NATIONAL METAL & ENGINEERING CURRICULUM

MODULE: **CELLS AND BATTERIES (NE139)**

PURPOSE: **This module aims to provide the student with the required skills to service and maintain cells and batteries.**

NOMINAL DURATION: **Half module**

A full module is designed on the assumption that most of the students will achieve the competencies specified in 35 to 40 hours.
The length of time taken to complete a module will vary depending on factors such as teaching method used, knowledge and skills at entry and individual students ability.

PREREQUISITES: Electrical Principles 1 (NE160) or
Introduction to Electricity and Electronics (NBB14)

LEARNING OUTCOMES On completion of this module the student will be able to:

1. Define a primary cell and state applications for common types.
2. Define a secondary cell and state applications for common types.
3. Connect cells in various configurations to increase voltage and current outputs.
4. Determine the state of charge of a secondary cell.
5. Describe a typical battery bank installation.

STUDENTS SHOULD BE MADE AWARE OF OCCUPATIONAL HEALTH AND SAFETY ISSUES IN ALL SITUATIONS AND BE EXPECTED TO DEMONSTRATE SAFE WORKING PRACTICES AT ALL TIMES.

OUTLINE OF CONTENT: This module contains:

6. Primary cells
   - definition
   - basic composition and construction
   - common types
     - carbon-zinc
     - mercury (zinc-mercuric oxide)
     - alkaline (zinc-manganese dioxide)
     - lithium
   - terminal voltage
   - typical applications
   - storage, handling and disposal

2. Secondary cells
   - definition
   - basic composition and construction
     - (no chemical reactions)
   - common types
     - lead acid
     - nickel-iron (Edison)
     - nickel-cadmiuns
   - terminal voltage
   - typical applications
   - storage, handling and disposal

3. Cell configurations
   - series connections
   - parallel connections
   - series/parallel connections
   - terminal voltage
   - battery capacity
     - ampere-hour
     - cranking current

4. Secondary batteries
   - charge/discharge process
   - charge condition monitoring
     - hydrometer
     - load testing
   - internal resistance
   - safety resistance
   - commissioning procedures

5. Storage batteries banks
   - applications
   - charging methods
   - change over/on line methods
   - ventilation requirements
   - types of batteries
   - capacities
   - routine maintenance
   - handling procedures
   - first-aid requirements

ON THE JOB TRAINING: For consolidation the material in this module should be linked with and complemented by relevant on-the-job skill practice or other equivalent experience.

PERFORMANCE CRITERIA: The criteria for each learning outcome should be:

Learning Outcome 1

Assessment: Short answer questions

Performance:

a. Define a primary cell.

b. Identify common types of primary cells and state typical applications.

c. State the terminal voltage of common primary cells.

d. State correct storage, handling and disposal procedures.

Learning Outcome 2

Assessment: Short answer questions

Performance:

a. Define a secondary cell.

b. Identify common types of secondary cells and state typical applications.

c. State the terminal voltage of common secondary cells.

d. State correctly storage, handling and disposal procedures.

Learning Outcome 3

Assessment: Practical exercises

Performance:

a. Use appropriate test equipment to measure terminal voltage and output current to determine battery capacity.

b. Determine experimentally the effect on output voltage and capacity of connecting cells in
- series
- parallel
- series/parallel.

Learning Outcome 4

Assessment:		Short answer questions Practical exercises Assignment
Performance:	a.	Describe the charge/discharge process in common secondary cells.
	b.	Use appropriate test equipment and procedures to determine the state of charge of two types of secondary cells.
	c.	Determine practically and state the detrimental effects of internal resistance in secondary batteries.
	d.	State the safety precautions associated with secondary batteries.
	d.	Describe the commissioning procedures for various secondary batteries.

Learning Outcome 5

Assessment:		Assignment
Performance:	a.	Describe a typical battery bank installation.
	b.	Outline a typical routine maintenance program.