NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRICAL PRINCIPLES AND PRACTICE

NQF LEVEL 2

IMPLEMENTATION: JANUARY 2013
ELECTRICAL PRINCIPLES AND PRACTICE– LEVEL 2

CONTENTS

SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 Assessment in the National Certificates (Vocational)
2 Assessment framework for vocational qualifications
   2.1 Internal continuous assessment (ICASS)
   2.2 External summative assessment (ESASS)
3 Moderation of assessment
   3.1 Internal moderation
   3.2 External moderation
4 Period of validity of internal continuous assessment (ICASS)
5 Assessor requirements
6 Types of assessment
   6.1 Baseline assessment
   6.2 Diagnostic assessment
   6.3 Formative assessment
   6.4 Summative assessment
7 Planning assessment
   7.1 Collecting evidence
   7.2 Recording
   7.3 Reporting
8 Methods of assessment
9 Instruments and tools for collecting evidence
10 Tools for assessing student performance
11 Selecting and/or designing recording and reporting systems
12 Competence descriptions
13 Strategies for collecting evidence
   13.1 Record sheets
   13.2 Checklists

SECTION C: ASSESSMENT IN WELDING

1 Assessment schedule and requirements
2 Recording and reporting
3 Internal assessment of Outcomes in Electrical Principles and Practice– Level 2
4 Specifications for the external assessment in Electrical Principles and Practice- Level 2
   4.1 Integrated summative assessment task (ISAT)
   4.2 National examination
SECTION A: PURPOSE OF THE ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for the subject Electrical Principles and Practice Level 2 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 to prepare for and deliver Electrical Principles and Practice Level 2. 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 and develop the capacity of the nation.
- Relevance
  To be dynamic and responsive to national development needs.
- Credibility
  To demonstrate recognition of competencies and skills acquired, national and international added value and recognition of the acquired qualification
- 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 the setting of standards and the co-ordination of the achievements required for the qualification.

- **Access**
  To address barriers to learning experienced on different levels and to facilitate the students’ progress.

- **Progression**
  To ensure 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 obtained within a qualification from one learning institution and/or employer to another institution or employer.

- **Articulation**
  To allow for vertical and horizontal mobility in the educational system on condition that accredited pre-requisites have been successfully completed.

- **Recognition of Prior Learning**
  To grant credits for a unit of learning following an assessment process or where a student possesses the capabilities as specified in the outcomes.

- **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.
  Topics should be assessed individually and then cumulatively with other topics. There should be a final summative internal assessment prior to the external 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.
    - Cumulative and summative assessments must be weighted more than single topic tests for the internal mark.
    - There should be at least one standardised or norm test in each term
    - All standardised or norm tests must be moderated by a subject specialist.

- **Fairness and transparency**
  To verify that assessment processes and/or method(s) used neither hinders nor unfairly advantage 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
Electrical Principles and Practice Level 2 Assessment Guidelines (January 2013) National Certificates (Vocational)

- Comparison of students’ work with other students, based on learning styles and language

Assessment in Mathematics must take into consideration that the process or method carries more weight than the final answer.

- Practicability and cost-effectiveness

To integrate assessment tasks and/practices within an outcomes-based education and training system to 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-plays and case studies. The ICASS practical component is undertaken in a real workplace, a workshop or a “Structured Environment”. This component is moderated internally and quality assured externally 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 ESASS is either a single or a set of written papers set to the requirements of the Subject Learning Outcomes. The Department of Higher Education and Training administers the theoretical component according to relevant assessment policies. A compulsory component of 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 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 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 Higher Education and Training, 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 ICASS must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS
Assessors must be subject specialists and a competent assessor.

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.

