education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRONICS

NQF LEVEL 2

September 2007

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 Electronics 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: Electronics* to prepare for and deliver Electronics. 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 students' work with other students, 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 (ICASS) 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 or a 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 students' 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 (ISAT) is the most significant test of students' ability to apply their acquired knowledge.

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

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 for students who experience barriers to learning be customised 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 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 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 (1-7)
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 7) 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. They 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. It is a different way of assessment and 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 simply be a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes (SKVAs) 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 what criteria they are evaluated. Space for comments is essential.

SECTION C: ASSESSMENT IN ELECTRONICS

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 (PoE) and the external assessment include practical and written components. The practical assessment in Electronics 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

Electronics, Computer Hardware and Software and Data Communication and Networking, 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 should at least 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 (PoE) must at least include:

- 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 tasks cannot be contained as evidence in the Portfolio of Evidence (PoE), its exact location must be recorded and it must be readily available for moderation purposes.

The following guide internal assessment in Electronics:

NUMBER OF UNITS	ASSESSMENT	COVERAGE
6	Formal written tests	One or more completed topics
1	Internal written exam	All completed topics
6	Practical assessments	Must cover the related Subject Outcomes • Use and care for handheld electrical test instruments • Demonstrate soldering and de-soldering procedures • Construct basic electronics circuits • Explain basic programmable logic controllers • Define basic concepts of telecommunications

ASSESSMENT OF ELECTRONICS

LEVEL 2

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRONICS – LEVEL 2

Topic 1: Fundamentals of Electricity

SUBJECT OUTCOME	
Explain electron theory.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Atomic structures are explained in terms of electrical materials. • Electron flow in a conductor is explained with reference to electron theory. • The effect of an external power source on electrons in a conductor is explained with reference to electron theory. • The principles of basic electrical circuits are explained in terms of a power source and load. • The basic principles of voltage and current flow in an electrical circuit are explained in terms of electron theory.	• Explain atomic theory in terms of electrical materials. • Explain electron flow in a conductor with reference to electron theory. • Explain the effect of an external power source on electrons in a conductor with reference to electron theory. • Explain the principles of basic electrical circuits in terms of a power source and load. • Explain the basic principles of voltage and current flow in an electrical circuit in terms of electron theory.

SUBJECT OUTCOME	
Explain magnetic theory.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The concept of permanent magnet is explained in terms of the molecular structure of materials. • All five characteristics of magnetic lines of flux are explained in terms of magnetic theory. • The electromagnet concept is explained in terms of magnetic lines of flux around a current-carrying conductor and core. • The relationship between magnetic field and current flow is explained in terms of movement, field strength and conductor length in the magnetic field.	• Explain the concept of permanent magnet in terms of the molecular structure of materials. • Explain five characteristics of magnet lines of flux in terms of magnetic theory. • Explain the concept of an electromagnet in terms of magnetic lines of flux around a current-carrying conductor and core. • Explain and calculate the relationship between magnetic field and current flow in terms of movement, field strength and conductor length in the magnetic field.

SUBJECT OUTCOME	
Explain the fundamentals of power generation and distribution.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The production of electricity is explained with reference to pressure, heat, light, friction, magnetism and chemicals. • The conversion of resources into usable energy is explained with reference to coal, gas, nuclear, water, wind and solar energy. • The generation of direct current (DC) is explained in terms of a single loop in a magnetic field. • The generation of single phase alternating current (AC) is explained in terms of a single loop in a magnetic field.	• Explain the production of electricity with reference to pressure, heat, light, friction, magnetism and chemicals. • Explain conversion of resources into usable energy with reference to coal, gas, nuclear, water, wind and solar energy. • Explain the generation of direct current (DC) in terms of a single loop in a magnetic field. • Explain and calculate the generation of single phase alternating current (AC) in terms of a single loop in a magnetic field.

