NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRICAL SYSTEMS AND CONSTRUCTION

NQF LEVEL 3

IMPLEMENTATION: JANUARY 2014
ELECTRICAL SYSTEMS AND CONSTRUCTION – LEVEL 3

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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 the subject Electrical Systems and Construction Level 3 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 internal and external subject assessment. The lecturer must use this document with the Subject Guidelines: Electrical Systems and Construction Level 3 to prepare for and deliver Electrical Systems and Construction. 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 resource 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 qualifications 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 in order 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 components of the delivery system.

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

- **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 assessment or if a student possesses the capabilities specified in the outcomes statement.

- **Validity of assessments**
  To ensure that assessment covers a broad range of the knowledge, skills, values and attitudes (KSVAs) needed to demonstrate applied competency. This is achieved through:
  - clearly stating the outcome to be assessed;
  - selecting 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 ensure that 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 that of 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 (KSVAs) 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 paper(s) 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 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 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 that proper procedures are followed;
• ensures that 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 to 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 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 (KSVAs) that students bring to the classroom. This knowledge assists lecturers in planning 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 for making 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 achievement in the subject.
8 METHODS OF ASSESSMENT
Methods of assessment refer to who carries out the assessment and includes lecturer assessment, self-assessment, peer assessment and group assessment.

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

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE
All evidence collected for assessment purposes is kept or recorded in the student’s Portfolio of Evidence (PoE).

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

<table>
<thead>
<tr>
<th>METHODS FOR COLLECTING EVIDENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observation-based</strong> (Less structured)</td>
</tr>
</tbody>
</table>
| 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. These consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

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

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

When lecturers or assessors prepare an assessment task or question, they must ensure that it 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 record observations of students’ interactive and problem-solving skills, attitudes towards group work and involvement in a group activity.

13.2 Checklists

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

NQF LEVEL 3
SECTION C: ASSESSMENT OF ELECTRICAL SYSTEMS AND CONSTRUCTION

1. ASSESSMENT SCHEDULE AND REQUIREMENTS

Internal and external assessments are conducted and the results of both contribute 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 memoranda, rubrics, checklists).

The marks allocated to the minimum number of both practical and written assessment tasks conducted during the internal continuous assessment (ICASS) are kept and recorded in the Portfolio of Evidence (PoE) which is subject to internal and external moderation.

A year mark out of 100 is calculated from the ICASS marks contained in the PoE and submitted to DHET on the due date towards the end of the year.

The following internal assessment units GUIDE the internal assessment of Electrical Systems and Construction Level 3:

<table>
<thead>
<tr>
<th>TASKS</th>
<th>Time-frame</th>
<th>Type of assessment activity</th>
<th>Minimum time and proposed mark allocation <em>(can be increased but not reduced)</em></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>
</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 available on the Departmental website. 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 Systems and Construction, 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.

<table>
<thead>
<tr>
<th>Scale of achievement for the Vocational component</th>
<th>RATING</th>
<th>MARKS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>RATING CODE</td>
<td></td>
<td></td>
</tr>
<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 and 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 (memoranda, rubrics, checklists) 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 summary record 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), their exact location must be recorded and they must be readily available for moderation purposes.
3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRICAL SYSTEMS AND CONSTRUCTION - LEVEL 3

Topic 1: Wiring of a single-phase domestic installation

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Wire a single-phase domestic installation.</td>
</tr>
</tbody>
</table>

Range: Includes but is not limited to:
Wiring of distribution board, light switches, plugs, light fittings, geyser and stove point; Installing conduits and cabling according to regulations; Selecting cable sizes after performing the necessary calculations (general purpose wire, flat twin and earth and surfix cables)

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>All regulations and statutory requirements pertaining to the wiring and commissioning of a single phase domestic installation are understood and applied. <em>Range: SANS 10142 and Electrical installation regulations.</em></td>
<td>Apply all regulations and statutory requirements pertaining to the wiring and commissioning of a single phase domestic installation.</td>
</tr>
<tr>
<td>Electrical wiring circuit diagrams are drawn and interpreted.</td>
<td>Draw and interpret electrical wiring circuit diagrams.</td>
</tr>
<tr>
<td>Wire ways, distribution board, light switches, plugs, light fittings, geyser and stove point are correctly installed according to job requirements.</td>
<td>Install wire ways according to job requirements.</td>
</tr>
<tr>
<td>The installation is wired correctly using correct wire type, size and colour</td>
<td>Wire the installation using correct wire type, size and colour.</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

