NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRO TECHNOLOGY

NQF Level 2

April 2008

CONTENTS

SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for Electro Technology in the National Certificates (Vocational). It must be read with the *National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF)*. This assessment guideline will be used for National Qualifications Framework Levels 2-4.

This document explains the requirements for the internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines: Electro Technology* to prepare for and deliver Electro Technology. Lecturers should use a variety of resources and apply a range of assessment skills in the setting, marking and recording of assessment tasks.

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

Assessment in the National Certificates (Vocational) is underpinned by the objectives of the National Qualifications Framework (NQF). These objectives are to:

- Create an integrated national framework for learning achievements.
- Facilitate access to and progression within education, training and career paths.
- Enhance the quality of education and training.
- Redress unfair discrimination and past imbalances and thereby accelerate employment opportunities.
- Contribute to the holistic development of the student by addressing:
  - social adjustment and responsibility;
  - moral accountability and ethical work orientation;
  - economic participation; and
  - nation-building.

The principles that drive these objectives are:

- ***Integration***

To adopt a unified approach to education and training that will strengthen the human resources development capacity of the nation.

- ***Relevance***

To be dynamic and responsive to national development needs.

- ***Credibility***

To demonstrate national and international value and recognition of qualification and acquired competencies and skills.

- ***Coherence***

To work within a consistent framework of principles and certification.

- ***Flexibility***

To allow for creativity and resourcefulness when achieving Learning Outcomes, to cater for different learning styles and use a range of assessment methods, instruments and techniques.

- ***Participation***

To enable stakeholders to participate in setting standards and co-ordinating the achievement of the qualification.

- ***Access***

To address barriers to learning at each level to facilitate students' progress.

- ***Progression***

To ensure that the qualification framework permits individuals to move through the levels of the national qualification via different, appropriate combinations of the components of the delivery system.

- ***Portability***

To enable students to transfer credits of qualifications from one learning institution and/or employer to another institution or employer.

- ***Articulation***

To allow for vertical and horizontal mobility in the education system when accredited pre-requisites have been successfully completed.

- ***Recognition of Prior Learning***

To grant credits for a unit of learning following an assessment or if a student possesses the capabilities specified in the outcomes statement.

- ***Validity of assessments***

To ensure assessment covers a broad range of knowledge, skills, values and attitudes (SKVAs) needed to demonstrate applied competency. This is achieved through:

  - clearly stating the outcome to be assessed;
  - selecting the appropriate or suitable evidence;
  - matching the evidence with a compatible or appropriate method of assessment; and
  - selecting and constructing an instrument(s) of assessment.

- ***Reliability***

To assure assessment practices are consistent so that the same result or judgment is arrived at if the assessment is replicated in the same context. This demands consistency in the interpretation of evidence; therefore careful monitoring of assessment is vital.

- ***Fairness and transparency***

To verify that no assessment process or method(s) hinders or unfairly advantages any student. The following could constitute unfairness in assessment:

  - Inequality of opportunities, resources or teaching and learning approaches
  - Bias based on ethnicity, race, gender, age, disability or social class
  - Lack of clarity regarding Learning Outcome being assessed
  - Comparison of one student's work with another, based on learning styles and language

- ***Practicability and cost-effectiveness***

To integrate assessment practices within an outcomes-based education and training system and strive for cost and time-effective assessment.

2 ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS

The assessment structure for the National Certificates (Vocational) qualification is as follows:

2.1 Internal continuous assessment (ICASS)

Knowledge, skills values, and attitudes (SKVAs) are assessed throughout the year using assessment instruments such as projects, tests, assignments, investigations, role-play and case studies. The internal continuous assessment (ICASS) practical component is undertaken in a real workplace, a workshop or a "Structured Environment". This component is moderated internally, and externally quality assured by Umalusi. All internal continuous assessment evidence is kept in a Portfolio of Evidence (PoE) and must be readily available for monitoring, moderation and verification purposes.

2.2 External summative assessment (ESASS)

The external summative assessment is either a single paper or set of written papers set to the requirements of the Subject Learning Outcomes. The Department of Education administers the theoretical component according to relevant assessment policies.

A compulsory component of external summative assessment (ESASS) is the **integrated summative assessment task (ISAT)**. This assessment task draws on the student's cumulative learning throughout the year. The task requires **integrated application of competence** and is executed under strict assessment conditions. The task should take place in a simulated or "Structured Environment". The integrated summative assessment task is the most significant test of students' ability to apply acquired knowledge.

The integrated assessment approach allows students to be assessed in more than one subject with the same integrated summative assessment task.

External summative assessments will be conducted annually between October and December, with provision made for supplementary sittings.

