



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T510(E)(A6)T

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

(11041872)

**6 April 2018 (X-Paper)
09:00–12:00**

This question paper consists of 5 pages and 1 formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA
NATIONAL CERTIFICATE
ELECTRICAL TRADE THEORY N2
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
 2. Read ALL the questions carefully.
 3. Number the answers according to the numbering system used in this question paper.
 4. Where applicable, answers must be in accordance with the SABS (SANS) Code of Practice SANS 10142 – 1: 2003 for the Wiring of Premises.
 5. Leave at least THREE lines open after each question.
 6. Sketches must be neat, labelled and large enough to show the required detail.
 7. Round off answers to THREE decimal places.
 8. Write neatly and legibly.
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QUESTION 1: CONDUCTORS AND CABLES

- 1.1 Explain the term *armoured cable*. (1)
- 1.2 Give THREE advantages and THREE disadvantages of installing cables in ducts. (3 + 3) (6)
- 1.3 Determine the full-load line current of a 380 V, 100 kW, three-phase motor that has a full-load power factor of 0,9. (3)
- 1.4 Give a possible explanation for permissible volt drop between the supply point and any outlet point. (1)
- [11]**

QUESTION 2: SWITCHGEAR, CONTACTORS AND RELAYS

- 2.1 Give FIVE basic steps in making a joint in a cable. (5)
- 2.2 Explain how to identify the geyser subcircuit in a distribution board. (1)
- 2.3 It is important to use the correct materials when making a joint.
Give FIVE examples of materials used to make a joint. (5)
- 2.4 Which visual indication informs one that an MCB (miniature) has tripped? (1)
- [12]**

QUESTION 3: DC MOTORS AND STARTERS

- 3.1 Draw a neat, labelled circuit diagram of the rotation of a DC motor by reversing the direction of the armature current through the compound motor. (3)
- 3.2 Name TWO main types of internal connections. (2)
- 3.3 Make a neat, labelled sketch to show the construction of a DC motor. (5)
- 3.4 Give the main disadvantage of a shunt motor. (1)
- 3.5 Give the main advantage of a shunt motor. (1)
- [12]**

QUESTION 4: AC MOTORS AND STARTERS

- 4.1 Briefly explain how a rotating magnetic field is produced in a three-phase motor. (4)
- 4.2 Name FOUR types of starters that will limit the starting current of large induction motors. (4)
- 4.3 What is the function of a motor starter? (1)
- 4.4 List THREE tests that can be carried out on the stator windings of a three-phase motor and give the value of the readings one would expect to find in each case. (3 × 2) (6)
- [15]**

QUESTION 5: EARTHING

- 5.1 Explain what must be done with electrical equipment that has a metallic frame or metallic enclosures to prevent dangerous electric shocks. (2)
- 5.2 Explain the term *equipment earthing*. (3)
- 5.3 What is an earth continuity conductor? (3)
- 5.4 Explain how each of the following items in an outdoor substation is earthed:
- 5.4.1 The metal enclosure of the transformer
- 5.4.2 The lightning rods mounted on the highest point above the substation (2 × 2) (4)
- [12]**

QUESTION 6: PROTECTION

- 6.1 Explain the function of a lightning arrester. (3)
- 6.2 What is the function of a fuse? (1)
- 6.3 Describe the operation on overcurrent (overload relay). (4)
- 6.4 Answer the following questions on phase-imbalance protection:
- 6.4.1 Give the purpose of phase-imbalance protection. (1)
- 6.4.2 Which equipment requires phase-imbalance protection? (1)
- [10]**

QUESTION 7: MEASURING INSTRUMENTS

- 7.1 Name TWO methods that some municipalities use to switch off domestic geysers during peak periods. (2)
- 7.2 Explain the term *maximum demand* with reference to the supply of electricity. (2)
- 7.3 What is a frequency meter? (2)
- [6]**

QUESTION 8: TRANSFORMERS

- 8.1 A three-phase squirrel-cage motor is connected in delta across a 380 V, three-phase supply and draws a current of 10 A at 0,9 lagging.
- Calculate:
- 8.1.1 The voltage across each phase winding of the motor (1)
- 8.1.2 The current flow in each phase winding (2)
- 8.1.3 The output power of the motor if its efficiency is 94% (4)
- 8.2 In a balanced three-phase delta circuit the phase voltage is 250 V and the phase current is 12 A.
- If the phase angle is 25 lagging, calculate:
- 8.2.1 The power taken (5)
- [12]**

QUESTION 9: ELECTRONICS

- 9.1 Explain, with the aid of a graph, the operation of a diode in an AC circuit. (4)
- 9.2 Explain the term *intermittent current rating*. (3)
- 9.3 Explain how a SCR is triggered. (3)
- [10]**

TOTAL: 100

FORMULA SHEET

Any applicable formula may also be used.

Star $V_L = \sqrt{3} V_{PH}$

$$I_L = I_{PH}$$

Delta $V_L = V_{PH}$

$$I_L = \sqrt{3} I_{PH}$$

Transformer $\frac{V_1}{V_2} = \frac{N_1}{N_2} = \frac{I_2}{I_1} = \frac{E_1}{E_2}$

Single phase

Apparent power $S = vi$

True power $P = v \cos \phi$

Reactive power $Q = v \sin \phi$

Three phase

Apparent power $S = \sqrt{3} V_L I_L$

True power $P = \sqrt{3} V_L I_L \cos \phi$

Reactive power $Q = \sqrt{3} V_L I_L \sin \phi$

Fault current $I_{fc} = \frac{CIF \times A}{\sqrt{t}}$