<table>
<thead>
<tr>
<th>LECTURER ASSESSMENT</th>
<th>The lecturer assesses students’ performance against given criteria in different contexts, such as individual work, group work, etc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>SELF-ASSESSMENT</td>
<td>Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.</td>
</tr>
<tr>
<td>PEER ASSESSMENT</td>
<td>Students assess another student or group of students’ performance against given criteria in different contexts, such as individual work, group work, etc.</td>
</tr>
<tr>
<td>GROUP ASSESSMENT</td>
<td>Students assess the individual performance of other students within a group or the overall performance of a group of students against given criteria.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Assessment instruments</th>
<th>Observation-based (Less structured)</th>
<th>Task-based (Structured)</th>
<th>Test-based (More structured)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation, Class questions, Lecturer, student, parent discussions.</td>
<td>Assignments or tasks, Projects, Investigations or research, Case studies, Practical exercises, Demonstrations, Role-play, Interviews.</td>
<td>Examinations, Class tests, Practical, examinations, Oral tests, Open-book tests.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment tools</th>
<th>Observation sheets, Lecturer's notes, Comments.</th>
<th>Checklists, Rating scales, Rubrics.</th>
<th>Marks (e.g. %), Rating scales (1-7).</th>
</tr>
</thead>
</table>

| 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.
ASSESSMENT IN
ELECTRICAL PRINCIPLES AND PRACTICE
LEVEL 2
SECTION C: ASSESSMENT IN ELECTRICAL PRINCIPLES AND PRACTICE LEVEL 2

1 ASSESSMENT SCHEDULE AND REQUIREMENTS

Internal and external assessments are conducted and the results of both are contributing to the final mark of a student in the subject.
The internal continuous assessment (ICASS) mark accounts for 50 percent and the external examination mark for 50 percent of the final mark. A student needs a minimum final mark of 50 percent to enable a pass in the subject.

1.1 Internal assessment
Lecturers must compile a detailed assessment plan and assessment schedule of internal assessments to be undertaken during the year in the subject. (e.g. date, assessment task/or activity, rating code/marks allocated, assessor, moderator.)
All internal assessments are then conducted according to the plan and schedule using appropriate assessment instruments and tools for each assessment task (e.g. tests, assignments, practical tasks/projects and memorandum, rubric, checklist).

The marks allocated to both the minimum number of practical and written assessment tasks conducted during the internal continuous assessment (ICASS) are kept and recorded in the Portfolio of Evidence (PoE) which is subjected to internal and external moderation.
A year mark out of 100 is calculated from the ICASS marks contained in the PoE and submitted to the Department on the due date towards the end of the year.

The following internal assessment units GUIDE the internal assessment of Electrical Principles and Practice Level 2

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Time-frame</th>
<th>Type of assessment activity</th>
<th>Time and proposed mark allocation *(can be increased but not reduced)</th>
<th>Scope of assessment</th>
<th>% contribution to the year mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Term 1</td>
<td>Test</td>
<td>1 Hour (50 marks)</td>
<td>Topics completed in term 1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Term 1</td>
<td>Practical Assessment/ Assignment</td>
<td>Determined by the scope and nature of the task</td>
<td>One or more of the topics completed as an assignment</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>Term 2</td>
<td>Practical Assessment/ Assignment</td>
<td>Determined by the scope and nature of the task</td>
<td>One or more of the topics completed as an assignment</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>Term 2</td>
<td>Test*</td>
<td>1 Hour (50 marks)</td>
<td>Topics completed in term 1 and 2</td>
<td>10</td>
</tr>
</tbody>
</table>
Specifications for internal assessment may change over time. A separate internal assessment guideline document ‘Guidelines for the Implementation of Internal Continuous Assessment (ICASS) in the NC(V) qualifications at FET Colleges’ is developed, updated and distributed by the Department. The conduct and administration of internal assessments must always comply with specifications contained in the most current version of the guideline document.

2 RECORDING AND REPORTING
Electrical Principles and Practice is assessed according to five levels of competence. The level descriptions are explained in the following table.

