education

Department:
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NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRICAL PRINCIPLES AND PRACTICE

NQF Level 3

September 2007

ELECTRICAL PRINCIPLES AND PRACTICE – 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 Electrical Principles and Practice in the National Certificates (Vocational). It must be read with the *National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF)*. This assessment guideline will be used for National Qualifications Framework Levels 2-4.

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

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

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

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

The principles that drive these objectives are:

- ***Integration***

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

- ***Relevance***

To be dynamic and responsive to national development needs.

- ***Credibility***

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

- ***Coherence***

To work within a consistent framework of principles and certification.

- ***Flexibility***

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

- ***Participation***

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

- ***Access***

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

- ***Progression***

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

- ***Portability***

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

- ***Articulation***

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

- ***Recognition of Prior Learning***

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

- ***Validity of assessments***

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

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

- ***Reliability***

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

- ***Fairness and transparency***

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

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

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

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

2 ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS

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

2.1 Internal continuous assessment (ICASS)

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

2.2 External summative assessment (ESASS)

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

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

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

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

3 MODERATION OF ASSESSMENT

3.1 Internal moderation

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

3.2 External moderation

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

The external moderator:

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

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

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (ICASS)

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

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

5 ASSESSOR REQUIREMENTS

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

6 TYPES OF ASSESSMENT

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

6.1 Baseline assessment

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

6.2 Diagnostic assessment

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

6.3 Formative assessment

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

6.4 Summative assessment

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

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

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

7.2 Recording

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

7.3 Reporting

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

8 METHODS OF ASSESSMENT

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

LECTURER ASSESSMENT	The lecturer assesses students' performance against given criteria in different contexts, such as individual work, group work, etc.
SELF-ASSESSMENT	Students assess their own performance against given criteria in different contexts, such as individual work, group work, etc.
PEER ASSESSMENT	Students assess another student'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 PoE.

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

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	**Task-based** (Structured)	**Test-based** (More structured)
Assessment instruments	• Observation • Class questions • Lecturer, student, parent discussions	• Assignments or tasks • Projects • Investigations or research • Case studies • Practical exercises • Demonstrations • Role-play • Interviews	• Examinations • Class tests • Practical examinations • Oral tests • Open-book tests
Assessment tools	• Observation sheets • Lecturer's notes • Comments	• Checklists • Rating scales • Rubrics	• Marks (e.g. %) • Rating scales (1-7)
Evidence	• Focus on individual students • Subjective evidence based on lecturer observations and impressions	**Open middle**: Students produce the same evidence but in different ways. **Open end**: Students use same process to achieve different results.	Students answer the same questions in the same way, within the same time.

10 TOOLS FOR ASSESSING STUDENT PERFORMANCE

Rating scales are marking systems where a symbol (such as 1 to 7) or a mark (such as 5/10 or 50%) is defined in detail. The detail is as important as the coded score. Traditional marking, assessment and evaluation mostly used rating scales without details such as what was right or wrong, weak or strong, etc.

Task lists and **checklists** show the student what needs to be done. 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 and cannot be compared to tests. Each criterion described in the rubric must be assessed separately. Mainly two types of rubrics, namely holistic and analytical, are used.

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

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

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

12 COMPETENCE DESCRIPTIONS

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

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

13 STRATEGIES FOR COLLECTING EVIDENCE

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

13.1 Record sheets

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

13.2 Checklists

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

SECTION C: ASSESSMENT IN ELECTRICAL PRINCIPLES AND PRACTICE

1 SCHEDULE OF ASSESSMENT

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

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

2 RECORDING AND REPORTING

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

Scale of Achievement for the Vocational component

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

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

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

The college must standardise these documents.