SUBJECT OUTCOME	
Apply and explain electrical units and symbols.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Electrical units and symbols are identified and applied in accordance with SI units. • The relationship between voltage, current and	• Identify and apply the electrical units and symbols in accordance with SI units. • Explain the relationship between voltage, current and

resistance is explained and applied in terms of Ohm's law. • Factors influencing resistance are explained in terms of material type, length, diameter and temperature. • Power consumed by a simple resistive electrical circuit is calculated in terms of DC theory.	resistance in terms of Ohm's law. • Explain the factors influencing resistance in terms of material type, length, diameter and temperature. • Calculate the power consumed by a simple resistive electrical circuit in terms of DC theory.

SUBJECT OUTCOME	
Draw and interpret series, parallel and series-parallel DC resistive circuits and calculate variables.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Series, parallel and series-parallel circuits are drawn and interpreted according to instructions. • Resistance, voltage, current and power variances are interpreted and calculated in series circuits according to instructions. • Resistance, voltage, current and power variances are interpreted and calculated in parallel circuits according to instructions. • Resistance, voltage, current and power variances are interpreted and calculated in series-parallel circuits according to instructions.	• Draw and interpret series, parallel and series-parallel circuits according to instructions. • Calculate and interpret resistance, voltage, current and power variances in series circuits according to instructions. • Calculate and interpret resistance, voltage, current and power variances in parallel circuits according to instructions. • Calculate and interpret resistance, voltage, current and power variances in series-parallel circuits according to instructions.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 1	
• Class tests • Demonstrations • Practical tests	• Interviews • Assignment or tasks

Topic 2: Basic Electronic Theory and Concepts

SUBJECT OUTCOME	
Draw and explain atomic and electron theory in terms of current flow.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The structure of the atom is drawn and explained in the context of basic electron theory. • Free electrons are explained in the context of electron theory principles. • Conduction of different types of material is explained and understood in the context of electron theory principles. • The bonding processes between different molecule types are explained and lattice structures are drawn in the context of valence electron principles. • Doping of intrinsic materials is understood and explained in terms of the p-type and n-type semiconductor principles. • The effect of heat on semiconductor materials and conductors is explained in relation to their conductivity characteristics.	• Draw and explain the structure of an atom in the context of basic electron theory. • Explain the free electron in the context of electron theory principles. • Explain the conduction of different types of material in the context of electron theory principles. • Explain the bonding process between different molecule types and draw the lattice structure in the context of valence electron principles. • Explain the process of doping intrinsic materials in terms of p-type and n-type semiconductor principles. • Explain the effect of heat on semiconductor materials in relation to their conductivity characteristics.

SUBJECT OUTCOME	
Understand and explain the operation of basic electronic components.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The different types of values and symbols of resistors are listed and explained in relation to basic electronic theory and applications. • Explain and calculate the different types of values and symbols of capacitors in relation to basic electron theory and applications.	• Explain the different types of values and symbols of resistors in relation to basic electron theory and applications. • List and explain the different types of values and symbols of capacitors in relation to basic electron theory and applications.

• Explain and calculate the different types of values and symbols of inductors in relation to basic electron theory and applications. • The combination and effect of different basic electronic components in one circuit is graphically illustrated and explained in relation to basic electronic theory and applications.	• List and explain the different types of values and symbols of inductors in relation to basic electron theory and applications. • Explain and illustrate graphically the combination effect of different basic electronic components on one circuit in relation to basic electronic theory and applications.

SUBJECT OUTCOME	
Understand the operation of a P-N diode.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The creation and biasing of a P-N junction is described and graphically illustrated in the context of semiconductor theory. • The effect of temperature on a P-N junction is described in the context of semiconductor theory. • The forward biasing and reverse curves are drawn and described in the context of semiconductor theory. • The different types of specialised diodes are identified and described in the context of semiconductor theory. • Basic calculations are carried out in the context of semiconductor theory.	• Describe and illustrate graphically the creation and biasing of a P-N junction in the context of semiconductor theory. • Describe the effect of temperature on a P-N junction in the context of semiconductor theory. • Draw and describe forward bias and reverse bias in the context of semiconductor theory. • Identify and describe different types of specialised diodes in the context of semiconductor theory. • Explain basic calculations carried out in the context of semiconductor theory.

