higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T570**(E)**(A8)T

NATIONAL CERTIFICATE

ELECTRICAL TRADE THEORY N2

(11041872)

8 April 2019 (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 10142 – 1: 2003 for the Wiring of Premises.
5. Sketches must be neat, labelled and large enough to show the required detail.
6. Answers must be rounded to TWO decimals.
7. Write neatly and legibly.

QUESTION 1: CONDUCTORS AND CABLES

1.1 What line current will a 380 V, 80 KW motor, that runs at a full load power factor of 0,85 draw? (4)

1.2 An inductive circuit is supplied, with alternating current. Describe the influence that a decrease in the inductance of the circuit would have on the following:

1.2.1 Phase difference between current and voltage

1.2.2 Power factor

1.2.3 Current

(3 × 1) (3)

1.3 The cross-sectional area of the copper conductors of an XLPE insulated cable is 30 mm².

Determine the maximum time that the cable can carry a fault current of 1, 8 KA.

HINT: Use the table below to solve this problem.

TYPE OF INSULATION	TYPE OF CONDUCTOR	CIF
PVC	COPPER	96
PVC	ALUMINIUM	62
XPLE	COPPER	143
XPLE	ALUMINIUM	92
PAPER	COPPER	116
PAPER	ALUMINIUM	78

(4)

[11]

QUESTION 2: SWITCHGEAR, CONTACTORS AND RELAYS

2.1 Complete the following sentence by filling in the missing words. Write only the word or words next to the question number (2.1.1–2.1.4) in the ANSWER BOOK.

Time delay is afforded by the time taken for the (2.1.1) … to heat and (2.1.2) … which in turn depends upon the (2.1.3) … of the overload (2.1.4) … (4)

2.2 What is the function of a disconnector? (2)

2.3 Compare *disconnectors*; *relays* and *contactors* under the headings Construction and Uses. Present the answer in table format. (6)

[12]

QUESTION 3: DC MOTORS AND STARTERS

3.1 How do D.C motor starters limit the starting current? (2)

3.2 Draw a labelled circuit diagram for a separately excited motor. (4)

3.3 State the main disadvantage of each of the following DC motors:

3.3.1 Shunt motor

3.3.2 Series motor

(2 × 1) (2)

3.4 Name TWO circumstances where the protection devices in a face – plate starter will prevent the motor against possible damage. (2)

3.5 Name TWO types of field coil connections used in DC motors. (2)

[12]

QUESTION 4: AC MOTORS AND STARTERS

4.1 Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' of 'false' next to the question number (4.1.1–4.1.5) in the answer book.

4.1.1 A rotating magnetic field is set up in a single – phase motor because the current is alternating from positive to negative.

4.1.2 A universal motor will change direction every half – cycle when connected to an AC supply.

4.1.3 The purpose of a motor starter is to start a motor manually or automatically.

4.1.4 With auto-transformer starters the rotor is supplied with a reduced voltage obtained from the tappings of an auto-transformer.

4.1.5 With a star-delta starter the stator is connected in star while the rotor accelerates.

(5 × 1) (5)

4.2 Name TWO types of rotors found in induction motors. (2)

4.3 Explain the purpose of the stator of an alternating current motor. (2)

4.4 Discuss how an open circuit test is performed under the following points.

4.4.1 Name TWO measuring instruments that can be used to perform the test. (2)

4.4.2 How the measuring instrument is connected. (2)

4.4.3 The expected values that the meter will indicate if there are no faults. (2)

[15]

QUESTION 5: EARTHING

5.1 Complete the following sentence by filling in the missing words. Write only the word or words next to the question number (5.1.1–5.1.2) in the ANSWER BOOK.

Metallic … (5.1.1) and metallic enclosures of … (5.1.2) equipment shall be made electrically continuous. (2)

5.2 Give TWO reasons why the neutral is earthed at the supplier. (2)

5.3 Describe the purpose of bonding. (2)

5.4 Explain the purpose of the following components found in system and equipment earthing:

5.4.1 Earth rods and earth mats (2)

5.4.2 The consumer's earth terminal (2)

5.4.3 The supplier's earth terminal (2)

[12]

QUESTION 6: PROTECTION

6.1 Explain how a core-balance earth-leakage device protects against earth faults. (4)

6.2 Explain the function of the following components with reference to protection:

6.2.1 Overload relay with reset device

6.2.2 Fuses

6.2.3 Earth leakage relay

(3 × 2) (6)

[10]

QUESTION 7: MEASURING INSTRUMENTS

7.1 Explain the function of the following measuring instruments

7.1.1 Kilowatt-hour meter

7.1.2 Power Factor meter

7.1.3 Maximum demand meter

(3 × 1) (3)

7.2 Complete the following sentence by filling in the missing words. Write only the word or words next to the question number (7.2.1–7.2.2) in the ANSWER BOOK.
The amount of electricity consumed is referred to as 7.2.1…and is measured by means of a 7.2.2 … (2)

7.3 Name one method which can be used to switch off certain non – essential loads at certain times. (1)

[6]

QUESTION 8: TRANSFORMERS

8.1 A single-phase transformer is connected to a 220 V AC supply and the turn's ratio of the transformer is 25:1.

Calculate the input current if the transformer delivers 10 A. (3)

8.2 A 650 VA three – phase transformer has a delta connected primary and a star Connected secondary. If the supply voltage is 6 600 V and the secondary voltage 380 V, Calculate:

8.2.1 Primary and secondary phase voltage (3)

8.2.2 The secondary phase current (3)

8.2.3 The maximum power output at a power factor of 0.8 (3)

[12]

QUESTION 9: ELECTRONICS

9.1 Study FIGURE 1 below and answer the questions.

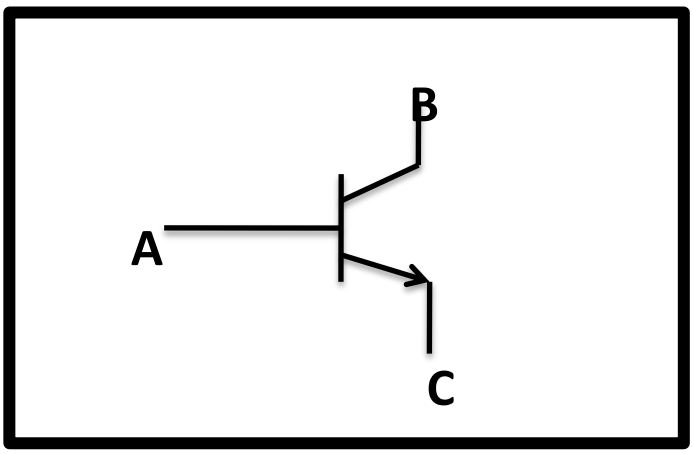

FIGURE 1

9.1.1 Identify the configuration. (2)

9.1.2 Label terminals indicated with letter A to C and write only the correct answer next to letter (A–C) in the ANSWER BOOK. (3)

9.2 Draw a half-wave rectifier circuit and clearly show the input and output wave forms. (5)

[10]

TOTAL: 100

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FORMULA SHEET

Any other 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 $P = VI\text{COS}ø$

REACTIVE POWER $Q = VI\text{SIN}ø$

THREE-PHASE

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

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

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

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