- Student is given the task of wiring a single-phase domestic installation. Oral or written test should precede the practical.
- Student is tested on interpretation of regulations, requirements, understanding of drawings and steps in the execution of the task.
- Student must draw up or interpret plans, produce a list of required components, tools and instruments for the successful execution of the task.
- Student measure and install wire ways (conduit, flexible conduit and trunking).
- Students must ensure that all safety precautions are in place before performing practical activities.
- Students must correctly select the correct size and type of wire for the installation.
- The task can be done in a simulated environment.
- Students must be informed of the mark allocations for assessment, for example; neatness counts 5%. 
Topic 2: Inspection and testing of a single-phase domestic installation

<table>
<thead>
<tr>
<th>SUBJECT OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2.1 Inspect and test a single phase domestic installation.</strong></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Components inside a supplier’s meter box, consumer’s distribution board and points of application are correctly identified.</td>
<td>Identify components inside supplier’s meter box, consumer’s distribution board and points of application.</td>
</tr>
<tr>
<td>All compulsory tests are listed and carried out as laid down in wiring regulations.</td>
<td>List and carry out all compulsory tests as laid down in the wiring regulations.</td>
</tr>
<tr>
<td>The required certificate of compliance is correctly completed.</td>
<td>Complete the required certificate of compliance.</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

- Student is given the task of inspecting and testing a single-phase domestic installation. An oral or written test should precede the practical.
- Student is tested on interpretation of regulations, use of measuring instruments, understanding of drawings and steps in the execution of the task.
- Student must interpret plans; produce a list of required documentation, tools and instruments for the successful execution of the task.
- Student must perform a visual inspection before performing any testing by using a suitable checklist.
- Student must carry out the entire compulsory test as per wiring regulations.
- Student must record all the results on a Certificate of Compliance (CoC) form.
- The task can be done in a simulated environment.
- Students must be informed of the mark allocations for assessment, for example; correct completion of test documentation counts 5%.

Topic 3: Fault-finding on Alternating Current (AC) and Direct Current (DC) systems

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.1 Fault-find on alternating current (AC) and direct current (DC) systems</strong></td>
</tr>
</tbody>
</table>

*Range: Includes but is not limited to 230V single phase; equipment such as transformers, motors and control gear, cables, lighting, switch gear and metering; safety and maintenance policies and procedures.*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>The principles and procedures for fault finding on single phase AC systems are explained.</td>
<td>Explain the principles and procedures for fault finding on single phase AC systems.</td>
</tr>
<tr>
<td>Planning is done and preparations made for fault finding on single phase AC and DC systems</td>
<td>Plan and prepare for fault finding on single phase AC and DC systems.</td>
</tr>
<tr>
<td>Faults are found on single phase AC and DC systems</td>
<td>Find faults on single phase AC and DC systems.</td>
</tr>
<tr>
<td>Faults are rectified on single phase AC and DC systems</td>
<td>Rectify faults on single phase AC and DC systems.</td>
</tr>
</tbody>
</table>
Student must perform a risk assessment before performing any fault-finding. 
Student is given the task of fault-finding on alternating current (AC) and direct current (DC) systems, circuits, wiring or schematic diagrams supplied where necessary. An oral or written test should precede the practical.
Student is tested on interpretation of safety regulations, maintenance policies and procedure, use of measuring instruments, understanding of drawings and steps in the execution of the task.
Student must interpret plans; produce a list of requirements, documentation, tools and instruments for the successful execution of the task.
The task can be done in a simulated environment.
Students must be informed of the mark allocations for assessment, for example correct completion of fault-finding within a specified time counts 10%. For each hour taken after the elapsed time, 5% is deducted from the total.

**Topic 4: Low voltage networks**

**SUBJECT OUTCOME**

4.1 Operate on low voltage networks.

Range: Includes but is not limited to: Switching, linking, safety testing and earthing of apparatus; The importance of earthing, installations and distribution systems.

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low voltage network diagrams are read and interpreted.</td>
<td>Read and interpret low voltage network diagrams.</td>
</tr>
<tr>
<td>The procedures for planning and preparing to operate on low voltage networks are explained</td>
<td>Explain procedures for planning and preparing to operate on low voltage networks.</td>
</tr>
<tr>
<td>Earthing is illustrated by means of sketches.</td>
<td>Illustrate with sketches how earthing is achieved.</td>
</tr>
<tr>
<td>The steps for switching and isolating apparatus on low voltage networks are explained</td>
<td>Explain the steps for switching and isolating apparatus on low voltage networks.</td>
</tr>
<tr>
<td>The steps for safety testing and earthing apparatus on low voltage networks is explained</td>
<td>Explain the steps for safety testing and earthing apparatus on low voltage networks.</td>
</tr>
<tr>
<td>The supply is restored after completing the task</td>
<td>Complete task and restore supply to low voltage network.</td>
</tr>
</tbody>
</table>

**ASSESSMENT TASKS OR ACTIVITIES**

- Student is given a task of operating on low voltage networks. An oral or written test should precede the practical.
- Student is tested on interpretation of low voltage regulations, use of measuring instruments, understanding of low voltage network diagrams and steps in the execution of the task.
Student must interpret diagrams; produce a list of required documentation, tools and instruments for the successful execution of the task.

