higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATES (VOCATIONAL)

ASSESSMENT GUIDELINES

ELECTRONIC CONTROL AND DIGITAL ELECTRONICS

NQF LEVEL 4

IMPLEMENTATION: JANUARY 2015

ELECTRONIC CONTROL AND DIGITAL ELECTRONICS – LEVEL 4

CONTENTS

SECTION A: PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides the lecturer with guidelines to develop and implement a coherent, integrated assessment system for the subject *Electronic Control and Digital Electronics 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 the internal and external subject assessment. The lecturer must use this document with the *Subject Guidelines: Electronic Control and Digital Electronics Level 4* to prepare for and deliver Electronic Control and Digital Electronics. 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 in order to facilitate students' progress.

- ***Progression***

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

- ***Portability***

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

- ***Articulation***

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

- ***Recognition of Prior Learning***

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

- ***Validity of assessments***

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

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

- ***Reliability***

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

- ***Fairness and transparency***

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

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

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

To integrate assessment practices within an outcomes-based education and training system and 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-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 assuror; and
- moderates in case of a dispute between an assessor and a student.

Policy on inclusive education requires that assessment procedures be customised for students who experience barriers to learning, 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 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.

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

9 INSTRUMENTS AND TOOLS FOR COLLECTING EVIDENCE

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

The following table summarises 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 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 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.

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SECTION C: ASSESSMENT IN ELECTRONIC CONTROL AND DIGITAL ELECTRONICS

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 *Electronic Control and Digital Electronics Level 4*:

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

TASKS	Time-frame	Type of assessment activity	Minimum time and proposed mark allocation *(can be increased but not reduced)	Scope of assessment Do not confuse the weightings of topics in the Subject Guidelines with the % contribution to the year mark	% contribution to the year mark
5	Term 3	Internal Examination*	*As per external examinations* (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'* 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

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 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 ELECTRONIC CONTROL AND DIGITAL ELECTRONICS - LEVEL 4

Topic 1: Alternating current theory

SUBJECT OUTCOME	
1.1 Explain RC circuits *Range: Series and parallel*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The relationship between current and voltage in an RC circuit is described	• Describe the relationship between current and voltage in an RC circuit
• The impedance and phase angle in an RC circuit is determined	• Determine the impedance and phase angle (ø) in an RC circuit
• The frequency selectivity characteristic of RC series circuit (low and high pass circuit) is explained	• Explain the frequency selectivity characteristic of RC series circuit (low and high pass circuit)
• The effect of faulty components in RC circuits is explained	• Explain the effect of faulty components in RC circuits

ASSESSMENT TASKS OR ACTIVITIES
• Written tests on learning outcomes • Calculate impedance, reactance, voltage, current, phase angle and draw a phasor diagram for the circuit. • Calculate the cut-off frequency and bandwidth of a RC series circuit • Compare voltage and current waveforms • Explain the effect on current and voltage when frequency is changed in a series circuit • Practical examination of the behaviour of series and parallel circuits • Show how impedance and phase angle vary with frequency in a parallel circuit • Build an RC circuit and demonstrate the effect of faulty components

SUBJECT OUTCOME	
1.2 Explain RL circuits *Range: Series and parallel*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The relationship between current and voltage in an RL circuit is described	• Describe the relationship between current and voltage in an RL circuit
• The impedance and phase angle in an RL circuit is calculated	• Determine the impedance and phase angle in an RL circuit
• The frequency selectivity characteristic of RL series circuit (low and high pass circuit) is explained	• Explain the frequency selectivity characteristic of RL series circuit (low and high pass circuit)
• The effect of faulty components in RL circuits is explained	• Explain the effect of faulty components in RL circuits
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Compare voltage and current waveforms • Explain the effect on current and voltage when frequency is changed in a series circuit • Determine impedance, reactance, voltage, current, phase angle and draw phasor diagram and impedance triangle of the circuit • Calculate the cutoff frequency and bandwidth of a RL series circuit • Build up a RL circuit and demonstrate the effect of faulty components • Practical examination of the behaviour of series and parallel circuits	

