



**higher education  
& training**

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

# **REPORT 191 PROGRAMME**

## **SYLLABUS**

### **ELECTRICAL TRADE THEORY**

**N1**

**Implementation: January 2021**

## **1. INTRODUCTION**

### **1.1 General Aims**

This subject provides an introduction to the basics of Electrical Trade Theory and introduces the learning at an elementary level. It is assumed that students have no previous electrical background and knowledge. Students learn how to plan and prepare for an electrical installation job in accordance with job requirements, relevant standards and appropriate workplace procedures to enable them to understand electrical installation and maintenance.

Electrical Trade Theory N1 will equip students with relevant theoretical knowledge to enable them to integrate meaningfully into:

- electrical apprenticeship;
- electrical learnership;
- electrical contracting environment;
- industrial environment; and
- power utility environment

### **1.2 Specific Aims**

Electrical Trade Theory strives to assist students to obtain trade-specific skills, knowledge, values and attitudes so that they can explain how electricity is applied. Students should be able to acquire in-depth knowledge of the following content:

- 1.2.1 Safety precautions
- 1.2.2 Fire and fire fighting
- 1.2.3 Hand and power tools
- 1.2.4 Direct current theory
- 1.2.5 Conductors and insulating materials
- 1.2.6 Wiring of premises
- 1.2.7 Testing of a single phase
- 1.2.8 Magnetism and electromagnetism
- 1.2.9 Renewable energies

## **2. Admission requirement**

Passed grade 9 or equivalent

### **3. Duration**

The duration of the subject is one trimester on full time, part time or distance learning mode.

### **4. Evaluation**

Candidates must be evaluated continually as follows:

#### **4.1 ICASS Trimester Mark**

4.1.1 **Two** formal class tests for full time and part time students (or **Two** assignments for distance learning students only)

4.1.2 Obtain a minimum of 40% in order to qualify to write the final examination.

4.1.3 Assessment marks are valid for a period of one year and are referred to as ICASS Trimester marks.

4.1.4 Calculation of trimester mark

Weight of test or assignment 1 = 30% of the syllabus

Weight of test or assignment 2 = 70% of the syllabus

#### **4.2 Examination**

4.2.1 The examination shall consist of 100 % of the syllabus

4.2.2 Duration shall be 3 hours

4.2.3 Minimum pass percentage shall be 40%

4.2.4 Closed book examination

4.2.5 Knowledge, understanding, application and evaluation are important aspects of the subject and should be weighted as follows:

<b>Knowledge</b>	<b>Understanding</b>	<b>Application</b>	<b>Evaluation</b>
60%	20%	15%	5%

#### **4.3 Promotion Mark**

The promotion mark consisting of the combination of the Trimester and Examination marks, shall be a minimum of 40%

#### **4.4 Weight value of modules**

<b>Module</b>	<b>Description</b>	<b>Weight Value (%)</b>
1.	Safety precautions	10
2.	Fire and Fire fighting	5
3.	Hand and power tools	5
4.	Direct Current theory	30
5.	Conductors and insulating materials	5
6.	Wiring of premises	25
7.	Testing of a single phase	5
8.	Magnetism and electromagnetism	10
9.	Renewable energies	5
<b>TOTAL</b>		<b>100%</b>

#### **5. General Information**

5.1 The regulations as prescribed in the SANS 10142-1 as amended, must be used in conjunction with each relevant section of work. All symbols and measurements must be in accordance with International Electrical Committee (IEC) and System International of Units (SI) standards

5.2 Practical examples and values must be used in all calculations.

5.3 Neat, fully labelled and large drawings must be presented where such is required.

5.4 Students should be encouraged to provide in their answers the number of facts according to the number of marks allocated

5.4 All calculations should in engineering notation are restricted to a maximum of three decimal places.

## **Module: 1 Safety Precautions**

### **General aim:**

On completion of this module, the student should be familiar with the health and safety in the electrical working environment