SUBJECT OUTCOME	
Understand the operation and function of power supplies.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The operation of various rectifier techniques is explained with the aid of graphics. • The operation of various half wave and full wave rectifiers is explained with the aid of graphics. • A basic DC power supply consisting of transformer and rectifier is explained with the aid of graphics.	• Explain the operation of various rectifier techniques with the aid of graphical representations. • Explain the operation of various half wave and full wave rectifiers with the aid of graphics. • Explain DC power supply consisting of transformer and rectifier with the aid of graphical representations.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 2	
• Class tests • Demonstrations • Practical tests	• Interviews • Assignment or tasks

Topic 3: Electrical Safety Standards

SUBJECT OUTCOME	
Understand the nature of electrical safety.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Characteristics of the danger of electricity are known and understood. • Electrical safety terminology is defined. *Range: Dead, live, restricted and/or prohibited and dangerous areas* • Characteristics of electrical flow are understood. • Earthing concepts and safety practices are known and understood. • Electrical apparatus isolation requirements are defined. *Range: Isolator locked in an open position and connecting to earth*	• Discuss the dangers of electricity. • Define electrical safety using applicable terminology. • Explain the characteristics of electrical flow. • Explain earthing concepts and safety practices. • Explain electrical apparatus isolation requirements.

SUBJECT OUTCOME	
Understand the governance of electrical safety.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Statutory requirements related to electrical safety are defined. *Range: Occupational Health and Safety Act* • Workplace procedures related to electrical safety are defined.	• Explain the statutory requirements related to electrical safety. • Explain workplace procedures related to electrical safety.

SUBJECT OUTCOME	
Understand first aid related to electrical incidents.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Causes of electrical shock are identified. • Effects of electrical shock on the body are known. • The victim of an electrical shock is freed. • Treatment after an electrical shock is explained.	• Explain causes of electrical shock. • Explain the effects of electrical shock on the body. • Explain and demonstrate how to free the victim of an electrical shock. • Explain and demonstrate how the treatment is given after an electrical shock.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 3	
• Class tests • Demonstrations • Practical tests	• Interviews • Observations • Assignment or tasks

Topic 4: Use and Care of Hand-held Electrical Test Instruments

SUBJECT OUTCOME	
Explain theoretical knowledge of principles related to use of hand-held electrical test instruments.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The purpose of using and caring for hand-held electrical test instruments are explained according to specified requirements. • Ohm's law is explained using the appropriate electrical units. • Electrical units pertaining to the use of hand-held electrical test instruments are defined accurately. • Methods of connecting instruments to measure voltage and current in AC and DC circuits are explained with reference to specified requirements.	• Explain the purpose of using and caring for hand-held electrical test instruments according to specified requirements. • Explain Ohm's law based on the appropriate electrical units. • Explain electrical units that pertain to the use of hand-held electrical test instruments. • Explain and demonstrate the methods of connecting instruments to measure voltage and current in AC and DC circuits with reference to specified requirements.

SUBJECT OUTCOME	
Care for hand-held electrical test instruments.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Personal protective equipment is examined and used according to requirements to protect the individual. • Test instruments are cleaned according to specified requirements. • Test instruments are examined and stored according to specified requirements. • Batteries are removed from a test instrument when stored for an extended period according to specified requirements. • The consequences of not caring for hand-held electrical test instruments according to specific requirements are explained with reference to personal	• Explain and demonstrate how personal protective equipment is examined and used according to specified requirements to protect the individual. • Explain and demonstrate how test instruments are cleaned. • Explain and demonstrate how test instruments are examined and stored according to requirements. • Explain and demonstrate how batteries are removed from a test instrument when stored for an extended period according to specified requirements. • Explain and demonstrate the consequences of not caring for hand-held electrical test instruments

and team safety, impact on the environment, production cost and lost time.	ccording to specific requirements, with reference to personal and safety, impact on environment, production cost and lost time.