SUBJECT OUTCOME	
1.3 Explain RLC circuits and resonance *Range: Series and parallel*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• RLC circuits are analysed	• Analyse an RLC circuits
• The impedance and phase angle in series and parallel RLC circuits are calculated	• Determine the impedance and phase angle in an RLC circuit – series / parallel
• Resonance in the circuit is analysed	• Analyse the circuit for resonance
• The operation of resonant filters is analysed	• Analyse the operation of resonant filters
• Practical applications for resonant circuits are listed	• List practical applications for resonant circuits
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes Students perform the following: • Determine current, voltage, impedance, phase angle, and draw phasor diagrams for an RLC circuit • Determine the resonant frequency • Calculate current, voltage and impedance for series resonance • Determine bandwidth and half-power frequency for series resonant band pass filters • Calculate the quality factor (Q) of a resonant circuit and its effects on bandwith • Calculate current and phase angle at parallel resonance • Determine the resonant frequency, bandwidth and output voltage of band pass parallel resonant filters • Practical examination of the behaviour of series and parallel circuits • Practical examination of measuring series and parallel resonant frequency	

Topic 2: Fundamental of electronics

SUBJECT OUTCOME	
2.1 Explain sinusoidal oscillators	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• An amplifier is compared to an oscillator	• Compare an amplifier to an oscillator
• The difference between damped and undamped oscillations is explained with sketches	• Explain the difference between damped and undamped oscillations
• Oscillation in an LC circuit is explained and oscillation frequency calculated	• Explain how oscillations are produced in an LC circuit and calculate oscillation frequency

• Factors that affect the oscillation frequency is listed	• List the factors that affect the oscillation frequency
• The operation of oscillator circuits is described and oscillation frequency is calculated *Range: Phase shift, Colpitts, Hartley and Wein bridge oscillator*	• Describe the operation of oscillator circuits and calculate frequency of oscillation
• The operation of a crystal oscillator circuit is described with the aid of a sketch	• Sketch and describe the operation of a crystal oscillator circuit.
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Practical demonstration of resonance in an LC circuit	

SUBJECT OUTCOME	
2.2 Explain non-sinusoidal oscillators	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The difference between sinusoidal and non-sinusoidal oscillators is explained	• Explain the difference between sinusoidal and non-sinusoidal oscillators
• The operation of transistor multivibrators is described and their applications are listed *Range: astable, bistable and monostable multivibrator*	• Describe the operation of transistor multivibrators • List applications of multivibrators
• The operation of a 555 timer in astable and monostable mode circuits is explained	• Explain the circuit operation of a 555 timer in astable and monostable mode
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Students make use of data sheets for a 555 timer	

SUBJECT OUTCOME	
2.3 Explain power supplies	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The uses, applications and functioning of an inverting power supply and a switch mode power supply are described with the aid of a block diagram	• Describe the uses, applications and functioning of an inverting power supply with the aid of a block diagram • Describe the uses, applications and functioning of a switch mode power supply with the aid of a block diagram

ASSESSMENT TASKS OR ACTIVITIES
• Written tests on learning outcomes • Students are shown Inverting and switch mode power supplies and must identify the various components verbally or in writing with reference to block and circuit diagrams

