higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTROTECHNOLOGY
NQF LEVEL 3

(12040423)

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
ELECTROTECHNOLOGY
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. Use only a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1

1.1 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 (1.1.1–1.1.5) in the ANSWER BOOK.

1.1.1 Which ONE of the following components is not part of a DC machine?

A Slip rings
B Armature
C Brushes
D Series field winding or shunt field winding

1.1.2 Which ONE of the following is not a type of DC motor?

A Separately and shunt-excited motors
B Series motor
C Split-phase motor
D Compound-wound motor

1.1.3 What will happen if two magnets are placed next to each other with their north poles facing each other?

A Attract each other
B Rotate
C Repel
D Move together

1.1.4 Which ONE of the following is a characteristic of a chain drive?

A Relies on friction to transmit power
B Can be replaced by either a flat belt or V-belt and have the same effect
C Positive drive that does not rely on friction to transmit power
D Can experience slipping at times

1.1.5 Which ONE of the following does not appear on motor nameplates?

A Insulation class
B Voltage
C Current
D Velocity

(5 × 1) (5)

1.2 Draw a neat, labelled circuit diagram of a DC series motor. Indicate the direction of the current flowing through the circuit. (3)

1.3 List THREE properties of a rubber belt coupling. (3)

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1.4 Draw a symbol for each of the following components used in electrical circuit diagrams:

1.4.1 Three-pole switch

1.4.2 Link

1.4.3 Normally open push-button

1.4.4 Mechanical interlock

1.4.5 Potentiometer

(5 × 1) (5)

1.5 A DC motor with an input power of 90 kW operating at 85% efficiency draws a current of 30 A from the supply.

Calculate:

1.5.1 The output power in kW

1.5.2 The total losses occurring in the motor

(2 × 2) (4)

[20]

QUESTION 2

2.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1.1–2.1.5) in the ANSWER BOOK.

2.1.1 Insulate means to cover conducting materials with nonconducting materials to prevent the transfer of electricity.

2.1.2 Reinforced insulation is a type of independent insulation applied in addition to basic insulation in order to provide greater protection against electric shock than basic insulation.

2.1.3 Double insulation comprises both basic and supplementary insulation.

2.1.4 Basic insulation is applied to live parts of electric circuits to provide basic protection against electric shock.

2.1.5 Supplementary insulation is a single insulation system applied to live parts, which provides a degree of protection against electric shock equivalent to double insulation.

(5 × 1) (5)

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2.2 Briefly explain each of the following terms:

2.2.1 Leakage current

2.2.2 Protection by isolation

(2 × 2) (4)

2.3 Explain each of the following terms that relate to indirect contact protection against the harmful effects of leakage currents:

2.3.1 Earthing

2.3.2 Bonding

2.3.3 Supplier's earth terminal

(3 × 2) (6)

2.4 Name FIVE safety functions that a motor controller should incorporate. (5)

[20]

QUESTION 3

3.1 Identify each of the following tools and instruments used in electrical installations:

3.1.1



3.1.2



3.1.3



3.1.4



3.1.5



(5 × 1) (5)

3.2 Choose a description from COLUMN B that matches a term in COLUMN A. Write only the letter (A–G) next to the question number (3.2.1–3.2.5) in the ANSWER BOOK.

