



higher education
& training

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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRONIC CONTROL AND DIGITAL ELECTRONICS

NQF LEVEL 2

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ELECTRONIC CONTROL AND DIGITAL ELECTRONICS– LEVEL 2

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SECTION A: PURPOSE OF THE ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for the subject *Electronic Control and Digital Electronics Level 2* in the National Certificates (Vocational). It must be read with the *National Policy Regarding Further Education and Training Programmes: Approval of the Documents, Policy for the National Certificates (Vocational) Qualifications at Levels 2 to 4 on the National Qualifications Framework (NQF)*. This assessment guideline will be used for National Qualifications Framework Levels 2-4.

This document explains the requirements for the internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines* to prepare for and deliver *Electronic Control and Digital Electronics Level 2*. Lecturers should use a variety of resources and apply a range of assessment skills in the setting, marking and recording of assessment tasks.

SECTION B: ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

1 ASSESSMENT IN THE NATIONAL CERTIFICATES (VOCATIONAL)

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

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

The principles that drive these objectives are:

- **Integration**

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

- **Relevance**

To be dynamic and responsive to national development needs.

- **Credibility**

To demonstrate recognition of competencies and skills acquired, national and international added value and recognition of the acquired qualification

- **Coherence**

To work within a consistent framework of principles and certification.

- **Flexibility**

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

- **Participation**

To enable stakeholders to participate in the setting of standards and the co-ordination of the achievements required for the qualification.

- **Access**

To address barriers to learning experienced on different levels and to facilitate the students' progress.

- **Progression**

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

- **Portability**

To enable students to transfer credits obtained within a qualification from one learning institution and/or employer to another institution or employer.

- **Articulation**

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

- **Recognition of Prior Learning**

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

- **Validity of assessments**

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

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

Topics should be assessed individually and then cumulatively with other topics. There should be a final summative internal assessment prior to the external assessment.

- **Reliability**

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

- Cumulative and summative assessments must be weighted more than single topic tests for the internal mark.
- There should be at least one standardised or norm test in each term
- All standardised or norm tests must be moderated by a subject specialist.

- **Fairness and transparency**

To verify that assessment processes and/or method(s) used neither hinders nor unfairly advantage any student. The following could constitute unfairness in assessment:

- Inequality of opportunities, resources or teaching and learning approaches
- Bias based on ethnicity, race, gender, age, disability or social class
- Lack of clarity regarding Learning Outcome being assessed

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

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

- **Practicability and cost-effectiveness**

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

2 ASSESSMENT FRAMEWORK FOR VOCATIONAL QUALIFICATIONS

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

2.1 Internal continuous assessment (ICASS)

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

2.2 External summative assessment (ESASS)

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

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

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

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

3 MODERATION OF ASSESSMENT

3.1 Internal moderation

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

3.2 External moderation

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

The external moderator:

- monitors and evaluates the standard of all summative assessments;
- maintains standards by exercising appropriate influence and control over assessors;
- ensures proper procedures are followed;
- ensures summative integrated assessments are correctly administered;
- observes a minimum sample of ten (10) to twenty-five (25) percent of summative assessments;
- gives written feedback to the relevant quality 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 their maximum potential.

4 PERIOD OF VALIDITY OF INTERNAL CONTINUOUS ASSESSMENT (ICASS)

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

The ICASS must be re-submitted with each examination enrolment for which it constitutes a component.

5 ASSESSOR REQUIREMENTS

Assessors must be subject specialists and a competent assessor.

6 TYPES OF ASSESSMENT

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

6.1 Baseline assessment

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

6.2 Diagnostic assessment

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

6.3 Formative assessment

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

6.4 Summative assessment

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

7 PLANNING ASSESSMENT

An assessment plan should cover three main processes:

7.1 Collecting evidence

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

7.2 Recording

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

7.3 Reporting

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

8 METHODS OF ASSESSMENT

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

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

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

All evidence collected for assessment purposes is kept or recorded in the student's Portfolio of Evidence (PoE).