3 MODERATION OF ASSESSMENT

3.1 Internal moderation

Assessment must be moderated according to the internal moderation policy of the Further Education and Training (FET) college. Internal college moderation is a continuous process. The moderator's involvement starts with the planning of assessment methods and instruments and follows with continuous collaboration with and support to the assessors. Internal moderation creates common understanding of Assessment Standards and maintains these across vocational programmes.

3.2 External moderation

External moderation is conducted by the Department of Education, Umalusi and, where relevant, an Education and Training Quality Assurance (ETQA) body according to South African Qualifications Authority (SAQA) and Umalusi standards and requirements.

The external moderator:

- monitors and evaluates the standard of all summative assessments;
- maintains standards by exercising appropriate influence and control over assessors;
- ensures proper procedures are followed;
- ensures summative integrated assessments are correctly administered;
- observes a minimum sample of ten (10) to twenty-five (25) percent of summative assessments;
- gives written feedback to the relevant quality assuror; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures be customised for students who experience barriers to learning, and supported to enable these students to achieve their maximum potential.

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (ICASS)

The period of validity of the internal continuous assessment mark is determined by the *National Policy on the Conduct, Administration and Management of the Assessment of the National Certificates (Vocational).*

The internal continuous assessment (ICASS) must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS

Assessors must be subject specialists and should ideally be declared competent against the standards set by the ETDP SETA. If the lecturer conducting the assessments has not been declared a competent assessor, an assessor who has been declared competent may be appointed to oversee the assessment process to ensure the quality and integrity of assessments.

6 TYPES OF ASSESSMENT

Assessment benefits the student and the lecturer. It informs students about their progress and helps lecturers make informed decisions at different stages of the learning process. Depending on the intended purpose, different types of assessment can be used.

6.1 Baseline assessment

At the beginning of a level or learning experience, baseline assessment establishes the knowledge, skills, values and attitudes (SKVAs) that students bring to the classroom. This knowledge assists lecturers to plan learning programmes and learning activities.

6.2 Diagnostic assessment

This assessment diagnoses the nature and causes of learning barriers experienced by specific students. It is followed by guidance, appropriate support and intervention strategies. This type of assessment is useful to make referrals for students requiring specialist help.

6.3 Formative assessment

This assessment monitors and supports teaching and learning. It determines student strengths and weaknesses and provides feedback on progress. It determines if a student is ready for summative assessment.

6.4 Summative assessment

This type of assessment gives an overall picture of student progress at a given time. It determines whether the student is sufficiently competent to progress to the next level.

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

The assessment plan indicates which Subject Outcomes and Assessment Standards will be assessed, what assessment method or activity will be used and when this assessment will be conducted.

7.2 Recording

Recording refers to the assessment instruments or tools with which the assessment will be captured or recorded. Therefore, appropriate assessment instruments must be developed or adapted.

7.3 Reporting

All the evidence is put together in a report to deliver a decision for the subject.

8 METHODS OF ASSESSMENT

Methods of assessment refer to who carries out the assessment and includes lecturer assessment, self-assessment, peer assessment and group assessment.

LECTURER ASSESSMENT	The lecturer assesses students' performance against given criteria in different contexts, such as individual work, group work, etc.
SELF-ASSESSMENT	Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.
PEER ASSESSMENT	Students assess another student's or group of students' performance against given criteria in different contexts, such as individual work, group work, etc.
GROUP ASSESSMENT	Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student's Portfolio of Evidence (PoE).

The following table summarises a variety of methods and instruments for collecting evidence. A method and instrument is chosen to give students ample opportunity to demonstrate that the Subject Outcome has been attained. This will only be possible if the chosen methods and instruments are appropriate for the target group and the Specific Outcome being assessed.

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	**Task-based** (Structured)	**Test-based** (More structured)
Assessment instruments	• Observation • Class questions • Lecturer, student, parent discussions	• Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews	• Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	• Observation sheets • Lecturer's notes • Comments	• Checklists • Rating scales • Rubrics	• Marks (e.g. %) • Rating scales (1-5)
Evidence	• Focus on individual students • Subjective evidence based on lecturer observations and impressions	**Open middle**: Students produce the same evidence but in different ways. **Open end**: Students use same process to achieve different results.	Students answer the same questions in the same way, within the same time.

10 TOOLS FOR ASSESSING STUDENT PERFORMANCE

Rating scales are marking systems where a symbol (such as 1 to 5) or a mark (such as 5/10 or 50%) is defined in detail. The detail is as important as the coded score. Traditional marking, assessment and evaluation mostly used rating scales without details such as what was right or wrong, weak or strong, etc.

Task lists and **checklists** show the student what needs to be done. These consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

Rubrics are a hierarchy (graded levels) of criteria with benchmarks that describe the minimum level of acceptable performance or achievement for each criterion. Using rubrics provides a different way of assessing that cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics, namely holistic and analytical, are used.

