



higher education  
& training

Department:  
Higher Education and Training  
REPUBLIC OF SOUTH AFRICA

## **NATIONAL CERTIFICATES (VOCATIONAL)**

### **ASSESSMENT GUIDELINES**

## **ELECTRICAL SYSTEMS AND CONSTRUCTION**

**NQF LEVEL 4**

**IMPLEMENTATION: JANUARY 2015**

# **ELECTRICAL SYSTEMS AND CONSTRUCTION – LEVEL 4**

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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 *Electrical Systems and Construction Level 4* 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 4* 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 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 in order 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 (KSVA) 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 (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 paper(s) set to the requirements of the Subject Learning Outcomes. The Department of Higher Education and Training (DHET) 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 assessor; 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 ICASS must be re-submitted with each examination enrolment for which it constitutes a component.

## **5 ASSESSOR REQUIREMENTS**

Assessors must be subject specialists and competent assessors.

## **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 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.

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

## 9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student's Portfolio of

Evidence (PoE).

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

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	Task-based (Structured)	Test-based (More structured)
<b>Assessment instruments</b>	<ul style="list-style-type: none"> <li>• Observation</li> <li>• Class questions</li> <li>• Lecturer, student, parent discussions</li> </ul>	<ul style="list-style-type: none"> <li>• Assignments or tasks</li> <li>• Projects</li> <li>• Investigations or re-search</li> <li>• Case studies</li> <li>• Practical exercises</li> <li>• Demonstrations</li> <li>• Role-play</li> <li>• Interviews</li> </ul>	<ul style="list-style-type: none"> <li>• Examinations</li> <li>• Class tests</li> <li>• Practical examinations</li> <li>• Oral tests</li> <li>• Open-book tests</li> </ul>
<b>Assessment tools</b>	<ul style="list-style-type: none"> <li>• Observation sheets</li> <li>• Lecturer's notes</li> <li>• Comments</li> </ul>	<ul style="list-style-type: none"> <li>• Checklists</li> <li>• Rating scales</li> <li>• Rubrics</li> </ul>	<ul style="list-style-type: none"> <li>• Marks (e.g. %)</li> <li>• Rating scales (1-7)</li> </ul>
<b>Evidence</b>	<ul style="list-style-type: none"> <li>• Focus on individual students</li> <li>• Subjective evidence based on lecturer observations and impressions</li> </ul>	<p><b>Open middle:</b> Students produce the same evidence but in different ways.</p> <p><b>Open end:</b> Students use same process to achieve different results.</p>	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 tasks. However, marks should be awarded against rubrics and should not simply be a total of ticks for right answers. Rubrics should explain the competence level descriptors for the skills, knowledge, values and attitudes that a student must demonstrate to achieve each level of the rating scale.

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

## **13 STRATEGIES FOR COLLECTING EVIDENCE**

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

### **13.1 Record sheets**

The lecturer observes students working in a group. These observations are recorded in a summary table at the end of each project. The lecturer can design a record sheet to 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 4**

## SECTION C: ASSESSMENT IN 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 achieve 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:

TASKS	Time-frame	Type of assessment activity	Minimum time and proposed mark allocation *(can be increased but not reduced)	Scope of assessment	% contribution to the year mark
				Do not confuse the weightings of topics in the Subject Guidelines with the % contribution to the year mark	
1	Term 1	Test	1 hour (50 marks)	Topics completed in Term 1	10
2	Term 1	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25

3	Term 2	Practical Assessment/ Assignment	Determined by the scope and nature of the task	One or more of the topics completed as an assignment	25
4	Term 2	Test*	1 hour (50 marks)	Topics completed in Term 1 and 2	10
5	Term 3	Internal Examination*	As per external examinations (P1 & P2 where applicable)	Topics completed to date (P1 =15 & P2=15, where applicable)	30
<b>TOTAL</b>					<b>100</b>

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*' has been developed, and is 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* 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 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 4