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

	METHODS FOR COLLECTING EVIDENCE		
	Observation-based (Less structured)	Task-based (Structured)	Test-based (More structured)
Assessment instruments	<ul style="list-style-type: none"> • Observation, • Class questions, • Lecturer, student, parent discussions. 	<ul style="list-style-type: none"> • Assignments or tasks, • Projects, • Investigations or research, • Case studies, • Practical exercises, • Demonstrations, • Role-play, • Interviews. 	<ul style="list-style-type: none"> • Examinations, • Class tests, • Practical, examinations, • Oral tests, • Open-book tests.
Assessment tools	<ul style="list-style-type: none"> • Observation sheets, • Lecturer's notes, • Comments. 	<ul style="list-style-type: none"> • Checklists, • Rating scales, • Rubrics. 	<ul style="list-style-type: none"> • Marks (e.g. %), • Rating scales (1-7).
Evidence	<ul style="list-style-type: none"> • Focus on individual students, • Subjective evidence based on lecturer observations and impressions. 	<p>Open middle: Students produce the same evidence but in different ways.</p> <p>Open end: 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. They consist of short statements describing the expected performance in a particular task. The statements on the checklist can be ticked off when the student has adequately achieved the criterion. Checklists and task lists are useful in peer or group assessment activities.

Rubrics are a hierarchy (graded levels) of criteria with benchmarks that describe the minimum level of acceptable performance or achievement for each criterion. It is a different way of assessment and cannot be compared to tests. Each criterion

described in the rubric must be assessed separately. Mainly, two types of rubrics, namely holistic and analytical, are used.

11 SELECTING AND/OR DESIGNING RECORDING AND REPORTING SYSTEMS

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

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

12 COMPETENCE DESCRIPTIONS

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

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

13 STRATEGIES FOR COLLECTING EVIDENCE

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

13.1 Record sheets

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

13.2 Checklists

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

**ASSESSMENT IN ELECTRONIC CONTROL AND DIGITAL
ELECTRONICS
LEVEL 2**

SECTION C: ASSESSMENT IN ELECTRONIC CONTROL AND DIGITAL ELECTRONICS LEVEL 2

1 ASSESSMENT SCHEDULE AND REQUIREMENTS

Internal and external assessments are conducted and the results of both are contributing to the final mark of a student in the subject

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

1.1 Internal assessment

Lecturers must compile a detailed assessment plan and assessment schedule of internal assessments to be undertaken during the year in the subject. (e.g. date, assessment task/or activity, rating code/marks allocated, assessor, moderator.)

All internal assessments are then conducted according to the plan and schedule using appropriate assessment instruments and tools for each assessment task (e.g. tests, assignments, practical tasks/projects and memorandum, rubric, checklist)

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

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

The following internal assessment units **GUIDE** the internal assessment of Electronic Control and Digital Electronics Level 2

TASKS	Time-frame	Type of assessment activity	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*	<i>As per external examinations</i> (P1 & P2 where applicable)	Topics completed to date (P1 =15 & P2=15, where applicable)	30
TOTAL					100

Specifications for internal assessment may change over time. A separate internal assessment guideline document '**Guidelines for the Implementation of Internal Continuous Assessment (ICASS) in the NC(V) qualifications at FET Colleges**' is developed, updated and distributed by the Department.. The conduct and administration of internal assessments must always comply with specifications contained in the most current version of the guideline document.

2 RECORDING AND REPORTING

Electronic Control and Digital Electronics 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/scheduled assessment should be recorded in the Lecturer's Portfolio of Assessment (PoA) for each subject. The minimum requirements for the **Lecturer's Portfolio of Assessment** should be as follows:

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

The college could standardise these documents.

The minimum requirements for the **student's Portfolio of Evidence (PoE)** should be as follows:

- Student information/identification
- Declaration of authenticity form – duly completed (signed and dated)
- A contents page/list of content (for accessibility)
- A subject assessment schedule
- The evidence of marked assessment tasks and feedback according to the assessment schedule
- A record/summary/ of results showing all the marks achieved per assessment for the subject
- Evidence of moderation (only where applicable for student's whose tasks were moderated)
- Where tasks cannot be contained as evidence in the Portfolio of Evidence (PoE), its exact location must be recorded and it must be readily available for moderation purposes.