SUBJECT OUTCOME	
Use hand-held electrical test instruments.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Personal protective equipment is examined and used according to specified requirements to protect the individual. • The correct test instrument is selected according to specified requirements. • A pre-use inspection and test is carried out according to specified requirements. • The test instrument is set and used to measure the required electrical unit. • Hazards and risks directly related to the use of hand-held electrical test instruments are identified and addressed according to specified requirements. • Test instruments, which are unsafe or defective, are dealt with according to specified requirements. • The manner in which positive interpersonal interaction, consistent with specified requirements, promotes effective teamwork and avoids dysfunctional conflict is explained. • The consequences of not caring for hand-held electrical test instruments according to specific requirements are explained with reference to personal and team safety, impact on the environment, production cost and lost time.	• Select and demonstrate correct test instruments according to specified requirements. • Explain and demonstrate how a pre-use inspection and test is carried out according to specified requirements. • Explain and demonstrate how the test instrument is set and used to measure the required electrical unit. • Identify and explain how to address hazards and risks when using hand-held electrical test instruments according to specified requirements. • Explain and demonstrate how test instruments, which are unsafe or defective, are dealt with according to specified requirements. • Explain how positive interpersonal interaction, consistent with specified requirements, promotes effective teamwork and avoids dysfunctional conflict. • Explain the consequences of not caring for hand-held electrical test instruments according to specific requirements, with reference to personal and safety, impact on environment, production cost and lost time.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 4	
• Class tests • Demonstrations • Practical tests	• Interviews • Assignment or tasks • Case studies

Topic 5: Soldering Techniques

SUBJECT OUTCOME	
Plan the work task.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Appropriate hand tools are identified and selected to meet the requirements of the job. *Range: Side cutters, long nose pliers, set of jeweller's screwdrivers, wire stripper and small files* • Appropriate hand tools are used safely to meet the requirements of the job according to worksite procedures. • Unsafe and faulty tools are identified and marked for repair or replacement according to set procedures. • Applicable test equipment is selected and checked for functionality.	• Identify and select appropriate hand tools to meet the requirements of the job. • Use appropriate hand tools safely to meet the requirements of the job according to worksite procedures. • Identify and mark unsafe and faulty tools for repair or replacement according to set procedures. • Select and test applicable test instrument for functionality.

SUBJECT OUTCOME	
Prepare for soldering.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Work area is inspected for safe working conditions	• Inspect the work area for safe working conditions.

and corrective action is taken where required. • Applicable soldering equipment is selected as required by task. *Range: Soldering iron (gas, electrical, battery), soldering stations and solder sucker* • Personal protective equipment is used as per Occupational Health and Safety Act and worksite regulations. • Correct soldering material is selected as required by task.	• Take corrective action where necessary. • Select applicable soldering equipment as required by task. • Identify and use personal protective equipment as per Occupational Health and Safety Act and worksite regulations. • Select correct soldering material as required by task.

SUBJECT OUTCOME	
Perform soldering and de-soldering. *Range: Straight wire to wire connection, solder connection to solder tag, screened cable to a connector (audio jack) and multi-core cable to a multi-pin connector*	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Applicable tools and equipment are used safely to meet the requirements of the job. • All connections are cleaned of dirt or oxidation using appropriate cleaning materials. • Tinning of connections is completed according to the manufacturer's specifications. • Connections are soldered according to set specifications or techniques.	• Use applicable tools and equipment safely to meet the requirements of the job. • Explain and demonstrate how connections are cleaned of dirt or oxidation using appropriate cleaning materials. • Explain and demonstrate tinning of connections according to the manufacturer's specifications. • Explain and demonstrate soldering connections according to set specifications or techniques.

SUBJECT OUTCOME	
Inspect the solder joint.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The process to ensure that the soldered joints are not dull in colour or do not have excessive resin is explained. • The process to ensure the soldered joints do not contain solder globules or insufficient solder that will cause a poor electrical or mechanical connection is explained. • The process to ensure that the components or soldering substrate are not scorched by excessive heat is explained.	• Explain and demonstrate how to ensure that the solder joints are not dull in colour or do not have excess resin. • Explain and demonstrate how to ensure that soldered joints do not contain solder globules or insufficient solder that will cause a poor electrical or mechanical connection. • Explain and demonstrate how to ensure that the components or soldering substrate are not scorched by excessive heat.