<b>Content</b>	<b>Learning Outcome</b>
1.1 Housekeeping	1.1.1 Define Good Housekeeping 1.1.2 Identify unsafe acts and unsafe conditions in the workshop 1.1.3 Explain the purpose of housekeeping
1.2 Accidents and incidents	1.2.1 Differentiate between an accident and incident 1.2.2 List the causes of accidents 1.2.3 State the safety precautions to be observed with regards to the following: 1.2.3.1 Machine guarding 1.2.3.2. Ladders
1.3 Safety Switches	1.3.1 Describe the purpose of the following safety Switches. 1.3.1.1 Electrical interlocks 1.3.1.2 Circuit Breaker 1.3.1.3. Overload Relay 1.3.1.4. Lock Out Switch 1.3.1.5 Earth Leakage Relay  1.3.2 State the procedure to be followed when isolating or locking out a circuit for inspection and repair purposes.
1.4 Signage	1.4.1 Identify the categories and the colour coding of safety signs 1.4.2 Describe the meaning of each sign
1.5 Occupational Health and Safety Act (OHS Act)	1.5.1 Explain the purpose of OHS Act 1.5.2 State the duties and/or responsibilities of the employer and employees according to the OHS Act.

1.6 Personal Protective Equipment (PPE)	1.6.1 Explain the purpose of the following types of PPE: <i>Hard hats, Safety goggles, Arc shields, Rubber gloves, Leather gloves, Leather aprons and Respirators</i>
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## Module: 2 Fire and Fire Fighting

### General aim:

On completion of this module, the student should be able to identify the different classes of fire and state the different types of fire extinguishers to be used for each class.

Content	Learning Outcome
2.1 Fire	2.1.1. State the causes of fire 2.1.2 Describe the different classes of fire.
2.2 Fire fighting	2.2.1 State the safety precautions to be observed while fighting a fire 2.2.2 Identify the different fire extinguishers for the different classes of fires

## Module 3 Hand and Power tools

### General aim:

On completion of this module, the student should be able to describe the care and use different hand and power tools used in the electrical working environment.

Content	Learning Outcome
3.1 Hand tools	3.1.1 Identify and explain the purpose/use of the following hand tools: Flat and Philips screwdrivers, long nose pliers, combination pliers, diagonal pliers (side cutters) crimping tool, hacksaw, cable knife, spring bender, hickey, and draw tape. 3.1.2 State the care and maintenance of hand tools in general.
3.2. Power Tools	3.2.1 State the care and maintenance of power tools (fixed, portable and cordless) 3.2.2 State the safety precautions to be observed when working with power tools.

## **Module: 4 Direct Current theory.**

### **General aim:**

On completion of this module, the student should be able to solve electrical circuits supplied from a DC source.

<b>Content</b>	<b>Learning Outcome</b>
4.1 Ohm's law.	4.1.1 State what is meant by the following terms? 4.1..1.1 Current 4.1.1.2 Potential difference (Voltage) 4.1.1.3 Resistance 4.1..1.2 State Ohm's law 4.1..1.3 Use Ohms Law to determine current, voltage, resistance, volt drop and power of a circuit having resistance connected in series, parallel and series-parallel (max 4 resistors)
4.2 Joule's Law	4.2.1 State Joule's law 4.2.2 Use Joule's law to determine the heat energy dissipated in an electrical circuit. 4.2.3 Calculate the cost of electrical energy.(kW x H x Tariff)
4.3 Factors that influence the resistance of a conductor.	4.3.1 State the factors that affect the resistance of a conductor. 4.3.2 State what is meant by resistivity 4.3.3 Calculate the resistance of a conductor at constant temperature.
4.4 Cells and Batteries	4.4.1 State the function of a cell or battery 4.4.2 Differentiate between primary and secondary cells. 4.4.3 Explain with the aid of a circuit diagram the difference between EMF and potential difference. 4.4.4 Calculate the total EMF and internal resistance of cells connected in series and parallel. 4.4.5 Calculate the total current in a circuit using the total EMF.