#### Topic 1: Electrical Infrastructure

SUBJECT OUTCOME	
<b>1.1 Explain electrical infrastructure and construction</b>	
<i>Range: Includes but is not limited to knowledge of the layout of the South African power grid, operating principles of coal fired power stations, layout of a typical small town power grid and how to install and terminate medium voltage overhead networks.</i>	
ASSESSMENT STANDARD	LEARNING OUTCOMES
<ul style="list-style-type: none"> <li>• The concepts of low, medium and high voltage networks are explained</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the concepts low, medium and high voltage networks</li> </ul>
<ul style="list-style-type: none"> <li>• The ratings on switchgear, transformers, control gear and Instruments are described and explained</li> </ul>	<ul style="list-style-type: none"> <li>• Describe and explain the ratings on switchgear, transformers, control gear and instruments</li> </ul>

<ul style="list-style-type: none"> <li>• How alternators can be switched into or out of the grid is explained</li> </ul>	<ul style="list-style-type: none"> <li>• Explain how alternators can be switched into or out of the grid</li> </ul>
<ul style="list-style-type: none"> <li>• The main components of a coal fired power station are described with the aid of diagrams</li> </ul>	<ul style="list-style-type: none"> <li>• Describe with the aid of diagrams, the main components of a coal fired power station</li> </ul>
<ul style="list-style-type: none"> <li>• The main components of a typical small town power grid are described with the aid of diagrams</li> </ul>	<ul style="list-style-type: none"> <li>• Describe with the aid of diagrams, the main components of a typical small town power grid</li> </ul>
<ul style="list-style-type: none"> <li>• Radial and ring feeds are described, and the effects of faulty transmission lines are explained</li> </ul> <p><i>Range: short circuit and open circuit</i></p>	<ul style="list-style-type: none"> <li>• Describe radial and ring feeds and explain the effects of faulty transmission lines</li> </ul>
<ul style="list-style-type: none"> <li>• Components, parts and equipment required to install medium voltage overhead networks are listed and explained.</li> </ul> <p><i>Range:</i></p> <p><i>Overhead line structures may include but are not limited to steel/wood/concrete poles</i></p> <p><i>Relevant equipment may include, but is not limited to medium voltage pole mounted isolators, fuses, breakers, sectionalisers, transformers, reclosers, surge arrestors and metering equipment.</i></p> <p><i>Hardware may include, but is not limited to cables, bare conductors, covered conductors, service cables, aerial bundle conductors, stays and struts, insulators, clamps, ferrules, lugs and bolts.</i></p> <p><i>Installation includes, but is not limited to building the line and carrying out pre-commission inspections and hand-over procedures.</i></p>	<ul style="list-style-type: none"> <li>• List and explain components, parts and equipment required to install medium voltage overhead networks.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
<ul style="list-style-type: none"> <li>• Written or oral tests to assess knowledge and understanding</li> <li>• Test on interpretation of regulations, network and system concepts, understanding of drawings and electrical components used in networks and systems</li> <li>• Student must sketch and explain the operation of electrical systems.</li> </ul>	

## Topic 2: Construction of a three phase circuit

<b>SUBJECT OUTCOME</b>
<b>2.1 Design and construct a three phase circuit</b>
<i>Range: Includes but is not limited to identifying electrical symbols (ISO and IEC standard) and components; gathering relevant components and describing the functioning of circuits and components (including contactors, protection (fuses, circuit breakers, earth leakage and overload relays), controls</i>

(temperature, limits, pressure, level, proximity and time switches), loads (resistive and inductive) and power supplies (maximum 550 volt).

Note: Circuits to be constructed are in a simulated environment and tested under supervision.

ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> <li>• Symbols (ISO and IEC standard) and components are identified</li> </ul>	<ul style="list-style-type: none"> <li>• Identify symbols (ISO and IEC standard) and components</li> </ul>
<ul style="list-style-type: none"> <li>• A three phase circuit diagram is designed to satisfy requirements</li> </ul> <p><i>Range: Circuits are limited to direct on line, forward and reverse, sequence and star-delta starting.</i></p>	<ul style="list-style-type: none"> <li>• Design a three phase circuit diagram that will satisfy the requirements.</li> </ul>
<ul style="list-style-type: none"> <li>• The components, tools and equipment needed for the construction of the circuit is listed</li> </ul>	<ul style="list-style-type: none"> <li>• List the components, tools and equipment needed for the construction of the circuit.</li> </ul>
<ul style="list-style-type: none"> <li>• The three phase circuit is constructed using acceptable working procedures and construction methods</li> </ul>	<ul style="list-style-type: none"> <li>• Construct the three phase circuit using acceptable working procedures and construction methods</li> </ul>
<ul style="list-style-type: none"> <li>• The operational functionality of the constructed circuit is evaluated and shortcomings are addressed</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the operational functionality of the constructed circuit and address any shortcomings.</li> </ul>
<ul style="list-style-type: none"> <li>• The task is completed by compilation of drawings, operating procedures and specifications of the design.</li> </ul>	<ul style="list-style-type: none"> <li>• Complete the task by compiling drawings, operating procedures and specifications of the design.</li> </ul>
ASSESSMENT TASKS OR ACTIVITIES	
<ul style="list-style-type: none"> <li>• Identify various types of components according to their respective symbols</li> <li>• Design and construct a three phase circuit such as <i>direct on line, forward and reverse, sequence and star-delta starting.</i></li> <li>• An oral or written test will precede the practical. Student is tested on interpretation of the task, understanding of drawing requirements for the successful execution of the task, and steps in the execution of the task.</li> <li>• Draw up or interpret plans, produce a list of required components, tools and instruments for the successful execution of the task.</li> <li>• The task can be done in a simulated environment.</li> <li>• Students must be informed of the assessment criteria in terms of percentage mark allocation.</li> </ul>	

### Topic 3: Construction of a three phase medium voltage overhead supply to domestic houses

<b>SUBJECT OUTCOME</b>	
<b>3.1 Construct a three phase medium voltage overhead supply to domestic houses</b>	
<i>Range: Includes but is not limited to 11kV/380V three phase 4-wire network; materials such as cables, conductors, aerial bundle conductors, poles, isolators and fuses, and pin and strain type insulators; a 220V single phase supply cable to a domestic house; connection to the consumer's meter box.</i>	
<i>Excludes mounting of 11kV/380V transformer on structure (assumed to be in place); plans (will be provided); and connection to the 11kV supply.</i>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>All statutory requirements as prescribed by the OHS Act, SABS 1418, Local Authority requirements and ESKOM reticulation specifications are listed and described</li> </ul>	<ul style="list-style-type: none"> <li>List and describe all statutory requirements as prescribed by the OHS Act, SABS 1418, Local Authority requirements and ESKOM reticulation specifications</li> </ul>
<ul style="list-style-type: none"> <li>The required parts and equipment are listed from the plans and diagrams</li> </ul>	<ul style="list-style-type: none"> <li>From the plans and diagrams draw up a list of parts and equipment needed</li> </ul>
<ul style="list-style-type: none"> <li>The terrain is assessed and the work to be done is decided</li> </ul>	<ul style="list-style-type: none"> <li>Assess the terrain and decide on work to be done</li> </ul>
<ul style="list-style-type: none"> <li>The route is marked out according to diagrams and servitude specifications</li> </ul>	<ul style="list-style-type: none"> <li>Mark out the route according to diagrams and servitude specifications</li> </ul>
<ul style="list-style-type: none"> <li>Holes or foundations are prepared, structures or poles erected and stays connected</li> </ul>	<ul style="list-style-type: none"> <li>Prepare holes or foundations, erect structures or poles and connect the stays</li> </ul>
<ul style="list-style-type: none"> <li>Conductive elements strung and the line is tensioned</li> </ul>	<ul style="list-style-type: none"> <li>String the conductive elements and tension the line</li> </ul>
<ul style="list-style-type: none"> <li>The 220V cable is connected to the overhead supply</li> </ul>	<ul style="list-style-type: none"> <li>Connect the 220V cable to the overhead supply</li> </ul>
<ul style="list-style-type: none"> <li>The transformer, isolator, fuses and other parts are connected as per statutory requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Connect the transformer, isolator, fuses and other parts as per statutory requirements</li> </ul>
<ul style="list-style-type: none"> <li>Surplus material is removed and disposed of, and the terrain restored according to environmental standards and the land owner's requirements.</li> </ul>	<ul style="list-style-type: none"> <li>Remove and dispose of surplus material and restore the terrain according to environmental standards and the land owner's requirements.</li> </ul>
<ul style="list-style-type: none"> <li>The task is concluded by completing the inspection sheets and pre-commissioning reports.</li> </ul>	<ul style="list-style-type: none"> <li>Conclude the task by completing the inspection sheets and pre-commissioning reports.</li> </ul>



