education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL CURRICULUM STATEMENT GRADES 10-12 (GENERAL)

SUBJECT ASSESSMENT GUIDELINES

ELECTRICAL TECHNOLOGY

JANUARY 2008

PREFACE TO SUBJECT ASSESSMENT GUIDELINES

The Department of Education has developed and published Subject Assessment Guidelines for all 29 subjects of the National Curriculum Statement (NCS). These Assessment Guidelines should be read in conjunction with the relevant Subject Statements and Learning Programme Guidelines.

Writing Teams established from nominees of the nine provincial education departments and the teacher unions formulated the Subject Assessment Guidelines. The draft copies of the Subject Assessment Guidelines developed by the Writing Teams were sent to a wide range of readers, whose advice and suggestions were considered in refining these Guidelines. In addition, the Department of Education field-tested the Subject Assessment Guidelines in 2006 and asked for the comments and advice of teachers and subject specialists.

The Subject Assessment Guidelines are intended to provide clear guidance on assessment in Grades 10 to 12 from 2008.

The Department of Education wishes you success in the teaching of the National Curriculum Statement.

CONTENTS

1. PURPOSE OF THE SUBJECT ASSESSMENT GUIDELINES

This document provides guidelines for assessment in the National Curriculum Statement Grades 10 - 12 (General). The guidelines must be read in conjunction with *The National Senior Certificate: A Qualification at Level 4 on the National Qualifications Framework (NQF)* and the relevant Subject Statements. The Subject Assessment Guidelines will be applicable for Grades 10 to 12 from 2008.

The Department of Education encourages teachers to use these guidelines as they prepare to teach the National Curriculum Statement. Teachers should also use every available opportunity to hone their assessment skills. These skills relate both to the setting and marking of assessment tasks.

2. ASSESSMENT IN THE NATIONAL CURRICULUM STATEMENT

2.1 Introduction

Assessment in the National Curriculum Statement is an integral part of teaching and learning. For this reason, assessment should be part of every lesson and teachers should plan assessment activities to complement learning activities. In addition, teachers should plan a formal year-long Programme of Assessment. Together the informal daily assessment and the formal Programme of Assessment should be used to monitor learner progress through the school year.

Continuous assessment through informal daily assessment and the formal Programme of Assessment should be used to:

- develop learners' knowledge, skills and values
- assess learners' strengths and weaknesses
- provide additional support to learners
- revisit or revise certain sections of the curriculum and
- motivate and encourage learners.

In Grades 10 and 11 all assessment of the National Curriculum Statement is internal. In Grade 12 the formal Programme of Assessment which counts 25% is internally set and marked and externally moderated. The remaining 75% of the final mark for certification in Grade 12 is externally set, marked and moderated. In Life Orientation however, all assessment is internal and makes up 100% of the final mark for promotion and certification.

2.2 Continuous assessment

Continuous assessment involves assessment activities that are undertaken throughout the year, using various assessment forms, methods and tools. In Grades 10-12 continuous assessment comprises two different but related activities: informal daily assessment and a formal Programme of Assessment.

2.2.1 Daily assessment

The daily assessment tasks are the planned teaching and learning activities that take place in the subject classroom. Learner progress should be monitored during learning activities. This informal daily monitoring of progress can be done through question and answer sessions; short assessment tasks completed during the lesson by individuals, pairs or groups or homework exercises.

Individual learners, groups of learners or teachers can mark these assessment tasks. Self-assessment, peer assessment and group assessment actively involves learners in assessment. This is important as it allows learners to learn from and reflect on their own performance.

The results of the informal daily assessment tasks are not formally recorded unless the teacher wishes to do so. In such instances, a simple checklist may be used to record this assessment. However, teachers may use the learners' performance in these assessment tasks to provide verbal or written feedback to learners, the School Management Team and parents. This is particularly important if barriers to learning or poor levels of participation are encountered.

The results of these assessment tasks are not taken into account for promotion and certification purposes.

2.2.2 Programme of Assessment

In addition to daily assessment, teachers should develop a year-long formal Programme of Assessment for each subject and grade. In Grades 10 and 11 the Programme of Assessment consists of tasks undertaken during the school year and an end-of-year examination. The marks allocated to assessment tasks completed during the school year will be 25%, and the end-of-year examination mark will be 75% of the total mark. This excludes Life Orientation.

In Grade 12, the Programme of Assessment consists of tasks undertaken during the school year and counts 25% of the final Grade 12 mark. The other 75% is made up of externally set assessment tasks. This excludes Life Orientation where the internal assessment component counts 100% of the final assessment mark.

The marks achieved in each assessment task in the formal Programme of Assessment must be recorded and included in formal reports to parents and School Management Teams. These marks will determine if the learners in Grades 10 and 11 are promoted. In Grade 12, these marks will be submitted as the internal continuous assessment mark. Section 3 of this document provides details on the weighting of the tasks for promotion purposes.

2.2.2.1 Number and forms of assessment required for Programmes of Assessment in Grades 10 and 11

The requirements for the formal Programme of Assessment for Grades 10 and 11 are summarised in Table 2.1. The teacher must provide the Programme of Assessment to the subject head and School Management Team before the start of the school year. This will be used to draw up a school assessment plan for each of the subjects in each grade. The proposed school assessment plan should be provided to learners and parents in the first week of the first term.

Table 2.1: Number of assessment tasks which make up the Programme of Assessment by subject in Grades 10 and 11

SUBJECTS		TERM 1	TERM 2	TERM 3	TERM 4	TOTAL
Language 1: Home Language		4	4*	4	4*	16
Language 2: Choice of HL or FAL	HL	4	4*	4	4*	16
	FAL	4	4*	4	4*	16
Life Orientation		1	1*	1	2*	5
Mathematics or Maths Literacy		2	2*	2	2*	8
Subject choice 1**		2	2*	2	1*	7
Subject choice 2**		2	2*	2	1*	7
Subject choice 3		2	2*	2	1*	7

Note:

* One of these tasks must be an examination

** If one or two of the subjects chosen for subject choices 1, 2 or 3 include a Language, the number of tasks indicated for Languages 1 and 2 at Home Language (HL) and First Additional Language (FAL) are still applicable. Learners who opt for a Second Additional Language are required to complete 13 tasks in total: 4 tasks in term 1 and 3 tasks in each of terms 2, 3 and 4.

Two of the assessment tasks for each subject must be examinations. In Grades 10 and 11 these examinations should be administered in mid-year and November. These examinations should take account of the requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Learning Outcomes of the subject.

Two of the assessment tasks for all subjects, excluding Life Orientation, should be tests written under controlled conditions at a specified time. The tests should be written in the first and third terms of the year.

The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and varied ways. Examples of assessment forms are debates, presentations, projects, simulations, written reports, practical tasks, performances, exhibitions and research projects. The most appropriate forms of assessment for each subject are set out in Section 3. Care should be taken to ensure that learners cover a variety of assessment forms in the three grades.

The weighting of the tasks for each subject is set out in Section 3.

2.2.2.2 Number and forms of assessment required for Programme of Assessment in Grade 12

In Grade 12 all subjects include an internal assessment component, which is 25% of the final assessment mark. The requirements of the internal Programme of Assessment for Grade 12 are summarised in Table 2.2. The teacher must provide the Programme of Assessment to the subject head and School Management Team before the start of the school year. This will be used to draw up a school assessment plan for each of the subjects in each grade. The proposed school assessment plan should be provided to learners and parents in the first week of the first term.

