higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N6

(8080126)

25 November 2024 (X-paper)
09:00–12:00

This question paper consists of 4 pages and 1 diagram sheet.

096Q1E2425

Copyright reserved

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
FAULT FINDING AND PROTECTIVE DEVICES N6
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. Use only a black or blue pen.
5. Write neatly and legibly.

Copyright reserved

QUESTION 1

1.1 Briefly explain the construction of a lead-acid battery. (5)

1.2 Name FIVE advantages of nickel-cadmium cells. (5)

1.3 Explain the following tests regarding lead-acid batteries:

1.3.1 Open-circuit voltage test (3)

1.3.2 Load test (2)

[15]

QUESTION 2

2.1 A three-phase, 11 kV alternator having p.u. X of 0,25 at 30 MVA is connected to the primary of a three-phase transformer having p.u. X of 0,1 at 40 MVA.

Calculate the primary current and S/C MVA when a three-phase, symmetrical short circuit occurs on the secondary of the transformer using a 30 MVA base. (8)

2.2 Study the figure on the DIAGRAM SHEET (attached), and answer the following questions.

Fully explain the operation of the relay circuit-breaker system with reference to:

2.2.1 Relay (3)

2.2.2 Circuit breaker (3)

2.2.3 Current transformer (2)

2.2.4 Battery (2)

2.3 Explain THREE causes of faults on overhead lines. (6)

[24]

QUESTION 3

3.1 List TEN things that need to be included on the switchgear auxiliaries. (10)

3.2 Give SIX reasons why the oil circuit breaker is prevented from closing. (6)

[16]

Copyright reserved

QUESTION 4

4.1 There are adequate warning signals indicating internal problems in the transformer.

State FIVE of these prominent signals. (5)

4.2 Oil forms part of the main insulation of most transformers, but it tends to deteriorate while in service.

Give THREE reasons why oil deteriorates while it is in service. (3)

4.3 Explain the following terms regarding faults in a transformer:

4.3.1 Rapid gas evaluation

4.3.2 Medium gas evaluation

4.3.3 Slow gas evaluation

(3 × 2) (6)
[14]

QUESTION 5

5.1 When a cable is laid, it should be inspected to make sure that it was not damaged during installation.

Name FOUR post-installation field checks to be carried out on MV and HV cable systems. (4)

5.2 The Murray loop test has limitations compared to other fault-testing methods.

State FIVE of these limitations. (5)

5.3 Draw a diagram of a Varley loop test used for testing short circuit faults. (8)
[17]

QUESTION 6

6.1 Describe the method used to establish whether the fault is in the main thyristor drive or in the trigger unit. (4)

6.2 Draw a fully labelled block diagram of a *logic comparator*, and explain its operation. (8)

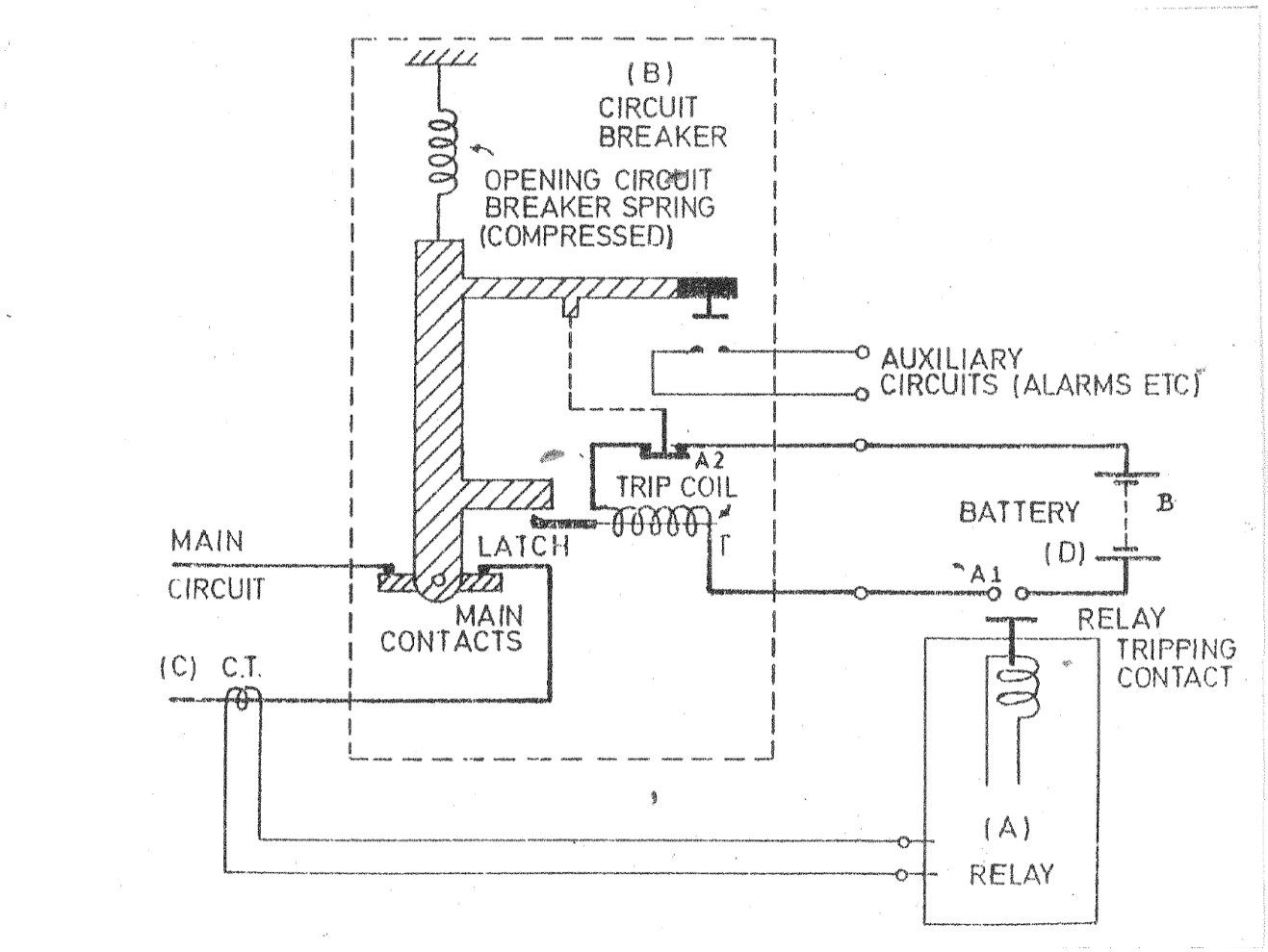
6.3 What is a *metal oxide varistor*? (2)
[14]

TOTAL: 100

Copyright reserved

(8080126)

DIAGRAM SHEET



Copyright reserved