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

The selection or design of recording and reporting systems depends on the purpose of recording and reporting student achievement. **Why** particular information is recorded and **how** it is recorded determine which instrument will be used.

Computer-based systems, for example spreadsheets, are cost and time effective. The recording system should be user-friendly and information should be easily accessed and retrieved.

12 COMPETENCE DESCRIPTIONS

All assessment should award marks to evaluate specific assessment tasks. However, marks should be awarded against rubrics and not be simply a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes (SKVAs) that a student must demonstrate to achieve each level of the rating scale.

When lecturers or assessors prepare an assessment task or question, they must ensure that the task or question addresses an aspect of a Subject Outcome. The relevant Assessment Standard must be used to create the rubric to assess the task or question. The descriptions must clearly indicate the minimum level of attainment for each category on the rating scale.

13 STRATEGIES FOR COLLECTING EVIDENCE

A number of different assessment instruments may be used to collect and record evidence. Examples of instruments that can be (adapted and) used in the classroom include:

13.1 Record sheets

The lecturer observes students working in a group. These observations are recorded in a summary table at the end of each project. The lecturer can design a record sheet to observe students' interactive and problem-solving skills, attitudes towards group work and involvement in a group activity.

13.2 Checklists

Checklists should have clear categories to ensure that the objectives are effectively met. The categories should describe how the activities are evaluated and against which criteria they are evaluated. Space for comments is essential.

SECTION C: ASSESSMENT IN ELECTRO TECHNOLOGY

1 SCHEDULE OF ASSESSMENT

At NQF levels 2, 3 and 4, lecturers will conduct assessments as well as develop a schedule of formal assessments that will be undertaken in the year. All three levels also have an external examination that accounts for 50 percent of the total mark. The marks allocated to assessment tasks completed during the year, kept or recorded in a Portfolio of Evidence (PoE) account for the other 50 percent.

The Portfolio of Evidence and the external assessment include practical and written components. The practical assessment in Electro Technology must, where necessary, be subjected to external moderation by Umalusi or an appropriate Education and Training Quality Assurance (ETQA) body, appointed by the Umalusi Council in terms of Section 28(2) of the *General and Further Education and Training Quality Assurance Act, 2001 (Act No. 58 of 2001).*

2 RECORDING AND REPORTING

Electro Technology, as is the case for all the other Vocational subjects, is assessed according to five levels of competence. The level descriptions are explained in the following table.

Scale of Achievement for the Vocational component

RATING CODE	RATING	MARKS %
5	Outstanding	80-100
4	Highly competent	70-79
3	Competent	50-69
2	Not yet competent	40-49
1	Not achieved	0-39

The programme of assessment should be recorded in the Lecturer's Portfolio of Assessment for each subject. The following at least should be included in the Lecturer's Assessment Portfolio:

- A contents page
- The formal schedule of assessment
- The requirements for each assessment task
- The tools used for each assessment task
- Recording instrument(s) for each assessment task
- A mark sheet and report for each assessment task

The college must standardise these documents.

The student's Portfolio of Evidence must include at least:

- A contents page
- The assessment tasks according to the assessment schedule
- The assessment tools or instruments for the task
- A record of the marks (and comments) achieved for each task

Where a task cannot be contained as evidence in the Portfolio of Evidence, its exact location must be recorded and it must be readily available for moderation purposes.

The following units guide internal assessment in Electro Technology Level 2:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
3	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
3	Practical assessments	• Practical exercises on Fundamental concepts of DC technology (installing, fault location and repair, commissioning and maintenance of Electrotechnical sub-systems), concepts of DC technology and simple DC technology related circuits. • 1.2 Impedance (Z), phase shift, phase angle, active, reactive and apparent power, characteristics of AC technology and characteristics of capacitors and inductors. • 1.3 Electromagnetic principles on the function of electro-magnetic components used in AC and DC applications in the workplace and in the installation of electrotechnical sub-systems. • 1.4 The principles of electronic theory in the construction and installation of electrotechnical sub-systems. • 2.1 Partial-, group- and overall drawings, electrical circuit diagrams, block, functions, mounting and connecting plans, working sketches, parts lists and electro-technical drawings. • 2.2 The installation of electrical equipment to standard. • 3.2 Constructing a basic electronic circuit. • 3.3 Testing and commissioning a basic electronic circuit. • 4.1 Locating, classifying and repairing fault conditions on electro-technical circuits.

ASSESSMENT OF ELECTRO TECHNOLOGY

LEVEL 2

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRO TECHNOLOGY – LEVEL 2

Topic 1: Explain the fundamental principles of electricity, electronics theory and electromagnetism.