<table>
<thead>
<tr>
<th>RATING CODE</th>
<th>RATING</th>
<th>MARKS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Outstanding</td>
<td>80-100</td>
</tr>
<tr>
<td>4</td>
<td>Highly Competent</td>
<td>70-79</td>
</tr>
<tr>
<td>3</td>
<td>Competent</td>
<td>50-69</td>
</tr>
<tr>
<td>2</td>
<td>Not yet competent</td>
<td>40-49</td>
</tr>
<tr>
<td>1</td>
<td>Not achieved</td>
<td>0-39</td>
</tr>
</tbody>
</table>

The planned/scheduled assessment should be recorded in the Lecturer’s Portfolio of Assessment (PoA) for each subject. The minimum requirements for the Lecturer’s Portfolio of Assessment should be as follows:

- Lecturer information
- A contents page
- Subject and Assessment Guidelines
- A subject Year plan /Work scheme/Pace Setter
- A subject assessment plan
- Instrument(s) (tests, assignments, practical) and tools (memorandum, rubric, checklist) for each assessment task
- A completed pre-moderation checklist for each of the ICASS tasks and their accompanying assessment tools
- A completed post-moderation checklist once the task has been administered and assessed
- Subject record sheets per level/class reflecting the marks achieved by students in the ICASS tasks completed
- Evidence of review – diagnostic and statistical analysis, including notes on improvement of the task for future use

The college could standardise these documents.
The minimum requirements for the student’s Portfolio of Evidence (PoE) should be as follows:

- Student information/identification
- Declaration of authenticity form – duly completed (signed and dated)
- A contents page/list of content (for accessibility)
- A subject assessment schedule
- The evidence of marked assessment tasks and feedback according to the assessment schedule
- A record/summary/ of results showing all the marks achieved per assessment for the subject
- Evidence of moderation (only where applicable for student’s whose tasks were moderated)
- 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.

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRICAL PRINCIPLES AND PRACTICE– LEVEL 2

Topic 1: SI Units of Measurements

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
</table>
| 1.1: Recognise and use basic SI units of measurement | • Basic units of measurements used in engineering are identified.  
• Physical quantities that are measured by the SI units are defined.  
• Rules about writing SI units of measurement are described.  
• Conversions between scientific and decimal notations are performed.  
• Common prefixes used in engineering are listed  
• New units are derived from relationships between the SI units.  

• The theory of plane and solid angles is explained and applied. | • Identify basic units of measurement used in engineering.  
• Define the physical quantities that are measured by the SI units.  
• Describe the rules when writing SI units of measurement.  
• Convert scientific notation to decimal notation and vice versa (Convert answer to 3 decimal digits).  
• List common prefixes used in engineering.  
• Derive new units from the relationships between the SI units (i.e. the quantities they measure).  
• Explain the theory and measure plane and solid angles. |
ASSESSMENT TASKS OR ACTIVITIES
Assessment tasks or activities include but are not limited to:
- Written test and assignments on basic SI units of measurements
- Written test and assignments on conversions of SI units
- Written assignments on new units

Topic 2: Electric and Magnetic Theories

SUBJECT OUTCOME
2.1 Explain fundamental concepts and basic principles of electricity

ASSESSMENT STANDARDS | LEARNING OUTCOMES
--- | ---
- The fundamental concepts and science of electricity is explained
  Range: Atom, electron, free electron, ionized atom, positive and negative charge, conductors and insulators, potential difference, electromotive force, conventional and electron current flow, resistance and Ohm's law, power and energy
- The units of measurement of electric entities are explained
- The relationship between entities is illustrated and explained using a series circuit containing a battery, switch and resistive component

ASSESSMENT TASKS OR ACTIVITIES
Assessment tasks or activities include but are not limited to:
- Written tests to assess whether the important definitions, conventions, analogies, symbols, units of measurements and concepts used in fundamental electrical theory have been retained.
- Demonstrations used to prove theoretical statements.
- Practical experiments to compare results with theoretical statements.

