Model Curriculum

QP Name: Product Assembly Assistant (Solar-LED)

QP Code: NIE/ELE/Q0901

Version: 1.0

NSQF Level: 3

Training Parameters

Sector	Electronics
Sub-Sector	Renewable Energy Electronics
Occupation	Electronics Assembly
Country	India
NSQF Level	3
Aligned to NCO/ISCO/ISIC Code	3113.1001, 3113.1002
Minimum Educational Qualification and Experience	10th Class Pass OR 8th Class Pass with 2 years of Experience in Electronics/Electrical/Allied Sector OR 8th Pass and pursuing continuous schooling in regular school with vocational subject OR 8th with 2 years of NTC after 8th
Pre-Requisite License or Training	-
Minimum Job Entry Age	16 Years
Last Reviewed On	29.09.2023
Next Review Date	29.09.2026
NSQC Approval Date	29.09.2023
QP Version	1
Model Curriculum Creation Date	29.09.2023
Model Curriculum Valid Up to Date	29.09.2026
Model Curriculum Version	2.0
Duration of the Course	330 Hours

Program Overview

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

Training Outcomes

1. Students will acquire a thorough understanding of various electronic components, including passive and active components, transformers, and operational amplifiers, enabling them to identify, test, and utilize them effectively in electronic circuit design.
2. Students will be able to design and implement electronic circuits for rectifiers, filter circuits, LED drivers, and power converters, demonstrating competence in selecting appropriate components, analyzing circuit characteristics, and achieving desired performance specifications.
3. Students will gain expertise in designing LED lighting systems, including LED driver circuits, assembly of LED lighting products such as bulbs, spotlights, and tube lights, and integrating them into solar-LED lighting products, fostering innovation and sustainability in lighting technology.
4. Students will comprehend the principles of solar photovoltaic cells, including characteristics and specifications, and gain knowledge of battery types and selection criteria for solar-LED lighting products, ensuring efficient energy storage and utilization in off-grid lighting applications.
5. Students will develop prototype models of solar-LED lighting products tailored to specific light intensity requirements, demonstrating proficiency in product development, assembly, and installation, and preparing them for roles in the renewable energy and lighting industries.

Compulsory Modules

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

NOS/Module Name	Training Duration (Hours)		
	Th.	Pr.	Total
NOS1: Conceptualizing Electronic Components and Devices NOS Code: NIE/ELE/N0909 NOS Version- 1.0 NSQF Level- 3	15	30	45
NOS2: LED characteristics & specifications NOS Code: NIE/ELE/N0902 NOS Version- 1.0 NSQF Level- 3	15	30	45
NOS3: AC-DC and DC-DC power conversion NOS Code: NIE/ELE/N0904 NOS Version- 1.0 NSQF Level- 3	10	20	30
NOS4: Design of LED Driver circuit NOS Code: NIE/ELE/N0905 NOS Version- 1.0 NSQF Level- 3	10	20	30
NOS5: LED lighting products Assembly NOS Code: NIE/ELE/N0906	10	20	30

NOS/Module Name	Training Duration (Hours)		
	Th.	Pr.	Total
NOS Version- 1.0 NSQF Level- 3			
NOS6: Solar PV cell: Characteristics, parameter and specification NOS Code: NIE/ELE/N0907 NOS Version- 1.0 NSQF Level- 3	10	20	30
NOS7: Batteries for Solar-LED lighting Products NOS Code: NIE/ELE/N0908 NOS Version- 1.0 NSQF Level- 3	10	20	30
NOS8: Design, assembly and installation of Solar-LED Lighting Products. NOS Code: NIE/ELE/N0903 NOS Version- 1.0 NSQF Level- 3	10	20	30
Sub Total	90	180	270
NOS9: Employability Skills NOS Code: DGT/VSQ/N0101 NOS Version- 1.0 NSQF Level- 3	30		30
Project/ OJT	0	0	30
Total	**120**	**180**	**330**

Module Details

Module 1/NOS 1: Conceptualizing Electronic Components and Devices

NOS Code: NIE/ELE/N0909

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Identify various types of Electronic Components
- Test various types of passive and active components using multimeter
- Realize half and full-wave rectifier for a given O/P voltage, and viewing output Waveform