Table 2.2: Number of assessment tasks which make up the Programme of Assessment by subject in Grade 12

SUBJECTS		TERM 1	TERM 2	TERM 3	TERM 4	TOTAL
Language 1: Home Language		5	5*	4*		14
Language 2: Choice of HL or FAL	HL	5	5*	4*		14
	FAL	5	5*	4*		14
Life Orientation		1	2*	2*		5
Mathematics or Maths Literacy		3	2*	2*		7
Subject choice 1**		2	2*	(2*) 3*		(6#) 7
Subject choice 2**		2	2*	(2*) 3*		(6#) 7
Subject choice 3		2	2*	(2*) 3*		(6#) 7

Note:

* One of these tasks in Term 2 and/or Term 3 must be an examination

** If one or two of the subjects chosen for subject choices 1, 2 or 3 include a Language, the number of tasks indicated for Languages 1 and 2 at Home Language (HL) and First Additional Language (FAL) are still applicable. Learners who opt for a Second Additional Language are required to complete 12 tasks in total: 5 tasks in term 1, 4 tasks in term 2 and 3 tasks in term 3.

The number of internal tasks per subject differs from 6 to 7 as specified in Section 3 of this document.

Schools can choose to write one or two internal examinations in Grade 12. Should a school choose to write only one internal examination in Grade 12, a scheduled test should be written at the end of the term to replace the other examination. Internal examinations should conform to the requirements set out in Section 3 of this document. They should be carefully designed and weighted to cover all the Learning Outcomes of the subject.

Two of the assessment tasks for all subjects, excluding Life Orientation, should be tests written under controlled conditions at a specified time.

The remainder of the assessment tasks should not be tests or examinations. They should be carefully designed tasks, which give learners opportunities to research and explore the subject in exciting and focused ways. Examples of assessment forms are debates, presentations, projects, simulations, assignments, case studies, essays, practical tasks, performances, exhibitions and research projects. The most appropriate forms of assessment for each subject are set out in Section 3.

2.3 External assessment in Grade 12

External assessment is only applicable to Grade 12 and applies to the final end-of-year examination. This makes up 75% of the final mark for Grade 12. This excludes Life Orientation which is not externally examined.

The external examinations are set externally, administered at schools under conditions specified in the *National policy on the conduct, administration and management of the assessment of the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF)* and marked externally.

In some subjects the external assessment includes practical or performance tasks that are externally set, internally assessed and externally moderated. These performance tasks account for one third of the end-of-year external examination mark in Grade 12 (that is 25% of the final mark). Details of these tasks are provided in Section 3.

Guidelines for the external examinations are provided in Section 3.

2.4 Recording and reporting on the Programme of Assessment

The Programme of Assessment should be recorded in the teacher's portfolio of assessment. The following should be included in the teacher's portfolio:

- a contents page;
- the formal Programme of Assessment;
- the requirements of each of the assessment tasks;
- the tools used for assessment for each task; and
- record sheets for each class.

Teachers must report regularly and timeously to learners and parents on the progress of learners. Schools will determine the reporting mechanism but it could include written reports, parent-teacher interviews and parents' days. Schools are required to provide written reports to parents once per term on the Programme of Assessment using a formal reporting tool. This report must indicate the percentage achieved per subject and include the following seven-point scale.

RATING CODE	RATING	MARKS %
7	Outstanding achievement	80 – 100
6	Meritorious achievement	70 –79
5	Substantial achievement	60 – 69
4	Adequate achievement	50 – 59
3	Moderate achievement	40 – 49
2	Elementary achievement	30 – 39
1	Not achieved	0 – 29

2.5 Moderation of the assessment tasks in the Programme of Assessment

Moderation of the assessment tasks should take place at three levels.

LEVEL	MODERATION REQUIREMENTS
School	The Programme of Assessment should be submitted to the subject head and School Management Team before the start of the academic year for moderation purposes. Each task which is to be used as part of the Programme of Assessment should be submitted to the subject head for moderation before learners attempt the task. Teacher portfolios and evidence of learner performance should be moderated twice a year by the head of the subject or her/his delegate.
Cluster/ district/ region	Teacher portfolios and a sample of evidence of learner performance must be moderated twice during the first three terms.
Provincial/ national	Teacher portfolios and a sample of evidence of learner performance must be moderated once a year.

3. ASSESSMENT OF ELECTRICAL TECHNOLOGY IN GRADES 10 – 12

3.1 Introduction

Electrical Technology focuses on understanding and applying electrical and electronic principles. The subject deals with the technological process inherent in the production of products, services and systems to improve the quality of life.

Electrical Technology prepares a learner with a range of skills, which are supplemented by a broad knowledge base. The envisaged learner will ultimately become an economically active, responsible and participating member of society.

The focus of assessment in Electrical Technology is learner performance in:

- demonstrating an awareness and understanding of the interrelationship between Electrical Technology, society and the environment;
- demonstrating an understanding of the concepts and principles related to Electrical Technology;
- solving practical problems in an Electrical Technology context using the technological process (identify, investigate, design, make, evaluate and communicate) in both cognitive and creative ways; and
- demonstrating the application of the principles, practice and skills used in Electrical Technology.

The following table suggests the weighting of the Learning Outcomes for the assessment components in Electrical Technology:

LEARNING OUTCOME	%
	Assessment Tasks
LO1: Technology, society and the environment	10%
LO2: Technological process	10%
LO3: Knowledge and understanding	40%
LO4: Application of knowledge	40%

Electrical Technology is a practically orientated subject and to assess all the knowledge, skills and values of the subject in an authentic manner a Practical Assessment Task (PAT) is necessary. The Practical Assessment Task should showcase the learners' broad range of knowledge, skills and values acquired during the learning process. It also provides learners the opportunity to express their creativity and innovativeness.

3.2 Daily assessment in Grades 10, 11 and 12

Daily assessment in Electrical Technology provides learners with multiple opportunities to improve and master the knowledge, skills and values related to the subject.

The following are examples of daily assessment tasks to develop learners' knowledge, skills and values:

- Investigating rules and concepts relating to electricity
- Designing and constructing circuits
- Building circuits from given diagrams
- Simulating circuits on training boards
- Simulating circuits with the aid of a computer simulated program

3.3 Assessment in Grades 10 and 11

3.3.1 Programme of Assessment in Grades 10 and 11

The Programme of Assessment for Electrical Technology in Grades 10 and 11 comprises seven tasks which are internally assessed. The six tasks which are completed during the school year make up 25% of the total mark for Electrical Technology. The seventh task is the end-of-year assessment which includes a Practical Assessment Task (PAT) and a written theory paper. Together these two tasks make up the remaining 75%.

PROGRAMME OF ASSESSMENT (400 marks)		
ASSESSMENT TASKS	**END-OF-YEAR ASSESSMENT**	
25% (100 marks)	**75% (300 marks)**	
	PAT	**EXAM PAPER**
	25% (100 marks)	**50% (200 marks)**
2 tests 1 exam (mid-year) 3 practical tasks	Design project (main focus LO4) • Portfolio (25) • Product/ artefact (75)	• Written exam LO1-4 • Main focus LO3

The Programme of Assessment comprises:

- Two tests (first and third term)
- One midyear examination (written)
- Three practical tasks (one per term in terms 1-3)
- The end-of-year assessment task (which includes a Practical Assessment Task and a written examination)

Example of an annual Programme of Assessment for Grades 10 and 11:

ASSESSMENT TASKS		**TERM ONE**	**TERM TWO**	**TERM THREE**	**TERM FOUR**	**% OF FINAL PROMOTION MARK**
Tests		1		1		5
Midyear examination (written)			1			5
Practical tasks: Simulations/ Investigations/ Small projects		1	1	1		15
End-of-year assessment	Written examination				1	50
	Practical Assessment Task				1	25

3.3.2 Examples of assessment tasks in Electrical Technology

Tests
The tests in Electrical Technology must be substantive in terms of time and marks. For example, a test should last at least 60 minutes and count a minimum of 50 marks. Tests should include the theory of the technological process, principles and concepts and the application (electronics and digital electronics) thereof in the production of electrical product(s)/ artefact(s).

Practical tasks
The practical tasks should incorporate both the design (planning and development) and the production of a product or artefact. These tasks should be based on practical activities such as simulations, investigations and small projects and should focus on more than one area of specialisation, i.e. electrical, electronics and digital electronics or an integration of two to three of these areas.