<table>
<tr><th colspan="2">SUBJECT OUTCOME</th></tr>
<tr><td colspan="2">1.1 Describe and apply the principles of direct current technology.</td></tr>
<tr><th>ASSESSMENT STANDARDS</th><th>LEARNING OUTCOMES</th></tr>
<tr><td>
• The following concepts are explained:
▪ what electricity is, with reference to atomic structure, material classification and the control thereof (conductors, semi-conductors and insulators).
▪ what makes up a simple electric circuit (function and symbols of on/off control (switches), connecting wires (current path), load resistances (lamps/DC motors), power sources (batteries) and the relationship of the base quantities of electricity to electric circuit (current, resistance, voltage, power and energy, using correct units).
• The following are demonstrated:
▪ The use of base quantities of electricity is demonstrated by solving problems graphically and by calculation using Ohm’s law and definition thereof
▪ the resistance of a conductor and the effect that light, temperature and voltage has on resistance is demonstrated and determined by calculation
▪ An understanding of potential difference, electromotive force, conventional and electron current flow
▪ Determination of an unknown quantity in various resistive configurations (series, parallel and series parallel) is demonstrated
▪ Graphical representations of DC concepts and quantities
▪ Multi-meter connectivity for the purpose of testing and measuring the base quantities of electricity
▪ The ability to explain voltmeter, ammeter and ohm-meter construction and operational principles
▪ an understanding of linear resistors, thermistors, varistor and LDR with regard to construction, operation and use.
• Fundamental concepts of DC technology are applied for the purpose of installing, fault location and repair, commissioning and maintenance of electrotechnical sub-systems.
• Concepts of DC technology are applied in a laboratory or workshop area to prove relationships and relative definitions.
• Simple DC technology related circuits are built for purposes of embedding fundamental electrical principles.
</td><td>
• Explain
▪ what electricity is, with reference to atomic structure, material classification and the control thereof (conductors, semi-conductors and insulators)
▪ the basic concept of what makes up a simple electric circuit (function and symbols of on/off control (switches), connecting wires (current path), load resistances (lamps/DC motors), power sources (batteries) and the relationship of the base quantities of electricity to electric circuit (current, resistance, voltage, power and energy, using correct units)
• Demonstrate
▪ the use of base quantities of electricity to solve problems graphically and by calculation using Ohm’s law and definition thereof
▪ an understanding of calculations of the resistance of a conductor and the effect that light, temperature and voltage has on resistance
▪ an understanding of the following terminology (potential difference, electromotive force, conventional and electron current flow)
▪ the determination of an unknown quantity in various resistive configurations (series, parallel and series parallel)
▪ an understanding of graphical representation of DC concepts and quantities
▪ An understanding of multi-meter connectivity for the purpose of testing and measuring the base quantities of electricity
▪ the ability to explain the voltmeter, ammeter and ohm-meter construction and operational principles
▪ an understanding of linear resistors, thermistors, varistor and LDR with regard to construction, operation and use.
• Apply fundamental concepts of DC technology for the purpose of installing, fault location and repair, commissioning and maintenance of electrotechnical sub-systems.
• Apply concepts of DC technology in a laboratory or workshop area to prove relationships and relative definitions.
• Build simple DC technology related circuits for the purpose of embedding fundamental electrical principles.
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<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">
• Class questions, observation and an open-book test on the concepts and definitions
• Practical exercises on fundamental concepts of DC technology (installing, fault location and repair, commissioning and maintenance of electrotechnical sub-systems), concepts of DC technology and simple DC technology related circuits
• Demonstrations, observation sheets and rubrics on:
▪ the use of base quantities of electricity, the resistance of a conductor and the effect that light, temperature and voltage have on resistance, potential difference, electromotive force, conventional and electron current flow
▪ determination of an unknown quantity in various resistive configurations (series, parallel and series parallel)
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</table>

- graphical representations of DC concepts and quantities
- mMulti-meter connectivity
- voltmeter, ammeter and ohm-meter construction and operational principles
- Linear resistors, thermistors, varistors and LDRs.