The student's PoE must include at least:

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

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

ASSESSMENT OF ELECTRICAL PRINCIPLES AND PRACTICE

LEVEL 3

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

Topic 1: Materials, components and interpret electrical drawings

<table>
<tr><th colspan="2">SUBJECT OUTCOME</th></tr>
<tr><td colspan="2">1.1 Identify the most commonly used electrical-materials and electrical-components.
Range: Materials such as copper, steel, glass, porcelain, mica, plastics, bakelite, carbon, oil-impregnated paper, rubber, lead, aluminium and tin. Components such as insulated cables, stranded conductors, flexible cables, steel cored cables, armoured cables, conduiting and associated fittings, clamps, cleats and saddles, porcelain, glass and mica insulators, busbars, fuses, heating elements, switches, circuit breakers, protection devices, luminairs, capacitors and transformers
Range: Machine components include but are not limited to:
(D.C. motors (separately excited, shunt, series and compound), A.C. motors (squirrel cage, wound rotor and universal)), and their associated internal circuitry and starting methods (face plate, star-delta, starting windings and direct-on-line)</td></tr>
<tr><th>ASSESSMENT STANDARD</th><th>LEARNING OUTCOME</th></tr>
<tr><td>• A wide range of materials used in the electrical field is familiar to the student.
• Properties of a wide range of materials used in the electrical field are familiar to the student.</td><td>• List types of materials and their properties.</td></tr>
<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">Oral or written test:
Student to list properties such as;
1. Conductive or non-conductive
2. High or low tensile strength
3. Ductile or brittle
4. Soft or hard
5. Flammable or inflammable
6. Toxic or non toxic,
etc.</td></tr>
<tr><th>ASSESSMENT STANDARD</th><th>LEARNING OUTCOME</th></tr>
<tr><td>• A wide range of materials used in the electrical field is familiar to the student.
• Properties of a wide range of materials used in the electrical field are familiar to the student.
• A wide range of components used in the electrical field is familiar to the student.</td><td>• State which materials are commonly used for conductors of electricity and which are insulator materials.</td></tr>
<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">Assessment Tasks/Activities include but are not limited to;
• Oral or written test
Student must know the common abbreviations and names used in practice;
Au, Ag, Cu, Fe, Sn, Pb, PVC, captyre, silicon, etc.</td></tr>
<tr><th>ASSESSMENT STANDARD</th><th>LEARNING OUTCOME</th></tr>
<tr><td>• A wide range of materials used in the electrical field is familiar to the student.
• Properties of a wide range of materials used in the electrical field are familiar to the student.
• A wide range of components used in the electrical field is familiar to the student.</td><td>• Illustrate with sketches the most commonly used cables, cords, conductors and insulators and where they are commonly used in the electrical field.</td></tr>
<tr><th colspan="2">ASSESSMENT TASKS OR ACTIVITIES</th></tr>
<tr><td colspan="2">Assessment Tasks/Activities include but are not limited to;
• Written test
1. Sketches of cables should be limited to:
Steel-cored stranded Aluminium,
PVC wire armoured and
Paper insulated, armoured cables
2. Sketches of insulators should be limited to:
Pin, Strain and suspension type</td></tr>
</table>

ASSESSMENT STANDARD	LEARNING OUTCOME
• A wide range of components used in the electrical field is familiar to the student.	• Know of flexible connections and where they are used
ASSESSMENT TASKS OR ACTIVITIES	
Understand SANS 10142 regulation 6.5.4 (SABS 0142)	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• A wide range of components used in the electrical field is familiar to the student.	• Identify meter boxes and distribution boxes and components found inside these boxes. • Identify electric earthing equipment. • Identify transformers and switchgear. • Identify electric motors.
ASSESSMENT TASKS OR ACTIVITIES	
Assessment Tasks/Activities include but are not limited to; • Written test Include pre-paid metering, low and high voltage earth continuity conductors, earth electrodes, etc Student uses name plate, connection box and physical appearance to limit the possibilities	

SUBJECT OUTCOME	
1.2 Identify and maintain batteries.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Batteries and battery maintenance is understood.	• Sketch and explain the operating principle of lead-acid batteries and how to use and maintain them.
ASSESSMENT TASKS OR ACTIVITIES	
Student should also gain practical experience on cleaning, connecting and charging lead-acid batteries.	