In Electrical Technology practical tasks of an investigative nature will require learners to gather, process, present, analyse and use information and data. This could include the following components:

- predicting
- hypothesising and testing (fault finding)
- generalising and testing
- proving a theory

Practical investigations include actions or operations undertaken with the aid of equipment and/or instruments in order to discover something unknown, to test a hypothesis, or establish or illustrate some known truth. Thus the learners will arrive at a conclusion after the completion of their practical investigations.

See Appendix 1 for an exemplar of a Grade 10 practical investigative task.

Teachers should decide at the start of the year which practical tasks will be done, keeping the following in mind:

- Time available
- Allocation of marks
- The Learning Outcomes and Assessment Standards
- The degree of difficulty
- The equipment available
- The material available/obtainable
- The teacher's field of experience

Practical Assessment Task (100 marks)
The Practical Assessment Task comprises a design project which leads to the development and production of a product or artefact and counts 25% of the total promotion mark in Grades 10 and 11. This task should take on the form of problem solving and realisation (making) and should be completed in the first three terms and handed in at the end of the third term. The project should incorporate a task where learners are provided with opportunities for higher

order thinking and problem solving. For example, Grade 11 learners could be asked to construct a light dimming circuit.

A Practical Assessment Task allows the teacher to directly and systematically observe actual learner applied competence. The assessment of performance is based on the demonstration of specific technological skills. Practical Assessment Tasks allow the learner to illustrate complex learning where knowledge, skills, and values are integrated in a performance. The learners should know the assessment criteria before they start with the Practical Assessment Task.

The Practical Assessment Task in Grades 10 and 11 is **internally** set, assessed and moderated. The project is completed under controlled conditions and is assessed by means of a rubric.

The Practical Assessment Task counts 100 marks and consists of a design portfolio (25 marks) and the final product (75 marks). The Practical Assessment Task therefore focuses on the development of the design portfolio as well as the product or artefact itself, including manipulative skills.

The design portfolio should include evidence of how the development of the solution was approached, that is:

- The planning process
- The knowledge and skills accumulated in the process
- The technological process followed
- The safety and environmental aspects considered
- The calculations used – if applicable, sketches or diagrams
- The starting time and ending time – how long it took to complete from start to finish
- The investigations or research undertaken, and
- Any other information that is relevant to the project.

The Practical Assessment Task for Electrical Technology will be undertaken in three phases:

Phase 1: Learners produce the relevant information and drawings or sketches and modelling and trial material which will lead to the making of the product or artefact. The evidence of this phase will be located in the design portfolio and this phase will be undertaken during term 1 and the start of term 2.

Phase 2: Learners develop the actual product or artefact at the start of the second term and finalise it by the end of term 3.

Phase 3: Learners submit the product or artefact for assessment by the end of the third term. The accompanying planning done in phase 1 (design portfolio) must also be submitted for assessment at this time.

See Appendix 2 for an example of a Grade 10 Practical Assessment Task and Appendix 3 for the assessment tools that can be used to assess learner performance in such a task.

Examinations

The mid-year and end-of-year examinations for Grades 10 and 11 should consist of one paper which counts 200 marks. The suggested duration of the paper is 3 hours. All the questions are compulsory. The questions should be set in such a way that they cover the knowledge and skills of Learning Outcome 3, the investigative assessment standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of the Electrical Technology Subject Statement.

The format must be similar to that outlined for Grade 12.

The following table suggests the outline for the written examination paper in Grades 10 and 11:

SUGGESTED OUTLINE OF THE WRITTEN EXAMINATION PAPER 200 marks (50% of final assessment mark)					
	LOs & ASs	**Concepts and content to be covered in Grade 10**	**Marks**	**Concepts and content to be covered in Grade 11**	**Marks**
	LO1	Technology, Society and the Environment will be used to provide the context for the questions to be set.	10	Technology, Society and the Environment will be used to provide the context for the questions to be set.	10
	LO2	The Technological Process will provide a process in which the questions will be set.	10	The Technological Process will provide a process in which the questions will be set.	10
• One paper of 3-hour duration	LO3 AS1	Occupational Health and Safety (OHS) Act where applicable	10	OHS Act and regulations where applicable	10
• The emphasis of examination will be on LO3 Some questions will be associated with the process of LO2 ASs can also be integrated depending on the context.	LO3 AS2	Use and care of tools and measuring instruments	10	Use and care of instruments	10
	LO3 AS3	Principles of magnetism	15	Principles of single phase AC generation	15
	LO3 AS4	Principles of electricity	30	Principles and effect of AC on R, L and C components and effect on combination of series circuits	30
	LO3 AS5	Principles of electrostatics	10	None	0
• All questions must be answered	LO3 AS6	Characteristics of electronic components	10	Operating principles, characteristics curves and use of semi-conductor devices	10
• Diagrams and sketches must be neat and labelled.	LO3 AS7	None	0	Operation of an amplifier circuit	10
	LO3 AS8	None	0	Principle of operation and use of single-phase transformers	15
• Formula calculation, answer and unit must be indicated	LO3 AS9	Principles of operation and use of power sources	30	Principles of operation and use of power supplies	15
	LO3 AS10	Basic logic concepts	20	Use of logic concepts to form logic systems	20
	LO3 AS11	Different types of protective devices	10	Operating principles of different protective devices	10
	LO3 AS12	Single-phase circuits	25	Operating principles and application of single-phase motors	25
	LO3 AS13	Electronic communication systems	10	Operating principles of modulation and demodulation with reference to communication systems	10
		TOTAL	**200**	**TOTAL**	**200**

3.4 Assessment in Grade 12

In Grade 12, assessment consists of two components: a Programme of Assessment which makes up 25% of the total mark for Electrical Technology and external assessment which makes up the remaining 75%. The Programme of Assessment for Electrical Technology comprises six tasks which are internally assessed. The external assessment component comprises two components: a Practical Assessment Task and a written theory paper. Together these two tasks make up the remaining 75%.

<table>
<tr><th>PROGRAMME OF ASSESSMENT
(100 marks)</th><th colspan="2">EXTERNAL ASSESSMENT
(300 marks)</th></tr>
<tr><td>ASSESSMENT TASKS</td><td colspan="2">EXTERNAL ASSESSMENT TASKS</td></tr>
<tr><td>25% (100 marks)</td><td colspan="2">75% (300 marks)</td></tr>
<tr><td rowspan="3">2 tests
2 exams (mid-year and trial)
2 practical tasks</td><td>PAT</td><td>EXAM PAPER</td></tr>
<tr><td>25% (100 marks)</td><td>50% (200 marks)</td></tr>
<tr><td>Design project (main focus LO4)
• Portfolio (25)
• Product/ artefact (75)</td><td>• Written exam LO1-4
• Main focus LO3</td></tr>
</table>

Together the Programme of Assessment and the external assessment component make up the annual assessment plan for Grade 12.

The annual assessment plan comprises:

- Two tests (first and third term)
- Two written examinations (midyear and trial)
- Two practical tasks (one per term in terms 1 and 2)
- The external assessment task (which includes a Practical Assessment Task and a written examination)

Example of an annual assessment plan for Grade 12:

ASSESSMENT TASKS		TERM ONE	TERM TWO	TERM THREE	TERM FOUR	% OF FINAL PROMOTION MARK
Tests		1		1		5
Examinations (midyear and trial)			1	1		10
Practical tasks: Simulations/ Investigations/ Small projects		1	1			10
External assessment	Written theory examination				1	50
	Practical Assessment Task			1		25

In Grade 12 one of the tasks in Term 2 and/or Term 3 must be an internal examination. In instances where only one of the two internal examinations is written in Grade 12, the other examination should be replaced by a test at the end of the term.