4.5 Temperature coefficient of resistance	4.5.1 Define temperature coefficient of resistance 4.5.2 State how temperature affects the resistance of pure metals, alloys, carbon, electrolytes and insulators. 4.5.3 Explain the difference between positive and negative temperature coefficients. 4.5.4 Calculate the resistance of a conductor at any temperature with the initial resistance given at zero degree Celsius
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## Module: 5 Conductor and insulating materials

### General aim:

On completion of this module, the student should be able to differentiate between conductors, semi-conductors and insulators

Content	Learning Outcome
5.1 .Conductor	5.1.1 State what is meant by a conductor 5.1.2 State the characteristics and example of materials that are good conductors 5.1.3 Provide examples of good conductors
5.2. Insulators	5.2.1 State what is meant by insulators 5.2.2 State the characteristics of a good insulators 5.2.3 Provide examples of good insulators
5.3. Semi-conductors	5.3.1 State what is meant by semi-conductors 5.3.2 State the two most commonly used semiconductor materials.

## Module: 6 Wiring of premises

### General aim:

On completion of this module, the student should be able to explain the fundamentals of wiring premises

Content	Learning Outcome
6.1 Symbols	6.1.1 Identify and draw different types of International Electro-technical Commission (IEC) symbols to be

	<p>used in a domestic electrical installation</p> <p>6.1.2 State the size of conductors and protective devices that are commonly used in the sub-circuit of the domestic electrical installation</p>
6.3 Wiring Diagrams	<p>6.3.1 Draw labelled circuit diagrams for the following sub-circuits of a single phase domestic installation:</p> <p>6.3.1.2 Light circuit (one way, two way, intermediate. Switching)</p> <p>6.3.1.2 Socket-outlet circuit.(maximum two outlets)</p> <p>6.3.1.3 Geyser circuit</p> <p>6.3.1.4 Stove circuit</p> <p>6.3.1.5 Distribution Board</p> <p>6.3.1.6 Single-phase Supply to installation.(overhead and underground.)</p>
6.4 Protective devices	<p>6.4.1 State the function of the following protective devices. Circuit Breaker, Earth Leakage Relay, Lighting Arrestor, Fuse.</p>
6.5 SANS 10142-1	<p>6.5.1 Apply the latest applicable SANS 10142-1 to different learning outcomes</p>

## **Module: 7 Testing of a single-phase**

### **General aim:**

On completion of this module, the student should be able to describe how to test a single phase domestic installation using insulation resistance tester.

<b>Content</b>	<b>Learning Outcome</b>
7.1 Insulation Resistance Tester	<p>7.1.1 Describe how the following basic tests are conducted (select correct scale and state minimum allowable reading).</p> <p>7.1.1.1 Continuity of bonding</p> <p>7.1.1.2 Polarity test</p> <p>7.1.1.3 Insulation resistance Test between conductors</p>

	7.1.1.4 Insulation resistance Test between conductors and earth.
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## Module: 8 Magnetism and electromagnetism.

### General aim:

On completion of this module, the student should be able to explain the concepts of magnetism and electromagnetism

Content	Learning Outcome
8.1 Magnetism	8.1.1 State the different types of magnets 8.1.2 State the characteristics of magnetic lines of force 8.1.3 State how the direction of the magnetic field around a current carrying conductor and coil is determined.
8.2 Electromagnetism	8.2.1 State Faraday's laws of electromagnetic induction. 8.2.2. Describe with the aid of Faraday's law how a sinusoidal wave is generated. 8.2.3 State the direction of current flow in a DC and AC system.

## Module: 9 Renewable energies

### General aim:

On completion of this module, the student should be able to understand the concept climate change

Content	Learning Outcome
9.1 Types of renewable energy	9.1.1 Define renewable energy. 9.1.2 Identify different types of renewable energy
9.2 Advantages of renewable energ	9.2.1 Explain the following terms: climate change, fossil fuel, greenhouse gases. 9.2.2 State the benefits of using renewable energy