higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

ELECTROTECHNOLOGY
NQF LEVEL 3

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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 expression is not an advantage of an AC machine?

A Rugged construction
B No brushes, no commutator, no capacitor, no moving switches, no governor, no slip-rings
C Cheaper in cost
D Big in size



1.1.2 Disadvantages of a universal motor:

A Low efficiency; brushes noisy; spark less, RFI perturbations; low life time (3000 hrs)
B Low efficiency; brushes noisy; spark less, RFI perturbations; high life time (3000 hrs)
C High efficiency; brushes noisy; spark less, RFI perturbations; low life time (3000 hrs)
D Low efficiency; brushes quiet; spark less, RFI perturbations; low life time (3000 hrs)

1.1.3 Which ONE of the following is not an application of a universal motor?

A Portable drills
B Hair dryers
C Grinders
D Washing machine



1.1.4 Advantages of using pulley systems

A Cheaper to manufacture; easy to install; change in speed can be achieved by pulleys; precise speed control can be achieved.
B Slip-on flats and V-belts are used; drive belts can be noisy; and belt life expectancy is short.
C Drive belts can be noisy; easy to install; and cheaper to manufacture.
D Belt life expectancy is short; easy to install; drive belts can be noisy.

1.1.5 Use of coupling systems

A Transfer energy from one point to another point in the system.
B Change the direction of energy transfer.
C Change the speed between the input and the output of the system.
D Connect two shafts of machines.



(5 × 1) (5)

1.2 Name TWO types of self-excited motors. (2)

1.3 Draw a fully labelled circuit diagram of a shunt generator. Clearly show all the currents. (4)

1.4 FIGURE 2 shows the pedestal drilling machine. Study the sketch and answer the questions:

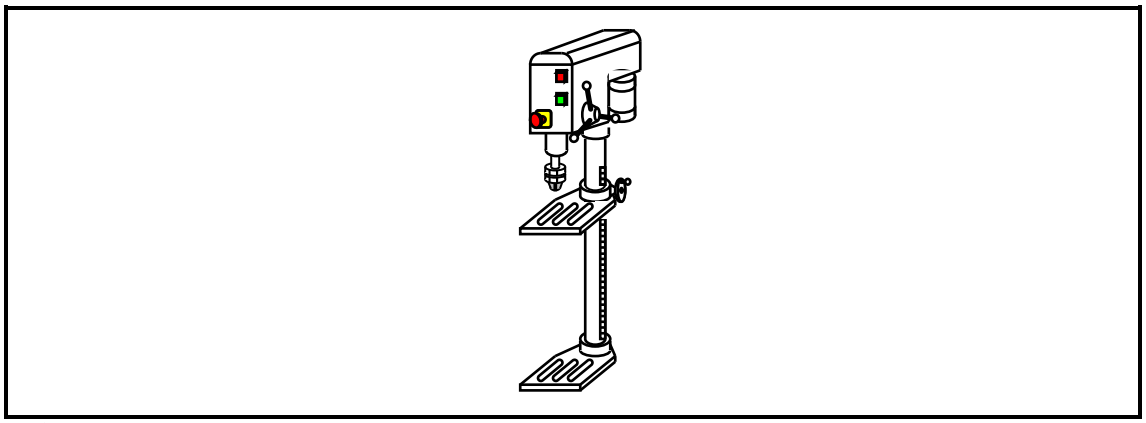


FIGURE 2

1.4.1 Draw the control circuit that is used to switch the machine ON and OFF. (5)

1.4.2 What is the name of the starter mentioned in QUESTION 1.4.1? (1)

1.5 A DC motor draws a current of 10 A from a 250 V supply. Calculate the motor's input in kW. (3)

HINT: $P = V \times I$

[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 The input power of an electric motor is given by the formula $P = V \times I$

2.1.2 Faraday's Motor Action holds that passing a current through a conductor freely suspended in a moving magnetic field creates a force that causes the conductor to move through the field.

2.1.3 For the rotor to rotate continuously, the polarity of the armature voltage must be reversed each time the rotor and stator fields line up.

