higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N5

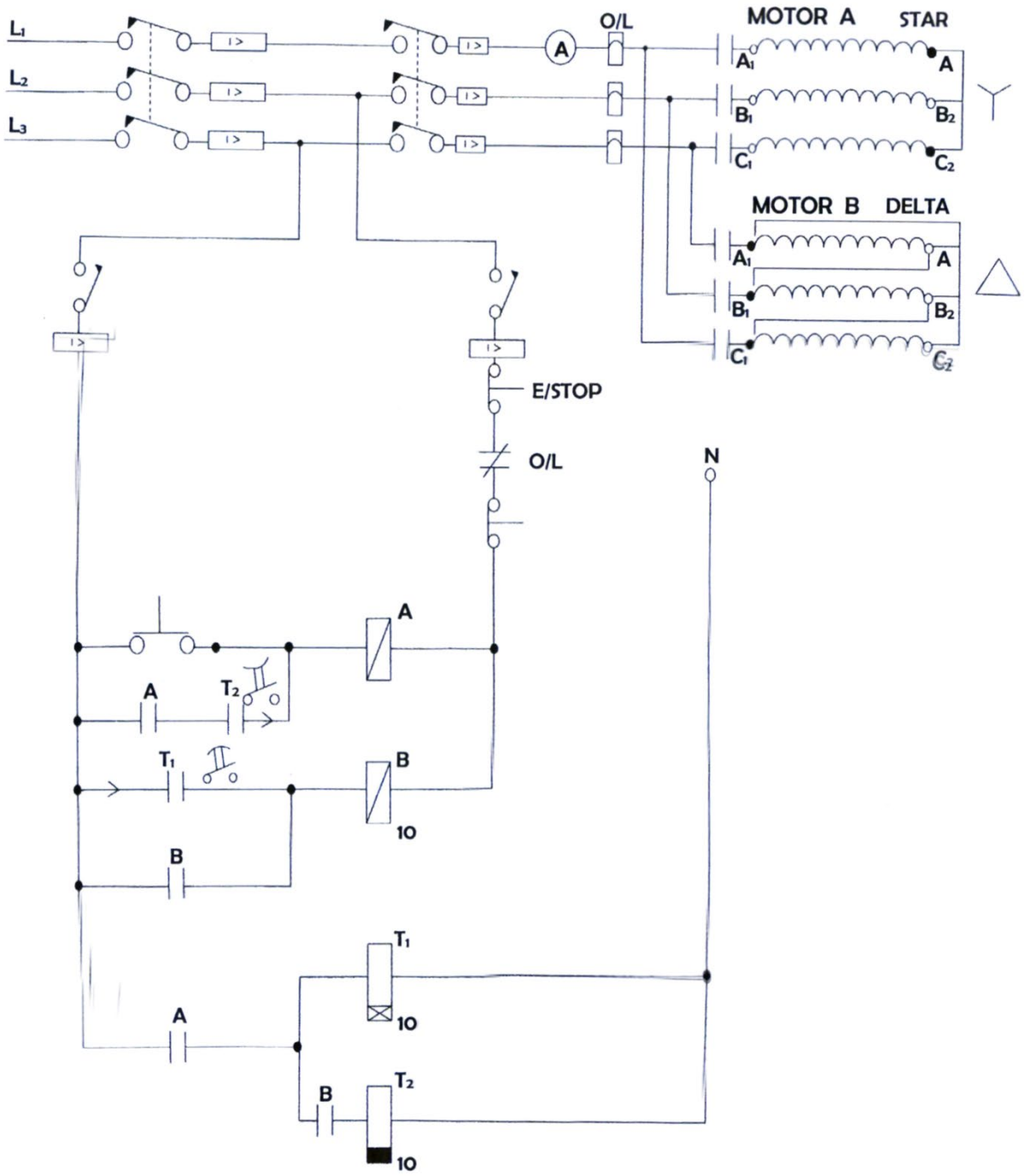
24 November 2023

This marking guideline consists of 7 pages.