ASSESSMENT STANDARDS | LEARNING OUTCOMES
--- | ---
- Explain the fundamental concepts and terms used in electricity.
- Explain the units of measurement of electric entities
- Explain, with an illustration, the relationship between entities using a series circuit containing a battery, switch and resistive component

SUBJECT OUTCOME
2.2 Perform calculations using Ohm’s law and Joule’s law (the power and energy formulae)

ASSESSMENT STANDARD | LEARNING OUTCOMES
--- | ---
- The relationship between electric entities is calculated using appropriate formulae and answers are provided in the correct unit of measurements (SI units)
  Range: Calculate resistance, voltage, current, energy and power

ASSESSMENT TASKS OR ACTIVITIES
Assessment tasks or activities include but are not limited to:
- Students recognising and correctly using formulae to calculate voltage, current, resistance, power and energy. (Converted to standard units of measurement.)
## SUBJECT OUTCOME

### 2.3 Explain the factors influencing electrical resistance of materials and perform calculations.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The theory behind the electrical resistance of materials is explained and practically applied.</td>
<td>• Describe with examples electrical conductors and the types of material commonly used to manufacture it</td>
</tr>
<tr>
<td>• The electrical resistance of material is calculated using the formulae</td>
<td>• List and explain with examples factors affecting electrical resistance (material, shape, size, length, area or cross sectional area, temperature)</td>
</tr>
<tr>
<td>$R = \frac{\rho l}{A}$ and $R_T = R_0 (1 + \alpha \Delta T)$</td>
<td>• Perform calculations to determine resistance using the formulae $R = \frac{\rho l}{A}$ and $R_T = R_0 (1 + \alpha \Delta T)$</td>
</tr>
</tbody>
</table>

### ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:

• Written tests to assess whether information and concepts have been retained.
• Calculations are performed to calculate resistance
• Students identify and explain samples of conductors.
• Students conduct practical experiments and compare the results with theoretical calculations.

## SUBJECT OUTCOME

### 2.4 Compare different electrical supply systems

*(Range: Direct current (DC), alternating current (AC), single phase and three phase AC supply systems)*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The difference between direct current (DC) and alternating current (AC) is explained with examples</td>
<td>• Explain with examples the difference between direct current (DC) and alternating current (AC)</td>
</tr>
<tr>
<td>• The following electrical supply systems are explained with examples:</td>
<td>• Explain with examples the following electrical supply systems:</td>
</tr>
<tr>
<td>➢ Single phase supply systems</td>
<td>➢ Single phase supply systems</td>
</tr>
<tr>
<td>➢ Three phase supply systems</td>
<td>➢ Three phase supply systems</td>
</tr>
<tr>
<td>• Sine wave voltage waveforms with different amplitudes and frequencies are sketched.</td>
<td>• Sketch sine wave voltage waveforms with different amplitudes and frequencies.</td>
</tr>
<tr>
<td>• Phase angle displacement in three-phase supplies is explained and sketched.</td>
<td>• Explain and sketch phase angle displacement in three-phase supplies.</td>
</tr>
<tr>
<td>• The use of different electrical supply systems in South Africa is explained with examples.</td>
<td>• Explain with examples the use of different electrical supply systems in South Africa</td>
</tr>
<tr>
<td>• The advantages and disadvantages of different electrical supply systems are explained.</td>
<td>• Explain the advantages and disadvantages of different electrical supply systems.</td>
</tr>
</tbody>
</table>
## ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:
- Test for understanding of concepts such as DC, AC, single phase and three-phase AC supplies, amplitude, frequency, phase angle, two-wire, three-wire and four-wire supply systems