SUBJECT OUTCOME	
1.3 Explain the operating principle of electrical components.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The operating principle of a wide range of components used in the electrical field is familiar to the student.	• Explain the operating principle of circuit breakers, isolators/disconnectors, lightning arrestors, earth leakage relays, no-volt and overload protection devices. • Sketch and explain the operating principle of geysers, stoves, thermostats, simmerstats, prepaid meters, energy control units (ripple relay and radio controlled), the incandescent and fluorescent lamp and light dimmers.
ASSESSMENT TASKS OR ACTIVITIES	
• Student must be tested against the outcomes. • Electrical components are based on the common components found in the wiring of domestic houses and factories. Example: A light dimmer is a device that prevents all of the supply from reaching the lamp, either by reducing the voltage across the lamp, or by removing the voltage for a part of the voltage cycle (A.C.). No sketch is necessary.	

SUBJECT OUTCOME	
1.4 Identify materials and components used in the distribution of electricity. *Range: Includes overhead lines (max. 1000V), poles, struts, ties, pin-, strain- and suspension-insulators, steel cored conductors, lightning arrestors, transformers, fuses, switchgear.* *Includes special erection tools such as the draw-vice.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• A wide range of materials used in the distribution of electricity is familiar to the student. • Properties of a wide range of materials used in the distribution of electricity are familiar to the student.	• List and identify components. • State type of material that components are made of. • Sketch typical erection layouts to illustrate how cable tension is maintained. • Identify enclosures and mountings for components such as transformers and switchgear.
ASSESSMENT TASKS OR ACTIVITIES	
• Test student on Learning Outcomes • Physical examples: The student must be exposed to the most commonly used materials and components used in the distribution of electricity, in photographs, sketches or on site.	

SUBJECT OUTCOME	
1.5 Identify common drawing symbols and abbreviations used in electrical drawings and know how components are cross-referenced (e.g. relay contacts appearing in another circuit diagram)	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Concepts of basic engineering drawings are understood. • Basic engineering drawings are interpreted. • Basic engineering drawings are produced.	• Discuss and explain basic engineering drawing concepts and material lists. • Interpret basic engineering drawings. • Produce drawing according to accepted International standards.
ASSESSMENT TASKS OR ACTIVITIES	
The student continuously increases his/her knowledge of basic engineering drawing concepts during the course, and CASS must be done by the lecturer to observe this progress	

Topic 2: Electric and magnetic theory

SUBJECT OUTCOME	
2.1. Understand fundamentals of electricity *Range: Includes but not limited to;* *p.d., e.m.f., current flow (conventional and electron), resistance, power (true, reactive and apparent), power factor and energy. Use R.M.S, D.C and instantaneous values where applicable*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The fundamentals of electricity are understood.	• Recall the definitions and units of measurement. • State relationships between entities, if any. • Manipulate formulae. • Understand the concepts.
• The relationship between electric current, potential difference and resistance can be applied.	• Understand case studies and calculate values. • Interpret the results.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Assess the student on the outcomes mentioned by writing tests. • Student must be able to explain whether answers are feasible.	

SUBJECT OUTCOME	
2.2 Do calculations using Ohms Law, the power and energy formulas, Joule's Law and the cost of electricity. *Range: Use typical values found in domestic houses*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The relationship between electric power and electric energy can be applied.	• Recall the definitions and units of measurement. • Understand case studies and calculate values. • Interpret the results.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Student must be able to explain whether answers are feasible.	

SUBJECT OUTCOME	
2.3 Explain the theory of magnetism and electromagnetism (magnetic poles, magnetic fields and field lines, flux, flux density, magnetic field around a current carrying conductor and the solenoid, m.m.f.(magneto motive force), magnetic field strength and force on a current carrying conductor	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The theory of magnetism and electromagnetism that has relevance to the electric field of study can be applied.	• Recall magnetic theory. • Explain and state the relation between flux and flux density. • Use the formula to calculate the force on a current carrying conductor in a magnetic field and apply Fleming's left hand rule. • Calculate the force of attraction or repulsion between two parallel current carrying conductors.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
2.4 Explain motor/generator theory (electromagnetic induction, Faraday and Lenz's Law)	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The theory of magnetism and electromagnetism that has relevance to motor/generator theory is understood.	• Recall definitions and theory of magnetism. • Apply Fleming's left hand rule. • Sketch a simple generator to illustrate the generation of electricity.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of level 2 Learning Outcomes for related topics. • Assess the student on the outcomes mentioned	