SUBJECT OUTCOME	
Complete the work task.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The work area is cleaned after completion of the task according to housekeeping standards. • Waste materials are disposed of according to site-specific standards and procedures. • The reason for the application of the disposal method is given in terms of human safety and environmental management. • Hand tools are cared for, maintained and stored according to worksite procedures.	• Explain and demonstrate how the work area is cleaned after completion of the task according to housekeeping standards. • Explain and demonstrate how waste materials are disposed of according to site-specific standards and procedures. • Provide reasons for the application of the disposal method in terms of human safety and environmental management. • Explain and demonstrate how to take care of, maintain and store hand tools according to worksite procedures.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 5	
• Observations • Class tests • Demonstrations • Practical exercises	• Interviews • Assignment or tasks • Projects

Topic 6: Basic Electronic Circuits

SUBJECT OUTCOME	
Plan to construct basic electronic circuits.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Instructions are interpreted and sequence of events is planned. • Tools and components are identified and selected according to the diagrams and instructions. • Applicable test equipment is selected and tested for functionality and safety prior to conducting the test. • Work area is prepared according to worksite procedures.	• Explain and demonstrate how a sequence of events is planned and instructions are interpreted. • Identify and select tools and components according to the diagrams and instructions. • Select and test applicable test equipment for functionality and safety prior to conducting the test. • Explain and demonstrate how to prepare a work area according to worksite procedures.

SUBJECT OUTCOME	
Construct basic electronic circuits.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The circuit diagram is analysed to ensure correct component layout on the board. • Components are laid out on the circuit board according to the circuit diagram. • Components are soldered using the correct soldering technique. • Components are laid out to conform to the circuit diagram.	• Analyse the circuit diagram to ensure correct component layout on the board. • Explain and demonstrate how to lay out components on the circuit board according to the circuit diagram. • Explain and demonstrate how to solder components using the correct soldering technique. • Explain and demonstrate how component layout conforms to the circuit diagram.

SUBJECT OUTCOME	
Test and commission the circuit.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• Circuit is visually checked for faults according to circuit and layout diagrams. • Circuit is correctly connected according to operating procedures. • Supply voltage is correctly selected and applied. • Circuit operation is visually confirmed with the aid of relevant test equipment. • Faults are identified and repaired according to worksite procedures.	• Explain and demonstrate how to visually check the circuit for faults according to circuit and layout diagrams. • Explain and demonstrate how to correctly connect the circuit according to operating procedures. • Select the correct supply voltage and demonstrate how it is applied. • Explain and demonstrate how to visually confirm circuit operation with the aid of relevant test equipment. • Identify and repair faults according to worksite procedures.

SUBJECT OUTCOME	
Complete the work task.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The work area is cleaned after completion of the task according to housekeeping standards. • Waste material is disposed of according to specific standards, procedures and environmental policies. • Tools and equipment are cleaned and stored	• Explain and demonstrate how to clean the work area after completion of the task according to housekeeping standards. • Explain and demonstrate how to dispose of waste materials according to specific standards, procedures

according to worksite procedures. • Job cards are completed and reported according to worksite procedures.	and environmental policies. • Explain and demonstrate how to clean and store tools and equipment according to worksite procedures. • Explain and demonstrate how job cards are completed and reported according to worksite procedures.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 6	
• Observations • Class tests • Demonstrations • Practical exercises	• Interviews • Assignment or tasks • Projects

Topic 7: Principles of Digital Logic

SUBJECT OUTCOME	
Describe the binary number systems.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The difference between analogue and binary number systems is explained. • The decimal systems are used to calculate. • Numbers are converted from the decimal to binary number system. • Numbers are converted from the binary to decimal number system. • Binary numbers are added and subtracted.	• Explain the difference between analogue and binary number systems. • Calculate using the decimal systems. • Convert from the decimal to the binary number system. • Convert from the binary to the decimal number system. • Add and subtract binary numbers.

