintenance Contract
CPR	Cardiopulmonary Resuscitation
DC	Direct Current
EM&B	E-Mobility & Battery
GPS	Global Positioning System
IC	integrated Circuit
NCO	National Occupational Standards
NOS	National Skills Qualification Committee
NSQF	National Skills Qualification Framework
OMR	Optical Mark Recognition
OJT	On-the-Job Training
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
TAB	Tablet
TC	Trainer Certificate
ToA	Training of Assessors
ToT	Training of Trainers
TP	Training Provider
VTP	Vocational Training Provider