**ASSESSMENT TASKS OR ACTIVITIES**

- Practical task of wiring and commissioning a single-phase domestic installation. An oral or written test should precede the practical
- Test 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
- The task can be done in a simulated environment
- Students must be informed of the assessment criteria in terms of percentage mark allocation.

**External Exam**

A written exam with no practical. The exam should test understanding of circuit design, electrical components, instrument usage, wiring code specifications, regulations, safety requirements, testing procedures, administrative work, etc.

**Topic 4: Inspection of a three phase industrial/commercial installation****SUBJECT OUTCOME****4.1 Test and inspect a three phase industrial/commercial installation**

*Range:*

- *Conducting an electrical test and inspection of a three phase industrial/commercial installation to ensure compliance with all statutory requirements and their application to the installation, using appropriate test instruments and understanding the indicated results, using and completing appropriate inspection documents with correct and relevant information.*
- *Test equipment may include but is not limited to multimeters, insulation tester, clip on ammeter, impedance testing equipment, earth leakage testing devices, earth electrode resistance testing equipment, continuity testers, phase rotation meters and any others appropriate to three phase industrial/commercial installations.*

*Note: All work must be conducted under supervision.*

<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>• Building plans, electric schematic and wiring diagrams are understood and their components identified</li> </ul> <p><i>Range: switch-yards, cabling, wire-ways, distribution boards, circuit protection devices, sub-circuits and points of delivery</i></p>	<ul style="list-style-type: none"> <li>• Interpret and explain the building plans, electric schematic and wiring diagrams, and their components identified</li> </ul>
<ul style="list-style-type: none"> <li>• The tasks required for inspecting and testing the installation are planned</li> </ul>	<ul style="list-style-type: none"> <li>• Plan the tasks required for inspecting and testing the installation</li> </ul>

<ul style="list-style-type: none"> <li>Appropriate tools, equipment and instruments are identified and selected to meet the requirements of the task according to statutory and environmental requirements</li> </ul>	<ul style="list-style-type: none"> <li>Identify and select the appropriate tools, equipment and instruments to meet the requirements of the task according to statutory and environmental requirements</li> </ul>
<ul style="list-style-type: none"> <li>The safety rules and regulations relevant to the task according to statutory requirements and safe work procedures are explained</li> </ul>	<ul style="list-style-type: none"> <li>Explain safety rules and regulations relevant to the task according to statutory requirements and safe work procedures</li> </ul>
<ul style="list-style-type: none"> <li>Environmental hazards and safety risks are identified according to environmental standards and safety risk analyses</li> </ul>	<ul style="list-style-type: none"> <li>Identify environmental hazards and safety risks according to environmental standards and safety risk analyses</li> </ul>
<ul style="list-style-type: none"> <li>The installation is inspected and tested for compliance according to statutory requirements of the wiring code</li> </ul>	<ul style="list-style-type: none"> <li>Inspect the installation and test for compliance according to statutory requirements of the wiring code</li> </ul>
<ul style="list-style-type: none"> <li>A test report / certificate of compliance (CoC) is completed fully and handed to the assessor</li> </ul>	<ul style="list-style-type: none"> <li>Complete a test report / certificate of compliance (CoC) and hand it to the assessor</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
<ul style="list-style-type: none"> <li>Student is given the task of testing and inspecting a three phase industrial/commercial installation. An 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</li> <li>Student must interpret plans, produce a list of required components, tools and instruments for the successful execution of the task</li> </ul> <p>The task can be done in a simulated environment.</p> <ul style="list-style-type: none"> <li>Students must be informed of the assessment criteria in terms of percentage mark allocation.</li> <li>Students complete a test report / certificate of compliance for each inspection and testing</li> </ul> <p><b>External Exam</b></p> <p>A written exam with no practical. The exam will test the student's understanding of circuit design, electrical components, instrument usage, wiring code specifications, regulations, safety requirements, testing procedures, administrative work, etc.</p>	