Topic 3: DC and AC Circuits

SUBJECT OUTCOME	
3.1 Explain the generation and distribution of D.C, A.C, single phase and 3-phase A.C supply systems, highlighting the advantages and disadvantages of the different systems. *Range: Calculations include P=VIcosϕ and the relationship between phase and line voltages* *Includes an introduction to power factor.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The theory behind electrical supply systems is understood and applied practically.	• Understand how electricity is generated in D.C. supply systems and A.C. supply systems. • Understand the waveforms and values of line and phase voltages. • Understand star and delta configurations and transformer connections in A.C. supply systems. • Understand the advantages of using high voltages for distribution networks and state the relative merits of A.C. and D.C. supply systems.
ASSESSMENT TASKS OR ACTIVITIES	
Theoretical assessment: • Assess the student on the achievement of the Learning Outcomes listed. **Practical assessment:** • Student does calculations on line and phase voltages, star and delta connected supplies and transformers.	

SUBJECT OUTCOME	
3.2 Do calculations for resistors in series, parallel and series-parallel *Range: Does not include a nested series circuit within a series-parallel circuit.* *Does not include a nested parallel circuit within a series-parallel circuit.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations for resistors in series, parallel and series-parallel are understood.	• Recall the formulas for total resistance, voltage, current and power. • Draw a circuit diagram from the given data, do the calculations and verify that the answers make sense by interpreting the results.
ASSESSMENT TASKS OR ACTIVITIES	
• Calculations become more advanced. **Level 2 example:** 4 cells, 1.5V and 0.4Ω each in series. A 6Ω and 8Ω resistor connected in parallel are connected to the battery. Calculate: a. Total emf of battery b. Total resistance of battery c. Total resistance of the 2 parallel resistors d. Total circuit resistance e. Current from the batteryy. **Level 3 example:** Show all steps to calculate the current from the battery in the above example. • Assess the student's retention of Level 2 Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.3 Understand the factors influencing the electrical resistance of materials and do calculations. *Range: Include two different materials connected in series or in parallel.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Factors influencing the electrical resistance of materials are understood and calculations can be done.	• Explain the formulae. • Do the calculations after interpreting the information supplied.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.4 Calculate current flow and use look-up tables to select wire and cable sizes	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations to determine wire sizes are understood.	• Understand the case studies. • Do the calculations and select the correct wire and cable sizes.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the students on the Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.5 Do calculations for capacitors in series, parallel and series-parallel *Range: Does not include a nested series circuit within a series-parallel circuit. Does not include a nested parallel circuit within a series-parallel circuit.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations for capacitors in series, parallel and series-parallel is understood	• Understand the concept 'capacitance' and the theory of connecting capacitors together. • Do the calculations.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the students on the Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.6 Do calculations for inductors in series, parallel and series-parallel *Range: Does not include a nested series circuit within a series-parallel circuit. Does not include a nested parallel circuit within a series-parallel circuit.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations for inductors in series, parallel and series-parallel is understood.	• Understand the concept 'Inductance' and the theory of connecting capacitors together. • Do the calculations.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the students on the Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.7 Do calculations with respect to grouping of cells (series, parallel and series-parallel), taking into account the cell resistance.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations for grouping of cells in series, parallel and series-parallel is understood.	• Understand the limitations and the theory of connecting cells together. • State the formulas to calculate terminal voltage and short circuit current. • Do typical calculations. • Interpret the results.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Assess the students on the Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

SUBJECT OUTCOME	
3.8 Do calculations to implement load balancing in a three-phase supplied system.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Calculations for load balancing in a three-phase supplied system is understood.	• Understand case studies. • Do calculations to split the loads. • Sketch end-result according to electrical drawing standards.
ASSESSMENT TASKS OR ACTIVITIES	
Practical experiment Student can analyse the three phase circuit, do the calculations, sketch the solution and re-wire the circuit	

SUBJECT OUTCOME	
3.9 Explain how transformers are constructed, their operating principle and do basic turns-ratio calculations. *Range: Includes 3-phase star-delta transformers.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Transformer construction and operating principle are understood	• Recall construction and operating principle theory. • Use the ideal transformer equation, phase and line voltage and current relations and total power formulae to do calculations.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Assess the students on the Learning Outcomes for this topic. • Student must understand case studies and calculate values.	

