

NATIONAL METAL AND ENGINEERING CURRICULUM

MODULE: POWER SUPPLY PRINCIPLES (NE04)

PURPOSE: This module aims to provide the student with an introduction to basic single phase and three phase power supplies.

NOMINAL DURATION: One 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: AC Principles (NE03)
Test Equipment (NE20)

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

1. Explain the construction, principle of operation and testing method of rectifier diodes.
2. Describe the operation of the following types of rectification
 - half wave
 - full wave
 - bridge
 - three phase
 - half wave
 - full wave
3. Use appropriate test equipment to monitor circuit conditions to enable analysis of operating parameters for single phase and rectification.
4. Describe the operation of various filter circuits.
5. Describe the operation of basic regulators.
6. Diagnose faults in typical power supply circuits.

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:

- 1. Rectifier diode**
 - N and P type materials
 - P-N junction
 - unbiased
 - forward biased
 - reverse bias
 - silicon and germanium characteristics
 - diode specifications
 - maximum forward voltage
 - maximum forward current
 - maximum reverse current
 - reverse voltage rating
 - maximum operating temperature
 - surge current
 - terminal identification
 - diode ohm meter testing

- 2. Half wave rectifier**
 - basic circuit
 - VAC/VDC relationship
 - peak inverse voltage
 - measurement and testing
 - applications

- 3. Centre tapped full wave**
 - basic circuit
 - VAC/VDC relationship
 - peak inverse voltage
 - measurement and testing
 - applications

- 4. Bridge rectifier**
 - basic circuit
 - block bridges
 - VAC/VDC relationship
 - measurement and testing
 - applications

- 5. Three phase rectifiers**
 - half wave
 - full wave
 - waveforms
 - % ripple
 - calculations of V & I (resistive loads only)

- 6. Filter circuits**
 - use appropriate test equipment to investigate the operating characteristics of the following types of filter circuits (brief treatment only, no calculations):
 - capacitor
 - inductive
 - L section
 - Pi section

7. **Zener regulators**
 - zener diode characteristics
 - shunt regulator circuit
 - regulator specifications
 - line/load regulation
 - series resistor calculations
 - applications
8. **Three-terminal regulators**
 - characteristics and specifications
 - connection diagram
 - circuit stability requirements
 - reverse voltage protection methods
9. **Dual polarity supplies**
 - need for dual polarity
 - basic IC dual polarity regulator
10. **Basic power supply protection**
 - fuses
 - VDR'S
 - LCR networks
11. **Fault-finding**
 - Fault-finding is to be incorporated into all topics in this module and should carry the major emphasis.
12. **Safety**
 - AS3000 considerations
 - safe working practices
 - PCB filled capacitors

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:

**Multiple choice questions
Short answer questions
Practical exercises/tests**

Performance:

- a. **Explain the basic construction and operation of semiconductor rectifiers.**
- b. **Perform simple calculations to select appropriate diodes.**
- c. **Use an ohmmeter to test diodes.**

Learning Outcome 2

Assessment:

**Multiple choice questions
Short answer questions
Calculations
Practical exercises/tests**

Performance:

Explain and verify, by practical exercises, the operating principles and characteristics of single and three phase power supplies.

Learning Outcome 3

Assessment:

**Objective practical assessment over the entire module
Short answer questions
Laboratory reports**

Performance:

Correctly connect appropriate test equipment to circuit to monitor circuit conditions to enable analysis of operation.

Learning Outcome 4

Assessment:

**Multi choice questions
Short answer questions
Practical exercises/tests**

Performance:

- a. **Explain and verify, by practical exercises, the characteristics of each type of filter.**
- b. **Identify each filter type and state a typical application.**

Learning Outcome 5

Assessment: Multiple choice questions
Short answer questions

Performance:

- a. Explain simple calculations to select appropriate regulator components and circuits.
- b. Explain the operation of basic zener and three terminal regulators.

Learning Outcome 6

Assessment: Practical exercises

Performance: Use appropriate test equipment to diagnose typical faults.

ADDITIONAL INFORMATION - (NE04)

1. SUGGESTED TEACHING/LEARNING STRATEGIES

**Integrated theory/practical
Practical exercises with analytical reports**

2. SUGGESTED MINIMUM RESOURCES

**Digital and analogue multimeters
General purpose CRO'S
Power supply training boards
Selection of components**

3. SUGGESTED TEXT

Understanding Electricity & Electronics, Patrick & Fardo, Prentice Hall, ISBN 0-13-943242-6.

4. SUGGESTED ON-THE-JOB TRAINING - FOR MAXIMUM SKILL ACQUISITION

For consolidation, the material in this module should be linked with and complimented by relevant on job skill practice or other equivalent experience.