3.4.1 Programme of Assessment in Grade 12

Tests

The tests in Electrical Technology must be substantive in terms of time and marks. For example, a test should last at least 60 minutes and count a minimum of 50 marks. Tests should include the theory of the technological process, principles and concepts and the application (electronics and digital electronics) thereof in the production of electrical product(s)/ artefact(s).

Practical Tasks

The practical tasks should incorporate both the design (planning and development) and the production of a product or artefact. These tasks should be based on practical activities such as simulations, investigations and small projects and should focus on more than one area of specialisation, i.e. electrical, electronics and digital electronics or an integration of two to three of these areas.

In Electrical Technology practical tasks of an investigative nature will require learners to gather, process, present, analyse and use information and data. This could include the following components:

- predicting
- hypothesising and testing (fault finding)
- generalising and testing
- proving a theory

Practical investigations include actions or operations undertaken with the aid of equipment and/or instruments in order to discover something unknown, to test a hypothesis, or establish or illustrate some known truth. Thus the learners will arrive at a conclusion after the completion of their practical investigations.

Teachers should decide at the start of the year which practical tasks will be done, keeping the following in mind:

- Time available
- Allocation of marks
- The Learning Outcomes and Assessment Standards
- The degree of difficulty
- The equipment available
- The material available/obtainable
- The teacher's field of experience

Examinations

The mid-year and trial examinations for Grade 12 should consist of one paper which counts 200 marks. The suggested duration of the paper is 3 hours. All the questions are compulsory. The questions should be set in such a way that they cover the knowledge and skills of Learning Outcome 3, the investigative assessment standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of the Electrical Technology Subject Statement.

The trial examination needs to be closely related to the final examination in terms of time allocation, layout of the paper and subject requirements. See Section 3.4.2.2 for an outline of the Grade 12 examination paper.

3.4.2 External assessment in Grade 12

The external assessment component in Grade 12 comprises the Practical Assessment Task (25%) and an externally written paper (50%).

3.4.2.1 Practical Assessment Task

Schools will be informed of the task at the beginning of the first term of each academic year. Schools will choose one option from given scenarios.

The Practical Assessment Task comprises a design project which leads to design and development of a product or artefact and counts 25% of the total promotion mark in Grade 12. This task should take on the form of problem solving and realisation (practical application) and should be completed in the first three terms and handed in at the end of the third term. The design project should incorporate a task where learners are provided with opportunities for higher order thinking and problem solving. For example, Grade 12 learners could be asked to construct a counter circuit. The learners should know the assessment criteria before they start with the project.

The Practical Assessment Task in Grade 12 is **externally** set and moderated, but internally assessed. The project is completed under controlled conditions and is assessed by means of a rubric.

The Practical Assessment Task counts 100 marks and consists of a design portfolio (25 marks) and the final product (75 marks). The Practical Assessment Task therefore focuses on the development of the design portfolio as well as the product or artefact itself.

The design portfolio should include evidence of how the development of the solution was approached, that is:

- The planning process
- The knowledge and skills accumulated in the process
- The technological process followed
- The safety and environmental aspects considered
- The calculations used – if applicable, sketches or diagrams
- The starting time and ending time – how long it took to complete from start to finish
- The investigations or research undertaken, and
- Any other information that is relevant to the project.

The Practical Assessment Task for Electrical Technology will be undertaken in three phases:

Phase 1: Learners produce the relevant information and drawings or sketches and modelling and trial material which will lead to the making of the product or artefact. The evidence of this phase will be located in the design portfolio and this phase will be undertaken during term 1 and the start of term 2.

Phase 2: Learners develop the actual product or artefact at the start of the second term and finalise it by the end of term 3.

Phase 3: Learners submit the product or artefact for assessment by the end of the third term. The accompanying planning done in phase 1 (design portfolio) must also be submitted for assessment at this time.

3.4.2.2 External written examination

The external examination for Grade 12 should consist of one paper which counts 200 marks. The duration of the paper is 3 hours. All the questions are compulsory. The questions should cover the knowledge and skills of Learning Outcome 3, the investigative Assessment Standard of Learning Outcome 2 and the values and attitudes of Learning Outcome 1 of Electrical Technology.

The following table provides guidelines for the written examination paper in Grade 12:

SUGGESTED OUTLINE OF THE EXAMINATION PAPER 200 marks (50% of final assessment mark)			
• One paper of 3-hour duration • The emphasis of the external examination will be on LO3 Some questions could be associated with the process of LO2 ASs can also be integrated depending on the context. • All questions must be answered • Diagrams and skeletons must be neat and labelled. • Formula calculation, answer and unit must be indicated.	**LOs & ASs**	**Concepts and content to be covered**	**Marks**
	LO1	Technology, Society and the Environment will be used to provide the content for the questions to be set.	10
	LO2	The Technological process will provide a process in which the question will be set	10
	LO3 AS1	OHS Act and regulations must be integrated where applicable	10
	LO3 AS3	Three-phase AC generation	10
	LO3 AS4	Effect of AC on series and parallel R, L and C component combination circuits	30
	LO3 AS6	Operating principles of switching and control circuits	25
	LO3 AS7	Output of amplifiers, their characteristics and feedback	25
	LO3 AS8	Operations and use of three-phase transformers	15
	LO3 AS10	Logic concepts as an introduction to programmable control	35
	LO3 AS12	Operating principles and application of three-phase motors and control	30
		TOTAL	**200**

3.5 Promotion

For promotion and certification purposes learners should achieve at least a level 2 rating (Elementary achievement: 30-39%) in Electrical Technology.

3.6 Moderation of Programme of Assessment tasks

All Grade 10 and 11 tasks are internally moderated, while Grade 12 tasks should be externally moderated. The subject head for Electrical Technology or head of department for Technology at school will generally manage this process.

APPENDIX 1:
EXAMPLE OF A GRADE 10 INVESTIGATIVE TASK

INVESTIGATE THE CHARACTERISTICS OF A LIGHT-EMITTING DIODE AND A SILICON DIODE (1N4002)

Learner's name _____

1. APPARATUS

- Variable voltage power supply (0 - 20 volt dc)
- Milli-ammeter (0 - 25 mA dc)
- 1000 ohm resistor (R1)
- Red light-emitting diode
- Silicon diode 1N4002
- Voltmeter (0 - 20 volt VTVM)

2. CIRCUIT

Draw a circuit diagram of a series circuit using the first four apparatus in the list above. Place the voltmeter parallel across the diode. (4)

3. METHOD

1. Connect the apparatus so as to form the drawn circuit.
   Note: *The teacher must first check the circuit before proceeding to point 2.* (4)
2. Adjust the voltage regulator of the power supply unit to zero volts and switch on.
3. Note and tabulate the voltage across the diode and the current through the diode, by varying the supply voltage from 0; 0,5; 1,0 - 10 volt at intervals as set out in the schedule on page 19.
4. Reverse the polarity of the supply voltage and repeat steps 1 to 3.
5. Replace the Red light-emitting diode with the 1N4002 silicon diode
6. Repeat steps 1 to 4 with the 1N4002 silicon diode.

4. SCHEDULE

WITH FORWARD BIAS					WITH REVERSE BIAS			
RED LED		SILICON DIODE			RED LED		SILICON DIODE	
V(LED)	I(LED)	V(SI)	I(SI)	VS	V(LED)	I(LED)	V(SI)	I(SI)
				0				
				0,5				
				1,0				
				1,5				
				2,0				
				2,5				
				3,0				
				3.5				
				4,0				
				5,0				
				6,0				
				7,0				
				8,0				
				9,0				
				10,0				

(30)

5. CHARACTERISTICS

Draw a graphical representation in the first and third quadrants on graph paper using the y-axis as the current flowing through the diode (light-emitting diode and silicon) and the x-axis as the voltages across the diode. (36)

6. CONCLUSION

In the forward bias condition the red light-emitting diode has ____volts across it. (2)
In the forward bias condition the silicon diode has _____volts across it (2)

Total [78]

7. CRITERIA FOR THE ASSESSMENT OF INVESTIGATION TASK

Diagram

1 mark per correct connection to a node with up to four connections
2 marks per correct connection to a node with up to eight connections
(ALL connections must be correct including the polarity where applicable)
1 mark per label

Wiring

As per above

Recording of information

0,25 mark per correct recorded value (alternatively 1 mark per value and divide total by 4)

Graph

2 marks for choice of appropriate scale for y-axis
2 marks for choice of appropriate scale for x-axis
0,5 mark per correct co-ordinate
2 marks for joining co-ordinates plus labels

Interpretation and conclusion

2 marks for each correct interpretation

APPENDIX 2:
EXAMPLE OF A GRADE 10 PRACTICAL ASSESSMENT TASK

The PAT consists of two components: a project and practical tasks.

