education

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NATIONAL CURRICULUM STATEMENT GRADES 10-12 (GENERAL)

LEARNING PROGRAMME GUIDELINES

ELECTRICAL TECHNOLOGY

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SECTION 1

INTRODUCTION

1.1 INTRODUCING THE NATIONAL CURRICULUM STATEMENT

1.1.1 BACKGROUND

In 1995 the South African government began the process of developing a new curriculum for the school system. There were two imperatives for this. First, the scale of change in the world, the growth and development of knowledge and technology and the demands of the 21st Century required learners to be exposed to different and higher level skills and knowledge than those required by the existing South African curricula. Second, South Africa had changed. The curricula for schools therefore required revision to reflect new values and principles, especially those of the Constitution of South Africa.

The first version of the new curriculum for the General Education Band, known as Curriculum 2005, was introduced into the Foundation Phase in 1997. While there was much to commend the curriculum, the concerns of teachers led to a review of the Curriculum in 1999. The review of Curriculum 2005 provides the basis for the development of the Revised National Curriculum Statement for General Education and Training (Grades R-9) and the National Curriculum Statement for Grades 10-12.

1.1.2 THE NATIONAL CURRICULUM STATEMENT

The National Curriculum Statement consists of 29 subjects. Subject specialists developed the Subject Statements which make up the National Curriculum Statement. The draft versions of the Subject Statements were published for comment in 2001 and then re-worked to take account of the comments received. In 2002 twenty-four subject statements and an overview document were declared policy through Government Gazette. In 2004 five subjects were added to the National Curriculum Statement. The National Curriculum Statement now consists of the Subject Statements for the following subjects:

- Languages – 11 official languages (each counted as three subjects to cater for the three levels Home Language, First Additional Language and Second Additional Language); 13 non-official languages

- Mathematics; Mathematical Literacy; Physical Sciences; Life Sciences; Computer Applications Technology; Information Technology

- Accounting; Business Studies; Economics

- Geography; History; Life Orientation; Religion Studies

- Consumer Studies; Hospitality Studies; Tourism

- Dramatic Arts; Dance Studies; Design; Music; Visual Arts

- Agricultural Sciences, Agricultural Management Practices, Agricultural Technology

- Civil Technology; Mechanical Technology; Electrical Technology; Engineering Graphics and Design

1.1.3 NATIONAL SENIOR CERTIFICATE

The *National Senior Certificate: A Qualification on Level 4 of the National Qualifications Framework (NQF)* provides the requirements for promotion at the end of Grades 10 and 11 and the awarding of the National Senior Certificate at the end of Grade 12. This document replaces two of the original National Curriculum Statement documents: the *Overview* and the *Qualifications and Assessment Policy Framework.*

1.1.4 SUBJECT ASSESSMENT GUIDELINES

The Subject Assessment Guidelines set out the internal or school-based assessment requirements for each subject and the external assessment requirements. In addition, the *National Protocol for Recording and Reporting (Grades R-12)* (an addendum to the policy, *The National Senior Certificate*) has been developed to standardise the recording and reporting procedures for Grades R to 12. This protocol came into effect on 1 January 2007.

1.2 INTRODUCING THE LEARNING PROGRAMME GUIDELINES

1.2.1 PURPOSE AND CONTENT OF THE LEARNING PROGRAMME GUIDELINES

The Learning Programme Guidelines aim to assist teachers and schools in their planning for the introduction of the National Curriculum Statement. The Learning Programme Guidelines should be read in conjunction with the National Senior Certificate policy and the National Curriculum Statement Subject Statements.

Section 2 of the Learning Programme Guidelines suggests how teaching the particular subject may be informed by the principles which underpin the National Curriculum Statement.

Section 3 suggests how schools and teachers might plan for the introduction of the National Curriculum Statement. The Department of Education encourages careful planning to ensure that the high skills, high knowledge goals of the National Curriculum Statement are attained.

The Learning Programme Guidelines do not include sections on assessment. The assessment requirements for each subject are provided in the Subject Assessment Guidelines which come into effect on 1 January 2008.

1.2.2 WHAT IS A LEARNING PROGRAMME

INTRODUCTION

A Learning Programme assists teachers to plan for sequenced learning, teaching and assessment in Grades 10 to 12 so that all Learning Outcomes in a subject are achieved in a progressive manner. The following three phases of planning are recommended:

- Phase 1 – develop a *Subject Framework* for grades 10 to 12

- Phase 2 – develop a *Work Schedule* for each grade

- Phase 3 – develop *Lesson Plans*

It is recommended that the teachers of a subject at a school or cluster of schools first put together a broad subject outline (Subject Framework) for the three grades to arrive at an understanding of the content of the subject and the progression which needs to take place across the grades (see Section 3.3.1). This will assist with the demarcation of content for each grade. Thereafter, teachers of the subject teaching the same grade need to work together to develop a year long Work Schedule. The Work Schedule should indicate the sequence in which the content and context will be presented for the subject in that particular grade (see Section 3.3.2). Finally, individual teachers should design Lesson Plans using the grade-specific Work Schedule as the starting point. The Lesson Plans should include learning, teaching and assessment activities that reflect the Learning Outcomes and Assessment Standards set out in the Subject Statements (see Section 3.3.3). Learning Programmes should accommodate diversity in schools and classrooms but reflect the core content of the national curriculum.

An outline of the process involved in the design of a Learning Programme is provided on page 6.

DESIGNING A LEARNING PROGRAMME

A detailed description of the process involved in the design of a Learning Programme is provided in Sections 3.3.1 – 3.3.3 of the Learning Programme Guidelines. The first stage, the development of a Subject Framework does not require a written document but teachers are strongly advised to spend time with subject experts in developing a deep understanding of the skills, knowledge and values set out in the Subject Statements. The quality and rigour of this engagement will determine the quality of teaching and learning in the classroom.

Once the Subject Framework has been completed, teachers should develop Work Schedules and Lesson Plans. Examples of Work Schedules and Lesson Plans are provided in the Learning Programme Guidelines. Teachers are encouraged to critically engage with these formats and develop their own.

Developing a Subject Framework (Grades 10-12)

Planning for the teaching of subjects in Grades 10 to 12 should begin with a detailed examination of the scope of the subject as set out in the Subject Statement. No particular format or template is recommended for this first phase of planning but the steps recommended should be used as a checklist.

Although no prescribed document is required for this stage of planning, school-wide planning (timetables, requisitioning, teacher development, classroom allocation) as well as the development of grade-specific work schedules would benefit from short documents which spell out:

- The scope of the subject – the knowledge, skills and values; the content; the contexts or themes; electives etc. to be covered in the three grades for each subject
- A three-year assessment plan for the subject
- The list of LTSM required for the subject