SUBJECT OUTCOME	
Explain basic logic gates.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The AND gate is explained using simple switches, a truth table and a symbol. • The OR gate is explained using simple switches, a truth table and a symbol. • The NOT gate is explained using simple switches, a truth table and a symbol. • The NAND gate is explained using simple switches, a truth table and a symbol. • The NOR gate is explained using simple switches, a truth table and a symbol.	• Explain the AND gate by using simple switches, a truth table and a symbol. • Explain the OR gate by using simple switches, a truth table and a symbol. • Explain the NOT gate by using simple switches, a truth table and a symbol. • Explain NAND gate by using simple switches, a truth table and a symbol. • Explain the NOR gate by using simple switches, a truth table and a symbol.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 7	
• Observations • Class tests • Demonstrations • Practical exercises	• Interviews • Assignment or tasks • Projects

Topic 8: Basic Programmable Logic Controllers (PLC)

SUBJECT OUTCOME	
Demonstrate an understanding of input/output peripherals.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The correct peripheral is identified (input/output, discrete, digital, analogue, intelligent). • The manuals or specifications and drawings are selected according to the peripheral. • Hazards associated with the use of the peripheral	• Identify the correct peripheral (input/output, discrete, digital, analogue and intelligent). • Select manuals or specifications and drawings according to the peripheral. • Explain how to recognise hazards and necessary

device are recognised and necessary precautions are taken according to worksite procedures. • The correct operation of the peripheral device must be demonstrated. • The peripherals are correctly removed and replaced according to the manufacturers specifications.	precautions associated with worksite procedures. • Demonstrate the correct operation of the peripheral device. • Explain and demonstrate how to correctly remove and replace peripherals according to the manufacturer's specifications.

SUBJECT OUTCOME	
Demonstrate an understanding of field devices interfaced to programmable logic controllers.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The correct field device is identified. • The operation of the field device is verified. • The field device is correctly connected to the appropriate peripheral. • Personal safety equipment is selected according to activity requirements.	• Identify the correct field device for a PLC. • Verify the operation of the field device. • Explain how to correctly connect the field device to the appropriate peripheral. • Select personal safety equipment according to activity requirements.

SUBJECT OUTCOME	
Demonstrate an understanding of the processor in a programmable logic controller.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The functions of the indicator lights of the processor are explained. • The battery of the processor is correctly identified, removed and replaced according to manufacturer specifications. • Faults are correctly diagnosed using the indicator lights. • The processor mode switch is correctly identified and used according to the task instruction. • Communication status indicators are correctly identified and the status correctly explained.	• Explain the functions of the indicator lights of the processor. • Explain and demonstrate how the battery of the processor is correctly identified, removed and replaced according to manufacturer specifications. • Explain and demonstrate how to correctly diagnose faults using the indicator lights. • Explain and demonstrate how the processor mode switch is correctly identified and used according to the task instruction. • Explain and demonstrate how to correctly identify communication status indicators.

SUBJECT OUTCOME	
Demonstrate an understanding of the back plane and power supply of a programmable logic controller.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The programmable logic peripherals and processor on the back plane are correctly placed according to the address structure of the back plane. • Correct addressing modes are selected on the back plane for the peripheral modules selected. • Correct insertion of the power supply is carried out according to manufacturer specifications. • Correct connections for redundant power supply are made.	• Explain and demonstrate how to correctly place programmable logic peripherals and processor on the back plane according to the address structure of the back plane. • Select the correct addressing modes on the back plane for the peripheral modules. • Explain and demonstrate how to insert the power supply correctly according to the manufacturer's specifications. • Explain and demonstrate how to correct connections for redundant power supply.

SUBJECT OUTCOME	
Demonstrate an understanding of the programming terminal.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• A hand-held or programming terminal is correctly connected to the processor. • Communication between the programmer and the processor is established. • The correct sequence is used to monitor an online programme that resides in the processor.	• Explain and demonstrate how to correctly connect a hand-held or programming terminal to the processor. • Explain and demonstrate how to establish communication between the programmer and the processor. • Explain and demonstrate the correct sequence to

• Instruction mnemonics are explained with reference to the field devices.	monitor an online programme that resides in the processor. • Explain instruction mnemonics with reference to field devices.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 8	
• Observations • Class tests • Demonstrations • Practical exercises	• Interviews • Assignment or tasks • Projects

Topic 9: Basic Concepts of Telecommunications

SUBJECT OUTCOME	
Demonstrate knowledge of the underlying concepts of telecommunications.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The underlying concepts are explained in simple non-mathematical terms with reference to their relevance to telecommunications. *Range: Sound, frequency, wavelength, bandwidth, modulation, attenuation and bits*	• Explain underlying concepts in simple non-mathematical terms with reference to their relevance to telecommunications.