## SUBJECT OUTCOME

2.5 Explain magnetism and electromagnetism theories

Range: magnetic poles, magnetic fields and field lines, flux, flux density, magnetic field around a current-carrying conductor and the solenoid, m.m.f, magnetic field strength and force on a current-carrying conductor.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>The concepts and theory of magnetism and electromagnetism that has relevance to the electric field of study is explained and sketched.</td>
<td>Explain the concepts and terms of magnetism and electromagnetism</td>
</tr>
<tr>
<td>The magnetic field around a current-carrying conductor and the solenoid is determined using the right-hand grip or screw rule and Fleming’s left-hand rule.</td>
<td>Explain the requirements for sketching magnetic field lines</td>
</tr>
<tr>
<td></td>
<td>Sketch magnetic field lines around bar and horseshoe magnets</td>
</tr>
<tr>
<td></td>
<td>Apply the right-hand grip or screw rule and Fleming’s left-hand rule to determine the magnetic field around a current-carrying conductor and the solenoid.</td>
</tr>
</tbody>
</table>

## ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:
- Test for understanding of concepts such as magnetic poles, magnetic field strength, magnetic fields and field lines, flux, flux density, m.m.f., etc.
- Students indicate the direction of the force on a current-carrying conductor inside a magnetic field.
**Topic 3: Direct Current (DC) and Alternating Current (AC) circuits**

### SUBJECT OUTCOME

#### 3.1 Explain continuity and current flow.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Closed and open circuits are identified from examples.</td>
<td>• Identify closed and open circuits from examples.</td>
</tr>
<tr>
<td>• A prediction is made whether current flow is possible.</td>
<td>• Predict whether current flow is possible.</td>
</tr>
</tbody>
</table>

### SUBJECT OUTCOME

#### 3.2 Explain and perform calculations on the grouping of electric cells

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The resultant e.m.f and possible current delivery when connecting electrolytic cells together is explained</td>
<td>• Explain the following concepts :</td>
</tr>
</tbody>
</table>
| • Calculations are done on typical electric circuits involving the grouping of cells.  
  *Range: series, parallel and series-parallel* |  > Electric cells  
  > emf of cells  
  > internal resistance  
  > grouping of cells  
  *Range: series, parallel and series-parallel* |
| | • Perform calculations on typical electric circuits involving the grouping of cells using practical examples |

### ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:

- Written tests to assess whether information and concepts have been retained.
- Calculations on resistance, current and voltage.
- Practical experiments to verify calculations.
- Sketching/drawing of circuit diagrams using standard symbols and drawing practices.

### SUBJECT OUTCOME

#### 3.3 Explain electric circuits and perform calculations

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
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</tr>
</thead>
</table>
| • Different electrical circuit combinations are described and sketched  
  *Range: series, parallel and series-parallel* | • Describe different electric circuit combinations  
  *Range: series, parallel, series-parallel* |
| • Formulae are used to calculate voltages, resistance, and currents in all the branches and volt drops across resistors.  
• Kirchhoff’s laws are applied in electric circuit calculations.  
• Practical experiments are conducted to verify calculations and illustrate principles of circuit | • Explain the principles of operation for a combination of series and parallel resistors  
• Sketch circuit diagrams from the information supplied, using IEC symbols.  
• Use appropriate formulae to calculate voltages, total resistance and currents in all the circuit branches and volt drops across resistors.  
• Apply Kirchhoff’s laws in electric circuit calculations.  
• Conduct practical circuit experiments to verify calculations. |
### Subject Outcome