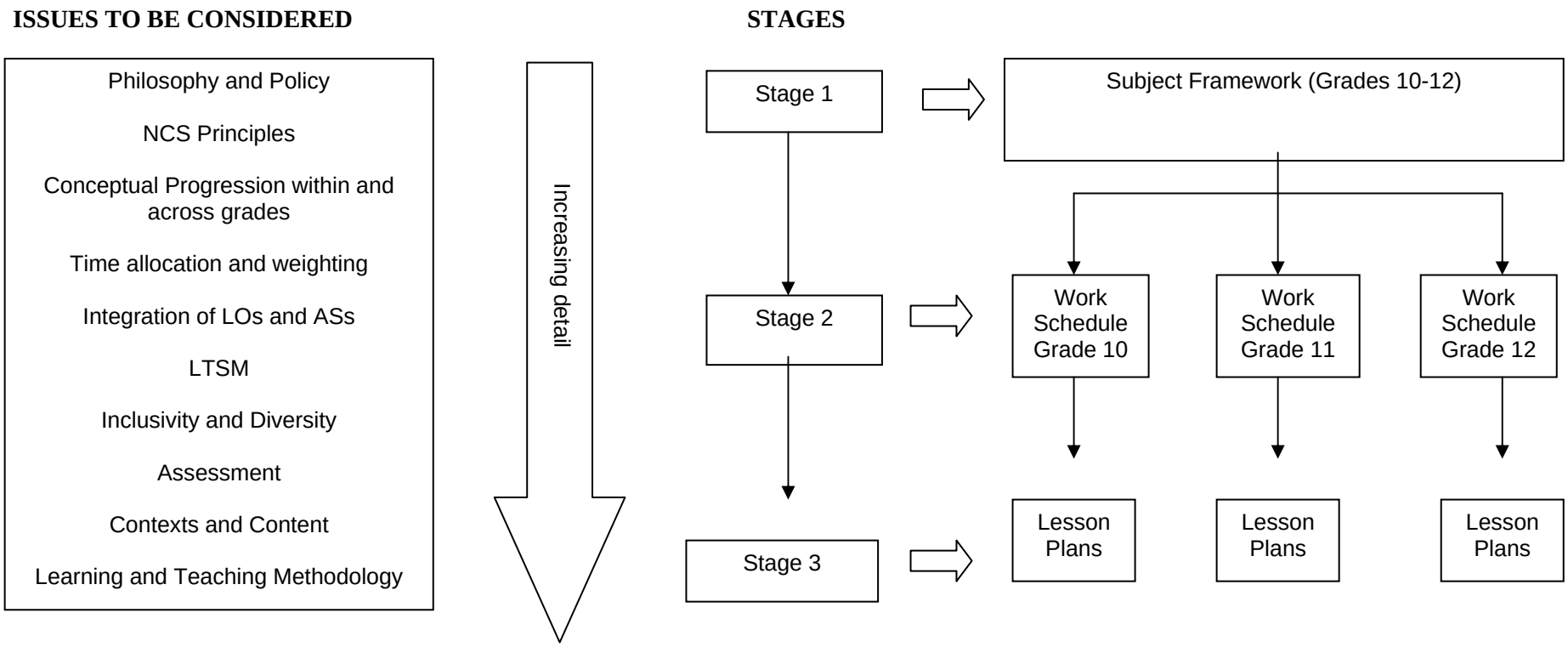
Designing Work Schedules

This is the second phase in the design of a Learning Programme. In this phase teachers develop Work Schedules for each grade. The Work Schedules are informed by the planning undertaken for the Subject Framework. The Work Schedules should be carefully prepared documents that reflect what teaching and assessment will take place in the 36-40 weeks of the school year.

Designing Lesson Plans

Each grade-specific Work Schedule must be divided into units of deliverable learning experiences, that is, Lesson Plans. Lesson Plans are not equivalent to periods in the school timetable. Each Lesson Plan should contain a coherent series of teaching, learning and assessment activities. A Lesson Plan adds to the level of detail for each issue addressed in the Work Schedule. It also indicates other relevant issues to be considered when teaching and assessing a subject.

FIGURE 1: RELATIONSHIP BETWEEN THE 3 STAGES OF PLANNING WHEN DEVELOPING A LEARNING PROGRAMME



SECTION 2

INTRODUCING ELECTRICAL TECHNOLOGY

2.1 WHAT IS ELECTRICAL TECHNOLOGY?

Electrical Technology focuses on the understanding and the application of electrical and electronic principles and the technological processes, inherent in the production of products, services and systems in order to improve the quality of life.

Electrical technology includes Power, Digital and Logic Systems in the Electrical and Electronic knowledge fields. The following are the Learning Outcomes for Electrical Technology:

Learning Outcome 1: Technology, Society and the Environment
The learner is able to demonstrate an awareness and understanding of the interrelationship between Technology, society and the environment.

Learning Outcome 2: Technological Process
The learner is able to understand and apply the technological process.

Learning Outcome 3: Knowledge and Understanding
The learner is able to demonstrate an understanding of the concepts and principles related to Electrical Technology.

Learning Outcome 4: Application of Knowledge
The learner is able to apply principles and practices related to Electrical Technology.

2.2 WHAT IS THE PURPOSE OF ELECTRICAL TECHNOLOGY?

Electrical Technology aims to equip learners with the knowledge, skills, values and attitudes that will enable them to participate and succeed in an economically complex society. The subject also aims to promote productivity, social justice and environmental sustainability. Learners will be provided with opportunities to:

- Understand the principles of Electrical Technology;
- Develop Electrical Technology skills;
- Develop practical skills and different types of thinking;
- Work as effective members of a team;
- Develop self-discipline through the need for effective time management in the meeting of deadlines which is an essential part of professional practice;
- Collect, analyse, organise and critically evaluate relevant resource information and apply it in Electrical Technology theory and practice;
- Appreciate Electrical Technology as a research and development-based process which requires the learner to investigate electrical and electronic systems;
- Develop appropriate presentation and communication skills in order to convey Electrical Technology concepts effectively;
- Relate electrical and electronic skills and knowledge to real situations by ensuring an integrated approach between theory and practice;

- Appreciate how systems and products relate to economic, environmental, social and political, historical and cultural contexts;
- Appreciate Electrical Technology as an integral part of the made world;
- Practise Electrical Technology as an enjoyable and fulfilling life experience;
- Understand the social contribution of Electrical Technology to economic growth, entrepreneurship and sustainability;
- Understand that Electrical Technology may be a tool for social change by improving the quality of life and providing solutions that are responsive to individual and community needs;
- Affirm cultural heritage through a focus on indigenous knowledge;
- Develop an awareness of career opportunities in the electrical industry; and
- Develop their creative potential.

2.3 WHAT IS THE RELATIONSHIP BETWEEN ELECTRICAL TECHNOLOGY AND THE NATIONAL CURRICULUM STATEMENT PRINCIPLES?

The Constitution of the Republic of South Africa (Act 108 of 1996) underpins the NCS and provides a basis for curriculum transformation and development in South Africa. The National Curriculum Statement Grades 10-12 (General) lays the foundation for the achievement of these goals by stipulating Learning Outcomes and Assessment Standards, and by spelling out the key principles and values that underpin the curriculum.

The National Curriculum Statement Grades 10-12 (General) is based on the following principles:

2.3.1 Social transformation

The Constitution of South Africa forms the basis for social transformation in a post-apartheid society and links to Learning Outcome 1: Technology, Society and the Environment.

2.3.2 Outcomes-Based Education

Electrical Technology makes use of learning outcomes and assessment standards to describe what a learner should know and be able to demonstrate i.e. the skills, knowledge, and values that are the results of learning. Electrical Technology encourages learners to develop inquiring and problem solving skills which support the practical application of knowledge in technology and involves active and high level teaching, learning and assessment.

2.3.3 High knowledge and high skills

Electrical Technology aims at developing a high level of knowledge and skills in learners. It sets high expectations of what South African learners can achieve.

2.3.4 Integration and applied competence

The integration of knowledge, skills, values and attitudes across and within subjects and terrains of practice is crucial for achieving applied competence in Electrical Technology as is defined in the National Qualifications Framework (NQF) and indicated in the attached Work Schedule.

2.3.5 Progression

Progression refers to the process of developing more advanced and complex knowledge and skills. The subject statement for Electrical Technology shows progression from one grade to another. Each Learning Outcome is followed by an explicit statement of what level of performance is expected for

the outcome per grade. The content and context of each grade will show progression from simple to complex and should be apparent in the learning programme.

2.3.6 Articulation and Portability

Electrical Technology in Grades 10-12 links with the exit levels of Grade 9 and the entrance levels of Electrical Technology to, inter alia, Higher Education.

2.3.7 Human Rights, Inclusivity, Environmental and Social Justice

The NCS is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors. The subject Electrical Technology is infused with these principles and practices and links to Learning Outcome 1: Technology, Society and the Environment.

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2.3.8 Valuing Indigenous Knowledge Systems

Electrical Technology has infused Indigenous Knowledge Systems into the Subject Statement to acknowledge the richness of the history and heritage of this country and its constitution and links to Learning Outcome 1: Technology, Society and the Environment, Assessment Standard 4.