Topic 4: Protection and measuring instruments

SUBJECT OUTCOME	
4.1 Sketch and explain the fundamentals of measuring instrument design (analog meters) and how measuring instruments are inserted into circuits *Range: ammeter and voltmeter (with/without shunt and multiplier resistors and current and potential transformers), wattmeter (single and 3-phase connections), frequency meter, megger and tong tester*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The fundamentals of measuring instrument design are understood.	• Illustrate with the aid of sketches how instruments work. • Illustrate with the aid of sketches how instruments are adapted to read a wide range of values. • Illustrate with the aid of sketches how 3-phase measurements are made.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of level 2 Learning Outcomes for this topic. • Assess the students on the Learning Outcomes for this topic. • Continuously assess the students on the Learning Outcomes for this topic by doing practical exercises and by sourcing information from lecturers of other subjects.	

SUBJECT OUTCOME	
4.2 Use and care for hand-held electrical test instruments *Range: tong-tester, ammeter, voltmeter, multimeter and megger*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Hand-held electrical test instruments are used and cared for.	• Set the instrument for use. • Select and read scaled readings off analogue and digital instruments. • Insert instruments correctly into circuits. • State how to care for the instrument. • Correctly store the instrument.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Assess the students on the Learning Outcomes for this topic by writing tests. • Continuously assess the students on the Learning Outcomes for this topic by doing practical exercises and by sourcing information from lecturers of other subjects.	

Topic 5: Circuit diagrams and Electric Machines

SUBJECT OUTCOME	
5.1 Draw circuit diagrams of star/delta connected transformers and how the windings are connected to form a star or delta system.	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Circuit diagrams of star/delta connected transformers are understood.	• Understand the case study. • Sketch the connection diagram.
ASSESSMENT TASKS OR ACTIVITIES	
Student supplied with a three phase supply point and transformer with tap/connection change facilities.	

SUBJECT OUTCOME	
5.2 Draw circuit diagrams of electrical sub-circuits *Range: Includes but not limited to a luminair circuit supplied from one circuit breaker, two or more luminairs supplied from one circuit breaker, two or more socket outlets supplied from one circuit breaker, a geyser circuit including isolator and ripple relay, a stove circuit including isolator(both single and 3-phase connection)*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Basic circuit diagrams of electrical sub-circuits are understood.	• Understand the requirements. • Circuit diagrams must conform to standard practice (international standards). • Draw up a parts list from the circuit diagram that includes component ratings.
ASSESSMENT TASKS OR ACTIVITIES	
• Assess the student's retention of Level 2 Learning Outcomes for this topic. • Assess the students on the Learning Outcomes for this topic. • Student's Parts List must be specific enough to use it as a stock list or as an order list (request for purchase list).	

SUBJECT OUTCOME	
5.3 Discuss how to identify, electrically connect and disconnect, and carry out detailed inspection on electric machines. *Range: Includes but not limited to;* *D.C motor and generator, universal motor, squirrel cage motor, single and 3-phase machines* *Does not include installation.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Students can identify, connect and inspect small electric machines.	• Machines smaller than 10kW are identified correctly. • Typical connection diagrams are reproduced. • List inspection points. • Electrically connect the machine.
ASSESSMENT TASKS OR ACTIVITIES	
Student supplied with; • A three phase supply point • A single phase supply point • A DC supply point • Electric machines • Starting circuit components for electric motors • Test and measuring equipment, tools and electrical components as determined by the student	

4 SPECIFICATION FOR EXTERNAL ASSESSMENT IN ELECTRICAL PRINCIPLES AND PRACTICE – 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 integrated summative assessment task (ISAT) draws on the students' cumulative learning achieved throughout the year. The task requires **integrated application of competence** and is executed and recorded in compliance with assessment conditions.

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

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

OR

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

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

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

4.2 National Examination

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

LEVEL 3	**KNOWLEDGE AND COMPREHENSION**	**APPLICATION**	**ANALYSIS, SYNTHESIS AND EVALUATION**
	50 - 60%	30 -40%	0 - 10%