#### 3.4 Explain and perform calculations to implement load balancing in a three-phase supply system.

<table>
<thead>
<tr>
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</thead>
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<tr>
<td>Assessment tasks or activities include but are not limited to:</td>
</tr>
<tr>
<td>- Written tests to assess whether information and concepts on electrical circuits have been retained.</td>
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<tr>
<td>- Students calculate resistance, current and voltage.</td>
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<tr>
<td>- Students conduct practical experiments to verify calculations.</td>
</tr>
<tr>
<td>- Students draw circuit diagrams using standard symbols and drawing practices.</td>
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<td>Assessment tasks or activities include but are not limited to:</td>
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<tr>
<td>- Written tests on terminology on loading per phase, circuit wiring limitations, single and three phase appliances, etc.</td>
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<tr>
<td>- Calculations on loading per phase and sketches of the resulting circuit diagrams.</td>
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</thead>
<tbody>
<tr>
<td>The theory behind load balancing is explained using an example/typical scenario</td>
<td>Use an example/typical scenario to explain the concept and advantages of load balancing</td>
</tr>
<tr>
<td>Basic load balancing calculations are done and the results are sketched</td>
<td>Calculate loads per phase using the information given and assuming all appliances are used simultaneously.</td>
</tr>
<tr>
<td>Sketch the load per phase results to illustrate how the loads must be connected.</td>
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</tbody>
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<td>Assessment tasks or activities include but are not limited to:</td>
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<td>- Written tests on terminology such as turns-ratio, step-up and step-down transformers, air and oil cooling, etc.</td>
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<tr>
<td>- Calculations on primary and secondary current and voltage.</td>
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</table>

### Subject Outcome

#### 3.5 Explain the construction and operating principals of single-phased transformers and perform basic turns-ratio calculations.

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<tbody>
<tr>
<td>The theory behind the design, construction and operation of transformers is explained from sketches/pictures.</td>
<td></td>
</tr>
<tr>
<td>Basic ideal transformer calculations are performed using the ideal transformer equation and typical examples.</td>
<td></td>
</tr>
<tr>
<td>Explain with the aid of sketches/pictures the design and construction of transformers and how they operate</td>
<td></td>
</tr>
<tr>
<td><strong>Range: the construction of transformers in terms of windings, core, connections and cooling</strong></td>
<td></td>
</tr>
<tr>
<td>Distinguish between different types of transformers and explain terminology related to transformers</td>
<td></td>
</tr>
<tr>
<td><strong>Range: turns-ratio, step-up and step-down transformers</strong></td>
<td></td>
</tr>
<tr>
<td>Use the ideal transformer equation to perform calculations.</td>
<td></td>
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</table>
### Topic 4: Protection, Measuring and Testing Instruments

#### SUBJECT OUTCOME

4.1 Explain the importance of earthing electrical appliances and installations.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
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</thead>
<tbody>
<tr>
<td>Earthing of electrical appliances and installations and its importance is explained</td>
<td>Explain the concept ‘earthing’ of electrical appliances and installations and its importance</td>
</tr>
<tr>
<td>Devices and systems which require earthing are identified according to the SABS Code of Practice (SANS 10142).</td>
<td>Identify devices and systems which require earthing according to the SABS Code of Practice (SANS 10142).</td>
</tr>
</tbody>
</table>

#### ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:
- Students explain how earthing of electrical appliances, installations and distribution systems is achieved in practice.
- Practical Task: Students research the SABS Code of Practice 0142 for earthing requirements (SANS 10142).

#### SUBJECT OUTCOME

4.2 Identify and explain the use of electrical measuring and testing instruments

Range: Ammeters, voltmeters, frequency meters, ohmmeters, Insulation Resistance Meters, Wattmeters, clamp-meters and continuity testers