SUBJECT OUTCOME	
1.2 Describe and apply the principles of alternating current technology.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following concepts are described and explained: ▪ and used: the elements that make up the oscilloscope, element function and scope operation ▪ various capacitor constructions, markings and types ▪ the charging and discharging process of a capacitor, phase shift between voltage and current, capacitive reactance, series and parallel circuiting of capacitors and reactive power of a capacitor ▪ construction of various coils in accordance to markings and size ▪ switch on/switch off process of a coil, phase shift between current and voltage on a coil, inductive reactance, series/parallel circuiting of coils, reactive power of coils • Impedance (Z), phase shift, phase angle, active, reactive and apparent power are determined by graph, measurement and calculation in series and parallel RL, RC, RLC circuits. • Terms such as reactance, impedance, capacitance, farads, inductance, henries , cycle, frequency, time period, amplitude, peak values, peak-to-peak values, reactive, apparent and real power, impedance, power factor, phase angle and phasor diagram are defined. • Characteristics of AC technology are established and displayed on an oscilloscope of sine wave voltage, active power and square wave voltage. • Characteristics of capacitors and inductors are established and displayed to solve problems graphically, visually and by means of calculation. • The fundamental concepts of AC technology are related to the workplace.	• Describe and explain ▪ and use the elements that make up the oscilloscope, element function and scope operation ▪ various capacitor constructions, markings and types ▪ the charging and discharging process of a capacitor, phase shift between voltage and current, capacitive reactance, series and parallel circuiting of capacitors and reactive power of a capacitor ▪ construction of various coils in accordance to markings and size ▪ switch on/switch off process of a coil, phase shift between current and voltage on a coil, inductive reactance, series/parallel circuiting of coils, reactive power of coils. • Determine impedance (Z), phase shift, phase angle, active, reactive and apparent power by graph, measurement and calculation in series and parallel RL, RC, RLC circuits. • Define terms such as reactance, impedance, capacitance, farads, inductance, henries , cycle, frequency, time period, amplitude, peak values, peak-to-peak values, reactive, apparent and real power, impedance, power factor, phase angle and phasor diagram. • Establish and display ▪ characteristics of AC technology on an oscilloscope of sine wave voltage, active power and square wave voltage ▪ characteristics of capacitors and inductors to solve problems graphically, visually and by means of calculation. • Relate the fundamental concepts of AC technology to the workplace.
ASSESSMENT TASKS OR ACTIVITIES	
• Practical exercises and checklists on impedance (Z), phase shift, phase angle, active, reactive and apparent power, characteristics of AC technology and characteristics of capacitors and inductors • Role-play on relating the fundamental concepts of AC technology to the workplace • Oral tests and an open-book test on the concepts that are addressed.	

SUBJECT OUTCOME	
1.3 Describe and apply electromagnetic principles. *Range: Components relays, coils, contactors transformers, reed switches*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following concepts are defined and demonstrated: ▪ magnets, magnetic theory and magnetic field characteristics ▪ electromagnetism ▪ electromagnetic principles applied in the construction of DC and AC components ▪ coupling factors, transformation ratio and resistance of transformers, apparent power by graphical, visual means and by calculation.	• Define and demonstrate an understanding of ▪ magnets, magnetic theory and magnetic field characteristics ▪ electromagnetism ▪ electromagnetic principles applied in the construction of DC and AC components ▪ coupling factors, transformation ratios and resistance of transformers, apparent power by graphical, visual means and by calculation.

▪ mutual- and self-induction ▪ Faraday's and Lenz's laws with respect to magnetism. • Electromagnetic principles are applied in the function of electromagnetic components used in AC and DC applications in the work place. • Electro-magnetic principles are applied in the installation of electro technical sub-systems. • Safe electrical working quantities are determined for selection and use of electro-technical components.	▪ mutual- and self-induction ▪ Faraday's and Lenz's laws with respect to magnetism. • Apply ▪ electromagnetic principles in the function of electromagnetic components used in AC and DC applications in the work place ▪ electromagnetic principles in the installation of electro technical sub-systems. • Determine safe electrical working quantities for selection and use of electro technical components.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments or tasks on concepts such as magnets, magnetic theory and magnetic field characteristics, electromagnetism ,electromagnetic principles applied in the construction of DC and AC components, coupling factors, transformation ratio and resistance of transformers, apparent power, mutual- and self induction, Faraday's and Lenz's laws with respect to magnetism. • Practical exercises on electromagnetic principles and the function of electromagnetic components used in AC and DC applications in the work place and in the installation of electro technical sub-systems • Role-play on selection and use of electro technical components.	