2.3.9 Credibility, quality and efficiency

Electrical Technology aims to achieve **credibility, quality and efficiency** through pursuing a transformational agenda and through providing an education that is comparable in quality, breadth and depth to those of other countries.

2.4 PROFILE OF AN ELECTRICAL TECHNOLOGY LEARNER

Learners wishing to pursue a study of electrical principles and its use in a variety of situations are encouraged to pursue a career in Electrical Technology. The learners who enter Grade 10 will have emerged from Grade 9 having studied eight learning areas. Depending on the local circumstances, learners will have varied knowledge of content and communication skills of technology.

The learner who chooses this subject will do so for a variety of reasons, namely to:

- Pursue a career in an electrical field;
- Acquire applied and transferable skills;
- Increase productivity levels;
- Complete a rounded education; and
- Acquire applied entrepreneurial skills.

The Electrical Technology learner, after achieving all the learning outcomes, should reflect the following qualities:

- Communication skills;
- Language proficiency;
- Scientific skills;
- Visual literacy;
- Fine psycho-motor skills;
- Logical and practical thinking skills;
- Creativity;

- Problem-solving skills;
- Willingness to learn and apply skills in different situations; and
- Willingness to engage in life-long learning.

All four of the learning outcomes of Electrical Technology have strong links with the GET learning areas: Technology, Economic and Management Sciences, Mathematics, Languages, Natural Sciences, Social Sciences, Life Orientation and Arts and Culture as illustrated in table 2.1 below.

Table 2.1 Comparison between the NCS in Grades R-9 and Grades 10-12

GET Learning Areas	LOs NCS: Grades R-9	LOs NCS: Grades 10-12
Technology	1, 2 and 3	1,2, 3 and 4
Economic and Management Sciences	3	2 and 3
Mathematics	4 and 5	2 and 3
Languages	1, 2, 3, 4, 5 and 6	1, 2, 3 and 4
Life orientation	1, 2, 3, 4 and 5	1
Natural Sciences	1, 2 and 3	1, 2 and 3
Arts and Culture	1 and 4	2 and 3
Social Sciences	3	1, 2 and 3

2.5 RELATIONSHIP BETWEEN THE ELECTRICAL TECHNOLOGY OUTCOMES, AND THE CRITICAL AND DEVELOPMENTAL OUTCOMES

The Critical and Developmental Outcomes are fundamental to the aims of Electrical Technology Education. These outcomes enable learners to become technologically literate and sensitive across a range of social contexts.

Table 2.2 below illustrates the relationship between the Critical and Developmental Outcomes, and possible application in developing Electrical Technology skills, knowledge and values.

Table 2.2 Relationships between the Critical and Developmental Outcomes, and the Electrical Technology Learning Outcomes

CRITICAL OUTCOMES	APPLICATION IN FET ELECTRICAL TECHNOLOGY	FET ELECTRICAL TECHNOLOGY LOs
Identify and solve problems and make decisions using critical and creative thinking.	Engage in creative, innovative thinking with the Technological process by solving problems, when conceptualising and realising a solution.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Work effectively with others as members of a team, group or organisation and community.	The Technological Process often requires participants to work together which involves sharing of ideas, developing interviewing skills, democratic practices and ethical responsibilities.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Organise and manage themselves and their activities responsibly and effectively.	Electrical Technology encourages learners to be self-disciplined, to plan, organise and manage their work, to keep to time schedules, to be committed to the task and to take responsibility for their actions.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Collect, analyse, organise and **critically evaluate** information.	Electrical Technology encourages learners to observe and record data in a variety of ways so that they are able to analyse, interpret and critically evaluate information and apply it in theory and practice of Electrical Technology.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Communicate effectively using visual, symbolic and / or language skills in various modes.	Learners are required to communicate through verbal, non - verbal and symbolic language forms that characterise the Technology field.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Use science and technology effectively and critically **showing responsibility** towards the environment and the health of others.	Electrical Technology concepts and end-products should develop effective social, ethical and environmental responsibility.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge

Demonstrate an understanding of the world as a set of related systems by recognising that **problem solving contexts do not exist in isolation.**	Electrical Technology involves learners in understanding how their own problem solving activities are influenced by, or may impact on, local, national and global contexts.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge

DEVELOPMENTAL OUTCOMES	APPLICATION IN FET ELECTRICAL TECHNOLOGY	FET ELECTRICAL TECHNOLOGY LOs
Reflect and explore a variety of strategies to learn more effectively.	Electrical Technology combines theory with practice in ongoing processes which enable learners continually to evaluate their knowledge and skills while at the same time supporting and enhancing teaching and learning.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Participate as **responsible citizens** in the life of local, national and global communities.	Learners develop responsibility towards their communities, both locally and nationally and understand the contribution of Electrical Technology towards the development of a vibrant local, national and international industry.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge
Be **culturally and aesthetically sensitive** across a range of social contexts.	Electrical Technology can influence or be influenced by other cultures and has the potential to be a powerful agent for change, transformation and affirmation.	LO.1 - Technology, Society and the Environment; LO.3 - Knowledge and Understanding; and LO.4 - Application of knowledge
Explore education and career opportunities.	The Electrical Technology field offers a varied range of professional and vocational opportunities, which can enable learners to make a significant economic contribution to self and society.	LO.1 - Technology, Society and the Environment; LO.3 - Knowledge and Understanding; and LO.4 - Application of knowledge
Develop **entrepreneurial** opportunities.	The Electrical Technology field offers a varied range of professional and vocational opportunities through commitment to best practice, the ability to initiate, market and manage skills, processes and end products.	LO.1 - Technology, Society and the Environment; LO.2 - Technological Process; LO.3 - Knowledge and Understanding; and LO.4 - Application of Knowledge

2.6 WAYS TO ACHIEVE ELECTRICAL TECHNOLOGY LEARNING OUTCOMES

The National Curriculum Statement encourages active learning, problem solving, lateral thinking, critical reflection, decision-making, and working in groups or independently.

It is important to note that the Learning Outcomes for Electrical Technology are the same for all grades. Each Learning Outcome has its own Assessment Standards. These Assessment Standards give detail to content and context and application of such content. The Assessment Standards describe ways of achieving the Learning Outcomes. They have been formulated in such a way that there is progression in the development of skills, processes, concepts, content knowledge, values and attitudes within as well as across grades. The performance of learners in the learning outcomes is measured against the assessment standards. Each grade builds on the competencies developed in the previous grade.

Possible ways of achieving the above are:

2.6.1 Integration of Learning Outcomes

The four Learning Outcomes are integrated and not presented in any specific order. They should not be considered sequential as each one supports and underpins the other. This approach supports and expands learners' opportunities to attain skills, acquire knowledge and develop appropriate attitudes and values.

Learners must be encouraged to use their own initiative. Project-based learning, collaborative learning and group work need to be encouraged. Content should be selected in such a way that it encourages the development of creativity, critical thinking, research skills, reading proficiency and interpretation skills.

2.6.2 Bloom's Taxonomy approach

The Learning Outcomes are formulated in a manner that specifies the broad context in which content has to be dealt with. Context in this sense refers to ***cognitive*** context. Examples include knowledge, understanding, application, analysis and evaluation. They are all contexts specified in the four Learning Outcomes to deal with content. Assessment Standards give more detail. Bloom's taxonomy assists the teacher and the learner in understanding the complexity of the Assessment Standards.

The following words are commonly used in explaining the levels of complexity:

Knowledge - memorises and recalls information: arrange, define, label, list, outline, and repeat order, select, recognise, name, state, identify.

Comprehension (understanding) - interpret information in one's own words: describe, indicate, restate, review, summarise, classify, predict, and distinguish.

Applications - apply knowledge to new situations: apply, calculate, draw, explain, identify, illustrate, prepare, operate, practice, solve, sketch, use, show, modify, classify, produce, use and sketch.

Analysis - breakdown knowledge into parts and show relationship among parts: analyse, categorize, compare, distinguish, discuss, examine, investigate, test, classify, survey, differentiate, select.

Synthesis - brings together parts of knowledge to form a whole; build relationships for new situation: arrange, compose, formulate, organize, plan, assemble, construct, create, develop, produce and design.