### Topic 5: Fault-finding and maintenance of three phase voltage electric circuits

<b>SUBJECT OUTCOME</b>
<b>5.1 Fault-find three phase voltage electric circuits</b>
<p><i>Range: Includes but is not limited to 380V three phase; equipment such as transformers, motors and control gear, cables, lighting, switch gear and metering. Safety policies must be adhered to.</i></p> <p><i>Note: Fault finding must be done under supervision and in a simulated environment.</i></p>

ASSESSMENT STANDARDS	LEARNING OUTCOME
<ul style="list-style-type: none"> <li>• Correctly fault-find three phase voltage electric circuits according to recognised procedures and occupational standards.</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the principles and procedures to be applied during fault finding on three phase AC systems.</li> <li>• Plan and prepare for fault finding on three phase AC systems.</li> <li>• Find faults and complete fault finding on faulty three phase AC systems.</li> <li>• Complete fault finding on three phase AC systems.</li> </ul>
ASSESSMENT TASKS OR ACTIVITIES	
<ul style="list-style-type: none"> <li>• Student is given the task to fault-find three phase AC systems. An oral or written test should precede the practical. Student is tested on interpretation of safety regulations, use of measuring instruments, understanding of drawings and steps in the execution of the task.</li> <li>• Student must interpret plans, produce a list of required documentation, tools and instruments for the successful execution of the task.</li> <li>• The task can be done in a simulated environment</li> <li>• Students must be informed of the assessment criteria in terms of percentage mark allocation. Completion time frames must be taken into account.</li> </ul>	

SUBJECT OUTCOME	
<p style="text-align: center;"><b>5.2 Repair three phase voltage electric circuits</b></p> <p><i>Range: Includes but is not limited to 380V three phase; equipment such as transformers, motors and control gear, cables, lighting, switch gear and metering. Safety policies must be adhered to. Repair procedures must be conducted in accordance with accepted practises.</i></p> <p><i>Note: Repair must be done under supervision and in a simulated environment.</i></p>	
ASSESSMENT STANDARD	LEARNING OUTCOME
<ul style="list-style-type: none"> <li>• Correctly repair three phase voltage electric circuits according to recognised procedures and occupational standards</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the principles and procedures for repairing three phase AC systems.</li> <li>• Plan and prepare for repairing three phase AC systems.</li> <li>• Repair faulty three phase AC systems.</li> <li>• Test and commission the repaired three phase AC system.</li> </ul>

<b>ASSESSMENT TASKS OR ACTIVITIES</b>
<ul style="list-style-type: none"> <li>• Student is given the task to repair three phase AC systems. An oral or written test should precede the practical. Students' interpretation of safety regulations, use of measuring instruments, understanding of drawings and steps in the execution of the task are tested.</li> <li>• Student must interpret plans, produce a list of required documentation, tools and instruments for the successful execution of the task.</li> <li>• The task can be done in a simulated environment</li> <li>• Students must be informed of the assessment criteria in terms of percentage mark allocation. Completion time frames must be taken into account.</li> </ul>