Key Learning Outcomes:

Duration: 15 hours	**Duration: 30 hours**
Theory	**Practical**
-Understand the fundamentals of Electronic components.	- Learn to identify by visualizing various types of electronic components
-Understand the Color-coding of resistors and capacitors	-Learn to read the ohmic value and tolerance by color band of a color-coded resistor.
-Understand the testing procedure of electronic components	-Hands-on exerciseson testing of electronic components
-Understand the working of Half-wave rectifier	-Realizing Half-wave rectifier circuit and measurement of output voltage using DMM
-Understand the working of Full- wave rectifier	-Realizing Full-wave rectifier circuit and measurement of output voltage using DMM
Classroom Aid	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment and Other Requirements	
Various type of electronic components, Tools, breadboard, power supply, wires, Digital multimeter, Oscilloscope, etc.	

Module 2/NOS 2: LED characteristics & specifications

NOS Code: NIE/ELE/N0902

Terminal Outcomes:

After completion of the module, the students shall be:

- Familiar with performance parameter and characteristics of LEDs
- Able to realize strings of LEDs by connecting LEDs together and powering Them from external supply

Duration:

Key Learning Outcomes:

Duration: 15 hours	**Duration: 30 hours**
Theory	**Practical**
- Understand the Fundamentals of Various types of LEDs, their color pattern, power rating, etc.	- Powering LED from external DC source(Limiting LED voltage and current)
- To understand how to connect LEDs togetherin series and parallel manner to form LED string.	-Hands on in realization of LED string.
- To understand how to use LED as Indicator,LED current and voltage requirement	- LED indicator circuit realization (Application of LED as indicator).
Classroom Aid	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment, and Other Requirements	
Various types of LEDs ,Tools, breadboard, power supply, wires, Digital multimeter, Oscilloscope, etc.	

Module 3/NOS 3: AC-DC and DC-DC power conversion

NOS Code: NIE/ELE/N0904

Terminal Outcomes:

After completion of the module, the students shall be:

- Able to realize AC-DC power conversion system for a given output voltage and current rating.
- To be familiar with the concept of PWM used in switching regulation
- Able to realize various DC-DC converter topology
- To be familiar with the concept of PWM used in switching regulation
- Able to realize DC-DC power conversion system for a given I/O voltage and Output current

Key Learning Outcomes:

Duration: 10 hours	**Practical: 20 hours**
Theory	**Practical**
- Understanding Power Supply	- Realizing AC-DC power supply for a given O/P voltage and current
- Understanding Regulator	- Realizing regulator circuit using 3-terminal regulator
-To understand PWM technique	-Realizing PWM circuit and demonstrating PWM action
-To understand DC-DC converter topology a. Buck converter b. Boost converter c. Buck-Boost converter	**-** Realizing various DC-DC converter
Classroom aids	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment and Other Requirements	
Resistor, capacitor, inductor of required values, tools, breadboard, power supply, wires, Digital multimeter, etc.	

Module 4/NOS 4: Design of LED Driver circuit

NOS Code: NIE/ELE/N0905

Terminal Outcomes:

After completion of the module, the students shall be:

- Able to Realize constant-voltage LED driver circuit
- Able to Realize constant-current LED driver circuit
- Able to Realize capacitive-dropout driver circuit
- Familiarity with Buck driving design fundamental
- Familiarity with Boost driving design fundamental
- Familiarity with Buck-Boost driving design fundamental

Key Learning Outcomes:

Duration: 10 hours	**Practical: 20 hours**
Theory	**Practical**
- To understand Constant-voltage LED driver	- Realizing constant-voltage LED driver
- To understand Constant-current LED driver	- Realizing constant-current LED driver
- To understand Capacitive-dropout driver	- Realizing Capacitive-dropout driver
- To understand Buck, Boost, and Buck- Boost driving design fundamental	- Realizing and testing of Buck, Boost, and Buck-Boost driver
Classroom aids	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment and Other Requirements	
Resistor, capacitor, inductor of required values, tools, breadboard, power supply, wires, Digital multimeter, etc.	

