



NATIONAL CERTIFICATE (VOCATIONAL)

SUBJECT GUIDELINES

ELECTRICAL SYSTEMS AND CONSTRUCTION

NQF Level 3

September 2007

ELECTRICAL SYSTEMS AND CONSTRUCTION

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INTRODUCTION

A. What is Electrical Systems and Construction?

In Level 2, Electrical Systems and Construction covers the basics of electrical systems and introduces this particular field of learning. It teaches students basic construction skills that are commonly found in the electrical field of practice. Students come into contact with standard Electrical Systems and Construction procedures.

In Level 3, the subject covers the basics of electrical systems and construction procedures. In Level 4, it covers some of the daily tasks of an electrical tradesperson and introduces the practical side of this field of learning. In Levels 3 and 4, students continue with the theoretical and practical implementation of the learning material. Some of the Level 2 theoretical knowledge is repeated in greater detail to further embed students' knowledge.

B. Why is Electrical Systems and Construction important in the Electrical Infrastructure Construction programme?

Electrical Systems and Construction addresses the necessary trade-specific skills, knowledge, values and attitudes so that students can understand the construction and application of electrical systems in practice.

C. The link between the Electrical Systems and Construction Learning Outcomes and the Critical and Developmental Outcomes

This subject covers a substantial portion of the practical knowledge component of electrical systems found in practice. With particular reference to Electrical Systems and Construction procedures, students should be able to:

- Identify and solve problems:
 - Recognise situations that require action and react appropriately.
- Work effectively with others:
 - Construct and test projects in groups or teams.
- Organise and manage themselves and their activities:
 - Apply the correct procedures for using, storing and looking after equipment, tools, test equipment, drawings and parts.
- Collect, organise and evaluate information and take appropriate action:
 - Use media centres to collect information.
- Communicate effectively:
 - Use common names for equipment, tools, test equipment, drawings and parts.
- Use science and technology:
 - Use and apply science and technology principles in both theory and practice.
- Demonstrate understanding of subject content through the application of acquired knowledge:
 - Solve problems by using subject content.

D. Factors that contribute to achieving the Electrical Systems and Construction Learning Outcomes

- An understanding of technical (electro-mechanical) principles
- Analytical ability
- An ability to do mathematical calculations and manipulations
- Practical skills
- Skill to interpret technical information

1 DURATION AND TUITION TIME

This is a one year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided all of the assessment requirements set out hereunder are adhered to.

2 SUBJECT LEVEL FOCUS

Use the principles of electricity to install and commission electric machines
Fault find electrical systems by applying the theoretical knowledge of their operating principles
Use accepted practices and procedures to test and inspect installations
Work with low voltage cables and conductors
Gain practical experience in repairing and maintaining equipment

3 ASSESSMENT REQUIREMENTS

3.1 Internal assessment (50 percent)

An assessor with at least a certificate of competence must finalise all internal assessments.

3.1.1 Theoretical Component

The theoretical component will form 40 percent of the internal assessment.

3.1.2 Practical Component

All practical components must be indicated in a Portfolio of Evidence (PoE).

The practical component will form 60 percent of the internal assessment.

Please note that a mathematical calculation that makes use of the theoretical background of the student can be considered to be the practical component.

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the theoretical component and the practical component of the internal continuous assessment.

3.1.4 Moderation of internal assessment mark

Internal assessment is subject to internal and external moderation procedures as set out in the *National Examinations Policy for Further Education and Training College Programmes*.

3.2 External assessment (50 percent)

A national examination is conducted annually in October or November by means of a paper/s set externally and marked and moderated internally.

4 WEIGHTED VALUES OF TOPICS

TOPICS	WEIGHTED VALUE
1. Wire and commission a single phase domestic installation	20
2. Test and inspect a single phase domestic installation	20
3. Fault find on single phase alternating current (AC) and direct current (DC) systems	20
4. Operate on low voltage networks,	20
5. Maintain lighting systems and demonstrate an understanding of energy efficiency	20
TOTAL	100

5 CALCULATION OF FINAL MARK

Continuous assessment:	$\text{Student's mark}/100 \times 50/1 = \text{a mark out of } 50$	(a)
Examination mark:	$\text{Student's mark}/100 \times 50/1 = \text{a mark out of } 50$	(b)
Final mark:	(a) + (b) = a mark out of 100	

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, purposes of moderation and verification.

6 PASS REQUIREMENTS

Students must obtain at least fifty (50) percent in ICASS and fifty (50) percent in the examination.