The task can be done in a simulated environment.

Students must be informed of the mark allocations for assessment. For example correct completion of safety testing within a specified time counts 10%. For each hour taken after the elapsed time, 5% is deducted from the total.

Topic 5: Lighting systems and energy efficiency

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Maintain lighting systems</td>
</tr>
<tr>
<td>Range: Includes but is not limited to applying and adhering to electrical safety; identifying and interpreting drawings; connecting luminaries; using and caring for hand tools and portable power tools; recording instrument readings; selecting, using and caring for electrical measuring instruments; installing electrical cables, conductors and luminaire fixtures; maintaining luminaries.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>The operating principles of lamps are explained. Range: incandescent, tungsten halogen, Hg- and Na-vapour, fluorescent.</td>
<td>Explain the operating principles of lamps</td>
</tr>
<tr>
<td>The circuitry needed to start and operate lamps is described.</td>
<td>Describe the circuitry needed to start and operate lamps.</td>
</tr>
<tr>
<td>The requirements pertaining to regulations regarding lighting systems are explained</td>
<td>Explain the requirements pertaining to regulations regarding lighting systems.</td>
</tr>
<tr>
<td>The requirements pertaining to safety when maintaining lighting systems are explained.</td>
<td>Explain the requirements pertaining to safety when maintaining lighting systems.</td>
</tr>
<tr>
<td>Continuity, earth continuity and insulation resistance testing are performed on lighting systems.</td>
<td>Perform continuity, earth continuity, and insulation resistance testing on lighting systems.</td>
</tr>
<tr>
<td>Lighting systems are maintained in accordance with the maintenance schedule.</td>
<td>Maintain lighting systems in accordance with maintenance schedule.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSESSMENT TASKS OR ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student is given the task of maintaining lighting systems. An oral or written test should precede the practical.</td>
</tr>
<tr>
<td>Student is tested on interpretation of lighting systems, use of measuring instruments, understanding of lighting system diagrams and steps in the execution of the task.</td>
</tr>
<tr>
<td>Student must interpret diagrams; produce a list of required documentation, tools and instruments for the successful execution of the task.</td>
</tr>
<tr>
<td>The task can be done in a simulated environment.</td>
</tr>
<tr>
<td>Students must be informed of the mark allocations for assessment. For example correct completion of testing within a specified time counts 10%. For each hour taken after the elapsed time, 5% is deducted from the total.</td>
</tr>
</tbody>
</table>
### SUBJECT OUTCOME

**5.2 Explain energy efficiency**

*Range: Includes but is not limited to energy input, output, losses, energy management and energy efficient devices*

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calculations are done to show resistive losses in cables and also the influence of power factor correction.</td>
<td>Do calculations to show resistive losses in cables and also the influence of power factor correction.</td>
</tr>
<tr>
<td>The purpose of ripple relays, load control relays and timers in geyser sub-circuits is explained.</td>
<td>Explain the purpose of ripple relays, load control relays and timers in geyser sub-circuits.</td>
</tr>
<tr>
<td>Energy efficient devices are explained by comparing the power usage of various components and equipment.</td>
<td>Explain energy efficient devices by comparing the power usage of various components and equipment.</td>
</tr>
</tbody>
</table>

#### ASSESSMENT TASKS OR ACTIVITIES

- Oral or written test to assess whether student understands losses, power factor correction, energy management, energy control devices, energy efficient devices and energy efficiency.
- Practical demonstration done to compare energy efficiency of, for example incandescent and fluorescent lamps.