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
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</thead>
<tbody>
<tr>
<td>A distinction is made between analogue and digital measuring instruments.</td>
<td>Distinguish between analogue and digital measuring instruments.</td>
</tr>
<tr>
<td>The elimination of the parallax error when reading analogue meters is explained and applied.</td>
<td>Understand and know how to eliminate parallax error in reading analogue meters.</td>
</tr>
<tr>
<td>The advantages of digital meters compared to analogue meters are listed.</td>
<td>List the advantages of digital meters compared to analogue meters.</td>
</tr>
<tr>
<td>The operation of moving-iron and moving coil instruments is explained.</td>
<td>Explain the operation of moving-iron and moving coil instruments.</td>
</tr>
<tr>
<td>Different electrical measuring and testing instruments used in practice are listed and examples are provided.</td>
<td>List and describe, with examples, different electrical measuring and testing instruments used in practice.</td>
</tr>
<tr>
<td>The insertion of measuring and testing instruments in circuits is sketched and explained.</td>
<td>Sketch and explain how measuring and testing instruments are inserted in circuits.</td>
</tr>
<tr>
<td>The precautions when using measuring and testing instruments are listed.</td>
<td>List the precautions when using measuring and testing instruments.</td>
</tr>
<tr>
<td>The basic design and operating principles of an insulation resistance tester is sketched and explained.</td>
<td>Sketch and explain the basic design and operating principles of an insulation resistance tester.</td>
</tr>
<tr>
<td>An illustration is provided indicating how instrument transformers are used to lower the voltage and current for the instrument (instrument transformers).</td>
<td>Indicate how instrument transformers are used to lower the voltage and current for the instrument (instrument transformers).</td>
</tr>
</tbody>
</table>
• An explanation is provided how to increase the range of a voltmeter and ammeter.

• Explain how the range of a voltmeter and ammeter can be increased.

**ASSESSMENT TASKS OR ACTIVITIES**

Assessment tasks or activities include but are not limited to:

• Written test on electrical measuring and testing instruments, its operation and use.

**SUBJECT OUTCOME**

4.3 Use, care for and store hand-held electrical test instruments

*Range: ammeters, voltmeters, frequency meters, ohmmeters, insulation resistance meters, wattmeters, clamp-meters and continuity testers*

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Practical applications of various electrical measuring instruments are done to familiarise students with its use.</td>
<td>Set the instruments for use</td>
</tr>
<tr>
<td>The correct care and storage of electrical measuring instruments are illustrated.</td>
<td>Select and read scaled readings off various analogue and digital instruments</td>
</tr>
<tr>
<td></td>
<td>Insert instruments correctly into circuits</td>
</tr>
<tr>
<td></td>
<td>Illustrate correct care for the instruments.</td>
</tr>
<tr>
<td></td>
<td>Illustrate correct storage of the instruments.</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

Practical assessment tasks or activities include but are not limited to:

Student must correctly:

- Insert ammeters, voltmeters, frequency meters, ohmmeters, insulation resistance meters and wattmeters into circuits.
- Couple current transformers and potential transformers to increase the range of the instruments.
- Read the value off the instruments.
- Correctly multiply the scale factor of the displayed value to attain the actual value.

**Topic 5: Circuit Diagrams**

**SUBJECT OUTCOME**

5.1 Draw circuit diagrams of electrical sub-circuits.

*Range: A luminaire circuit supplied from one circuit breaker, two or more luminaires supplied from one circuit breaker (including two-way and intermediate switching), two or more socket outlets supplied from one circuit breaker, a geyser circuit including isolator and ripple relay, a stove circuit including isolator (single-phase only).*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARDS</th>
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</thead>
<tbody>
<tr>
<td>Basic circuit diagrams of electrical sub-circuits are correctly drawn and interpreted and part lists are compiled</td>
<td>Explain the requirements of a typical electrical circuit.</td>
</tr>
<tr>
<td></td>
<td>Draw different circuit diagrams that conform to standard practice (international standards).</td>
</tr>
<tr>
<td></td>
<td>Compile a parts list from the circuit diagram that includes component ratings.</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

Assessment tasks or activities include but are not limited to:

• Written test on drawings to assess that students correctly connect typical electrical sub-circuits:
  - Supply live and neutral
  - Earth, if required
  - Switch to isolate live wire
  - Parallel connections
• Stove isolator disconnects both live and neutral, etc.
• Students name and rate components:
  ▪ Maximum permissible current rating, if applicable
  ▪ Operating voltage rating, if applicable
  ▪ Power rating, if applicable

