higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTRICAL WORKMANSHIP
NQF LEVEL 4

(12041014)

15 November 2022 (X-paper)
09:00–12:00

This question paper consists of 7 pages.

311Q1N2215

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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 section on a new page.
5. Use only a black or blue pen.
6. Freehand drawing will NOT be allowed, use the correct drawing tools.
7. Draw a neat line across any work that must not be marked.
8. Round off all calculations to TWO decimal places.
9. Write neatly and legibly.

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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.4) in the ANSWER BOOK.

1.1.1 The step potential is caused by current passing through the human body via one hand and one foot.

1.1.2 Electric shock causes haemorrhage in the brain or other vital organs.

1.1.3 Electrical safeguards such as double-insulated appliances and power tools can reduce the possibility of electrical accidents.

1.1.4 Loose electrical terminal connections and overloading of circuits will not cause overheating of conductors.

(4 × 1) (4)

1.2 Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–F) next to the question number (1.2.1–1.2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.2.1	Hazards caused by machinery	A	adjustable guards
1.2.2	Machine guards that can handle a wide variety of material sizes	B	back injuries
1.2.3	Substances on floor surfaces that can cause slipping and falling	C	point of operation
1.2.4	Employers must make the working environment as comfortable and pleasant as possible for workers	D	contaminants
1.2.5	One of the three basic parts of machines where most mechanical hazards occur	E	space and seating
		F	entanglement

(5 × 1) (5)

1.3 Safe work procedures and practices must be used in the workplace at all times.

1.3.1 What must be clearly stated in a permit to work? State only THREE aspects. (3)

1.3.2 Explain TWO factors to consider when isolating machinery and equipment. (2)

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1.4 There are three ways in which to deal with hazards.

Name TWO of these methods used in the workplace. (2)

1.5 Explain the difference between *fatal* and *major* injuries. (2 × 1) (2)

1.6 PPE is a very important part of the higher hierarchy of control to minimise or eliminate the exposure of workers to hazards.

Name TWO types of PPE that must be used in the workplace. (2)
[20]

QUESTION 2

2.1 IEC symbols are used in all electrical circuit diagrams.

2.1.1 What does the acronym IEC stand for or represent?

2.1.2 Explain why IEC symbols are used?

(2 × 1) (2)

2.2 Explain how a DOL motor starter circuit is latched when the starter push button is pressed and released. (3 × 1) (3)

2.3 Draw a block diagram showing how you would connect a timer to a load.

(4 × 1) (4)

2.4 It is very important for electricians to comply with electrical regulations for the safe operation of all electrical installations.

2.4.1 What does Regulation 5.1.3.1 state with regard to earth-fault current protection? (2 × 1) (2)

2.4.2 Calculate the phase-to-neutral voltage at any wall plug socket outlet point of an installation if the line voltage is 388 volts. (4 × 1) (4)

2.5 A cable which has a cross-sectional area of 20 mm^2 can withstand a fault current of 850 A for 2 seconds.

2.5.1 Calculate the conductor insulation factor (k or CIF). (4)

HINT: $Sp = \frac{\sqrt{(I^2 x\ t)}}{k}$ or $Ifc = \frac{CIF\ x\ A}{\sqrt{t}}$

2.5.2 Name the type of conductor and insulation for this type of cable using the table provided below. (1)

Type of insulation	Type of conductor	k or CIF
PVC	copper	143
PVC	aluminium	95
PVC	steel	52
XLPE	copper	176
XLPE	aluminium	116
XLPE	steel	64
butyl rubber	copper	166
butyl rubber	aluminium	110
butyl rubber	steel	60

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QUESTION 3

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (3.1.1–3.1.2) in the ANSWER BOOK.

3.1 3.1.1 Name ONE term used in the basis of illumination:

A Indirect lighting
B Two-way switching
C Semi-indirect lighting
D Luminance (L)

3.1.2 Which ONE of the following sentences describes a characteristic of a good lighting scheme?

A When the reflected light does not fall directly on the object or surface
B In a system where the light shines upwards towards the ceiling
C It should avoid glare and hard shadows as far as possible
D When lights are mounted in such a way as to shine into the eyes of people in the area

(2 × 1) (2)

3.2 Make a sketch showing how direct lighting reflects light onto a surface. (3 × 1) (3)

3.3 Explain the operation of an incandescent lamp. (3 × 1) (3)

3.4 Draw a fully labelled block diagram showing how an electronic ballast is connected to a single fluorescent tube light fitting. (5 × 1) (5)

3.5 Fluorescent lamps need a starter for illumination to take place.

3.5.1 Name ONE type of starter used in fluorescent lamps.

3.5.2 Explain ONE function of a fluorescent lamp starter.

(2 × 1) (2)

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3.6 Fluorescent lamps create a very dangerous condition in the workplace.

3.6.1 Name this condition. (1)

3.6.2 Explain TWO methods of minimising this dangerous effect. (2 × 2) (4)

[20]

QUESTION 4

4.1 List THREE types of fault-finding techniques used by electricians. (3)

4.2 Complete the table below by providing the possible causes and corrective actions or remedies for these appliances and power tools. Write only the answer next to the question number (4.2.1–4.2.6) in the ANSWER BOOK. (6 × 1) (6)

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
An electrical iron shocks the user	4.2.1	4.2.2
A very noisy tumble dryer	4.2.3	4.2.4
A power tool that does not work at all	4.2.5	4.2.6

4.3 Power tools will last longer if they are maintained regularly.

Explain FOUR basic maintenance procedures that must be followed. (4)

4.4 List FOUR factors to consider when replacing appliance or power tool supply cables or cords. (4)

4.5 Explain the procedure that must be followed before connecting a repaired power tool or appliance to the main supply. (3 × 1) (3)

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QUESTION 5

5.1 The correct sizing of motors is very important when planning an installation.

Explain why it is necessary to install an oversized motor. (3 × 1) (3)

5.2 State THREE reasons why it is so important to always use overload protection when installing electric machines. (3 × 1) (3)

5.3 Certain tests and checks must be done when commissioning electric motors.

Explain why the insulation resistance tests must be done. (3 × 1) (3)

5.4 Explain the basic operation of a DC face plate motor starter. (3 × 1) (3)

5.5 Draw the fully labelled three-phase motor terminal connection box, showing how to connect a motor to run in delta. (5 × 1) (5)

5.6 List THREE types of maintenance procedures or checks that must be done on electric motors or generators according to the maintenance checklist. (3)

[20]

TOTAL: 100

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