3 INTERNAL ASSESSMENT OF SUBJECT OUTCOMES IN ELECTRONIC CONTROL AND DIGITAL ELECTRONICS– LEVEL 2

Topic 1: Components and Circuit Drawings

SUBJECT OUTCOME	
1.1: Explain the concept of basic atomic theory	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The structure of an atom is explained with the aid of a sketch. • Atomic number and atomic mass are defined. • The distribution of electrons in an atom is explained. • The following concepts of atomic theory are explained: '<i>Valence electron, ionize atoms, energy levels, free electrons, conductors, semiconductors and insulators</i>'. • Methods of bonding in an atom are explained. <i>Range: Ionic, Covalent and Metallic bond.</i> 	<ul style="list-style-type: none"> • Explain with the aid of a sketch the structure of an atom. • Define atomic number and atomic mass. • Explain how electrons are distributed in an atom. • Explain the following concepts of atomic theory: '<i>Valence electron, ionize atoms, energy levels, free electrons, conductors, semiconductors and insulators</i>'. • Explain the methods of bonding in an atom. <i>Range: Ionic, Covalent and Metallic bond.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Components of atoms are sketched. • Written tests on the learning outcomes 	

SUBJECT OUTCOME
<p>1.2: Identify, rate and explain the function of basic electronic components. <i>Range: Resistors, potentiometers, capacitors (polarised and non-polarised), inductors, relays, transformers.</i></p>

ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The components in the range are recognised. The components are rated and classified in the range according to their physical sizes and function. The basic functions and operation of the components in the range are described. 	<ul style="list-style-type: none"> Recognise the components in the range. Indicate the rating of the components in the range according to their physical sizes. Classify the components in the range according to their functions. Describe the basic functions and operation of the components in the range.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Components provided in the range are recognised from physical examples and written examples. 	

SUBJECT OUTCOME	
1.3: Explain semiconductors	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The properties of semiconductors are stated. Intrinsic and Extrinsic semiconductors are distinguished. N-type and P-type semiconductor are explained using the atomic structure. The meaning of majority and minority charge carriers is explained. 	<ul style="list-style-type: none"> Describe the properties of semiconductors. Distinguish between Intrinsic and Extrinsic semiconductors. Explain N-type and P-type semiconductor using the atomic structure. Explain the meaning of majority and minority charge carriers.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Different types of semiconductors are used to explain the atomic structures with written examples 	

SUBJECT OUTCOME	
1.4: Explain the formation of P-type and N-type Junctions (PN junction)	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The formation of the depletion layer in a PN junction is explained. The voltage applied across a PN junction is explained. <i>Range: Forward and reverse bias.</i> The limitation in the operating conditions of PN junction is explained. <i>Range: Maximum forward current, peak inverse voltage and maximum power rating.</i> 	<ul style="list-style-type: none"> Explain the formation of the depletion layer in a PN junction. Explain how voltage is applied across a PN junction. <i>Range: Forward and reverse bias.</i> Explain the limitation in the operating conditions of PN junction. <i>Range: Maximum forward current, peak inverse voltage and maximum power rating.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> The use of P-type and N-type Junctions (PN junction) and their limitations are explained 	

SUBJECT OUTCOME	
1.5: Outline different types of diodes	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The characteristic curve of a typical diode is drawn. The basic operation of diodes (Zener and Light Emitting Diode) is explained. The functions and application of diodes are described. The components are rated by means of physical markings on them. Diode specification sheets are used. The operation of a half-wave and full-wave rectifier circuit including filter circuits is explained. 	<ul style="list-style-type: none"> Draw the characteristic curve of a typical diode. Explain the basic operation of diodes (Zener and Light Emitting Diode). Describe the functions and applications of diodes. Indicate the rating of the components by means of physical marking on them. Use diode specification sheets. Explain the operation of a half-wave and full-wave rectifier circuits including filter circuits.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Assessments on the operation and use of diodes and their components Different type of diodes are drawn Diode specification sheets are used 	

