higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T510(**E**)(N24)T

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

(11041872)

24 November 2017 (X-Paper)
09:00–12:00

This question paper consists of 6 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. Formulae used in Electrical Trade Theory N2 can be found at the end of the question paper.
8. Answers must be given to THREE decimal places.
9. Write neatly and legibly.

QUESTION 1: CONDUCTORS AND CABLES

1.1 The declared line to neutral voltage at the supply point of an installation is 230 V.

Determine the minimum allowable voltage between live and neutral that can be expected at any outlet in the installation. (4)

1.2 State TWO advantages of installing cables underground (buried). (2)

1.3 Define the term *power factor*. (2)

1.4 State ONE factor to be taken into account when selecting a cable. (1)

1.5 State what the Code of Practice stipulates with regard to maximum permissible volt drop in an installation. (1)

1.6 When wiring a domestic installation, certain conductor sizes must be considered. State the cross-sectional area of the live and neutral conductors you would use for a plug circuit. (1)

[11]

QUESTION 2: SWITCH GEAR, CONTACTORS AND RELAYS

2.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (2.1.1–2.1.6) in the ANWER BOOK.

2.1.1 In many smaller applications joints are made in conduit boxes, cable-joining boxes, appliances and light fittings.

2.1.2 When large-diameter copper conductors are joined, insulated strip connectors are almost always used.

2.1.3 When making a Scotch-cast joint, insulation tape is used to cover the complete joint.

2.1.4 A ferrule is used to terminate conductors.

2.1.5 Married joints are used where tensile strength is low.

2.1.6 A binding wire is used when a Brittannia joint is made.

(6 × 1) (6)

2.2 State TWO disadvantages of high-voltage distribution. (2)

2.3 Name the main function of isolating material (Isolators) (2)

2.4 State the main difference between a relay and a disconnector (2)

[12]

QUESTION 3: DC MOTORS AND STARTERS

3.1 Draw a neat, labelled circuit diagram of a short-shunt compound motor. Clearly show the TWO windings. (4)

3.2 Draw the load characteristic of a series motor. (3)

3.3 Explain the function of a commutator. (2)

3.4 Explain the need for a motor starter. (3)
[12]

QUESTION 4: AC MOTORS AND STARTERS

4.1 Draw a neat, labelled circuit diagram of a capacitor star-/induction-run single-phase motor. (4)

4.2 Explain the term *squirrel-cage rotor construction*. (3)

4.3 The overcurrent-protection devices used for motors must meet certain requirements.

Discuss these requirements under the following headings:

