higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL SYSTEMS AND CONSTRUCTION
NQF LEVEL 3

(12041033)

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09:00–12:00

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ELECTRICAL SYSTEMS AND CONSTRUCTION
NQF LEVEL 3
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. Start each question on a new page.
5. Use only a black or blue pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 The aim of SANS 10142-1 is to ensure that people, animals and property are protected from hazards that may arise from the operation of an electrical installation under both normal and fault conditions.

State FOUR faults that an electrical installation must provide protection against in accordance with the wiring code. (4)

1.2 Complete the following paragraph by filling in the missing word or words. Write only the word or words next to the question number (1.2.1–1.2.6) in the ANSWER BOOK.

Any point of a (1.2.1 …) that has to be reached during normal operation shall not exceed a height of (1.2.2 …) above floor level. However, the board may be mounted higher if it can be disconnected from the supply by a (1.2.3 …) that is less than 2,2 m above floor level. Unless a residential distribution board is housed in an (1.2.4 …) and direct access cannot be obtained by an infant, no part of an indoor distribution board shall be less than (1.2.5 …) above the floor level and no part of an outdoor distribution board shall be less than (1.2.6 …) above the ground level. (6 × 1) (6)

1.3 Various sub-circuits are found in a single-phase domestic electrical installation.

1.3.1 Draw a neat, fully labelled diagram of a single-phase stove sub-circuit. (5)

1.3.2 State TWO guidelines to consider when selecting the conductor size for the sub-circuit in QUESTION 1.3.1 above. (2)

1.4 An electrician needs to compile a list of all materials required for a specific installation.

Name TWO main categories of these materials. (2)

1.5 Describe each of the following types of wireways:

1.5.1 Lay-in wireways

1.5.2 Feed-through wireways

(2 × 2) (4)

1.6 Give TWO disadvantages of metal conduit. (2)

[25]

QUESTION 2

2.1 A distribution board is an enclosure that contains all protection devices for the various circuits in the electrical installation as well as the main earth and neutral bars.

2.1.1 Name TWO types of distribution boards used in domestic electrical installations. (2)

2.1.2 List THREE protection devices mounted inside a distribution board. (3)

2.2 Define the term, *emergency lighting.* (2)

2.3 An electrician needs to measure the resistance of the earth continuity conductors between the earth terminal and the earthing terminals of all points of consumption and switches and the values should not exceed those listed in Table 8.1 of SANS 10142-1.

Complete the table below by filling in the missing information. Write only the answer next to the question number (2.3.1–2.3.4) in the ANSWER BOOK.

Sub-circuit	Rated current of protective device (A)	Maximum resistance of earth continuity conductor (Ω)
Lights	2.3.1 …	2.3.2 …
Socket outlets	2.3.3 …	2.3.4 …

(4 × 1) (4)

2.4 Draw a neat, fully labelled diagram to show how the continuity of a ring circuit consisting of three socket outlets can be tested. (6)

2.5 During an insulation resistance test, certain voltage sensitive electronic equipment must be disconnected.

List FIVE voltage sensitive electronic equipment that must be disconnected so that they are not subjected to the test voltage. (5)

2.6 Calculate the maximum voltage drop allowed at a geyser if the supply voltage to the installation is 230 V. (2)

2.7 Explain the function of the test button found on an earth leakage unit. (1)

[25]

QUESTION 3

3.1 A job hazard analysis is a technique that focuses on job tasks to identify hazards prior to the start of any new project, task or job.

State FOUR questions used in a hazard analysis. (4)

3.2 Once an open circuit fuse has been found and the cause rectified, the fuse must be replaced.

Give FOUR guidelines to keep in mind when replacing fuses. (4)

3.3 The table below shows the tests carried out on a single-phase capacitor-start induction-run motor.

Indicate whether the values obtained for each test are ACCEPTABLE or UNACCEPTABLE. Write only 'Acceptable' or 'Unacceptable' next to the question number (3.3.1–3.3.5) in the ANSWER BOOK.

Tests conducted	Values obtained	Acceptable/ Unacceptable
Resistance of start winding	Infinity	3.3.1 …
Resistance of run winding	0 Ω	3.3.2 …
Insulation resistance between windings	200 Ω	3.3.3 …
Continuity of centrifugal switch	0 Ω	3.3.4 …
Insulation resistance between capacitor and earth	5 MΩ	3.3.5 …

(5 × 1) (5)

3.4 Name TWO types of diagrams that can be used for troubleshooting faults. (2)
[15]

QUESTION 4

4.1 State FOUR tasks that must be completed before the supply to a low-voltage network is restored. (4)

4.2 Up to the point of supply, only TN-C-S and TN-S earthing systems are permitted for use in South Africa.

Draw a neat, fully labelled diagram of a TN-S earthing system. (6)
[10]

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QUESTION 5

5.1 Explain the term, *illuminance,* and give the unit of measurement. (2)

5.2 The air inside an incandescent lamp is removed and replaced with an inert gas to reduce the evaporation rate of the tungsten filament.

Name the inert gas. (1)

5.3 Mercury vapour lamps are used in industrial applications and for outdoor lighting because of their low cost and long life.

Describe the construction of a high-pressure mercury vapour lamp. (5)

5.4 State TWO functions of a starter in fluorescent lamps. (2)

5.5 No practical conductor transmits all the electricity that is passed through it, as some is lost due to resistance.

List THREE factors that influence resistive losses in a conductor. (3)

5.6 Name TWO methods used by municipalities to switch off geysers in order to limit electricity demand. (2)
[15]

QUESTION 6

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (6.1–6.10) in the ANSWER BOOK.

6.1 Each silicon solar cell produces approximately 0,5 V of electricity.

6.2 The total irradiance striking the earth on a clear day is about one kilo-watt per square centimetre.

6.3 Polyvinyl chloride (PVC) is commonly used to glaze photovoltaic modules.

6.4 Most photovoltaic modules are designed to operate at temperatures of -20 to 83 °C.

6.5 A by-pass diode is connected across each solar panel to avoid the high resistance of a shaded module.

6.6 Photovoltaic systems should operate at voltages close to the maximum power point.

6.7 The total voltage and current for two modules of 12 V:2 A each connected in series is 12 V:4 A.

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6.8 Photovoltaic controllers are voltage regulators and prevent overcharging of batteries.

6.9 A typical PV module has a nominal short-circuit current of 23,4 amperes.

6.10 An active solar water heater system uses an electric pump to circulate water between the collector and the storage tank.

(10 × 1) **[10]**

TOTAL: 100

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