<b>SUBJECT OUTCOME</b>	
<b>5.3 Maintain three phase voltage electric circuits</b>	
<i>Range: Includes but is not limited to 380V three phase; equipment such as transformers, motors and control gear, cables, lighting, switch gear and metering. Safety policies must be adhered to.</i>	
<i>Note: Maintenance procedures must be conducted under supervision and in a simulated environment.</i>	
<b>ASSESSMENT STANDARDS</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>• Correctly maintain three phase voltage electric circuits according to recognised procedures and occupational standards</li> </ul>	<ul style="list-style-type: none"> <li>• Explain the principles and procedures to be applied during maintenance on three phase AC systems.</li> <li>• Plan and prepare for maintenance on three phase AC systems.</li> <li>• Maintain three phase AC systems.</li> <li>• Record data and schedule next maintenance on the three phase AC systems.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	

<ul style="list-style-type: none"> <li>• Student is given the task of maintaining three phase AC systems. An oral or written test should precede the practical. Student is tested on interpretation of safety regulations, use of electrical instruments, understanding of drawings and steps in the execution of the task.</li> <li>• Student must interpret plans, produce a list of required documentation, tools and instruments for the successful execution of the task.</li> <li>• The task can be done in a simulated environment.</li> <li>• Students must be informed of the assessment criteria in terms of percentage mark allocation. Completion time frames must be taken into account.</li> </ul>
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**Topic 6: Renewable energy system**

<b>SUBJECT OUTCOME</b>	
<b>6.1 Sketch a basic renewable circuit diagram</b>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>• Instructions are interpreted according to work site procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Interpret instructions according to work site procedures.</li> </ul>
<ul style="list-style-type: none"> <li>• Symbols that conform to ISO standards are used</li> </ul>	<ul style="list-style-type: none"> <li>• Use symbols that conform to ISO standards.</li> </ul>
<ul style="list-style-type: none"> <li>• The function of each component is correctly described</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the function of each component correctly.</li> </ul>
<ul style="list-style-type: none"> <li>• Circuit diagrams are neatly, symmetrically sketched and are functional according to instructions</li> </ul>	<ul style="list-style-type: none"> <li>• Sketch circuit diagrams neatly and symmetrically according to instructions.</li> <li>• Ensure that circuit diagrams are functional according to instructions.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
Assessment tasks or activities include but are not limited to: <ul style="list-style-type: none"> <li>• Students should interpret, describe components and sketch circuit diagrams</li> <li>• An oral or written test precedes the practical assessment.</li> <li>• <b>External exam:</b> Students are tested on the ability to interpret the circuit diagram.</li> </ul>	

<b>SUBJECT OUTCOME</b>	
<b>6.2 Calculate a typical solar home or solar school load</b>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>• Appliance loads are correctly identified as per data plates</li> </ul>	<ul style="list-style-type: none"> <li>• Identify appliance loads correctly as per data plates.</li> </ul>
<ul style="list-style-type: none"> <li>• Approximate time of use is correctly determined for each appliance</li> </ul>	<ul style="list-style-type: none"> <li>• Correctly determine approximate time of use for each appliance.</li> </ul>
<ul style="list-style-type: none"> <li>• The total kWhr load for the system is correctly calculated</li> </ul>	<ul style="list-style-type: none"> <li>• Calculate the total kWhr load correctly for the system.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
Assessment tasks or activities include but are not limited to: <ul style="list-style-type: none"> <li>• Calculate solar loads</li> <li>• An oral or written test precedes the practical assessment.</li> </ul>	

<b>SUBJECT OUTCOME</b>	
<b>6.3 Assess renewable energy resource</b>	
<i>Range: Wind and solar</i>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>Data manuals are correctly identified according to geographical location</li> </ul>	<ul style="list-style-type: none"> <li>Identify data manuals correctly according to geographical location.</li> </ul>
<ul style="list-style-type: none"> <li>Data are correctly analysed for application</li> </ul>	<ul style="list-style-type: none"> <li>Analyse data correctly for application.</li> </ul>
<ul style="list-style-type: none"> <li>Adjustments for height (wind data) are correctly carried out</li> </ul>	<ul style="list-style-type: none"> <li>Carry out adjustments for height (wind data) correctly.</li> </ul>
<ul style="list-style-type: none"> <li>Data is correctly applied to determine the average available energy</li> </ul>	<ul style="list-style-type: none"> <li>Apply data correctly to determine the average available energy.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
Assessment tasks or activities include but are not limited to: <ul style="list-style-type: none"> <li>Students analyse data</li> <li>An oral or written test precedes the practical assessment.</li> <li><b>External exam:</b> Students are tested on the application of data of the renewable energy.</li> </ul>	