Evaluation - makes judgments on basis of criteria: appraise, assess, comment on, critically analyse, evaluate, conclude, interrogate, judge, predict, compare, score, judge, relate, summarise, recommend, criticize, support.

2.6.3 Resource materials

Textbooks, while essential to teaching Electrical Technology, should not be considered as the only source of content. Other relevant resources such as newspapers, user manuals, magazines, journal articles, radio and television, other electronic media and Internet sites need to be incorporated into the content.

Learners must be encouraged to use their own initiative. Project-based learning, collaborative learning and group work need to be encouraged. Content needs to be selected in such a way that it encourages the development of creativity, critical thinking, research skills, reading proficiency and interpretation skills.

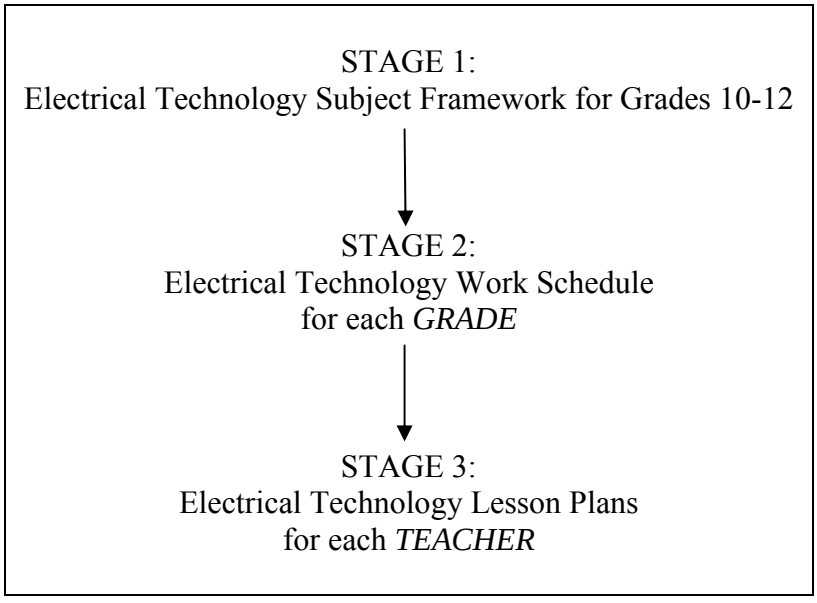
SECTION 3

DESIGNING A LEARNING PROGRAMME FOR ELECTRICAL TECHNOLOGY

3.1 INTRODUCTION

A Learning Programme is a tool to plan for sequenced learning, teaching and assessment across Grades 10-12 so that all four Learning Outcomes in Electrical Technology are achieved in a progressive manner. It is recommended that the Electrical Technology teachers at a school first put together a broad subject outline (i.e. Subject Framework) for Grades 10-12 to arrive at an understanding of the progression which needs to take place across the grades (see Section 3.3.1). This will assist with the demarcation of content for each grade. Thereafter, Electrical Technology teachers teaching the same grade need to work together and draw from the content and context identified for their grade in the Subject Framework, to develop a Work Schedule in which they indicate the sequence in which the content and context will be presented for Electrical Technology in that particular grade (see Section 3.3.2). Finally, the individual Electrical Technology teacher should design Lesson Plans using the grade-specific Work Schedule as the starting point. The Lesson Plans should include learning, teaching and assessment activities (see Section 3.3.3).

An outline of the process involved in the design of a Learning Programme for Electrical Technology is provided in the diagram below:



The process to be followed in the development of a Learning Programme is not a neatly packaged sequence of numbered steps that follow one another in a particular order. Teachers may find themselves moving back and forth in the process as they plan and critically reflect on decisions taken before moving on to the next decision in the process. The process is therefore not strictly linear and is reflective in nature. For this reason the steps provided in this Section are a guide and should be used as a checklist in the planning process.

3.2 ISSUES TO ADDRESS WHEN DESIGNING A LEARNING PROGRAMME

The issues to be addressed in the development of an Electrical Technology Learning Programme are presented in a tabular format to indicate the implications of each issue at each of the three stages of the development of a Learning Programme:

- Stage 1 – Subject Framework
- Stage 2 – Work Schedule
- Stage 3 – Lesson Plan

3.2.1 Policies and Principles

STAGE 1 **Subject Framework** **STAGE 2** **Work Schedule** **STAGE 3** **Lesson Plan**	The various Policies that impact on curriculum implementation should be considered throughout the planning process. *NCS*: • Principles: Refer to Section 2.3 to see how Electrical Technology supports the application of the nine principles of the NCS • Critical and Developmental Outcomes: Refer to Section 2.5 to see how Electrical Technology supports the application of the Critical and Developmental Outcomes *Other Policies and Legislation*: • White Paper 6, Language in Education Policy, Religion and Education Policy, HIV/AIDS Policy– all have implications for LTSM and teaching methods in Electrical Technology • White Paper 7 – gives an indication on the use of computers in the classroom and therefore has implications for LTSM and teaching methods in Electrical Technology

3.2.2 Content

In the NCS Grades 10-12 content means the combination of knowledge, skills and values.

STAGE 1 **Subject Framework**	The content is provided by the ASs. These give an indication of the knowledge, skills and values (KSVs) to be covered in each of the three grades. The Subject Framework sets out the content for the three years (i.e. Grades 10, 11 and 12).
STAGE 2 **Work Schedule**	The Work Schedule sets out the content for one year. Here the focus falls on the grade-specific KSVs required by the NCS.
STAGE 3 **Lesson Plan**	The Lesson Plans set out the content to be covered in each coherent series of learning, teaching and assessment activities. Each Lesson Plan can be one or more weeks in duration.

3.2.3 Integration

Integration involves the grouping of Assessment Standards according to natural and authentic links.

STAGE 1 **Subject Framework**	Integration within the subject should be considered in broad terms during discussions at this stage. All Grade 10-12 teachers should consider integration of ASs within and across the grades.
STAGE 2 **Work Schedule**	The integration and sequencing of the ASs is undertaken in the Work Schedule to ensure that all ASs for a particular grade are covered in the 40-week contact period.

STAGE 3 **Lesson Plan**	The same groupings of LOs and ASs as arrived at in the Work Schedule should be used to develop a coherent series of learning, teaching and assessment activities for each Lesson Plan.

3.2.4 Conceptual Progression

STAGE 1 **Subject Framework**	The Subject Framework should indicate the increasing depth of difficulty across Grades 10-12. Progression across the three grades is shown in the ASs per Learning Outcome.
STAGE 2 **Work Schedule**	Progression in a grade is evident in the increasing depth of difficulty in that particular grade. Grade-specific progression is achieved by appropriately sequencing the groupings of integrated LOs and AS in the Work Schedule.
STAGE 3 **Lesson Plan**	In the individual Electrical Technology classroom increasing depth of difficulty is shown in the activities and Lesson Plans. Progression is achieved by appropriately sequencing the activities contained within each Lesson Plan and in the series of Lesson Plans.

3.2.5 Time Allocation and Weighting

STAGE 1 **Subject Framework**	4 hours per week is allocated to Electrical Technology in the NCS. This is approximately 160 hours per year. The teachers of the subject should plan how this time will be used for the teaching of Electrical Technology in the three grades.
STAGE 2 **Work Schedule**	The groupings of ASs as arrived at in the integration process should be paced across the 40 weeks of the school year to ensure coverage of the curriculum.
STAGE 3 **Lesson Plan**	The amount of time to be spent on activities should be indicated in the Lesson Plans.

3.2.6 LTSM

LTSM refers to any materials that facilitate learning and teaching. LTSM need to be chosen judiciously because they have cost implications for the school and the learner. The NCS provides scope for the use of a variety of resources. All teachers and learners must have a textbook. However, teachers are required to go beyond the textbook. They do not necessarily need exotic, specialised materials. Rather common and readily available items can be used.