SUBJECT OUTCOME	
1.4 Describe and apply the principles of electronic theory.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following concepts are defined and described: ▪ atomic theory in relation to the atomic structure and material classification (semi-conductors), specifically the release of free electrons ▪ ionisation, bonding, intrinsic and extrinsic materials, bonding, N-type and P-type materials and minority and majority carriers ▪ PN-junction creation by the process of diffusion and the operating characteristics thereof ▪ the use of the PN- diode used in rectification applications and diode protection circuits ▪ the creation of bi-polar transistors and the operating characteristics thereof ▪ the use of a bi-polar transistor in electronic basic switching and amplification circuits ▪ zener diodes (on/off characteristics), DC voltage limiting, AC voltage limiting, voltage stabilisation ▪ light emitting diodes ▪ Silicon Controlled Rectifiers. • Simple electronic circuits are constructed to prove fundamental working characteristics by graphical representation, measurement or calculation. • Principles of electronic theory are applied in the construction and installation of electro-technical sub-systems.	• Define and describe ▪ atomic theory in relation to atomic structure and material classification (semi-conductors), specifically the release of free electrons ▪ ionisation, bonding, intrinsic and extrinsic materials, bonding, N-type and P-type materials and minority and majority carriers ▪ PN-junction creation by the process of diffusion and the operating characteristics thereof ▪ the use of the PN-diode in rectification applications and diode protection circuits ▪ the creation of bi-polar transistors and the operating characteristics thereof ▪ the use of a bi-polar transistor in electronic basic switching and amplification circuits ▪ zener diodes (on/off characteristics), DC voltage limiting, AC voltage limiting, voltage stabilisation ▪ light emitting diodes ▪ Silicon Controlled Rectifiers. • Construct simple electronic circuits so as to prove fundamental working characteristics by graphical representation, measurement or calculation. • Apply principles of electronic theory in the construction and installation of electro-technical sub-systems.
ASSESSMENT TASKS OR ACTIVITIES	
• Class questions, lecturer-student discussions and observation sheets on concepts that are addressed • Assignment or task on simple electronic circuits to prove fundamental working characteristics by graphical representation, measurement or calculation • Practical exercises on the principles of electronic theory in the construction and installation of electrotechnical sub-systems.	

Topic 2: Read, interpret and produce electrical wiring diagrams for installation of electrical equipment, components and circuits in accordance with safety regulations.

SUBJECT OUTCOME	
2.1 Read, interpret and produce electrical wiring diagrams. *Range: Circuits: single-way light circuit (single and multi-lamp), two-way light circuit, three-way light switching, low voltage transformer connection, plug circuit, geyser connection, stove connection, distribution board connection, and protection circuits*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Distinctions are made between technical and electrotechnical drawings. • Electrical symbols, block diagrams, electrical installation diagrams and current flow diagrams are read, interpreted and a wiring sketch produced. • The terminal and contact wiring of electrical components are defined and described. • Off load, cable and component ratings (current, power and voltage) are determined by calculation or name plate. • The operating principles of electrical components are demonstrated as found in basic circuits. • The purpose of protection circuit types is demonstrated. • Partial, group and overall drawings are read and applied. • Electrical circuit diagrams, block, functions, mounting and connecting plans are read and applied. • Working sketches are drawn. • Parts lists are drawn up. • Electrotechnical drawings are read and interpreted for the purpose of installing, measuring, controlling, testing, fault finding and maintenance.	• Distinguish between technical and electro-technical drawings. • Read, interpret and produce ▪ electrical symbols to standard ▪ block diagrams ▪ electrical installation diagrams ▪ current flow diagrams ▪ a wiring sketch. • Define and describe the terminal and contact wiring of electrical components. • Determine off load, cable and component ratings (current, power and voltage) by calculation or name plate. • Demonstrate ▪ the operating principles of electrical components as found in basic circuits ▪ the purpose of protection circuit types. • Read and apply ▪ partial, group and overall drawings ▪ electrical circuit diagrams, block, functions, mounting and connecting plans. • Draw working sketches. • Draw up parts lists. • Read and interpret electrotechnical drawings for the purpose of installing, measuring, controlling, testing, fault finding and maintenance.
ASSESSMENT TASKS OR ACTIVITIES	
• Assignments on electrical symbols, block diagrams, electrical installation diagrams and current flow diagrams • Case studies on technical and electrotechnical drawings • Practical exercises on partial, group and overall drawings, electrical circuit diagrams, block, functions, mounting and connecting plans, working sketches, parts lists and electrotechnical drawings • Demonstrations on operating principles of electrical components and the purpose of protection circuit types • Observation sheets on terminal and contact wiring of electrical components, off load, cable and component ratings.	

SUBJECT OUTCOME	
2.2 Install electrical equipment to standard. *Range: Components: switches, circuit breakers, isolators, thermal switches, relays, timers, counters, earth leakage units, plug tops and sockets, luminaries, incandescent lamps, double pole and neutral isolators, fuses, transformers, lamp holders, connecting plugs* *Range: Consumables: solid and stranded wire, ferrules, spade connectors, cable ties and clips, glands, connecting boxes, conduit* *Range: Assembling tools: electrical pliers, long nose, side cutter, hole saw, junior hack saw, hammer, steel ruler, tape, scriber, centre punch, various files, screw drivers and spanners* *Range: Test equipment: continuity tester, multi meter, megger.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following terms are defined and described: ▪ SABS code of practice of installation safety and quality ▪ preparation and execution of an installation task ▪ Installation of electrical equipment in a safe manner ▪ selecting and using the correct assembly tools and	• Define and describe ▪ SABS code of practice of installation safety and quality ▪ preparation and execution of an installation task ▪ Installation of electrical equipment in a safe manner.