<b>SUBJECT OUTCOME</b>	
<b>6.4 Calculate battery bank rating</b>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>KWhr load values are correctly converted to Ahr value</li> </ul>	<ul style="list-style-type: none"> <li>Convert KWhr load value correctly to Ahr value.</li> </ul>
<ul style="list-style-type: none"> <li>Battery losses are considered when calculating battery bank rating</li> </ul>	<ul style="list-style-type: none"> <li>Consider battery losses when calculating battery bank rating.</li> </ul>
<ul style="list-style-type: none"> <li>Autonomy correction is made based on available data</li> </ul>	<ul style="list-style-type: none"> <li>Make the autonomy correction based on available data.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
Assessment tasks or activities include but are not limited to: <ul style="list-style-type: none"> <li>Convert load values</li> <li>An oral or written test precedes the practical assessment.</li> <li><b>External exam:</b> Students are tested on their competence to calculate battery bank ratings.</li> </ul>	

<b>SUBJECT OUTCOME</b>	
<b>6.5 Calculate the solar array and/or wind turbine rating</b>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>Solar array and/or wind turbine rating are correctly calculated as per available resource, load data and manufacturers' specifications</li> </ul>	<ul style="list-style-type: none"> <li>Calculate solar array and/or wind turbine rating correctly as per available resource, load data and manufacturers' specifications.</li> </ul>
<ul style="list-style-type: none"> <li>Winter and summer variations are calculated for solar array and/or wind turbine rating</li> </ul>	<ul style="list-style-type: none"> <li>Calculate winter and summer variations for solar array and/or wind turbine rating.</li> </ul>
<ul style="list-style-type: none"> <li>The effect of factors such as dirt build up and performance deterioration through aging on the calculations are described and explained</li> </ul>	<ul style="list-style-type: none"> <li>Describe and explain the effect of factors such as dirt build up and performance deterioration through aging on the calculations.</li> </ul>
<ul style="list-style-type: none"> <li>System losses in the calculations are explained</li> </ul>	<ul style="list-style-type: none"> <li>Explain the effect of system losses in the calculations.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
<p>Assessment tasks or activities include but are not limited to:</p> <ul style="list-style-type: none"> <li>Calculate solar array and/or wind turbine rating</li> <li>An oral or written test precedes the practical assessment.</li> <li><b>External exam:</b> Students are tested on their ability to calculate ratings.</li> </ul>	

<b>SUBJECT OUTCOME</b>	
<b>6.6 Select wire sizes correctly.</b>	
<b>ASSESSMENT STANDARD</b>	<b>LEARNING OUTCOME</b>
<ul style="list-style-type: none"> <li>Specifications in regard to minimum voltage drop are explained</li> </ul>	<ul style="list-style-type: none"> <li>Explain specifications in regard to minimum voltage drop.</li> </ul>
<ul style="list-style-type: none"> <li>Wire size tables are identified and explained</li> </ul>	<ul style="list-style-type: none"> <li>Identify and explain wire size tables.</li> </ul>
<ul style="list-style-type: none"> <li>Wire sizes are correctly selected as per specifications and standards</li> </ul>	<ul style="list-style-type: none"> <li>Select wire sizes correctly as per specifications and standards.</li> </ul>
<b>ASSESSMENT TASKS OR ACTIVITIES</b>	
<p>Assessment tasks or activities include but are not limited to:</p> <ul style="list-style-type: none"> <li>Identify and explain wire sizes</li> <li>An oral or written test precedes the practical assessment</li> <li>Design a stand-alone renewable energy system as a project</li> <li><b>External exam:</b> Students are tested on the selection of wire sizes</li> </ul>	

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

### 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 during 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:

LEVEL 4	KNOWLEDGE AND COMPREHENSION	APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	30 - 40%	50 – 60%	0 - 20%