A. PROJECT (50 marks)

The project spans the first three terms of the year. Teachers should set due dates for each phase of the project and assess learner progress during and at the end of each phase. A final assessment of the project is carried out at the end of term 3. The phases of the project could include:

- Research: Collect the information needed to solve the problem
- Plan: Devise a plan with which to solve the problem including relevant diagrams
- Simulate: Assembly of a model to simulate the solution
- Present: Submit project including the model for assessment

POSSIBLE TOPICS FOR PROJECTS

The following scenarios are possible electrical technology projects:

- People often leave bath water running and forget to switch the tap off. Can you design a system that will warn you when the tap is to be turned off. Remember that old people can be short-sighted and hard of hearing.
- Design an exit barrier system for a car park. The barrier must open when a vehicle breaks a light beam, and must remain open until the vehicle is clear of the barrier.
- You have a water pollution problem. Design and construct a water pollution indicator using sensors and transistors.
- Seventy five percent of all school break-ins result in loss of computer –related equipment. Devise a system that will prevent anybody from stealing your school computers.
- Design a system that automatically opens a garage door when the car headlights are flashed. To add security to the system, the car must be standing in a particular position when the lights are flashed.
- Design a system where a light in a room can be switched off/on without getting out of bed.

OUTLINE OF A PROJECT

Teachers should provide learners with the following information prior to the start of a project:

- Background to the concepts
- Brief on what to design
- Context of the design
- Component requirements for the design
- Specifications of the design
- Description of the capability task

EXAMPLE OF A PROJECT

TASK: IDENTIFY AND DESIGN A TESTER

TEST APPARATUS

This project must be carried out strictly according to the criteria laid down in the assessment document for Electrical Technology.

1. BACKGROUND

Two important concepts when dealing with electrical circuits are conductors and insulators. It is very important to know which components conduct electricity and which components keep conductors apart to avoid short-circuits.

Learning Outcome 4 has four Assessment Standards in Electrical Technology:

- Select, use and care for tools and instruments.
- Construct and comprehend single-phase circuits.
- Construct and comprehend electronic circuits.
- Construct and comprehend digital circuits.

2. BRIEF

Identify and design a tester that can be used in Electrical Technology.

- The design of the tester must be based on the basic principles of electricity.
- The tester must be easy to make.
- The tester must be safe to work with.
- The new design must provide the possibility of entrepreneurship.

3. CONTEXT

Investigation into basic components, circuits and construction methods forms part of the project portfolio and includes the following:

- Cells and batteries
- Resistors
- Switches
- Diodes
- Light-emitting diodes
- Basic electric circuits with emphasis on polarity
- Logic circuits
- Earthing
- Vero board
- Containers (small plastic boxes)

4. COMPONENT LIST

A component list with each component's specific details is required.

5. SPECIFICATIONS

- All the components must be mounted inside the box, except Light-emitting diodes, switches, potentiometers that are mounted on the box.
- The test leads must protrude from one of the short sides of the box.

- The vero board must be exactly 60 mm x 17 mm (22 holes x 6 strips).
- The vero board must contain at least one wire connection between copper strips.
- The vero board must have at least one break in a copper strip.
- To simplify construction and maintenance, all the terminating ends from the vero board must be as close as possible to one of the short sides of the board.
- All components must be laid out square and parallel with regards to each other and to the sides of the board.
- Polarity and identification marks must, where applicable, be indicated on the layout.
- A circuit diagram must be provided.

6. CAPABILITY TASK

- The final assembly of the tester must be done neatly in a box and all the surface components, for example switches and lights, must be clearly explained with labels.
- Design and draw the complete layout of the box to accommodate all components.
- Design the vero board layout.
- Label with polarity identification.
- Indicate links and breaks on vero board.
- The component layout should have a scale 1:1.
- Indicate on a diagram how the surface components are connected.
- Indicate with a drawing where the surface components must be mounted.
- The operation of the tester must be explained.
- An instruction manual for the tester must be written.
- Problems encountered and suggestions to eliminate these problems in future designs must be given.

B. PRACTICAL TASKS (50 marks)

EXAMPLES OF GRADE 10 PRACTICAL TASKS

Name of Learner_____ Class Group_____

Name of School_____ Name of Teacher_____

SECTION 1: ELECTRICAL CIRCUITS

TASK No.1

Design and wire a single-phase circuit with one light so that it is controlled independently by two switches

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS.10.3.11 describe and compare different type of protective devices

AS.10.312 draw single-phase circuits

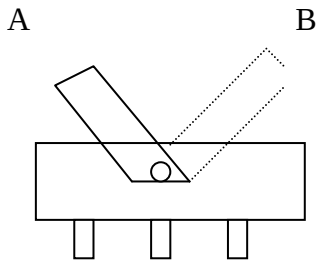
APPLICATION OF KNOWLEDGE AND SKILLS

AS.4.2: Construct an electrical circuit

1.1 Material

1 32 volts ac supply
2 Two single pole double throw switches
3 32 volts 40 watt incandescent lamp in a lamp holder
4 connecting cables

1.2 Test, identify and mark terminals of switch No.1

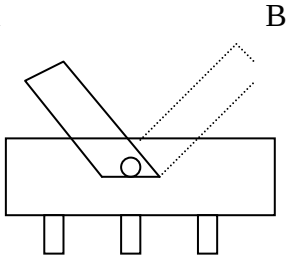


Switch No.1

Position A		Position B	
Test between terminals no.	Test reading	Test between terminals no.	Test reading
1 and 2		1 and 2	
1 and 3		1 and 3	
2 and 3		2 and 3	
Thus the common terminal is terminal no. ……			

(6)

1.3 Test, identify and mark terminals of the switch No.2



Switch No.2

Position A		Position B	
Test between terminals no.	Test reading	Test between terminals no.	Test reading
1 and 2		1 and 2	
1 and 3		1 and 3	
2 and 3		2 and 3	
Thus the common terminal is terminal no. ……			

(6)

1.4 Circuit

Draw the diagram of the electrical circuit.

(9)

1.5 Wiring

1.5.1 Wire the circuit as drawn in point 4 above.
NB: THE SUPPLY MAY NOT BE CONNECTED UNLESS THE TEACHER HAS FIRST CHECKED THE WIRING. (10)

1.5.2 What is the more common name for the switches used in this exercise?

(1)

TOTAL [32]

TASK No.2

Relate the basic installation tests to the voltages measured across a wall plug and identify and interpret different voltages measured across a wall plug.

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS.10.3.11 describe and compare different types of protective devices

AS.10.312 draw single-phase circuits

INFORMATION

Study diagram 1 below, and then answer the questions. Diagram 1 represents a three pin wall plug with three neon lights connected across the different terminals. The RED is connected between Earth and Neutral; the ORANGE between Earth and Live, and the green light between Neutral and Live.