2.1.4 V = Velocity of the conductor through the field

2.1.5 Output Power = Input power – Power losses

(5 × 1) (5)

2.2 Explain the term *insulator.* (2)

2.3 Explain the term *earthed.* (3)

2.4 Give FIVE examples of insulators that are generally used in the electrical industry. (5)

2.5 State the function of the circuit breaker. (2)

2.6 SANS 10142 states that an electrical installation should provide protection.

Identify THREE conditions against which an electrical installation should provide protection. (3)

[20]

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QUESTION 3

3.1 Choose a term from COLUMN A that matches a description in COLUMN B. Write only the letter (A–L) next to the question number (3.1.1–3.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
3.1.1	Relay	A	delay-on timer used for delay on control applications
3.1.2	Contactor	B	delay-off timer used for delay-off control applications
3.1.3	Connectors	C	used to bring the control voltage to 24V DC.
3.1.4	Limit switch	D	used to link high voltage circuits to the low voltage control circuits
3.1.5	Termination	E	push to make with spring return – green or black button used for start or reset function in a control circuit of a system
3.1.6	Timer	F	used in low voltage control applications using relay ladder logic and as a safety control relay
3.1.7	Power Supply	G	termination strip where incoming and outgoing conductors are connected.
3.1.8	Pushbutton (NO)	H	contact-type sensor used to detect position
3.1.9	Programmable logic controller	I	used to control applications by means of a source program (PLC ladder diagrams)
3.1.10	Emergency stop pushbutton (NC)	J	used to remove the supply from the power and control circuits when an emergency hazard is present – requires manual resetting
		K	can be operated by a pushbutton, key, or rotary action used to turn a system on or off
		L	used to link high voltage circuits to the low voltage control circuits

(10 × 1) (10)

3.2 Mechatronic personnel need to work on the control box but need to have proper safety measures for installing protective devices.

3.2.1 List FIVE protective devices and state the function of each. (5)

3.2.2 State the function of each of the protective devices mentioned in QUESTION 3.2.1. (5)

3.2.3 Name TWO types of interlocks used in forward and reverse control circuits. (2)

3.3 Name THREE measuring instruments that can be used to test an electrical circuit. (3)

3.4 Show with the aid of a diagram the overload relay contact arrangement and numbering. (5)

[30]

QUESTION 4

4.1 Complete the following sentences by writing only the missing word or words next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.

4.1.1 Each output device can only be represented … in the diagram.

4.1.2 All the input and output … must be placed horizontally (vertically for the IEC format).

4.1.3 Current in the … diagram must flow from left to right (top to bottom for IEC format).

4.1.4 Diagrams must be … and commented correctly.

4.1.5 Timers can be used for motor … starting and stopping.

(5 × 1) (5)

4.2 Study the circuit diagram below and answer the questions

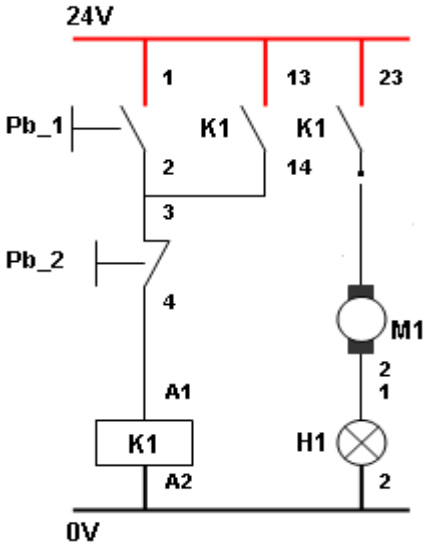


FIGURE 3

4.2.1 Identify the fault in this circuit diagram. (3)

4.2.2 Redraw the correct diagram circuit. (4)

4.3 The factory manager wants to make use of a relay ladder control to start conveyor belt systems in a positive sequence

You are the TECHNICIAN and you have to draw a relay ladder control diagram . Ensure that the following is included:

- A start pushbutton (S1) to put the conveyor belt system on standby
- An amber lamp (E1) to indicate that the system is on standby
- A stop pushbutton (S2) to turn the system and the conveyor belt material transfer process off
- An E/Stop pushbutton to turn only the conveyor belt material transfer process off (motor1 and motor2)
- A sensor (B1) to start the conveyor belt motor (motor1)
- A timer (T1) to start the conveyor belt motor (motor 2) 15 seconds after the conveyor belt motor (motor1) has started
- A timer (T2) to turn off both conveyor belt motors (motor 1 and motor 2) after 30 seconds (8)

[20]

QUESTION 5

Explain the following terms in relation to maintenance and commissioning:

5.1	Fault	(2)
5.2	Symptoms	(2)
5.3	Troubleshooting	(2)
5.4	Failure	(2)
5.5	Malfunction	(2)
		[10]

TOTAL: 100

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