STAGE 1 **Subject Framework**	Compile a list of general LTSM (text books and other resources) that will be necessary and useful in the teaching, learning and assessment of the content. This assists with the requisition and availability of LTSM at a school.
STAGE 2 **Work Schedule**	List grade-specific LTSM (resources) required in the learning, teaching and assessment process for the grade.
STAGE 3 **Lesson Plan**	Identify specific resources related to the individual activities contained within a Lesson Plan.

3.2.7 Assessment

All Grade 10, 11 and 12 learners are expected to complete seven internal tasks for Electrical Technology. Of the seven tasks, two must be tests, two must be examinations and the remaining three tasks can take any form suitable to the teaching and assessment of Electrical Technology – See Section 3 of the Subject Assessment Guidelines for Electrical Technology.

In order to administer effective assessment one must have a clearly defined purpose. It is important that all the tasks are well covered as spelt out in the Subject Assessment Guideline document. By answering the following questions the teacher can decide what assessment activity is most appropriate:

- What concept, skill or knowledge needs to be assessed?
- What should the learners know?
- At what level should the learners be performing?
- What type of knowledge is being assessed: reasoning, memory or process?

Observation-based assessment requires that learner performance be assessed while the learner is actually performing a skill in the classroom as there will be no concrete product for the teacher to assess after the performance. Not all observations need culminate in a formally recorded assessment of learner performance. **Performance-based** assessment relies on the availability of a product as evidence of learner performance that can be assessed by the teacher after the completion of the performance. **Test-based** assessment focuses on assessing the presentation and application of knowledge.

STAGE 1 **Subject Framework**	Develop a three-year assessment plan using the Subject Assessment Guidelines for Electrical Technology. This should ensure the use of a variety of assessment forms relevant to the subject and progression across the three grades.
STAGE 2 **Work Schedule**	Use the Subject Assessment Guidelines for Electrical Technology to develop a grade-specific assessment plan. The forms of assessment listed must facilitate the achievement of the particular LOs and ASs in each grouping.
STAGE 3 **Lesson Plan**	Indicate more classroom-specific assessment strategies, by mentioning the methods, forms and tools that will be used to assess learner performance in each activity. HINT: Not all activities need to be assessed – some may just be introductory in nature or for enrichment. The choice of an assessment strategy is determined by the LOs and ASs that have been grouped together for a particular Lesson Plan. The assessment strategy chosen must facilitate the achievement of these particular LOs and ASs in the classroom.

3.2.8 Inclusivity and Diversity

The following steps can be taken to effectively address diversity in the classroom when planning Electrical Technology teaching activities:

- consider individual past experiences, learning styles and preferences;
- develop questions and activities that are aimed at different levels of ability;
- provide opportunity for a variety of participation levels such as individual, pairs and small group activities;
- consider the value of individual methods ; and
- assess learners based on individual progress.

STAGE 1 **Subject Framework**	Teachers should be sensitive to inclusivity and diversity when identifying content, teaching styles and methods, forms of assessment and LTSM (Resources). Diversity

STAGE 2 **Work Schedule**	should be accommodated in the following areas: • Learning styles: provide optional activities / different ways of doing same activity • Pace of learning: provide for both slower and faster learners by providing optional extra activities, reading or research, as well as multiple assessment opportunities • Differences in levels of achievement: provide optional extra activities, challenges and materials that cater for these differences between learners. • Gender diversity: ensure that teachers do not inadvertently allow or contribute towards discrimination against boys or girls in the classroom on the basis of gender. • Cultural diversity: recognise, celebrate and be sensitive when choosing content, assessment tasks and LTSM.
STAGE 3 **Lesson Plan**	This is catered for as EXPANDED OPPORTUNITIES in the Lesson Plan. Enrichment is provided for high achievers and remediation or other relevant opportunities for learners requiring additional support. It is not necessary to develop an activity to cater for each type of diversity which arises in the classroom. Teachers may find it possible to cater for different diversities within one activity with effective planning.

3.2.9 Learning and Teaching Methodology

STAGE 1 **Subject Framework**	It is not necessary to record Teaching Methods for either of these stages.
STAGE 2 **Work Schedule**	
STAGE 3 **Lesson Plan**	This is catered for as TEACHING METHOD in the Lesson Plan. It provides an indication of how teaching and learning will take place, that is, how each activity will be presented in the classroom.

3.3 DESIGNING A LEARNING PROGRAMME

A detailed description of the process involved in the design of a Learning Programme for Electrical Technology is provided in this section (see Sections 3.3.1 – 3.3.3). The process presented here is a suggestion of how to go about designing a Learning Programme.

3.3.1 Subject Framework (Grades 10-12) for Electrical Technology

Planning for the teaching of Electrical Technology in Grades 10 to 12 should begin with a detailed examination of the scope of the subject as set out in the Subject Statement. No particular format or template is recommended for this first phase of planning but the five steps below should be used as a checklist.

Although no prescribed document is required for this stage of planning, school-wide planning (timetables, ordering, teacher development, classroom allocation) as well as the development of grade-specific work schedules would benefit from short documents which spell out:

- The scope of the subject – the knowledge, skills and values; the content; the contexts or themes; electives etc. to be covered in the three grades (see Appendix A)
- A three-year assessment plan
- The list of LTSM required

❶ Clarify the Learning Outcomes and Assessment Standards.

The essential question for Electrical Technology is: What Learning Outcomes do learners have to master by the end of Grade 12 and what Assessment Standards should they achieve to show that they are on their way to mastering these outcomes?

All learning, teaching and assessment opportunities must be designed down from what learners should know, do and produce by the end of Grade 12. The Learning Outcomes and Assessment Standards that learners should master by the end of Grade 12 are specified in the Electrical Technology Subject Statement.

❷ Study the conceptual progression across the three grades.

Study the Assessment Standards for Electrical Technology across the three grades. Progression should be clearly evident across the grades.

❸ Identify the content to be taught.

Analyse the Assessment Standards to identify the skills, knowledge, attitudes and values to be addressed in each grade. Also consider the content and context in which they will be taught.

❹ Identify three-year plan of assessment.

Use the Subject Assessment Guidelines to guide the three-year assessment plan. Consider what forms of assessment will be best suited to each of the Learning Outcomes and Assessment Standards. This ensures that assessment remains an integral part of the learning and teaching process in Electrical Technology and that learners participate in a range of assessment activities.

❺ Identify possible LTSM (resources).

Consider which LTSM will be best suited to the learning, teaching and assessment of each Learning Outcome in the three grades using the Assessment Standards as guidance.

3.3.2 Designing Work Schedules for Electrical Technology

This is the second phase in the design of a Learning Programme. In this phase teachers develop Work Schedules for each grade. The Work Schedules are informed by the planning undertaken for the Subject Framework. The Work Schedules should be carefully prepared documents that reflect what teaching and assessment will take place in the 40 weeks of the school year. See Appendix B for examples of Work Schedules for Grades 10, 11 and 12.

The following steps provide guidelines on how to approach the design of a Work Schedule per grade for Electrical Technology:

❶ Package the content.

Study the Learning Outcomes and Assessment Standards prescribed for the particular grade in Electrical Technology and group these according to natural and authentic links.

❷ **Sequence the content.**

Determine the order in which the groupings of Learning Outcomes and Assessment Standards will be presented in the particular grade in Electrical Technology. Besides the conceptual progression in the Assessment Standards for Electrical Technology, *context* can also be used to sequence groupings in Electrical Technology.

❸ **Pace the content.**

Determine how much time in the school year will be spent on each grouping of Learning Outcomes and Assessment Standards in the particular grade.

❹ **Review forms of assessment.**

Revisit the forms of assessment listed for the particular grade in the Subject Assessment Guidelines, and refine them to address each grouping of Learning Outcomes and Assessment Standards as developed in Step 1.

❺ **Review LTSM.**

Revisit the LTSM (resources) listed for the particular grade in the Subject Framework, and refine them to address each grouping of Learning Outcomes and Assessment Standards as developed in Step 1.