Module 5/NOS 5: LED lighting products Assembly

NOS Code: NIE/ELE/N0906

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Use various tools and measuring instruments used to assemble LED-based lighting product
- Assemble LED bulb light
- Assemble LED spotlight
- Assemble LED tube light

Key Learning Outcomes:

<table>
<tr><th>Duration: 10 hours</th><th>Practical: 20 hours</th></tr>
<tr><td>Theory</td><td>Practical</td></tr>
<tr><td>- Applications of various tools and measuring instruments; pliers, cutter, screw-driver set, lux meter, multimeter</td><td rowspan="4">- Step-by-step procedure (Hands-on) to Assemble and testing various LED-based lighting products:
a) LED bulb light
b) LED spotlight
c) LED tube light</td></tr>
<tr><td>-Understand the working of LED bulb light</td></tr>
<tr><td>-Understand the working of LED spotlight</td></tr>
<tr><td>-Understand the working of LED tube light</td></tr>
<tr><td colspan="2">Classroom aids</td></tr>
<tr><td colspan="2">Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).</td></tr>
<tr><td colspan="2">Tools, Equipment and Other Requirements</td></tr>
<tr><td colspan="2">Various parts of LED lighting product; Encapsulates, heat sink, thermal pottants, housing, driverboard, LED chips, lens, tools, breadboard, power supply, wires, Digital multimeter, etc</td></tr>
</table>

Module 6/NOS 6: Solar PV cell: Characteristics, parameter and specification

NOS Code: NIE/ELE/N0907

Terminal Outcomes:

After completion of the module, the students shall be able to:

- Understand the concepts of solar photo voltaic cells
  Familiarity with the working of SPV's, ratings and performance parameter of SPV cell
- Understand the effect of temperature on performance parameter of solar panel
- Understand the operating parameter of solar panel/module

Key Learning Outcomes:

Duration: 10 hours	**Practical: 20 hours**
Theory	**Practical**
- To understand PV effect and SPV cell	- To draw VI characteristics ofPV module
- To understand Characteristics of SPV cell	- To draw Voltage-Power characteristics of PV module
- To understand SPV module; Electrical parameter	- Measurement of various parameter of a given SPV module
- To understand Effect of temperature on performance parameter of SPV module	- Selection of SPV module for agiven application
Classroom aids	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	

Tools, Equipment and Other Requirements
SPV modules in different power rating, tools, wires, Digital multimeter, LUX meter,etc

Module 7/NOS 7: Batteries for Solar-LED lighting Products

NOS Code: NIE/ELE/N0908

Terminal Outcomes:

After completion of the module, the students shall have:

- Ability to understand the various parameter of batteries.
- Familiarity with various types of batteries; NiCad batteries, Lead- acid batteries, NiMH (Nickel Metal Hydride) batteries, Li-ion batteries, Lithium-Ion Phosphate Batteries.
- Ability to select battery for a given application(Battery sizing)

Key Learning Outcomes:

Duration: 10 hours	**Practical: 20 hours**
Theory	**Practical**
- To understand various parameter of battery; voltage rating, AH rating, energy rating, power rating, SoC, DoD, life cycle,etc	- Measurement of various parameter of Battery
- To understand NiCad batteries	- Testing of battery
- To understand Lead- acid batteries	- To check charging state ofbattery
- To understand NiMH (Nickel Metal Hydride) batteries	- To check battery health
- To understand Li-ion batteries	- Preventive maintenance of batteries
- To understand Lithium-Ion Phosphate Batteries	-Battery comparison and selection of battery for Solar-LEDlighting product
Classroom aids	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment and Other Requirements	
Various types of battery, multimeter, hydrometer, tools, wires, resistive loads, etc	

Module 8/NOS 8: Design, assembly and installation of Solar-LED Lighting Products

NOS Code: NIE/ELE/N0903

Terminal Outcomes:

After completion of the module, the students shall have:

- Ability to Create detailed solar-LED designs meeting specified requirements
- Ability to document, communicate design concepts, rationale, and fault Diagnosis.
- Able to Select components, understand specs, integrate solar and LED tech effectively
- Ability to Diagnose and address faults in various solar-LED products effectively
- Ability to Apply innovation to overcome design and troubleshooting challenges