Topic 6: Electrical Materials and Components

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.1</strong> Identify and explain materials and components most commonly used in the electrical field</td>
</tr>
</tbody>
</table>

Range:
Materials such as copper, steel, glass, porcelain, mica, plastics, bakelite, carbon, oil-impregnated paper, rubber, lead, aluminium and tin

Components such as insulated cables, stranded conductors, flexible cables, steel-cored cables, armoured cables, conduit and associated fittings, clamps, cleats and saddles, porcelain, glass and mica insulators, busbars, fuses, heating elements, switches, circuit breakers, protection devices, luminaires, capacitors and transformers

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>A range of most commonly used materials and components used in the electrical field are described referring to their appearance properties, application and uses.</td>
<td>Describe and explain electrical conductors and insulators</td>
</tr>
<tr>
<td></td>
<td>List and describe types, properties and application of materials used as electric conductors</td>
</tr>
<tr>
<td></td>
<td>List and describe types, properties and application of materials used as electric insulators</td>
</tr>
<tr>
<td></td>
<td>Illustrate with sketches/pictures and describe the most commonly used cables, cords, conductors and insulators and their use in the electrical field.</td>
</tr>
<tr>
<td></td>
<td>Explain flexible connections.</td>
</tr>
<tr>
<td></td>
<td>Identify meter boxes and distribution boxes and components found inside these boxes.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>ASSESSMENT TASKS OR ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment tasks or activities include but are not limited to:</td>
</tr>
<tr>
<td>• Written test on Learning Outcomes.</td>
</tr>
<tr>
<td>• Sketches of cables should be limited to steel-cored stranded aluminium and PVC wire armoured and paper-insulated, armoured cables.</td>
</tr>
<tr>
<td>• Sketches of insulators should be limited to pin, strain and suspension type.</td>
</tr>
<tr>
<td>• Practical assignments:</td>
</tr>
<tr>
<td>• Students observe, handle and answer questions on most commonly used electrical materials and components.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>SUBJECT OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6.2</strong> Describe the operating principles of the most commonly used electrical components and equipment.</td>
</tr>
</tbody>
</table>

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<tr>
<th>ASSESSMENT STANDARD</th>
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</thead>
</table>
| The operating principles and uses of the most commonly used electrical equipment and components are explained and illustrated with examples where applicable | Describe the operating principle of protection devices/components to ensure safety in electricity

Range: circuit breakers, isolators, surge protection devices (SPDs), lightning arrestors and earth leakage relays |

- Sketch and explain the operating principle of protection devices/components to ensure safety in electricity

- Sketch and explain the operating principle of common electric devices

Range: geysers, stoves, thermostats, simmerstats, prepaid meters, energy control units (ripple relay and radio controlled), incandescent and fluorescent lamp and light dimmers.

- Explain with practical examples types of DC sources

Range: Leclanché dry cell, mercury or silver-oxide cells, rechargeable Ni-Cd or metal hydride cells.

- Sketch and explain lead-acid batteries as follows:
  - Operating principle of the batteries
  - Proper use of the batteries
  - Maintenance of the batteries |

### ASSESSMENT TASKS OR ACTIVITIES

Assessment tasks or activities include but are not limited to:

- Written test on operating principles and uses of the most commonly used electrical devices and components with practical examples and illustrations if applicable |

### 4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN SUBJECT ELECTRICAL PRINCIPLES AND PRACTICE– 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 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 ISAT.

4.2 National Examination
A National Examination is conducted annually in October/November by means of a paper(s) set and moderated externally. The following distribution of cognitive application should be followed:

<table>
<thead>
<tr>
<th>LEVEL 2</th>
<th>KNOWLEDGE</th>
<th>COMPREHENSION AND APPLICATION</th>
<th>ANALYSIS, SYNTHESIS AND EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>50-60% %</td>
<td>30-40%</td>
<td>0-10%</td>
</tr>
</tbody>
</table>