



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

## **ELECTRICAL TECHNOLOGY**

### **EXAMINATION GUIDELINES**

## **GRADE 12**

## **2009**

**This guideline consists of 6 pages.**

## INTRODUCTION

The examination guidelines for Electrical Technology provide learners and their teachers with minimum requirements scope for the final Grade 12 examination. The Department of Education provides schools with examination guidelines in order to prepare learners for the examination by outlining and explaining the minimum standards and content to be covered by all learners. These guidelines should be read in conjunction with the Subject Assessment Guidelines (SAG) and Learning Programme Guidelines (LPG).

These guidelines consist of two parts. Part A describes the topics and concepts covered by in the examination paper. Note that all three learning outcomes and their assessment standards are covered in their appropriate weighting. Part B outlines the sources used to set the questions. These learning materials include the textbooks used at schools. However, teachers are encouraged not to base their teaching and learning activities on a particular textbook, as this stifles learners' creativity and critical thinking.

**PART A: TOPICS AND CONCEPTS COVERED BY THIS EXAM PAPER**

| LOs & Ass  | TOPIC AND CONCEPTS                               | DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LO 1       | TECHNOLOGY, SOCIETY AND ENVIRONMENT<br><b>10</b> | <ul style="list-style-type: none"> <li>Positive and negative impact of technology on the environment</li> <li>Entrepreneurial skills</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| LO 2       | TECHNOLOGICAL PROCESS<br><b>10</b>               | <ul style="list-style-type: none"> <li>Developing a solution within an electrical context, e.g sketching a block diagram of INPUT, PROCESS and OUTPUT</li> <li>Specifications of the proposed design solution</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                        |
| LO 3, AS 1 | OCCUPATION HEALTH AND SAFETY<br><b>10</b>        | The understanding of unsafe acts and conditions. Awareness of HIV/AIDS. The above must be placed in the context of an electrical technology centre.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| LO 3, AS 3 | THREE-PHASE AC GENERATION<br><b>10</b>           | The concept of three-phase systems as compared to single-phase systems which will include calculations. Recognition of star and delta systems, including phasor diagrams. Functions/purpose of the wattmeter, kilowatt-hour meter and power factor meter.                                                                                                                                                                                                                                                                                                                                                                       |
| LO 3, AS 4 | R, L, C CIRCUITS<br><b>30</b>                    | <p>Calculations with reference to a phasor diagram or analysing of a phasor diagram followed by calculations of the required information.</p> <p>Calculations of both series and parallel circuits using only pure components in series &amp; parallel circuits.</p> <p>The emphasis will be primarily on circuits containing only ONE resistor, ONE inductor and ONE capacitor.</p> <p>Calculation of inductive reactance, capacitive reactance and impedance</p> <p>Resonance in ac circuits</p> <p>Effects of the change in frequency to capacitive reactance, inductive reactance, impedance and current in ac circuits</p> |
| LO 3, AS 6 | SWITCHING AND CONTROL CIRCUITS<br><b>25</b>      | The functional operation of the SCR, DIAC and TRIAC with characteristic curves. Operation of lamp dimming circuits using above components                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| LO 3, AS 7 | AMPLIFIERS<br><b>25</b>                          | <ol style="list-style-type: none"> <li>Characteristics of amplifiers</li> <li>Bandwidth and feedback</li> <li>Loadline</li> <li>Different methods of operation</li> <li>Oscillators: LC, RC, phase shift, etc</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                        |