equipment ▪ how to test installation wiring for continuity and polarity against an installation/wiring drawing ▪ applying fundamental installation techniques. • Electrical safety is applied and maintained while working. • Electrical components are identified and selected for a specific purpose. • Circuit components are checked and tested for functionality. • Plug-in units, cabinets, and switch boards are mounted. • Cable ducts are determined and installed according to regulation. • Components for controlling, measuring and monitoring are controlled, mounted and labelled. • Wire is selected, adjusted, installed and connected by taking into consideration the mechanical and electrical loads, the kind of wiring and purpose. • Connecting pieces to wires such as cable plugs, wire end ferrules, switches and plugs are installed. • Wires are wired and connected by soldering, clamping and plug-in connections. • Cables are joined.	▪ selecting and using the correct assembly tools and equipment ▪ how to test installation wiring for continuity and polarity against an installation/wiring drawing ▪ applying fundamental installation techniques. • Apply and maintain electrical safety while working. • Identify and select electrical components for a specific purpose. • Check and test circuit components for functionality. • Mount plug-in units, cabinets, and switch boards. • Determine and install cable ducts in accordance to regulation. • Control, mount and label components for controlling, measuring and monitoring. • Select, adjust, install and connect wire by taking into consideration the mechanical and electrical loads, the kind of wiring and purpose. • Install connecting pieces to wires such as cable plugs, wire end ferrules, switches and plugs. • Wire and connect wires by soldering, clamping and plug-in connections. • Join cables.
ASSESSMENT TASKS OR ACTIVITIES	
• Practical exercises, demonstrations, assignments or tasks and rubrics on the installation of electrical equipment to standard.	

Topic 3: Build and test electronic components and circuits to perform function in a safe way

SUBJECT OUTCOME	
3.1 Plan to construct a basic electronic circuit.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The sequence of actions by means of which to construct a basic electronic circuit is described. • The manner in which the work area should be prepared is described. • The reasons for testing function of tools and equipment are given. • Tools, components and equipment are identified and selected in accordance with a plan, diagrams and/or instructions. • A work area preparation plan is applied. • Tools and equipment are tested for function. • A work plan, material list, circuit diagram and circuit operation are drawn up.	• Describe ▪ the sequence of actions by means of which to construct a basic electronic circuit ▪ how to prepare the work area ▪ why tools and equipment must be tested for function. • Identify and select tools, components and equipment in accordance with a plan, diagrams and/or instructions. • Apply a work area preparation plan. • Test tools and equipment for function. • Draw up a work plan and material lists. • Draw up a circuit diagram and circuit operation.
ASSESSMENT TASKS OR ACTIVITIES	
• Observation, class questions and an assignment on planning to construct a basic electronic circuit.	

SUBJECT OUTCOME	
3.2 Construct a basic electronic circuit.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• A circuit diagram is analysed and the relation between components and component layout on a circuit board described. • The factors that must be considered when laying out and preparing a circuit board are described. • Component handling precautions are described. • The manner in which to connect wire and external components to an electronic circuit is described. • Electronic components of a circuit board are prepared and laid out safely. • Electronic components are safely inserted using the correct tools. • Wires and external components are connected to a circuit. • An electronic circuit is inserted into protective housing.	• Analyse the circuit diagram and describe how the components are related to component layout on a circuit board. • Describe ▪ the factors that must be considered when laying out and preparing a circuit board ▪ component handling precautions ▪ how to connect wire and external components to an electronic circuit. • Prepare and lay out electronic components of a circuit board safely. • Use the correct tools to insert electronic components safely. • Connect wires and external components to a circuit. • Insert an electronic circuit into protective housing.
ASSESSMENT TASKS OR ACTIVITIES	
• Practical exercises, oral tests and observation sheets on constructing a basic electronic circuit.	