SUBJECT OUTCOME	
Demonstrate knowledge of the operation of a simple telephone and a basic fax machine.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The use of a simple telephone in an analogue circuit is explained with the aid of a diagram and with reference to components, signalling and transmission of speech. *Range: Microphone, receiver, tone signalling, ringing and anti-sidetone control* • Explain the use of a simple facsimile machine with the aid of a diagram and with reference to components, signalling and transmission of pictures. *Range: Signalling, tone detection, paper path, scanning, modulation, receiving and printing*	• Explain the use of a simple telephone with the aid of a diagram and with reference to components, signalling and transmission of speech. • Explain the use of a simple facsimile machine with the aid of a diagram and with reference to components, signalling and transmission of pictures.

SUBJECT OUTCOME	
Demonstrate knowledge of the underlying technologies used in telecommunications.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• The types of modulation and the principle of multiplexing as used in telecommunication systems are explained. *Range: Process, input and output waveforms, advantages and applications* • The concepts of impedance, termination, reflection, crosstalk, noise and signal level are explained in non-mathematical terms and in relation to transmission media. • The transmission media employed in telecommunications are explained. *Range: Untwisted shielded pair from audio through to category 5, coaxial, fibre optic, analogue and digital microwave relay systems, cellular radio and microcell networks* • Digital transmission of data is compared to analogue	• Explain types of modulation and the principle of multiplexing as used in telecommunication systems. • Explain concepts of impedance, termination, reflection, crosstalk, noise and signal level in non-mathematical terms and in relation to transmission media. • Explain the transmission media employed in telecommunications. • Compare digital transmission of data to analogue transmission. • Explain the basic components and concepts of a data network with reference to the operation of the network.

transmission. *Range: Signal waveforms, bandwidth requirements, errors, tolerance to noise and line coding* • The basic components and concepts of a data network are explained with reference to the operation of the network. *Range: Computer, file server, modem, channel access, collision avoidance, bus, star and ring*	

SUBJECT OUTCOME	
Demonstrate knowledge of the operation and use of networks and systems in telecommunications.	
ASSESSMENT STANDARDS	**LEARNING OUTCOMES**
• PSTN is described in terms of its operation and the service provided. *Range: Switching plan and topology, PABX and bandwidth limitations* • Data network services are described in terms of their operation, the services provided and the key features of each. *Range: Leased data services, packet switch network, ISDN and frame relay* • Computer networks are described in terms of their operation and the services provided. *Range: LANs, WANs and the Internet*	• Describe Public Switched Telephone Network (PSTN) in terms of its operation and the service provided. • Describe data network services in terms of their operation, the services provided and the key features of each. • Describe computer networks in terms of their operation and the services provided.

ASSESSMENT TASKS OR ACTIVITIES FOR TOPIC 9	
• Practical tests • Class tests • Demonstrations	• Interviews • Assignment or tasks

4 SPECIFICATION FOR EXTERNAL ASSESSMENT IN ELECTRONICS – 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 (ISAT) draws on the students' 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 (ISAT) 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 (ISAT).

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 should be followed:

LEVEL 2	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	40%	40%	20%

MARK ALLOCATION PER QUESTION		
Section 1: Compulsory (must cover all topics)		
Two questions of 25 marks each, covering short questions, e.g. true or false, leave out words and monkey puzzles.		**50 marks**
Section 2: Compulsory		
Nine compulsory application questions covering all the topics.		
Question 1:	Fundamentals of Electricity	10 marks
Question 2:	Basic Electronic Theory and Concepts	10 marks
Question 3:	Electrical Safety Standards	15 marks
Question 4:	Basic Concept of Telecommunications	15 marks
Question 5:	Use and Care of Handheld Electrical Test Instruments	10 marks
Question 6:	Soldering andTechniques	10 marks
Question7:	Basic Electronics Circuits	10 marks
Question 8	Principles of Digital Logic	10 marks
Question 9:	Basic Programmable Logic Controllers	10 marks
		100 marks
	GRAND TOTAL	**150 marks**