SUBJECT OUTCOME	
1.6: Explain Bipolar Junction transistors	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The basic structure and operation of bipolar junction transistors are described. The current of a bipolar junction transistor is calculated. <i>Range: $I_E = I_B + I_C$</i> The circuit configurations of bipolar junction transistor are understood. <i>Range: Common- Base (CB), Common-Emitter (CE) and Common-Collector (CC).</i> The rating of components is recognised according to the physical markings on them. Bipolar junction transistor specification sheets are used. A description is provided on the operation of a bipolar junction transistor as an amplifier. 	<ul style="list-style-type: none"> Describe the basic structure and operation of bipolar junction transistors. Calculate the current of a bipolar junction transistor. <i>Range: $I_E = I_B + I_C$</i> Explain the circuit configuration of bipolar junction transistor. <i>Range: Common- Base (CB), Common-Emitter (CE) and Common-Collector (CC).</i> Recognise the rating of the components by means of the physical markings on them. Use bipolar junction transistor specification sheets. Describe the operation of a bipolar junction transistor as an amplifier
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Students are given a variety of bipolar junction transistor as amplifiers Specification sheets are used. 	

SUBJECT OUTCOME	
1.7: Describe integrated circuits	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Integrated circuits are explained 	<ul style="list-style-type: none"> Explain what is integrated circuits

<ul style="list-style-type: none"> Advantages and disadvantages of integrated circuits are listed. Integrated circuits are classified according to their function. <i>Range: Linear and Digital</i> The basic functions and operation of the circuit components are described. <i>Range: Voltage regulators and op-amps.</i> 	<ul style="list-style-type: none"> List the advantages and disadvantages of integrated circuits. Classify Integrated circuits according to their function. <i>Range: Linear and Digital.</i> Describe the basic functions and operation of the circuit components. <i>Range: Voltage regulators and op-amps.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Assessment on integrated circuits according to their classification, functions and operation. Results of circuits in series and parallel are calculated, built on breadboards and measured using the appropriate meters. 	

SUBJECT OUTCOME	
1.8: Read and draw symbols of electronic components (elementary circuit drawings). <i>Range: Resistors and potentiometers, capacitors (polarised and non-polarised), inductors, relays, transformers, diodes (rectifier, high speed, zener light emitting), bi-junction transistors and integrated circuits (regulators, analogue op-amps)</i>	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The symbols of the components in the range are recognised and sketched. Elementary circuits are interpreted. Elementary circuits are drawn and labelled. 	<ul style="list-style-type: none"> List the symbols of the components in the range. Sketch the symbols of the components in the range. Interpret elementary circuits Sketch and label elementary circuits.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> The symbols are recognised from sketched examples and drawn on paper or appropriate medium. 	

SUBJECT OUTCOME	
1.9: Test electronic components.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Resistors, capacitors, inductors, diodes and transistors are tested for value and operation using appropriate equipment. Diodes and bi-junction transistors are tested with a diode tester or an ohmmeter A technical manual is used to look up semi-conductor components. 	<ul style="list-style-type: none"> Test resistors, capacitors, inductors and transformers using appropriate test equipment. Test diodes and bi-junction transistors with a diode tester or an ohmmeter (digital or analogue). Look up for semi-conductor components in a technical manual.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Testing is done practically using appropriate meters and results are recorded. The operation of referencing components is practically demonstrated. Components are tested for faults. 	

SUBJECT OUTCOME	
1.10: Use basic electronic tools and measuring equipment.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> The layout of a breadboard is explained using an ohmmeter or continuity tester. The use of a Voltmeter, Ammeter and Ohmmeter is demonstrated. Basic electronic tools are used. 	<ul style="list-style-type: none"> Explain the layout of a breadboard using an ohmmeter or continuity tester. Demonstrate the use of a Voltmeter, Ammeter and Ohmmeter. Use basic electronic tools
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Use an ohmmeter on its lowest scale or continuity tester to demonstrate how a breadboard is connected internally. Use basic electronic tools. Use a voltmeter to measure voltage over a power supply. Use an ammeter to measure current flowing through a load. 	

SUBJECT OUTCOME	
1.11: Apply safety precautions and procedures when replacing components.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Correct safety procedures are followed when soldering and de-soldering on a PC board and on a Vero board. The manual dexterity needed to remove and replace a variety of components on a PC board is demonstrated. Safety precautions are taken when handling electrostatic sensitive devices. <i>Range: Safety precautions for the work-area, receipt and storage of components, PCB assembly and testing.</i> 	<ul style="list-style-type: none"> Adhere to safety precautions and procedures when soldering and de-soldering on a PC board and on a Vero board. Demonstrate the manual dexterity needed to remove and replace a variety of components on a PC board. Explain the dangers of electrostatic charges. Adhere to safety precautions when handling electrostatic sensitive devices. <i>Range: Safety precautions for the work-area, receipt and storage of components, PCB assembly and testing.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Practical tasks demonstrating safe removal and replacement of a variety of components on a PC board. 	