3.3.3 Designing Lesson Plans for Electrical Technology

Each grade-specific Work Schedule for ELECTRICAL TECHNOLOGY must be divided into units of deliverable learning experiences, that is, Lesson Plans. A Lesson Plan adds to the level of detail in the Work Schedule. It also indicates other relevant issues to be considered when teaching and assessing Electrical Technology.

A Lesson Plan is not equivalent to a subject period in the school timetable. Its duration is dictated by how long it takes to complete the coherent series of activities contained in it.

❶ **Indicate the content, context, Learning Outcomes and Assessment Standards.**

Copy this information from the Work Schedule for the particular grade.

❷ **Develop activities and select teaching method.**

Decide how to teach the Learning Outcomes and Assessment Standards indicated in Step 1 and develop the activity or activities that will facilitate the development of the skills, knowledge, attitudes and values in the particular grouping. Thereafter, determine the most suitable teaching method(s) for the activities and provide a description of how the learners will engage in each activity.

❸ **Consider diversity.**

Explore the various options available within each activity that will allow expanded opportunities to those learners that require individual support. The support provided must ultimately guide learners to develop the skills, knowledge, attitudes and values indicated in the grouping of Learning Outcomes and Assessment Standards.

❹ **Review assessment and LTSM.**

Indicate the details of the assessment strategy and LTSM to be used in each activity.

❺ Allocate time.

Give an indication of how much time will be spent on each activity in the Lesson Plan.

3.3.4 Reflection and review of the Electrical Technology Learning Programme

After the Learning Programme has been delivered by means of Lesson Plans in the classroom, the teacher should reflect on what worked, how well it worked and what could be improved. Teachers need to note these while the experience is still fresh in their minds, so that if necessary, they can adapt and change the affected part of the Electrical Technology Learning Programme for future implementation. It is advisable to record this reflection on the Lesson Plan planning sheets.

APPENDIX A:
CONTENT FRAMEWORK FOR ELECTRICAL TECHNOLOGY

Note:

- See the Defining Content and Context document for Electrical Technology (Department of Education, 2006) for further guidance on the content to be addressed in Electrical Technology.

UNPACKING THE CONTENT IN LEARNING OUTCOMES 3 AND 4

Electrical Technology Gr. 10 The learner is able to apply principles (LO.3) and practices (LO.4) related to Electrical Technology. We know this when the learner is able to:		
	ASSESSMENT STANDARD	**POSSIBLE CONTENT**
10.3.2	Describe the use and care of measuring instruments.	Multimeter; Continuity/insulation tester and Oscilloscope.
10.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	Relevant tools to be dealt with during the practical sessions.
10.3.1	Demonstrate an understanding of the OHS Act where applicable.	
10.3.3	Describe the principles of magnetism.	Define magnetism e.g. Natural, electro-magnetism. Faraday's law. Lenz's law. Self- and mutual induction. Inductance. Application of magnetism e.g. magnetic motor.
10.3.4	Describe the principles of electricity.	Theory of current flow. Ohm's law. Series circuit as voltage divider. Parallel circuit as a current divider. Combination circuits. Specific resistance. Temperature coefficient. Verify Ohm's law. Investigate specific resistance and effect of temperature.
10.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	
10.3.1	Demonstrate an understanding of the OHS Act where applicable.	
10.3.5	Describe the principles of electrostatics.	Basic principles of electrostatic charge. Capacitance.
10.3.6	Identify and describe the characteristics of electronic components.	Resistor/capacitor/inductor/and other. Semi-conductor devices, characteristic curves and symbols e.g. diodes, LEDs, Zener diodes.
10.4.3	Construct and comprehend electronic circuits.	Diode circuits. Conversion of circuit diagrams to practical applications.
10.3.9	Describe the principles of operation and use of power sources.	Different electrical energy sources. Capacity and Power rating.

10.3.10	Describe basic logic concepts.	The use of number systems in digital electronics. Basic logic functions and gates e.g. AND, OR and NOT.
10.4.4	Construct and comprehend digital circuits.	Construct basic switching logic circuits e.g. AND, OR and NOT.
10.3.11	Describe and compare different types of protective devices.	Current/voltage operating devices. Earth leakage devices.
10.3.12	Draw single-phase circuits.	Switching. Distribution boards.
10.4.2	Construct and comprehend single - phase circuits.	Construct lighting switching circuits and include protective devices.
10.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	Test portable equipment for insulation, continuity and earth continuity.
10.3.1	Demonstrate an understanding of the OHS Act where applicable.	
10.3.13	Describe electronic communication systems.	Signalling with lamp/buzzer. Applications of different systems e.g. wireless channel systems.

Grade 11

The learner is able to apply principles (LO.3) and practices (LO.4) related to Electrical Technology.
We know this when the learner is able to:

	ASSESSMENT STANDARD	POSSIBLE CONTENT
11.3.2	Explain the use and care of instruments.	Function generator and oscilloscope. Learners must be able to interpret and calculate voltage, frequency and phase angle from waveforms obtained on an oscilloscope.
11.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	Relevant tools to be dealt with during the practical sessions.
11.3.1	Apply the OHS Act and regulations where applicable.	
11.3.3	Explain the principles of single-phase ac generation.	Generation of a single-phase supply by rotating a conductor loop through a two-pole magnetic field. Difference between direct current and alternating current.
11.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	Establish concepts of series and parallel circuits. Kirchhoff's laws.
11.3.1	Apply the OHS Act and regulations where applicable.	
11.3.4	Explain the principles and effect of ac on R, L and C components and determine the effect on combination of series circuits.	To establish effect of alternating current on R, L and C components in series circuits. The emphasis will be on circuits containing ONE resistor, ONE capacitor and ONE inductor. Phasor and wave representation. Resonance with its characteristic curves. Calculations.
11.4.1	Identify unsafe conditions and acts, and apply tools and instruments correctly.	Do practical activities to verify the above.
11.3.1	Apply the OHS Act and regulations where applicable.	
11.3.6	Explain the operating principles and use of semi-conductor devices.	Functional operation and composition of bipolar transistors and their characteristic curves. Functional operation and composition of bipolar transistors and their characteristic of Thyristors Transistor as switch - Reference to regions of operation as well as Vcc and Vce.
11.3.7	Explain the operation of an amplifier circuit.	Identify, describe the operation of a transistor amplifier; compare and draw circuit diagrams, adding the input and output signals. Compare the connection and characteristics of common base, common emitter and common collector amplifiers The interpretation of a load line with an ac signal (Active region) to determine the values of the base and collector current. Alternatively, the construction of a load line
11.4.3	Construct and apply electronic circuits.	Do practical activities to verify 11.3.7 Construct a Darlington circuit to investigate the current gain.

11.3.8	Describe the principle of operation and use of single-phase transformers.	Function and operation of transformers. Application of transformers types including instrument transformers. Ratings and calculations on full load transformers.
11.3.9	Describe the principles of operation and use of power supplies.	Principles and operation of DC power supplies e.g. transformation, rectification, filtering and regulating.
11.3.10	Combine logic concepts to form logic systems.	Identify and interpret logic gates and symbols. Apply logic gates with a maximum of three inputs as a "black box" device. Simplify logic equations by using Boolean expressions and drawing the logic circuits.
11.4.4	Construct and apply digital circuits.	Design and construct applications circuits, with the aid of truth tables.
11.3.11	Explain the operating principles of different protective devices.	Over current and under-voltage protection.
11.4.2	Construct and apply single-phase circuits.	Design and construct relay logic control circuits that include protective and timing devices.
11.3.12	Explain the operating principles and application of single-phase motors.	Explain the operation of single- phase induction motors and how to obtain a rotating magnetic field in single-phase motors. Identify and explain the function of components on diagrams, and explain the function of the relevant motor control circuit.
11.4.1	Identify unsafe conditions and acts, and apply tools and instruments.	Test portable equipment for insulation, continuity and earth continuity. Construct a phase control circuit.
11.3.1	Apply the OHS Act and regulations where applicable.	
11.4.2	Construct and apply single-phase circuits.	
11.3.13	Explain the operating principles of modulation and demodulation with reference to communication systems.	Modulation e.g. AM, FM. Demodulation. Medium used as carrier.