SUBJECT OUTCOME	
3.3 Test and commission a basic electronic circuit.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The following terms and concepts are explained the visual approach to check circuits for faults in accordance with circuit and layout diagrams is explained. • The manner in which to set up and apply circuit supply voltage from a power supply is explained. • The manner in which to check electronic components using a multi-meter and/or scope is explained. • The manner in which to use the relevant circuit diagram to check circuit diagrams in accordance with voltage and current testing is explained. • Fault finding techniques in accordance with procedure are explained. • Circuit boards are checked visually for errors. • Circuit supply voltages are set up and connected. • Components are checked for function. • Voltage testing and measurement are used to determine circuit failure. • Fault finding techniques are applied to locate faults.	• Explain ▪ the visual approach to check circuits for faults in accordance with circuit and layout diagrams ▪ how to set up and apply circuit supply voltage from a power supply ▪ how to check electronic components using a multi-meter and/or scope ▪ how to check circuit diagrams in accordance with voltage and current testing using the relevant circuit diagram ▪ fault finding techniques in accordance with procedure. • Visually check circuit boards for errors. • Set up and connect circuit supply voltage. • Check components for function. • Use voltage testing and measurement to determine circuit failure. • Apply fault finding techniques to locate faults.
ASSESSMENT TASKS OR ACTIVITIES	
• Observation and class questions on the terms and concepts. • Projects, practical exercises and a class test on testing and commissioning a basic electronic circuit.	

Topic 4: Locate, identify and repair fault conditions on electrotechnical circuits in a safe manner in accordance with procedure.

SUBJECT OUTCOME	
4.1 Locate, classify and repair types of fault conditions on electrotechnical circuits. *Range: Faults that can occur in electrotechnical components and basic circuits.* *Range: Trouble shooting techniques such as visual, history, input/output method, half-cut method, operational methods, continuity testing and resistance testing.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Fault types such as short circuit, open circuit, high and low resistance joints are listed. • Different trouble-shooting techniques are classified. • The purpose of a structured scientific approach to maintenance and trouble shooting is explained. • Input and output signals are checked and results tested, measured and recorded. • Troubleshooting techniques, voltage, current and resistance testing are applied in basic circuits and components. • Components are ordered and electro-technical systems repaired.	• List fault types (short circuit, open circuit, high and low resistance joints). • Classify different trouble-shooting techniques. • Explain the purpose of a structured scientific approach to maintenance and trouble shooting. • Check input and output signals and test, measure and record results. • Apply troubleshooting techniques. • Apply voltage, current and resistance testing in basic circuits and components. • Order components and repair electrotechnical systems.
ASSESSMENT TASKS OR ACTIVITIES	
• Projects, practical exercises, checklists and rating scales in locating, classifying and repairing fault conditions on electrotechnical circuits.	

Topic 5: Produce and use necessary documentation while working.

SUBJECT OUTCOME	
5.1 Produce and use working documentation. *Range: Fault reports, material lists, incident reports, accident reports, maintenance reports, simple budgets (project/task costing) and time management.*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The importance of work based documentation is demonstrated. • The function of various work based documents is described. • The purpose of costing, budgets and time management is explained. • Accident/ incident reports, fault reports (circuit, component, tool and personal safety equipment) and material lists are produced and used. • Simple budgets are produced.	• Demonstrate an understanding of ▪ the importance of work based documentation ▪ the function of various work based documents • Explain the purpose of ▪ costing and budgets ▪ time management. • Produce and use ▪ accident/ incident reports ▪ fault reports (circuit, component, tool and personal safety equipment) ▪ Material lists. • Produce simple budgets.
ASSESSMENT TASKS OR ACTIVITIES	
• Case studies, role-play and an open-book test to produce and use working documentation.	

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN ELECTRO TECHNOLOGY – LEVEL 2

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the **integrated summative assessment task (ISAT)**. The integrated summative assessment task draws on the student's cumulative learning achieved throughout the year. The task requires integrated application of competence and is executed and recorded in compliance with assessment conditions.

Two approaches to the integrated summative assessment task (ISAT) may be as follows:

- The students are assigned a task at the beginning of the year which they will have to complete in phases throughout the year to obtain an assessment mark. A final assessment is made at the end of the year when the task is completed.

OR

- Students achieve the competencies throughout the year but the competencies are assessed cumulatively in a single assessment or examination session at the end of the year.

The integrated summative assessment task is set by an externally appointed examiner and is conveyed to colleges in the first quarter of the year.

The integrated assessment approach enables students to be assessed in more than one subject with the same integrated summative assessment task.

4.2 National Examination

A national examination is conducted annually in October or November by means of a paper(s) set and moderated externally. The following distribution of cognitive application is suggested:

LEVEL 2	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30%	50%	20%

MARK ALLOCATION PER QUESTION		
Section 1: Compulsory (must cover all topics)		
Question 1:	Explain the fundamental principles of electricity, electronics theory and electro-magnetism.	20
Question 2:	Read, interpret and produce electrical wiring diagrams for installation of electrical equipment, components & circuits in accordance with safety regulations.	25
Question 3:	Build and test electronic components & circuits to perform function in a safe way.	25
Question 4:	Locate, identify and repair fault conditions on electro-technical circuits in accordance with procedure in a safe manner.	20
Question 5:	Produce and use necessary documentation while working.	10
	GRAND TOTAL	**100**