SUBJECT OUTCOME	
1.12: Construct simple circuits on breadboards.	
<i>Range: Resistors, capacitors, inductors, LED's, buzzer and transistors.</i>	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> Arrangements of series and parallel circuits of components in the range are calculated, built and measured. The ability to mount, wire and connect components is demonstrated. 	<ul style="list-style-type: none"> Build series and parallel circuits on breadboards. Calculate the outcomes of the built circuits and verify the outcomes using the appropriate meters. Mount components to a breadboard and connect to a circuit.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> Results of circuits in series and parallel are calculated, built on breadboards and measured using the appropriate meters. 	

- Students builds simple circuits
Range but not limited to: Connecting of LED's in a circuit and calculating series resistor required, connecting a buzzer in a circuit, connecting transistors in circuits.

Topic 2: Digital Electronics

SUBJECT OUTCOME	
2.1: Explain basic digital concepts	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Analogue and digital signals are distinguished. • The advantages of digital systems over analogue systems are listed. • Voltage level used to represent bits are explained and interpreted by a digital circuit. • The concepts of positive and negative logic in terms of voltage levels are explained. • Positive and negative going pulse is described. • Clock and timing diagrams are used to explain how a digital waveform carries binary information. 	<ul style="list-style-type: none"> • Distinguish between analogue and digital signals. • List the advantages of the digital systems over the analogue systems. • Explain how voltage levels are used to represent bits. • Explain how voltage levels are interpreted by a digital circuit. • Explain the concepts of positive and negative logic in terms voltage levels. • Describe the general characteristic of a pulse. <i>Range: Positive and negative going pulse.</i> • Explain how a digital waveform carries binary information. <i>Range: Clock and timing diagrams.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • The voltage level used to represent bits is interpreted by digital circuit. • Negative and positive pulse are described • Difference between analogue and digital signals as well as advantages of one over the other are discussed. 	

SUBJECT OUTCOME	
2.2: Explain number systems	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Conversions are done between the binary and decimal systems. <i>Range: Whole numbers only (no fractions); calculations restricted to addition and subtraction only.</i> • The binary number is converted to its 1's and 2's complement. • The ability to count in the binary system is demonstrated. • A parity bit is used to detect error. 	<ul style="list-style-type: none"> • Convert from binary systems to decimal systems and vice versa by means of calculations. <i>Range: Whole numbers only (no fractions); calculations restricted to addition and subtraction only.</i> • Convert a binary number to its 1's and 2's complement. • Demonstrate the ability to count in the binary system. • Use a parity bit to detect error.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Conversions between binary and decimal systems and vice versa are done in writing without the use of a calculator. 	

- An ability to count up or down in binary to a minimum of four bits is demonstrated in writing.

SUBJECT OUTCOME	
2.3: Explain and use logic gates	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The operation of the logic gates and respective truth tables are described. • IEC symbols are correctly used to represent logic gates. • Each logic gate is used in a simple application. • Basic data sheet information is interpreted. <i>Range: AND, OR, NOT, NAND, NOR, XOR and XNOR.</i> 	<ul style="list-style-type: none"> • Describe the operation of logic gates and respective truth tables. • Correctly use IEC symbols to represent logic gates. • Use each logic gate in a simple application. • Interpret basic data sheet information. <i>Range: AND, OR, NOT, NAND, NOR, XOR and XNOR.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Student builds logic gates and record truth table. • Given a logic gate student must be able to identify by using data sheets. 	

SUBJECT OUTCOME	
2.4: Explain flip-flops and their truth table	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Logic gates are used to construct flip-flops. • Working circuits are built using flip-flops to construct their truth tables. • The application of flip-flops for data storage is described. • IEC symbols are correctly used to represent flip-flops. <i>Range: (RS, RS master slave flip-flops and D, T and JK) type simulated by using RS flip-flops.</i> 	<ul style="list-style-type: none"> • Use logic gates to construct flip-flops. • Build working circuits using flip-flops to construct their truth tables. • Describe the application of flip-flops for data storage • Correctly use IEC symbols to represent flip-flops. <i>Range: (RS, RS master slave flip-flops and D, T and JK) type simulated by using RS flip-flops.</i>
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Circuits in the range are built on a breadboard. Resultant truth is written on paper or appropriate medium. • Up/down counters are physically built on breadboards using flip-flops. 	