Gr. 12 The learner is able to apply principles (LO.3) and practices (LO.4) related to Electrical Technology. We know this when the learner is able to:		
	ASSESSMENT STANDARD	**POSSIBLE CONTENT**
12.4.1 12.3.1	Identify unsafe conditions and acts, and apply tools and instruments correctly. Apply the OHS Act and regulations where applicable.	The selection, use and care of the relevant tools to be integrated with practical activities.

12.3.3	Explain three-phase AC generation.
	.
		• **Advantages and disadvantages** of single- and three-phase systems – not only restricted to motors
		• **Identifying and sketching** the wave form and phasor diagrams to show the difference between single- and three-phase systems
		• **Distinguishing** between schematic (sketch without indication of components) and diagrammatic (sketch with components) representations of three-phase systems.
		  • Power in balanced three-phase systems
		  • Only balance loads
		  • Introduction to star and delta calculations with reference to basic line /phase values.
		  • Power in balance 3 phase system, calculations $P = \sqrt{3}\ VI \cos \Phi$
		  • For exams purposes, efficiency to be taken as 100%
		  • Only concept of pf correction – no calculations for exam purposes
		  • Identify and explain purpose of wattmeter, kWh meter and pf meter when connecting instruments in circuits. (All diagrams and circuits must be given, and then questions asked referring to diagrams/ circuits)
		  • Reference will be made to kW, kVA.
		Emphasis will be on active and apparent power

12.3.4	Determine the effect of AC on series and parallel resistor, inductor and capacitor component combination circuits.	• Calculations with reference to a phasor diagram or analysing of a phasor diagram followed by calculations of the required information • Establishing the basic concepts of series and parallel circuits using only pure components in series & parallel circuits. The emphasis will be primarily on circuits containing only ONE resistor, ONE inductor and ONE capacitor. • Insight questions such as the following can be asked: "What will happen to the brightness of a lamp in a series RL or RC circuit if the frequency is increased/decreased?"
12.4.1 12.3.1	Identify unsafe conditions and acts, and apply tools and instruments correctly. Apply the OHS Act and regulations where applicable	Calculations and phasor diagrams. In parallel resonance circuits the approximated formulas may be used if $X_L > 10R$. Integrate practical activities to verify 12.3.4.

12.3.6	Explain the operating principles of switching and control circuits.	• All circuits must be given and questions asked relating to circuits • Identification of components. • Characteristic curves • Function, operation and purpose of components. • No construction of components.
12.4.3	Construct and analyse electronic circuits	Construct thyristor control circuits and investigate the input and output.
12.3.7	Analyse the output of amplifiers, taking characteristics and feedback into account	• **Characteristics** of an Op-amp • **Draw, identif**y and **give the applications** of comparator, inverting- and non-inverting amplifier circuits. • **Draw** the input and output signals. • The effect on feedback.
12.4.3	Construct and analyse electronic circuits.	Integrate practical activities to verify 12.3.7.
12.3.8	Explain the operation and use of three-phase transformers. .	• For exams purposes, efficiency to be taken as 100% • Explain the **operation and connections** of three phase transformers. • **Transformer calculations** can be asked to and from the load. • **Concept and understanding** of losses (No calculation on losses)
12.3.10	Combine logic concepts as an introduction to programmable control	• Only Simple designs to be asked for exam purposes. • Diagrams can be given and questions asked relating to diagrams. • Definition and applications of programmable control. • Programmable logic terminology, symbols. • Describe programmable logic elements as black box device. • Describe ladder diagram format. Explain and understand the concepts such as: Contactors, Coils, Counters, Latches and Timers
12.4.4	Construct and analyse programmable control circuits.	Integrate practical activities to verify 12.3.10.

12.3.12	Explain the operating principles and application of three-phase motors and control.	• For exams purposes, efficiency to be taken as 100% • No calculations on slip. • Three phase induction motors only • **Analysing and describing** electrical and mechanical faultfinding • **Identifying and explaining** function of components on diagrams, and explaining the function of the relevant motor control circuit. (For exam purposes all control circuits to be given, and questions to be asked relating to control circuits.) • Explaining **the operation of three-phase induction motors** • **Identifying, explaining and comparing diagrammatic representations of various types of** motor starters. (For **exam** purposes all control circuits to be given, and questions to be asked relating to control circuits) • Suggested control circuits: Direct on line, Forward / Reverse, Sequence starting (Auto / Manual) & Star- Delta.
12.4.2 12.4.1 12.3.1	Construct and analyse single–phase and three-phase circuits. Identify unsafe conditions and acts, and apply tools and instruments correctly. Apply the OHS Act and regulations where applicable.	Wire various types of control circuits that include protective and timing devices for the control of motors. Test, analyse and describe electrical and mechanical faults on three-phase equipment.

APPENDIX B:
EXAMPLES OF WORK SCHEDULES FOR ELECTRICAL TECHNOLOGY

Example of a Grade 10 Work Schedule

- Key to code used in table e.g. 10.1.1
- The grade is indicated with the first number, the second number indicates the LO, while the last number indicates the AS.

1ST TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
1	Introduction 10.1.1 10.1.5 10.2.1	Technology, Classroom organisation and project.		Classroom
2 3 4 5 6	10.1.3 10.3.1 10.3.4 10.4.2	Principles of electricity and safety: • Theory of current flow. • Ohm's law. • Series circuit as voltage divider. • Parallel circuit as a current divider. • Combination circuits. • Specific resistance. • Temperature coefficient. • Verify Ohm's law. • Investigate specific resistance and effect of temperature.	Assignments (Peer) Experiments (Task based)	Computer Lab and Light current lab
7	10.3.3 10.4.1	Describe principles of magnetism: • Define magnetism e.g. natural, electro-magnetism. • Faraday's law. • Lenz's law. • Self and mutual induction. • Inductance. • Application of magnetism e.g. magnetic motor.	Assignments (Task based)	Computer Lab Light Current lab
8 9	10.3.1 10.3.2 10.4.1 10.4.2	Care and use of measuring instruments. Verify electrical laws in dc circuits: • Multimeter. • Continuity/insulation tester. • Oscilloscope. • Relevant tools to be dealt with during the practical sessions. • Verify Ohm's law. • Investigate specific resistance and effect of temperature. • Test portable equipment for insulation, continuity and earth continuity.	Assignments (Peer) Experiments (Task based).	Light current lab.
10	Assessment			

2ND TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
10 11 12 13 14	10.1.3 10.1.4 10.3.1 10.3.2 10.3.4 3.4.1 3.4.2	Care and use of tools, measuring instruments: • Describe the use and care of measuring instruments. Verify electrical laws in dc circuits.	Assignments (Peer) Experiments (Task based)	Computer Lab Light current lab
15 16	10.1.1 10.1.2 10.2.1 10.3.4 10.3.9 10.4.2	Power Generation: • The impact of power generation on the environment and energy as a basic need.	Assignments (Task based)	Field trip to power station
17 18	10.1.3 10.1.4 10.3.5	Electrostatics: • Basic principles of electrostatic charge and capacitance.	Assignments (Task based)	Computer Lab Light current lab
19 20	Assessment – Midyear examinations			

3RD TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
19 20 21 22 23 24 25	10.1.4 10.1.5 10.2.2 10.2.3 10.2.4 10.2.5 10.3.4 10.4.3	Working principles and construction of electronic circuits and complete project: • Resistor/capacitor/inductor/and other. • Semi-conductor devices, characteristic curves and symbols e.g. diodes, LEDs, Zener diodes. • Diode circuits. • Conversion of circuit diagrams to practical applications.	Case Studies Experiments Applied Theory and Project (Task based)	Computer Lab Light current lab Workshop PC-board section
26 27	10.1.4 10.3.13 10.4.3	Electronic communication systems by means of signalling: • Resistor/capacitor/inductor/and other. • Semi-conductor devices, characteristic curves and symbols e.g. diodes, LEDs, Zener diodes. • Diode circuits. • Conversion of circuit diagrams to practical applications.	Assignments (Task Based)	Computer Lab and Light current lab
28	Assessment			