SUBJECT OUTCOME	
2.4 Explain bipolar junction transistor (BJT) biasing and amplifiers	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The various operating points within the limits of operation of a transistor are explained	• Explain the various operating points within the limits of operation of a transistor
• The DC load line of a common emitter amplifier is analysed	• Analyse the DC load line of a common emitter amplifier
• The factors that affect the stability of the Q point is listed	• List the factors that affect the stability of the Q point
• The different coupling methods used in amplifiers are explained and the respective advantages, disadvantages and applications are listed *Range: Resistance-capacitance, transformer and direct coupling*	• Explain the different coupling methods used in amplifiers. • List the advantages, disadvantages and applications of the different coupling methods used in amplifiers
• The operation and characteristics of class A, B and C amplifiers are described	• Describe the operation and characteristics of class A, B and C amplifiers
• The operation of a class B push-pull amplifier is explained and advantages listed	• Explain the operation and list the advantages of a class B push-pull amplifier
• The difference between positive and negative feedback amplifiers is explained and the different types of feedback connections are compared and explained *Range: Voltage-series, voltage-shunt, current-series and current-shunt feedback connection*	• Distinguish between positive and negative feedback amplifiers • Explain and compare the different types of feedback connections
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Explain active, cut-off and saturation region • Calculate the value of the saturation current and cut off voltage for a transistor circuit; plot the DC load line and locate the Q point • A load line is given and the required values of V_{cc}, R_c and R_B are calculated for a fixed-bias configuration	

SUBJECT OUTCOME	
2.5 Explain silicon control rectifier (SCR)	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The operation of the silicon controlled rectifier (SCR) and its ON and OFF triggering are explained	• Explain the operation of the silicon controlled rectifier (SCR) • Explain how SCRs are triggered ON and OFF
• The characteristic curve of an SCR and its ratings are explained	• Explain the characteristic curve of a SCR and its ratings
• The applications of the SCR are listed	• List the applications of the SCR
• The operation of a phase control circuit is explained with the aid of a circuit diagram and waveforms	• Explain with the aid of a circuit diagram, input and output waveforms the operation of a phase control circuit
• The operation of Triac is explained and its applications listed	• Explain how a Triac operates • List the applications of Triac
• The difference between SCR and Triac are listed	• The difference between the SCR and Triac are listed
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Identify the terminals of SCR and Triac and use specification sheets • Discuss and demonstrate an example of a battery charger using an SCR	

Topic 3: Basic design procedures

SUBJECT OUTCOME	
3.1 Demonstrate the ability to read and interpret semi-conductor manuals	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Semi-conductor technical manuals are used to find operational limits and replacement parts and other data for semi-conductor devices is interpreted	• Show how to find any semi-conductor's operational limits by using technical manuals • Interpret the data found in technical manuals • Show how to look up replacement parts in technical manuals
ASSESSMENT TASKS OR ACTIVITIES	
• Demonstrations are given of the ability to extract information from a semi-conductor manual • Students are given a circuit diagram and must compile a parts list for components including alternative numbers	

SUBJECT OUTCOME	
3.2 Demonstrate an understanding of the design, construction, testing, fault-finding and repair of basic electronic circuits. *Range: Includes but not limited to components such as resistors, capacitors, inductors, diodes, transistors, switches, batteries, ICs, 555 timers, LEDs, relays, transformers, opto-couplers, LDRs, SCR, Triac and analogue op-amps.*	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Basic electronic circuits are designed *Range: Timing, circuits, oscillator circuits using SCR and triac, amplifiers and power supplies* *All experimental circuit designs are to be build on bread board and final project on viro board.*	• Design basic electronic circuits
• Basic electronic circuits are constructed	• Construct basic electronic circuits.
• Basic electronic circuits are tested	• Test basic electronic circuits.
• Fault-finding is conducted on basic electronic circuits	• Fault-find basic electronic circuits.
• Basic electronic circuits are repaired	• Repair basic electronic circuits.
ASSESSMENT TASKS OR ACTIVITIES	
• Timing circuits, oscillator circuits, circuits using SCR and triac, amplifiers and power supplies are design and build and tested practically • Students repair various electronic equipment • Power supplies are repaired • A project is design and build on viro board	