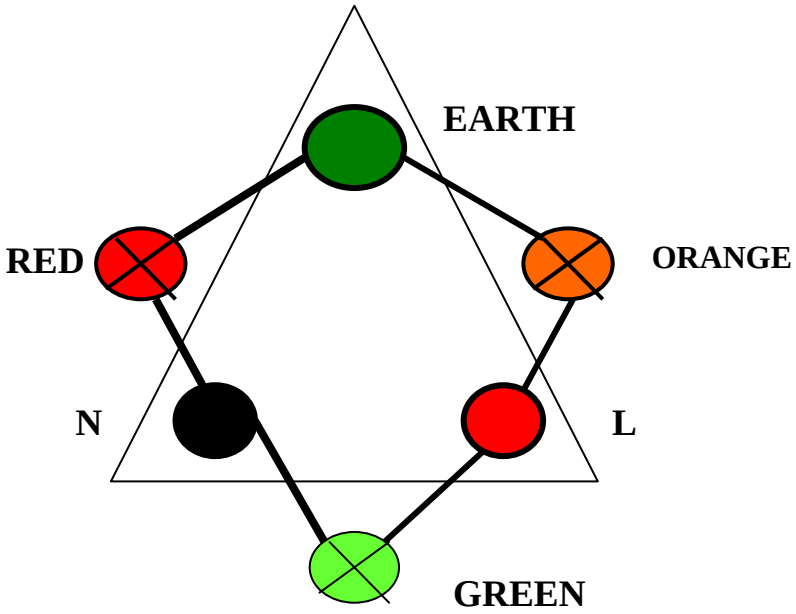


Diagram 2

2.1 When the plug is plugged into the wall socket, even before the switch of the wall socket is switched on, the RED light lights up BRIGHTLY, and the other two lights, light up dimly. Besides the fact that the live wire does not go through the switch, give two more wiring faults that may be present in this system.

.....……..

.....……

.....

.....……..(4)

2.2 Explain the operation of the lights (circuit) if the three-pin wall socket was wired correctly.

.....
.....
.....…….. (6)

2.3 Explain the operation of the lights (circuit) if the earth wire is not connected to the wall socket.

.....
.....
.....
.....
.....
.....
.....…….…… (6)

TOTAL [16]

SECTION 2: ELECTRONIC CIRCUITS

TASK No.3

Analyse and wire a circuit.

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS10.3.2 describe the use and care of tools and measuring instruments

AS.10.3.4 describe the principles of electricity

AS.10.3.5 describe the principles of electrostatics

AS.10.3.6 identify and describe the characteristics of electronic components

SKILLS, KNOWLEDGE AND VALUES

AS10.4.3 construct and comprehend electronic circuits

INSTRUCTIONS

Study the diagram below and then answer the questions that follows. The type of switch that is depicted in diagram 6, has THREE switch positions, "1"; "0" & "2". The OFF position is in the centre and is indicated with a "0".

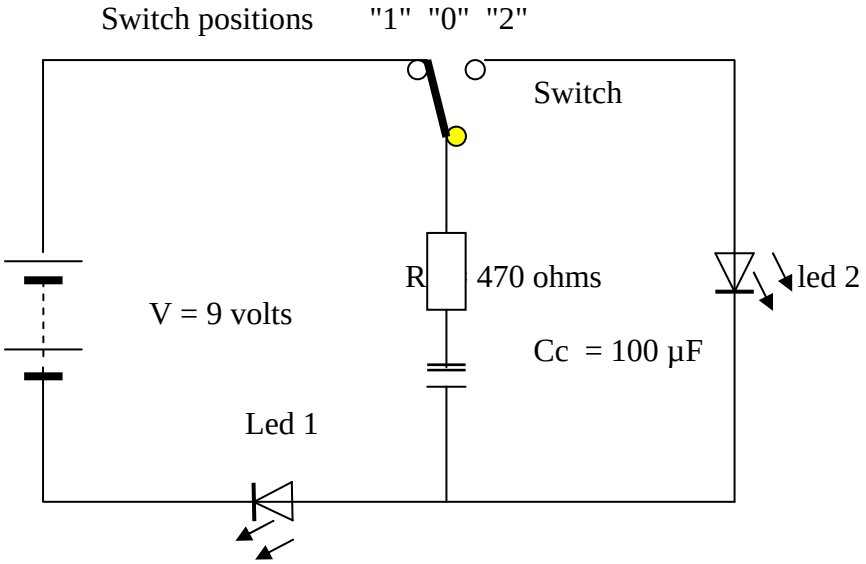


Diagram No.3

3.1 Describe what will happen and what will be observed if the switch is switched from position "0" to position "1". (8)

3.2 Describe what will happen and what will be observed if the switch is now switched from position "1" to position "2". (8)

3.3 If the value of the resistor (R1) is increased; how will it influence the observation made in 3.1? (2)

3.4 How will it influence the observation made in 3.2? (2)

Wire the circuit according to the diagram No. 3 above.
NB THE SUPPLY MAY NOT BE CONNECTED UNLESS THE TEACHER HAS FIRST CHECKED THE WIRING. (10)

TOTAL [30]

TASK No.4

Design and wire a simple power supply

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS10.3.2 describe the use and care of tools and measuring instruments

AS.10.3.5 describe the principles of electrostatics

AS.10.3.4 describe the principles of electricity

AS.10.3.6 identify and describe the characteristics of electronic components

SKILLS, KNOWLEDGE AND VALUES

AS10.4.3 construct and comprehend electronic circuits

4.1 Apparatus and material

1. 230/12 volt single-phase transformer
2. 1N4007 silicon diode
3. 100 µF 35 volts electrostatic capacitor
4. 1 kilo-ohm load resistor
5. matrix board
6. connecting cables

4.2 Circuit

Design and draw the circuit diagram. (8)

4.3 Wiring

4.3.1 Wire the circuit as drawn in point 4.2 above.

NB THE SUPPLY MAY NOT BE CONNECTED UNLESS THE TEACHER HAS FIRST CHECKED THE WIRING. (10)

TOTAL [18]

SECTION 3: LOGIC CIRCUITS

TASK No.5

Design and wire a logic circuit in such a way that both switches must be activated before the light will light up.

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS.10.3.10 describe basic logic concepts

AS.10.312 draw single-phase circuits

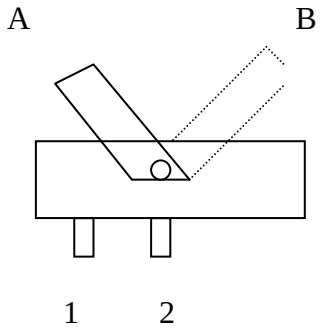
APPLICATION OF KNOWLEDGE AND SKILLS

AS.4.2: Construct and design logic circuits

5.1 Material

1 12 volts ac (or dc) supply
2 Two single pole single throw switches
3 12 volts lamp in a lamp holder
4 connecting cables

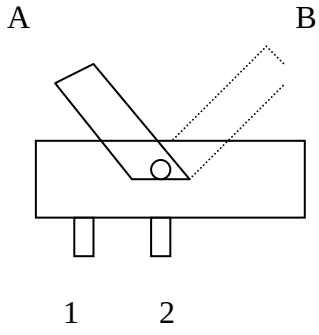
5.2 Test, identify and mark terminals of switch No.1



Position A		Position B	
Test between terminals no.	Test reading	Test between terminals no.	Test reading
1 and 2		1 and 2	

(2)

5.3 Test, identify and mark terminals of switch No.2



Position A		Position B	
Test between terminals no.	Test reading	Test between terminals no.	Test reading
1 and 2		1 and 2	

(2)

5.4 Circuit diagram

Design and draw the circuit diagram in such a way that both switches must be activated before the light will light up, by making use of the given material.

(8)

5.5 Wiring

Wire the circuit according to the diagram above. ***NB THE SUPPLY MAY NOT BE CONNECTED UNLESS THE TEACHER HAS FIRST CHECKED THE WIRING.*** (10)

5.6 Observation

5.6.1 Complete the truth table for the circuit. (4)

A	B	F
0	0	
0	1	
1	0	
1	1	

5.6.2 What logic function is represented by this circuit? (1)

TOTAL [27]

TASK No.6

Identify and wire a logic circuit.