Key Learning Outcomes:

Duration: 10 hours	**Practical: 20 hours**
Theory	**Practical**
- Design specification of solar-LED lighting products	- Hands-on-practice for assembly ofsolar-LED lighting products
- Selection of components for integration and testing of solar-LEDlighting product	- Testing of assembled solar-LEDlighting products for performanceparameter
- Diagnose and address faults in various solar-LED products	
Classroom aids	
Whiteboard, Marker, Projector, Laptop, Internet with Wi-Fi (Min 2 Mbps Dedicated).	
Tools, Equipment and Other Requirements	
Various parts of LED lighting product; Encapsulates, heat sink, thermal pottants, housing, driverboard, LED chips, lens, battery, tools, breadboard, power supply, wires, Digital multimeter, SPV modules in different power rating, tools, wires, Digital multimeter, LUX meter,etc	

Module 9: Employability Skills

NOS Code: DGT/VSQ/N0103

Terminal Outcomes:

After completing this program, participants will be able to:

- Outline the importance of Employability Skills for the current job market and future of work.
- List different learning and employability-related GOI and private portals and their usage.
- Research and prepare a note on different industries, trends, required skills, and the available opportunities.

Key Learning Outcomes:

Duration: 30
Key Learning Outcomes
Constitutional Values – Citizenship • Explain constitutional values, including civic rights and duties, citizenship, responsibility towards society, and personal values and ethics such as honesty, integrity, caring, and respecting others that are required to become a responsible citizen. • Demonstrate how to practice different environmentally sustainable practices. **Becoming a Professional in the 21st Century** • Discuss relevant 21st-century skills required for employment. • Highlight the importance of practicing 21st-century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn, etc., in personal or professional life. • Create a pathway for adopting a continuous learning mindset for personal and professional development. **Basic English Skills** • Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone. • Read and understand text written in basic English. • Write a short note/paragraph/letter/e-mail using correct basic English. **Career Development & Goal Setting** • Create a career development plan. • Identify well-defined short- and long-term goals. **Communication Skills** • Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette. • Write a brief note/paragraph on a familiar topic. • Explain the importance of communication etiquette, including active listening for effective communication. • Role-play a situation on how to work collaboratively with others in a team. **Diversity and Inclusion** • Demonstrate how to behave, communicate, and conduct appropriately with

all genders and PwD.

- Discuss the significance of escalating sexual harassment issues as per the POSH act.

Financial and Legal Literacy

- Discuss various financial institutions, products, and services.
- Demonstrate how to conduct offline and online financial transactions safely and securely and check passbook/statement.
- Explain the common components of salary such as Basic, PF, Allowances (HRA, TA, DA, etc.), and tax deductions.
- Calculate income and expenditure for budgeting.
- Discuss legal rights, laws, and aids.

Essential Digital Skills

- Describe the role of digital technology in day-to-day life and the workplace.
- Demonstrate how to operate digital devices and use the associated applications and features safely and securely.
- Demonstrate how to connect devices securely to the internet using different means.
- Follow the dos and don'ts of cyber security to protect against cybercrimes.
- Discuss the significance of displaying responsible online behavior while using various social media platforms.
- Create an email id and follow email etiquette to exchange emails.
- Show how to create documents, spreadsheets, and presentations using appropriate applications.
- Utilize virtual collaboration tools to work effectively.

Entrepreneurship

- Explain the types of entrepreneurship and enterprises.
- Discuss how to identify opportunities for potential business, sources of funding, and associated financial and legal risks with its mitigation plan.
- Describe the 4Ps of Marketing-Product, Price, Place, and Promotion and apply them as per requirement.
- Create a sample business plan for the selected business opportunity.

Customer Service

- Classify different types of customers.
- Demonstrate how to identify customer needs and respond to them in a professional manner.
- Discuss various tools used to collect customer feedback.
- Discuss the significance of maintaining hygiene and dressing appropriately.

Getting ready for Apprenticeship & Jobs

- Draft a professional Curriculum Vitae (CV).
- Use various offline and online job search sources to find and apply for jobs.
- Discuss the significance of maintaining hygiene and dressing appropriately for an interview.
- Role-play a mock interview.
- List the steps for searching and registering for apprenticeship opportunities.