Topic 3: Basic Computer Components

SUBJECT OUTCOME	
3.1: Explain the functions of the basic components that make up a personal computer.	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • The hardware, software and firmware of a personal computer are identified. • The components in a personal computer are recognised and their functions explained. 	<ul style="list-style-type: none"> • Identify the hardware, software and firmware of a personal computer. • Name and describe the components in a personal computer

<p><i>Range: Power supply and connections, motherboard and connections, CPU, RAM, ROM, secondary memories (hard disk, CD, DVD and flash memory), peripherals (monitor, keyboard, mouse, printer, fax, scanner) and ports (PS/2, VGA, RG-45, USB)</i></p> <ul style="list-style-type: none"> • Volatile and non volatile memories are distinguished. <p><i>Range: Hard disk, CD, DVD and flash memory</i></p> <ul style="list-style-type: none"> • The storage of the binary levels in the peripheral memory devices is explained. 	<p><i>Range: Power supply, motherboard and connections, CPU, RAM, ROM, secondary memories (hard disk, CD, DVD and flash memory), peripherals (monitor, keyboard, mouse, printer/fax/scanner) and ports (PS/2, VGA, RG-45, USB).</i></p> <ul style="list-style-type: none"> • Distinguish between volatile and non-volatile memories. <p><i>Range: Hard disk, CD, DVD and flash memory.</i></p> <ul style="list-style-type: none"> • Explain how the binary levels are stored in the peripheral memory devices.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Hardware, software and firmware of a personal computer are correctly identified and explained. • Components are identified and their functions are explained. • Volatile and non-volatile memories and the physical way binary levels are stored in the memory devices in the range is explained. 	

Topic 4: Transducers Used In Process Control

SUBJECT OUTCOME	
4.1: Explain Transducers.	
<p><i>Range:</i> <i>Level- Sight glass, float (ball and chain), probes (conductive, capacitive and ultrasonic)</i> <i>Pressure – Manometers, pressure gauges (diaphragm, bellows and bourdon tubes)</i> <i>Temperature- Thermometer, bimetallic strip, thermistors and thermocouples</i> <i>Flow – flow meters</i> <i>Light – Photovoltaic, photoconductive, photoemission, semiconductors (photodiodes and phototransistors)</i></p>	
ASSESSMENT STANDARDS	LEARNING OUTCOMES
<ul style="list-style-type: none"> • Simple non-electrical examples of instruments used to measure the physical conditions in the range are named and the limitations of these instruments are explained. • Examples of transducers that will sense the physical conditions provided in the range are listed. • Transducers are classified according to their functions, constructions and basic operations. 	<ul style="list-style-type: none"> • Name simple non-electrical examples of instruments that measure the physical conditions in the range. • Explain the limitations of using the instruments named as sensors and transducers. • List examples of transducers that sense the physical conditions in the range. • Classify the listed transducers according to their functions. • Describe the function of the listed transducers. • Describe the construction and basic operation of the listed transducers.
ASSESSMENT ACTIVITIES	
<ul style="list-style-type: none"> • Examples of non-electrical instruments that react to variables provided in the range are listed and their limitations are explained. 	

- Examples of transducers that react to conditions in the range are named, recognised, classified and described in terms of their functions, construction, and operation.

4 SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN SUBJECT ELECTRONIC CONTROL AND DIGITAL ELECTRONICS– LEVEL 2

4.1 Integrated summative assessment task (ISAT)

A compulsory component of the external assessment (ESASS) is the **integrated summative assessment task (ISAT)**. The ISAT draws on the students' cumulative learning achieved throughout the year. The task requires **integrated application of competence** and is executed and recorded in compliance with assessment conditions.

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

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

OR

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

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

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

4.2 National Examination

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

LEVEL 2	KNOWLEDGE	COMPREHENSION AND APPLICATION	ANALYSIS, SYNTHESIS AND EVALUATION
	50-60% %	30-40%	0-10%