PRIOR KNOWLEDGE AND UNDERSTANDING

AS.10.3.1 demonstrate an understanding of the OHS Act and regulations where applicable

AS.10.3.10 describe basic logic concepts

AS.10.312 draw single-phase circuits

APPLICATION OF KNOWLEDGE AND SKILLS

AS.4.2: Construct and design logic circuits

6.1 Material

1 12 volts ac (or dc) supply
2 Two single pole single throw switches
3 12 volts lamp in a lamp holder
4 connecting cables

6.2 Instruction

Study diagram1 below and then answer the questions.

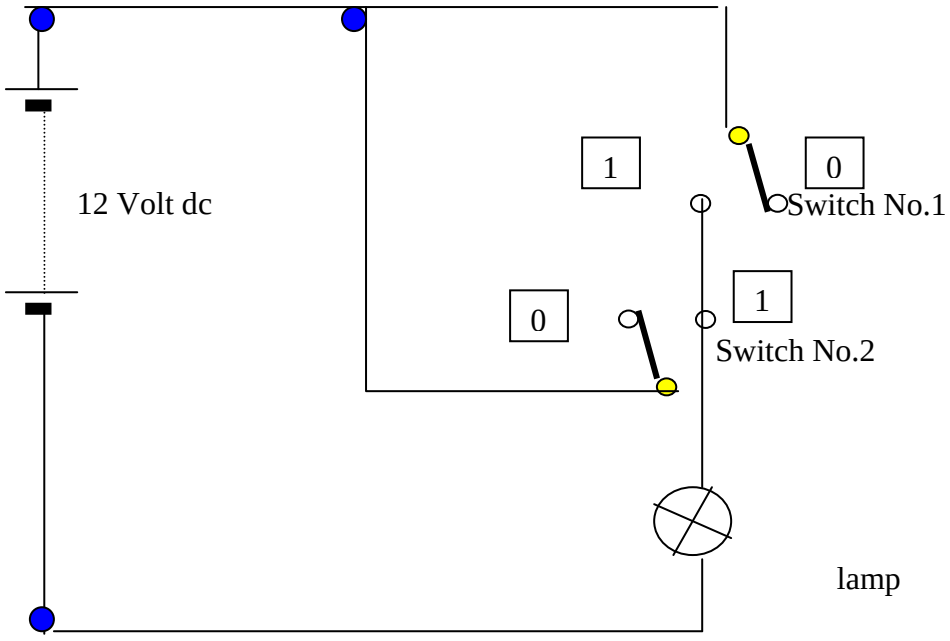


Diagram No.6

The circuit diagram represented in diagram No.6 will normally be used for the cab light of a car.

6.2.1 Explain the operation of the circuit in the four different switch combinations. (18)

6.2.2 What do we call this type of electrical switching? (1)

6.2.3 Complete the truth table below for the switching circuit represented by diagram 6.

S1	S2	Lamp
0	0	
0	1	
1	0	
1	1	

(4)

6.3 What logic function is represented by this kind of switching? (1)

TOTAL [24]

CRITERIA FOR THE ASSESSMENT OF A SIMULATION

1. DIAGRAM

1 mark per correct connection to a node with up to four connections
2 marks per correct connection to a node with up to eight connections
(ALL connections must be correct including the polarity where applicable)
1 mark per label

2. WIRING

As per above

3. RECORDING OF INFORMATION

Allocate 1 mark per value and divide total by 4

4. RECORDING OF INFORMATION

0.25 mark per correct recorded value (AS PER 3 ABOVE)

5. INTERPRET READINGS AND LABEL DIAGRAM

1 mark per correct label on diagram.

6. SET UP TABLE, TEST AND RECORD READINGS

Identify test combinations and record 0.25 mark per correct set, 0.25 mark per correct recorded test value.

7. CHECK WIRING

In this case NO MARKS are awarded for the wiring, (The proof of the pudding is in eating it) The educator must just check for short circuit – check that neutral conductors are ALL on one side of coil / timer / lamp / etc)

8. OPERATION OF CIRCUIT

10 marks if the circuit works the first time
5 marks if it works the second time
2 marks if it works the third time

APPENDIX 3
EXAMPLES OF ASSESSMENT TOOLS FOR THE PRACTICAL ASSESSMENT TASK

A. RUBRIC FOR ASSESSMENT OF THE DESIGN PORTFOLIO

CRITERIA	7	6	5	4	3	2	1
Front cover	The following is done extremely neatly: • Learner's name • Register class • Year • Appropriate illustration • Appropriate title • School's name	Five of the following are done neatly: • Learner's name • Register class • Year • Appropriate illustration • Appropriate title • School's name	Four of the following are done neatly: • Learner's name • Register class • Year • Appropriate illustration • Appropriate title • School's name	Three of the following are done: • Learner's name • Register class • Year • Appropriate illustration • Appropriate title • School's name	Two of the following are done: • Learner's name • Register class • Year • Illustration • Appropriate title • School's name	Only name or register class is given.	Neither name nor register class given.
Index and content	Extremely neat, complete with: • Headings • Subheadings • Page numbers • Page numbers on index match content	Very neat, complete with: • Headings • Subheadings • Page numbers • Page numbers on index match content	Neat, complete with: • Headings • Page numbers • Page numbers on index match content	Neat, with: • Headings • Page numbers	Some attempt made at: • Headings • Page numbers	Only headings or page numbers are given.	No headings or page numbers are given.
Investigate problem , need or opportunity	• Complete description of the situation • Needs and opportunities thoroughly analysed • At least three constraints and specifications given • Logical articulation • At least three relevant applications suggested	• Very good description of the situation • Needs and opportunities well analysed • At least three constraints and specifications given • Very good articulation • At least three other applications suggested	• Good description of the situation • Needs and opportunities analysed • At least two constraints and specifications given • Good articulation • At least two other applications suggested	• Acceptable description of the situation • Needs and opportunities adequately analysed • At least two constraints and specifications given • Good articulation • At least two other applications suggested	• Some description of the situation • Needs and opportunities scarcely analysed • One constraint and specification given • Two other applications suggested	• Poor description of the situation • No analysis of needs and opportunities • No constraints or specifications given • One other application suggested	• No description of the situation • No other application suggested.

Design	The rough work indicates that a wide range of diverse alternatives was considered, and that logic and well-reasoned decisions were made about the following aspects: • Board correct size to fit situation • Components square to one another • Cross connections • Terminating points on the same side of the board • Correct spacing to fit components • Composite overlay	The rough work indicates that a range of diverse alternatives was considered and that well-reasoned decisions were made about the following aspects: • Board correct size to fit situation • Components square to one another • Cross connections • Terminating points on the same side of the board • Correct spacing to fit components • Composite overlay	The rough work indicates that alternatives were considered and reasoned decisions were made about most of the following aspects: • Board correct size to fit situation • Components square to one another • Cross connections • Terminating points on the same side of the board • Correct spacing to fit components • Composite overlay	The rough work indicates that alternatives were considered and that some decisions were made about: • Board correct size to fit situation • Components square to one another • Cross connections • Terminating points on the same side of the board • Correct spacing to fit components • Composite overlay	The rough work indicates that few alternatives of any real worth were considered. The rough work cannot be interpreted.	The rough work indicates only one alternative.	The rough work indicates no alternatives.
Cost and material – component list	• Complete component list with all sundry items • Items fully described • Realistic cost per component • Total cost given	• Complete component list with sundry items • Items fully described • Total cost given	• Component list with sundry items • Items well described • Realistic cost per component • Total cost given	• Component list with some sundry items • Items reasonably described • Realistic cost per component • Total cost given	• Component list with only a few sundry items • Items not well described • Unrealistic cost per component • No total cost given	• Component list incomplete • Items not described • Unrealistic cost per component or not given • No total cost given	• No component list provided • No cost per component or not given
Circuit diagram	Complete circuit diagram, indicating all external connections and drawn extremely neatly. Supply clearly shown (+ and -)	Complete circuit diagram, indicating all external connections and drawn neatly. Supply clearly shown	Complete circuit diagram indicating all external connections	Complete circuit diagram indicating some external connections	Photocopy of circuit diagram indicating some external connections	Photocopy of circuit diagram	No diagram provided