4.3.1 The tripping value (2)

4.3.2 The time delay (3)

4.4 Study Figure 4.1. Identify the type of motor that is used in a 300 W, 220 V AC hand drill. (1)

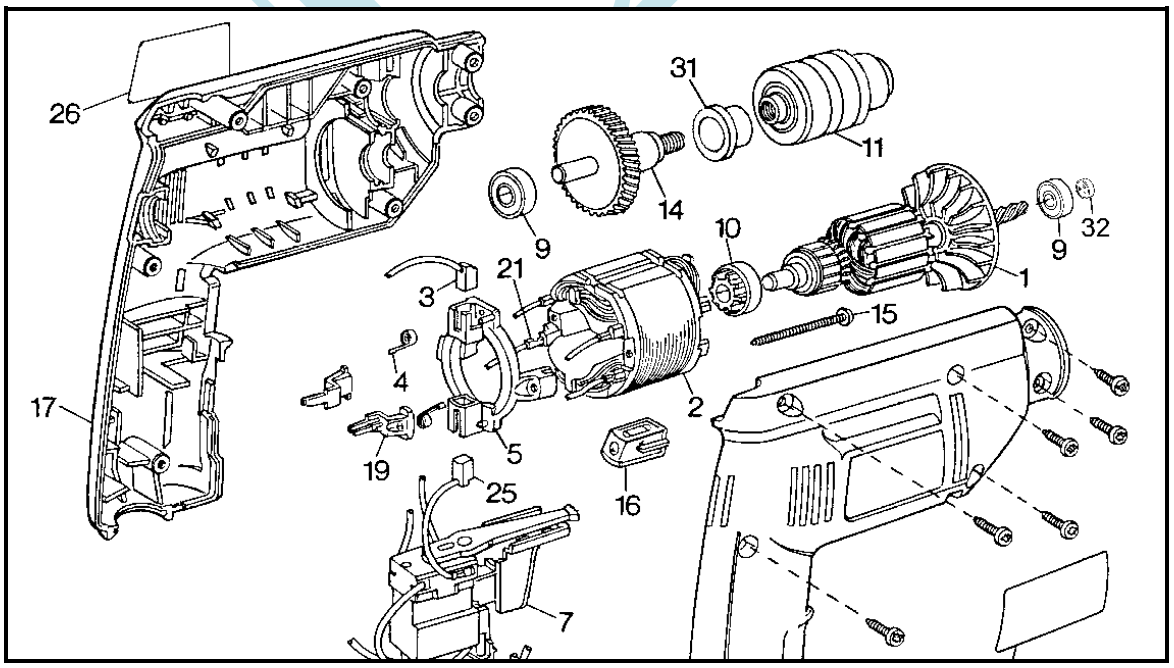

FIGURE 4.1: DRILL MOTOR

4.5 The compound motor is widely used for small AC applications.

Name TWO applications using compound motors. (2)
[15]

QUESTION 5: EARTHING

5.1 Explain why earthing is important. (3)

5.2 Briefly explain what is meant by *equipment earthing.* (3)

5.3 Define the term *system earthing*. (3)

5.4 Explain the term *floating earth* as it applies to a portable appliance like an electrical lawn mower. (3)
[12]

QUESTION 6: PROTECTION

6.1 State THREE advantages of an HRC fuse over a rewireable fuse. (3)

6.2 Describe, with the aid of a drawing, the operation of a thermal overload protection. (4)

6.3 State how many ratings a fuse has and explain the meaning of the rating. (3)

[10]

QUESTION 7: MEASURING INSTRUMENTS

7.1 Measuring instruments are important for circuit diagnostics and recording.

Give the name of the instrument you would use to determine each of the following:

7.1.1 If the current rating of a supply cable is being exceeded

7.1.2 The amount of electric power consumed

(2 × 1) (2)

7.2 Draw a neat, fully labelled circuit diagram to show the connection of a watt hour meter in a single-phase system. (4)
[6]

QUESTION 8: TRANSFORMERS

8.1 A three-phase delta-star transformer is connected to a 2,2 kV supply. The secondary-phase voltage is measured and found to be 220 V.

Determine the following:

8.1.1 The secondary-line voltage (3)

8.1.2 The primary-phase current when it draws its full-load current of 120 A from the supply (3)

8.1.3 The full-load rating of the transformer in kVA (3)

8.2 When a transformer is connected to a load, it draws 10 A from the supply of 110 V at an angle of 36,87°.

Calculate the reactive power. (3)
[12]

QUESTION 9: ELECTRONICS

9.1 Draw a neat, labelled circuit diagram of a full-wave rectifier with a centre-tap transformer. Clearly show the output waves. (6)

9.2 Explain how a thyristor operates as a power-controlling device. (3)

9.3 State ONE use of a transistor. (1)
[10]

TOTAL: 100

ELECTRICAL TRADE THEORY N2

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 $P = VI\text{COS}\phi$

REACTIVE POWER $Q = VI\text{SIN}\phi$

THREE-PHASE

APPARENT POWER $S = \sqrt{3}\, V_L I_L$

TRUE POWER $P = \sqrt{3}\, V_L I_L\ COS\phi$

REACTIVE POWER $Q = \sqrt{3}\, V_L I_L\ \text{SIN}\phi$

FAULT CURRENT $Ifc = \frac{CIF \times A}{\sqrt{t}}$