7 SUBJECT AND LEARNING OUTCOMES

On completion of Electrical Systems and Construction Level 3 the student should have covered the following topics:

Topic 1:	Wire and commission a single-phase domestic installation_
Topic 2:	Test and inspect a single phase domestic installation
Topic 3:	Fault finding on alternating current (AC) and direct current (DC) systems
Topic 4:	Operate on low voltage networks
Topic 5:	Maintain lighting systems and demonstrate an understanding of energy efficiency

7.1 Topic 1: Wire and commission a single phase domestic installation

7.1.1 Subject Outcome 1: Wire and commission a single phase domestic installation.

Range: Includes but is not limited to; wiring of distribution board, light switches, plugs, light fittings, geyser and stove point. Install conduiting and cabling according to regulations. Select surfex and cable sizes after performing the necessary calculations.

Learning Outcomes

- Understand all regulations and statutory requirements pertaining to the wiring and commissioning of a single phase domestic installation.
- Draw up or interpret plans, drawings and circuit diagrams that will satisfy the requirements.
- Install wire ways according to standard practice.
- Install distribution board, light switches, plugs, light fittings, geyser and stove point.
- Wire the installation using correct wire type, size and colour.
- Commission the single phase domestic installation.

7.2 Topic 2: Test and inspect a single-phase domestic installation.

7.2.1 Subject Outcome 1: Test and inspect a single phase domestic installation.

Range: Includes but is not limited to statutory requirements, reading of electrical drawings, plans and circuit diagrams, and inspection documentation.

Learning Outcomes

- Identify components inside supplier's meter box, consumer's distribution board and points of application.
- Carry out all compulsory tests as laid down by the wiring regulations.
- Complete the required documentation.

7.3 Topic 3: Fault find on alternating current (AC) and direct current (DC) systems.

7.3.1 Subject Outcome 1: Fault find on alternating current (AC) and direct current (DC) systems.

Range: Includes but is not limited to 250V single phase, equipment includes transformers, motors and control gear, domestic appliances, cables, lighting, switchgear and metering. Also includes safety, policy, installing and maintenance procedures.

Learning Outcomes

- Explain the principles and procedures to be applied during fault finding on single phase AC systems.
- Plan and prepare for fault finding on single phase AC and DC systems.
- Find faults on single phase AC and DC systems.
- Complete fault finding on single phase AC and DC systems.

7.4 Topic 4: Operate on low voltage networks.

7.4.1 Subject Outcome 1: Operate on low voltage networks.

Range: Includes but is not limited to; switching, linking, safety testing and earthing of apparatus and the importance of earthing of electrical appliances, installations and distribution systems.

Learning Outcomes

- Read and interpret low voltage network diagrams.
- State procedures for planning and preparing to operate on low voltage networks.
- Illustrate with sketches how earthing is achieved.
- State the steps taken in switching apparatus on low voltage networks.
- State the steps taken in isolating apparatus on low voltage networks.
- State the steps taken in safety testing and earthing apparatus on low voltage networks.
- Switch, isolate, earth, safety test apparatus on low voltage networks.
- Complete task and restore supply to low voltage network.

7.5 Topic 5: Maintain lighting systems and demonstrate an understanding of energy efficiency

7.5.1 Subject Outcome 1: Understand and maintain lighting systems.

Range: Includes but is not limited to;

- *Apply and adhere to electrical safety*
- *Identify and interpret drawings*
- *Connect luminaries*
- *Use and care for hand tools and portable power tools*
- *Record instrument readings*
- *Select, use and care for electrical measuring instruments*
- *Install electrical cables, conductors and luminair fixtures*
- *Maintain luminaries*

Learning Outcomes

- Know the principle of operation of lamps (incandescent, tungsten halogen, Hg- student Na-vapour, fluorescent).
- Understand the circuitry needed to start and operate lamps (incandescent, tungsten halogen, Hg- and Na-vapour, fluorescent).
- Explain the requirements pertaining to maintaining lighting systems.
- Explain the requirements pertaining to regulations regarding lighting systems.
- Explain the requirements pertaining to safety when maintaining lighting systems.
- Do continuity, earth continuity, and insulation resistance testing on lighting systems.

7.5.2 Subject Outcome 2: Demonstrate an understanding of energy efficiency.

Range: includes but is not limited to; energy input, output, losses, energy management and energy efficient devices.

Learning Outcomes

- Do calculations to show resistive losses in cables and also the influence of power factor correction.
- Demonstrate an understanding of energy management by explaining the purpose of ripple relays and equivalents in geyser sub-circuits.
- Demonstrate an understanding of energy efficient devices by comparing the power usage of various components and equipment.

8 RESOURCE NEEDS FOR THE TEACHING OF ELECTRICAL SYSTEMS AND CONSTRUCTION - LEVEL 3

8.1 Physical resources

Well equipped classrooms and workshops are essential for this practical orientated subject. If possible, using the facilities of employers in the electrical field, for training, is preferred.

8.2 Human resources

Registered post level 1 or higher educators at FET institutions.

8.3 Financial resources

The institution should make provision for

- consumables during practicals,
- maintenance of physical resources and
- purchasing of new equipment.