Final layout of design	Layout complete and extremely neat: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	Layout complete and very neat: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	Layout complete: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	Some detail in layout lacking: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	Only few details on layout: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	Most of the detail lacking on layout: • All polarities shown • Component identification marks indicated on the top side of the layout • Components square to the board • No cross connections • Terminating Points on the same side of the board • Correct size to fit components • Wiring diagram includes connections to external components	All detail lacking on layout: • No polarities shown • No component identification marks indicated • Components not square to the board • No connections • No terminating points indicated • Incorrect size to fit components • Wiring diagram does not include connections to external components
Sequence of production steps [This is not only production steps]	The artefact can be realised without any problem because: • The steps are laid out logically, clearly and unambiguously • Appropriate clarification sketches, diagrams and notes are supplied • Correct terminology is used throughout • Product can be achieved without any consultation with the designer	The artefact can be realised without any problem because: • The steps are laid out logically, clearly and unambiguously • Appropriate clarification sketches, diagrams and notes are supplied • Correct terminology is used throughout • Product can be achieved with only some consultation with the designer	It will be possible to realise the artefact because: • The steps are generally laid out logically and clearly • Clarification sketches and notes supplied • Correct terminology is used throughout • Product can be achieved with considerable consultation with the designer	It will be possible to realise the artefact because: • The steps are generally laid out clearly • Clarification sketches and notes are supplied • Correct terminology is used	It will be difficult to realise the artefact because: • The steps are not laid out logically • Few clarification sketches or notes are supplied • Only sometimes is the correct terminology used	It will be extremely difficult to realise the artefact because: • The steps are not laid out logically • Clarification sketches or notes are not supplied • Incorrect terminology is used throughout	It will not be possible to realise the artefact because: • Steps are missing • No clarification sketches or notes are supplied

Tools or equipment required	Complete list with all sundry items fully and separately described to the last detail: • Tools • Equipment • Stationery • Chemicals • Sundries: sandpaper, steel wool, etc.	Complete list with all sundry items fully described: • Tools • Equipment • Stationery • Chemicals • Sundries: sandpaper, steel wool, etc.	Complete list with sundry items: • Tools • Equipment • Stationery • Chemicals • Sundries: sandpaper, steel wool, etc.	Reasonably complete list of sundry items: • Tools • Equipment • Stationery • Chemicals • Sundries: sandpaper, steel wool, etc.	A list with no more than the general items; • Tools • Equipment • Stationery	An incomplete list: • Tools • Equipment	No lists of tools or equipment provided
Block diagram and operation of circuit	The circuit is thoroughly analysed and the different functions are laid out in a neat and logic block diagram. The circuit as a whole is fully described logically and correctly.	The circuit is analysed and the different functions are laid out in a neat block diagram. The operation of circuit is fully and correctly described.	The circuit is analysed and the different functions are laid out in a block diagram. The operation of the circuit is described correctly.	A block diagram describes the overall operation. The operation of the circuit is described.	An incomplete block diagram describes the overall operation. The operation of the circuit is very poorly described.	No block diagram is given to describe the overall operation. The operation of the circuit is incompletely described.	The operation of the circuit is not described at all.
Evaluation: Problems experienced and suggestions	Complete annotated list of all problems experienced Good logical explanation of how the problems were identified and solved After evaluation a list of limitations is given in logical order Well-considered and reasoned suggestions to prevent or rectify similar problems in future given	Complete annotated list of all problems experienced. Good explanation of how the problems were identified and solved After evaluation a list of limitations is given Well-reasoned suggestions to prevent or rectify similar problems in future given	Complete annotated list of all problems experienced Explanation of how the problems were identified and solved After evaluation a list of limitations is given Reasoned suggestions to prevent or rectify similar problems in future given	List of all problems experienced Some explanation of how the problems were identified and solved Limitations of project noted Suggestions to prevent or rectify similar problems in future given.	List of only some problems experienced Limitations of project sketched Some suggestions to prevent or rectify similar problems in future given	Very inadequate list of problems experienced No suggestions to prevent or rectify similar problems in future given	No list provided.

Bibliography	Detailed list of at least five reference sources with the following: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address • Date of visit	Detailed list of at least four reference sources with the following: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address • Date of visit	Detailed list of at least three reference sources with the following: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address • Date of visit	List of at least two reference sources with at least two of the following specifications: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address • Date of visit	List of at least two reference sources with at least one of the following specifications: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address • Date of visit	One reference source with only one of the following specifications: BOOKS • Title • Author • Publisher and date WEBSITE • Search engine and Website address	No reference to sources
Technical quality	Outstanding and impressive final product Proof of pride and very hard work: • Bound • Index • Glossary • Bibliography	Excellent presentation – made full use of available sources and technology: • Bound • Index • Glossary • Bibliography	Good presentation – made use of available sources and technology, three of the following: • Bound • Index • Glossary • Bibliography	Presentation acceptable – made use of some available sources and technology, two of the following: • Bound • Index • Glossary • Bibliography	Presentation partially acceptable. One of the following: • Bound • Index • Glossary • Bibliography	Very little trouble taken Minimal effort made Untidy, shabby and confusing presentation	No effort or trouble taken

B. RUBRIC FOR ASSESSMENT OF THE FINAL PRODUCT/ ARTEFACT

ASPECT	CRITERIA
Sequence of production steps. [This is not only production steps.]	The artefact can be realised without any problem because: the steps are laid out logically, clearly and unambiguously; appropriate clarification sketches, diagrams and notes are supplied; correct terminology is used throughout. The product can be achieved without any consultation with the designer.
Tools or equipment required	Complete list with all sundry items fully and separately described to the last detail: tools; equipment; stationery; chemicals and sundries, e.g. sandpaper, steel wool
Block diagram and operation of circuit	The circuit is thoroughly analysed and the different functions are laid out in a neat and logical block diagram and the circuit as a whole is described logically and correctly.
Evaluation: problems experienced and suggestions (LO2, AS4)	Complete annotated list of all problems experienced provided. Good logical explanation of how the problems were identified and solved. After evaluation a list of limitations is given in logical order. Well-considered and reasoned suggestions to prevent or rectify similar problems in future are given.
Bibliography	Detailed list of at least five reference sources with the following is given: Books - Title; author; publisher and date Website - Search engine and Website address, date of visit
Technical quality	Outstanding and impressive final product Proof of pride and very hard work: bound; index; glossary; bibliography
LEARNING OUTCOME 4: CHECKLIST FOR ARTEFACT	
PCB or vero board	Correct size; sides square; neatly filed and sanded; smooth edges; no marks on the PCB itself (from clamped in vice); cleaned (completely shiny); Tracks eaten through
Soldering	Soldering joints should be clean, neat and shiny; no dry solder joints; joints mechanically sound (no blobs) Solder runs around terminal completely (no gaps or holes) but does not run onto the tracks; No sign of excess heat applied (insulation melted back excessively); Leads uniformly cut
Mounting of components	Resistors (components) mounted parallel with respect to each other as far as possible; components fit neatly into correct holes; terminals of components are bent 90°; no extra (wrong) holes; no tracks replaced with links of wire; components mounted flush on PCB; no excessive terminals on solder side (nipped off correctly); all end points exit on same side of PCB
Final product including the box	Name and logo of the artefact; labels – all lights, switches, variables (e.g. pots) labelled extremely neatly; own test leads and points supplied; ergonomically appealing (Will it attract a customer's attention if put in shop window? All holes drilled in line and well spaced on box; all wiring done neatly (tied, strapped, run 90° where possible, colour-coded)
Operation	**DOES IT WORK?** Yes: 7 marks; No: 0 marks