Topic 4: Binary decoding and loading software onto a computer

SUBJECT OUTCOME	
4.1 Explain Boolean algebra	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Boolean expression are stated and applied *Range: AND, OR, NOT, NAND, NOR, XOR and XNOR*	• State and apply Boolean expressions
• Boolean laws are stated and applied *Range: Commutative, associative and distributive laws*	• State and apply Boolean laws
• The twelve basic rules of Boolean algebra are stated and applied	• State and apply the twelve basic rules of Boolean algebra

• The De-Morgan theorems are stated and applied	• State and apply the De-Morgan theorems
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes	

SUBJECT OUTCOME	
4.2 Demonstrate an understanding of binary code	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Decimal numbers are converted to binary coded decimal (BCD) and vice versa. *Range: 8421 and 2421 code*	• Convert decimal numbers to binary coded decimal (BCD) and vice versa.
• Decimal numbers are converted to excess 3 code	• Convert from decimal to excess 3 code
• Alphanumeric codes are used	• Use alphanumeric codes
• Decimal are converted to floating point numbers	• Convert decimal numbers to floating point numbers
• Binary numbers are converted to floating point numbers	• Convert binary numbers to floating point numbers
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes	

SUBJECT OUTCOME	
4.3 Demonstrate an understanding of encoders, decoders and shift registers	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• The operation and functioning of encoders and decoders are explained with the aid of sketches	• Explain with the aid of sketches the operation and functioning of encoders and decoders
• The respective uses of encoders and decoders are listed	• List uses of encoders and decoders
• The two basic functions of a register are explained *Range: Data storage and data movement*	• Explain the two basic functions of a register

• The operation and function of shift registers are explained with the aid of sketches and respective uses are listed *Range: Serial in – serial out, serial in-parallel out, parallel in – serial out and bidirectional shift registers*	• Explain with the aid of sketches the operation and function of shift registers • List uses of shift registers
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Encoders, decoders and shift registers are built for demonstration.	

SUBJECT OUTCOME	
4.4 Demonstrate an ability to load software onto a computer	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• A variety of software is loaded onto a functioning computer	• Demonstrate an ability to load a variety of software onto a functioning computer
• Problems that affect the normal operation of computer software are explained in terms of effect, possible origins, cures and preventions	• Explain the types of problems that can affect the proper running of computer software • Explain the possible origins, cures and prevention of computer software problems
ASSESSMENT TASKS OR ACTIVITIES	
• Loading of software is demonstrated using application and system software • Problems such as bugs, viruses and corrupted software are explained verbally or in writing • Antivirus software are loaded and computer scan	

Topic 5: Operating PLCs

SUBJECT OUTCOME	
5.1 Design and fault-find PLC circuits	
ASSESSMENT STANDARD	**LEARNING OUTCOME**
• Ladder logic diagrams are interpreted, used to solve simple problems, designed, used to analyse, and	• Interpret the working of simple ladder logic diagrams • Solve simple problems using ladder logic diagrams • Design and build simple solutions to repetitive mechanical actions using ladder logic diagrams
• Simple faults occurring in a PLC circuit are analysed	• Analyse simple faults occurring in a PLC circuit

• Faults occurring in transducers to PLC connections including wiring connections are diagnosed and repaired *Range: Input and output devices: Limit switches, proximity switches, photo electric sensors and switches, encoders, temperature sensors, displacement sensors, strain gauges, pressure sensors, keypads, contactors, motors, lamps sinking and sourcing connections*	• Diagnose faults occurring in transducers to PLC connections • Repair faults on a transducer-PLC control circuit including wiring connections
ASSESSMENT TASKS OR ACTIVITIES	
• Written tests on learning outcomes • Diagrams for solutions to problems are done in writing and demonstrated using a PLC simulator. • Students are given a task of diagnosing and repairing a simple PLC circuit including transducers.	

4. SPECIFICATIONS FOR EXTERNAL ASSESSMENT IN ELECTRONIC CONTROL AND DIGITAL ELECTRONICS - 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
	50-60%	30-40%	0-20%