Annexure

Trainer Requirements

Trainer Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/ Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
B. Tech or Equivalent as per NCrF	Electrical Engineering/ Electronics and Communication/ allied branches	1	Solar-LED based lighting product Designing	-	-	-

Trainer Certification	
Domain Certification	**Platform Certification**
Certified for ToT for Job Role: NIE/ELE/Q0901: "Product Assembly Assistant (Solar-LED)"or equivalent as per NCrF. Minimum accepted score is 80%	Recommended that the Trainer is certified for the Job Role: "Trainer (VET and skills)", mapped to the Qualification Pack: "MEP/Q2601, v2.0" or equivalent as per NCrF. Minimum accepted score is 80%

Assessor Requirements

Assessor Prerequisites						
Minimum Educational Qualification	Specialization	Relevant Industry Experience		Training/ Assessment Experience		Remarks
		Years	Specialization	Years	Specialization	
B.Tech	Electrical Engineering/ Electronics and Communication/ allied branches	2	Solar-LED Based lighting product Designing			

Assessor Certification	
Domain Certification	**Platform Certification**
Certified for ToA for Job Role: NIE/ELE/Q0901 "Product Assembly Assistant (Solar-LED)" or equivalent as per NCrF. Minimum accepted score is 80%	Recommended that the assessor is certified for the Job Role: "Trainer (VET and skills)", mapped to the Qualification Pack: "MEP/Q2701, v2.0" or equivalent as per NCrF. Minimum accepted score is 80%

Assessment Strategy

Assessment of the qualification evaluates candidates to ascertain that they can integrate knowledge, skills and values for carrying out relevant tasks as per the defined learning outcomes and assessment criteria.

The underlying principle of assessment is fairness and transparency. The evidence of the outcomes and assessment criteria. Competence acquired by the candidate can be obtained by conducting Theory (Online), Practical assessment, internal assessment, Project/Presentation/ Assignment, Major Project. The emphasis is on the practical demonstration of skills & knowledge gained by the candidate through the training. Each OUTCOME is assessed & marked separately. A candidate is required to pass all OUTCOMES individually based on the passing criteria.

About Examination Pattern:

1. The question papers for the theory and practical exams are set by the Examination wing (assessor) of NIELIT HQS.
2. The assessor assigns roll number.
3. The assessor carries out theory online assessments through remote proctoring methodology. Theory examination would be conducted online and the paper comprise of MCQ. Conduct of assessment are through trained proctors. Once the test begins, remote proctors have full access to candidate's video feeds and computer screens. Proctors authenticate the candidate based on registration details, pre-test image captured and I- card in possession of the candidate. Proctors can chat with candidates or give warnings to candidates. Proctors can also take screenshots, terminate a specific user's test session, or re-authenticate candidates based on video feeds.
4. An External Examiner/ Observer may be deployed including NIELIT officials for evaluation of Practical examination/ internal assessment / Project/ Presentation/. Major Project (if applicable) would be evaluated preferably by external/ subject expert including NIELIT officials.
5. Pass percentage would be 50% marks in each component.
6. Candidates may apply for re-examination within the validity of registration (only in the assessment component in which the candidate failed).
7. For re-examination prescribed examination fee is required to be paid by the candidate only for the assessment component in which the candidate wants to reappear.
8. There would be no exemption for any paper/module for candidates having similar qualifications or skills.
9. The examination will be conducted in English language only.

Quality assurance activities: A pool of questions is created by a subject matter expert and moderated by other SME. Test rules are set beforehand. Random set of questions which are according to syllabus appears which may differ from candidate to candidate. Confidentiality and impartiality are maintained during all the examination and evaluation processes.

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 Outcome	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 training on site
OJT (R)	On-the-job training (Recommended); trainees are recommended the specified hours of training on site
Procedural Knowledge	Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying Cognitive, affective or psychomotor skills.
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
QP	Qualification Pack
NSQF	National Skills Qualification Framework
NSQC	National Skills Qualification Committee
NOS	National Occupational Standards