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### Topic 6: Renewable energy

**6.1 Apply safety precautions and procedures when working with solar panels at the worksite**

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential safety hazards are identified at the worksite.</td>
<td>Identify potential safety hazards at the worksite.</td>
</tr>
<tr>
<td>A safety planning checklist is used.</td>
<td>Use a safety planning checklist.</td>
</tr>
<tr>
<td>The procedures for safely lifting tools, materials and equipment are listed.</td>
<td>List the procedures for lifting tools, materials and equipment safely.</td>
</tr>
<tr>
<td>The method of checking, using and storing ladders is explained.</td>
<td>Explain how ladders are checked, used and stored.</td>
</tr>
<tr>
<td>The use of fall protection systems as safety measures is explained.</td>
<td>Explain how fall protection systems can be used as safety measures</td>
</tr>
</tbody>
</table>

#### ASSESSMENT TASKS OR ACTIVITIES

- Students must evaluate and identify safety hazards to eliminate risks and potential injuries.
- Students make use of a safety planning checklist before installing solar panels.
- Students list the procedures for lifting tools, materials and equipment safely on roof or at heights where installations will take place.
- Students evaluate ladders at the worksite and perform a safety check and select the correct type of ladder for the task.
• Students explain the use of fall protection systems and equipment such as personal fall arrest system, personal fall restraint system and guard rail systems for working at heights. Students demonstrate the safe use of this equipment together with other personal protective equipment.

<table>
<thead>
<tr>
<th>SUBJECT OUTCOME</th>
<th>ASSESSMENT TASKS OR ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2 Install photovoltaic systems</td>
<td>Theory tests on the Learning Outcomes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
</table>
| Solar radiation is explained.  
Range: Insolation, peak sun hours, orientation and tilt angle. | Explain solar radiation |
| The operation of a photovoltaic cell is described  
Range includes but is not limited to: photons, colour spectrum, IV curves, amorphous, thin film and crystalline. | Describe the operation of a photovoltaic cell |
| The characteristics of photovoltaic modules are explained.  
Range: cell material, glazing material and electrical connection | Explain the characteristics of photovoltaic modules |
| The performance of photovoltaic modules are explained.  
Range: maximum power point, open-circuit voltage, short-circuit voltage, short-circuit current, rated power, efficiency, rating label, blocking and by-pass diodes. | Explain the performance of photovoltaic modules |
| The factors that affect the performance of photovoltaic modules are listed.  
Range: cell material, load resistance, sunlight intensity, cell temperature and shading. | List the factors that affect the performance of photovoltaic modules |
| Photovoltaic modules and batteries are connected  
Range: series, parallel and series-parallel. | Connect photovoltaic modules and batteries |
| The function of photovoltaic controllers and inverters are explained. | Explain the function of photovoltaic controllers and inverters |
| Block diagrams are drawn to show how photovoltaic arrays are connected  
Range: DC and AC loads | Draw block diagrams to show how photovoltaic arrays are connected |
| Advantages of photovoltaic systems are listed | List the advantages of photovoltaic systems |

ASSESSMENT TASKS OR ACTIVITIES:
- Theory tests on the Learning Outcomes.
- Students connect modules together and position the panels.
- Students connect wires to inverters and wire distribution boxes.
- Loads are connected to demonstrate the use of renewable energy.
SUBJECT OUTCOME

6.3 Demonstrate an understanding of how solar thermal systems operate and function

<table>
<thead>
<tr>
<th>ASSESSMENT STANDARD</th>
<th>LEARNING OUTCOME</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The benefits of solar water heaters are listed.</td>
<td>• List the benefits of solar water heaters.</td>
</tr>
<tr>
<td>• The conversion of solar radiation to heat is explained</td>
<td>• Explain how solar collectors convert solar radiation to heat.</td>
</tr>
<tr>
<td>Range: Flat plate and evacuated tube collector</td>
<td></td>
</tr>
<tr>
<td>• Heat losses from the collector are explained</td>
<td>• Explain heat losses from the collector.</td>
</tr>
<tr>
<td>• The different types of solar water heaters are explained.</td>
<td>• Explain the different types of solar water heaters.</td>
</tr>
</tbody>
</table>

ASSESSMENT TASKS OR ACTIVITIES

• Theory tests on the learning outcomes.
• Students identify the different types of solar water heaters.

4. SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN ELECTRICAL SYSTEMS AND CONSTRUCTION – LEVEL 3

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 ISAT may be as follows:

• The students are assigned a task at the beginning of the year which they must complete in phases during 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 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 or November by means of a paper(s) set and moderated externally. The following distribution of cognitive application is suggested:
<table>
<thead>
<tr>
<th>LEVEL 3</th>
<th>KNOWLEDGE</th>
<th>COMPREHENSION AND APPLICATION</th>
<th>ANALYSIS, SYNTHESIS AND EVALUATION</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>30 - 40%</td>
<td>50 - 60%</td>
<td>0 - 10%</td>
</tr>
</tbody>
</table>