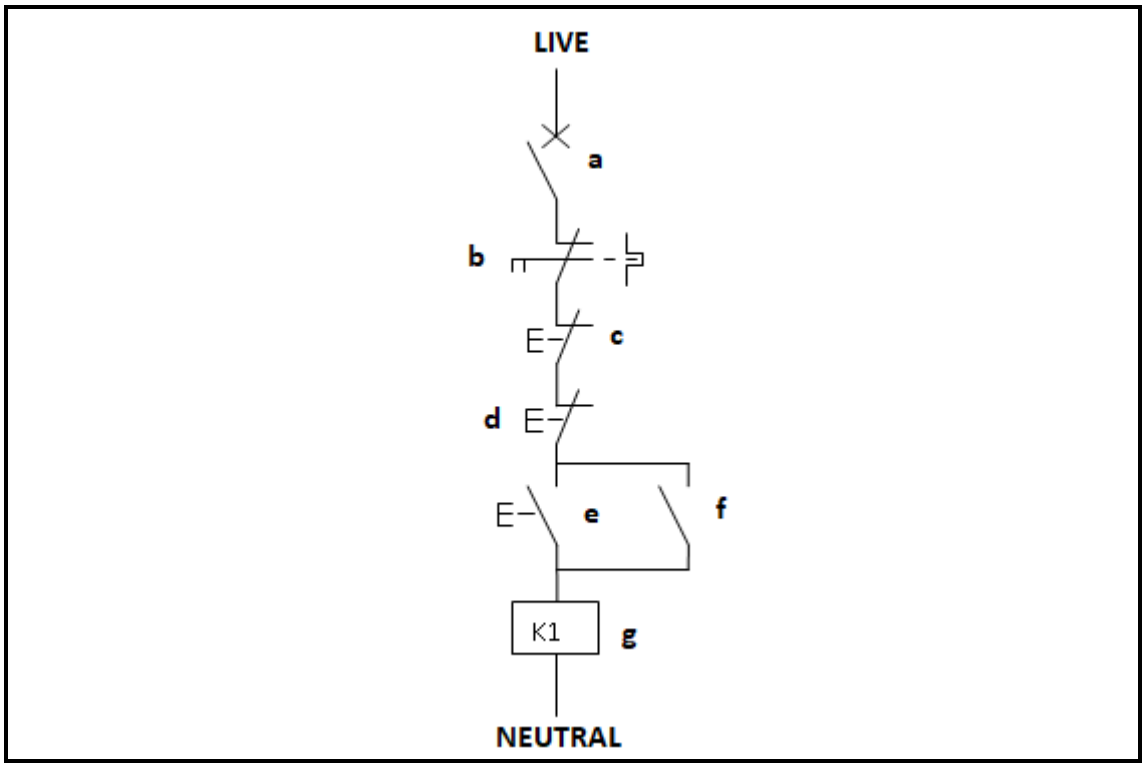
COLUMN A		COLUMN B	
3.2.1	Electrical interlock	A	used in the control circuit of motor starters
3.2.2	Circuit breaker	B	can be installed for emergency purposes
3.2.3	Auxiliary contact	C	used in the power circuit of motor starters
3.2.4	Isolator	D	for protecting the circuit
3.2.5	Main contactor	E	trips where there is an overload or a short circuit
		F	prevents a motor from running in both directions at the same time
		G	used to electrically separate the supply from the load for maintenance purposes

(5 × 1) (5)

3.3 SANS 10142 regulation 6.16.5.1.5 states that each motor shall be supplied by a manually operated disconnector.

List the FOUR requirements that this disconnector must meet. (4)

3.4 Study the direct-on-line starter control circuit shown in the figure below.



3.4.1 Name the components of the direct-on-line starter in the FIGURE above by writing only the answer next to the letter (a–g) in the ANSWER BOOK. (7 × 1) (7)

3.4.2 Explain the purpose of component b in the FIGURE above. (2)

3.4.3 Briefly explain the operation of the circuit in the FIGURE above. (4)

3.5 Name THREE parts of a motor that must be mechanical assessed. (3)

[30]

QUESTION 4

4.1 Design a relay logic circuit using the following design brief:

- Press start button 1. Motor (M1) will start running.
- Motor (M2) cannot be switched on before motor (M1).
- Press start button 2. Motor (M2) will start running.
- Once the emergency stop button is activated, both motors must stop simultaneously. (12)

4.2 Explain each of the following relay logic components:

4.2.1 Counter

4.2.2 Output coil

4.2.3 Normally open

(3 × 1) (3)

4.3 Complete the following sentences by writing only the missing word or words next to the question number (4.3.1–4.3.5) in the ANSWER BOOK.

4.3.1 Logical control systems were designed and built exclusively around … relays.

4.3.2 A logical circuit must make sense even when a … contact is left unconnected at either end.

4.3.3 The coil is controlled by a/an … that can be provided by a push-button anything from 1 metre to 50 metres away.

4.3.4 In hardwired relays, a special latching relay is used to remember important events while the … is off.

4.3.5 A CPU performs a/an … on its function, verifying the operation of its hardware.

(5 × 1) (5)
[20]

QUESTION 5

5.1 Explain the procedure to follow when the motor of a water-pump system does not start (motor not dead). (5)

5.2 List FIVE aspects of client information that will be required when completing a fault report. (5)
[10]

TOTAL: 100

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