|                |                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                |                                                                | <p>Op-amps</p> <ol style="list-style-type: none"> <li>1. Characteristics</li> <li>2. Working principles of op-amps</li> <li>3. The different modes of operation</li> <li>4. Identify and draw circuits showing the different modes of operation with the input/output wave forms with the gain</li> </ol>                                                                                                                                                                                                     |
| LO 3, AS<br>8  | <p>THREE-PHASE<br/>TRANSFORMERS</p> <p><b>15</b></p>           | <p>Explanation of the operation and use of three-phase transformers</p> <p>Explain the <b>connections</b> of three phase transformers.</p> <p><b>Transformer calculations</b> to and from the load.</p> <p><b>Concept and understanding</b> of losses</p> <p>Causes of heating and method to cool transformers</p>                                                                                                                                                                                            |
| LO 3, AS<br>10 | <p>LOGIC CONCEPTS<br/>AND PLCs</p> <p><b>35</b></p>            | <ol style="list-style-type: none"> <li>1. Introduction to PLCs</li> <li>2. Advantages</li> <li>3. Different programming languages (ladder, block and IL)</li> <li>4. Operands</li> <li>5. De Morgan's theorem</li> <li>6. Combination logic circuits (simplify)</li> <li>7. Karnaugh maps (max four terms) simplifying</li> <li>8. Relay logic</li> <li>9. Ladder-circuit ladder</li> <li>10. Block diagrams</li> <li>11. Sequential logic systems such as memory, shift register, timing diagrams</li> </ol> |
| LO 3, AS<br>12 | <p>THREE-PHASE<br/>MOTORS AND<br/>CONTROL</p> <p><b>30</b></p> | <p>Operation of three-phase induction motor including calculations, fault finding and inspections. Identifying, explaining and comparing motor starters. Keeping with suggested starters.</p>                                                                                                                                                                                                                                                                                                                 |

**WEIGHTING OF THE CONTENT**

| <b>Total marks: 200</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                                                                                                          |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------------------------------------------------|--------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>LOs &amp; ASs</b> | <b>Concepts and content to be covered</b>                                                                | <b>Marks</b> |
| <ul style="list-style-type: none"> <li>One paper of 3-hour duration</li> <li>The emphasis of the external examination will be on LO3<br/>Some questions could be associated with the process of LO2</li> <li>ASs can also be integrated depending on the context.</li> <li>All questions must be answered</li> <li>Diagrams and sketches must be neat and labelled.</li> <li>Formula calculation, answer and unit must be indicated.</li> </ul> | 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<br>AS1           | OHS Act and regulations must be integrated where applicable                                              | 10           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS3           | Three-phase AC generation                                                                                | 10           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS4           | Effect of AC on series and parallel R, L and C component combination circuits                            | 30           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS6           | Operating principles of switching and control circuits                                                   | 25           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS7           | Output of amplifiers, their characteristics and feedback                                                 | 25           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS8           | Operations and use of three-phase transformers                                                           | 15           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS10          | Logic concepts as an introduction to programmable control                                                | 35           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | LO3<br>AS12          | Operating principles and application of three-phase motors and control                                   | 30           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>TOTAL</b>         |                                                                                                          | <b>200</b>   |

**PART B: REFERENCE MATERIAL THAT MAY BE USED**

Teaching and learning materials mentioned below form the basis from which explanations and discussions, as well as practical activities can begin. No single textbook or learning materials can meet the personal needs of each learner and educator. Therefore, it is imperative to use other sources to enhance deeper insight into a particular concept.

| NO | NAME OF BOOK                              | AUTHOR                        | PUBLISHER/ISBN NO                                |
|----|-------------------------------------------|-------------------------------|--------------------------------------------------|
| 1  | Electrical Technology                     | Jan Randewijk & Raimund Swart | Guidelines ISBN-13 9781770172227                 |
| 2  | First steps in electronics book 3         | E.Glasspoole                  | Shades Technical Publications ISBN 1-875033-02-5 |
| 3. | Hughes eighth edition                     | I Mckenzie Smith              | Pearsons Education Limited ISBN 0582 40519X      |
| 4. | Design and technology 2 <sup>nd</sup> Ed. | James Garratt                 | Cambridge University Press 0-521-64831-9         |
| 5  | Electrical Trade Theory                   | C. du Preez                   | ISBN 007 04505742                                |