4th TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
28 29 30 31 32	10.3.4 10.3.11 10.3.12 10.4.2	Construct single-phase circuits with protective devices in the home environment: • Theory of current flow. • Series circuit as voltage divider. • Parallel circuit as a current divider. • Combination circuits. • Current/voltage operating devices. • Earth leakage devices. • Switching. • Distribution boards. • Construct lighting switching circuits.	Applied theory (Observation) Fault finding (Task based)	Class room Heavy current lab
33	10.3.4 10.3.11 10.3.12 10.4.1	Perform test on electrical portable equipment: • Test portable equipment for insulation, continuity and earth continuity.	Fault finding (Observation and Task based)	Class room Heavy current lab
34 35 36 37	10.3.4 10.3.10 10.4.4	Logic concepts and circuits: • The use of number systems in digital electronics. • Basic logic functions and gates e.g. AND, OR and NOT. • Construct basic switching logic circuits e.g. AND, OR and NOT.	Assignments (Peer) Experiments (Task based)	Computer Lab Light current lab
38 39 40	Revision and Assessment			

Example of a Grade 11 Work Schedule

- Key to code used in table e.g. 11.1.1
- The grade is indicated with the first number, the second number indicates the LO, while the last number indicates the AS.

1ST TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
1	Introduction. 11.1.1 11.1.2 11.1.6 11.2.1	Technology, Classroom organisation and project.		
2 3 4	11.1.1 11.1.5 11.3.1 11.3.2	Explain the principles of ac generation and verify electrical laws in both ac and dc circuits and Safety.	Assignments (Task based)	
5 6 7 8 9	11.3.1 11.3.3 11.4.2 11.4.3	Explain and apply the Oscilloscope and function generator to establish the effect of ac on circuits containing combination or R, L and C components.	Assignments (Peer) Experiments (Task based)	
10	Assessment			

2ND TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
11 12	11.3.7 11.4.8	Principles and operation of single-phase transformers.	Assignments Applied Theory (Task based)	
13 14	11.3.1 11.3.8 11.3.10 11.4.1 11.4.6	Operation and application of power supplies.	Assignments Applied Theory (Task based)	
15	11.3.5 11.4.2 11.2.2	Semiconductors.	Assignments (Peer) Experiments (Task based)	
16 17 18	11.3.6 11.4.5 11.2.2 11.2.3 11.2.4 11.2.5	Operation and construction of amplifiers.	Case Studies Experiments Applied Theory and Project (Task based)	
19	Revision		Assignments (Peer)	
20 21	Assessment – Midyear examinations			

3RD TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
22 23 24	11.3.1 11.3.10 11.3.11 11.4.1 11.4.6	Operation and construction of power control circuits and complete. Project.	Case Studies Experiments Applied Theory and Project (Task based)	
25	11.3.10 11.4.4	Protective devices		
26 27 28	11.3.10 11.3.11 11.4.4 11.4.8	Design and construct single phase circuit and the testing of installations and motors.	Assignments Applied Theory (Task based)	
29	Revision			
30 31	Assessment			

4th TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
32 33 34	11.1.5 11.3.1 11.3.5 11.3.12 11.4.5	Modulation, demodulation and mediums.	Assignments Applied Theory (Task based)	
35 36 37	11.3.1 11.3.9 11.4.7	Logic concepts and circuits.	Assignments Applied Theory (Task based)	
38 39 40	Revision and Assessment			

Example of a Grade 12 Work Schedule

- Key to code used in table e.g. 12.1.1
- The grade is indicated with the first number, the second number indicates the LO, while the last number indicates the AS.

1ST TERM

Wk	LOs & ASs	CONTENT	ASSESSMENT	RESOURCES
1	Introduction. 12.1.1 12.1.2 12.1.5 12.2.1	Technology, classroom organisation and project.	Case study Assignments and Applied Theory (Task based)	Classroom and workshop
2 3 4 5	12.3.4 12.4.1	Explain the effect of ac on RLC-circuits by using an Oscilloscope and function generator: • Establish the effect of ac and frequency change on R, L, and C circuits. (A series circuit must contain only ONE resistor, ONE inductor and ONE capacitor. In parallel circuits there must only be one component per branch.) • Calculations and phasor diagrams. • In parallel resonance circuits the approximated formulas may be used if $X_L > 10R$. Integrate practical activities to verify 12.3.4	Assignments (Peer)	
6 7 8	12.1.2 12.1.1 12.1.4 12.1.5 12.3.3 12.4.1	Three phase AC generation and distribution, impact on the environment and safety: • Generation of three-phase supply by rotating a conductor loop through a two-pole magnetic field. • Advantages and disadvantages of single- and three-phase systems – not only restricted to motors. • Identify and sketch the waveform and phasor diagrams to show the difference between single- and three-phase systems. • Distinguish between schematic (sketch without indication of components) and diagrammatic (sketch with components) representations of three-phase systems. • Power in balanced three-phase systems, calculations. • Concept of power and power factor correction and calculations. • Identify and explain the function of the wattmeter, kWh meter and power factor meter when connecting instruments in circuits. Integrate practical activities to verify 12.3.4	Case study Assignments and Applied Theory (Task based)	Classroom and workshop
9	Revision			
10	Assessment			

2ND TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
11 12	12.3.8 12.4.2	Transformers and three phase transformers and circuits: • Explain the operation and connections of three phase transformers. Power calculations to be taken from the load back to the supply (for calculation purposes consider ideal transformers). • Concept and understanding of losses. Integrate practical activities to verify 12.3.4	Assignments Applied Theory	Classroom Workshop
13 14 15	12.3.7 12.4.3	Amplifiers and oscillators: • Explain the characteristics of an Op-amp. e.g. comparator, inverting and non-inverting circuits. • Identify and explain the effect of positive feedback on amplifier circuits and calculate the oscillation frequency. Integrate practical activities to verify 12.3.7	Assignments Experiments	Classroom Electronic laboratory
16 17 18	12.3.10 12.2.2 12.2.3 12.2.4 12.2.5 12.4.4	Logic concepts, circuits and control and complete project: • Simplifying logic equations by using Karnaugh maps and drawing the logic circuits. • Applications of De Morgan's laws. • Designing and drawing half, full and extended adders (gate and block representation with inputs and outputs). • Use logic inputs, timers, counters and timing diagrams as an introduction to programme control. Integrate practical activities to verify 12.3.10	Case Studies Experiments Applied Theory and Project	Classroom Electronic laboratory
19	Revision		Assignments	Peer
20 21	Assessment – Midyear examinations			

3RD TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
22 23	12.3.6	Thyristor family control: • Operation of thyristor family (Diac and Triac) and application in practical control circuits. • Construct thyristor control circuits and investigate the input and output.	Assignments (Peer) Experiments (Task based) Assignments (Observation) Applied Theory (Task based)	Classroom Electronic laboratory
24 25 26 27 28 29	12.1.4 12.3.12 12.3.12 12.4.1 12.4.2	Design and construct three phase motor circuits. Testing of three phase equipment: • Operation of three-phase induction motors. • Function of motor starters and interpretation of schematic diagrams. • Motor calculations including efficiency. • Wire various types of control circuits that include timing devices for the control of motors.	Assignments Testing/fault finding (Task based)	Classroom Electronic laboratory
30 31	Assessment – Trial Examination			

4th TERM				
Wk	**LOs & ASs**	**CONTENT**	**ASSESSMENT**	**RESOURCES**
32	12.4.1 12.4.2	Test, analyse and describe electrical and mechanical faults on three-phase equipment.	Testing/fault finding (Task based)	Classroom Electronic laboratory
33 34	LO1 – LO4	Completion of Practical Assessment Task	Practical Model Product	Classroom Electronic laboratory
35	LO1 – LO4	Revision on areas that learners performed poorly		Classroom Electronic laboratory
36-40		Final assessment – External Examination		