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QUESTION 1

Press start button, motor A starts after 10 seconds motor B starts, after a further 10 seconds motor A stops.



[10]

QUESTION 2

2.1 When a motor is started, the armature draws a very high amount of current, which can damage armature conductors,✓ because of a very low resistance on armature conductors. Since the armature is not yet rotating, there is no EMF to oppose the supply voltage.✓ Because R_a is so small a very high current✓ will be drawn from the supply.✓ Resistance is placed in series with the armature to limit the starting current.✓ (5)

2.2
- Fault: One of the phases/line is reversed.✓✓
- Remedy: Swap the connection of any two phases (lines) e.g. red and blue phases and test.✓
- If not corrected, swap connections of the next phases/lines and test again.✓
- Continue with the next phases until the reverse has been found.✓ (5)

[10]

QUESTION 3

3.1
- Use the correct grate of brushes.
- Clean the commutator.
- Bed the brushes (provide them with the oval shape to fit the arc of the commutator).
- Set the brush pressure (by adjusting the spring tension within the brush box or holder). (4)

3.2
- Carbon brushes
- Copper brushes
- Graphite brushes
- Electro-graphite brushes (4)

3.3
- To cool
- To clean
- To reduce friction
- Viscosity must not change with a change in temperature. (Any 2 × 1) (2)

[10]

QUESTION 4

4.1 Supply current:

$$I_S = \frac{25000}{220}$$
$$= 113{,}636A \checkmark$$

When the motor runs at full speed, the current is 150% of the supply current.

$$I_{fullspeed} = I_s \times 1{,}5 \checkmark$$
$$= 113{,}636 \times 1{,}5$$
$$= 170{,}455A \checkmark$$

The value of DB resistor:

$$R_{DB} = \frac{V_T}{I_{fullspeed}} \checkmark$$
$$= \frac{220}{170{,}455} \checkmark$$

= 1,291 Ω ✓ (6)

4.2
- To reduce wear on the mechanical brake system (reduce wear on shoes or pads).✓✓
- To protect coupling (drive gears) from damage due to sudden braking action (dead brakes).✓✓

(4)
[10]

QUESTION 5

5.1 To obtain the neutral point of the brushes on the commutator.✓✓

5.2 To locate an open circuit, short circuit and wrong connections in the armature, rotor and stator of electrical machines.✓✓

5.3 To check the correct polarity of the field winding **OR**
To check whether the supply is in the correct direction to set up the magnetic field with the required polarity.✓✓

5.4 To obtain the short-circuit current that will flow at rated voltage to draw a circuit diagram.✓✓

5.5 To check the voltage drop across commutator segments.✓✓

(5 × 2) **[10]**

QUESTION 6

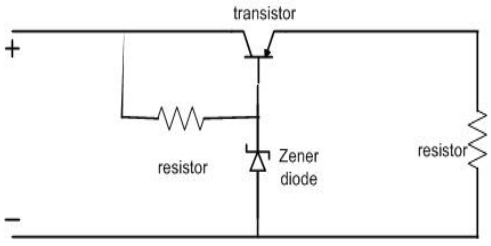
6.1 The SCR will conduct✓ during the positive half cycles of the supply when the switch is closed.✓ The SCR acts as a half-wave rectifier when triggered,✓✓ during the negative half cycle the SCR will not conduct.✓✓ (6)

6.2 The diode prevents reversal of gate current flowing to the gate.✓✓ (2)

6.3 R limits the gate current.✓✓ (2)
[10]

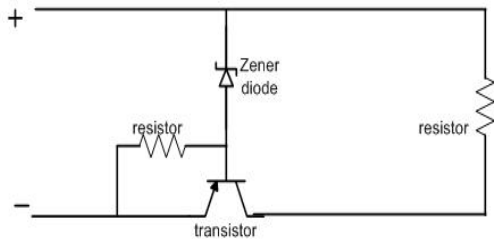
QUESTION 7

7.1



(5)

7.2



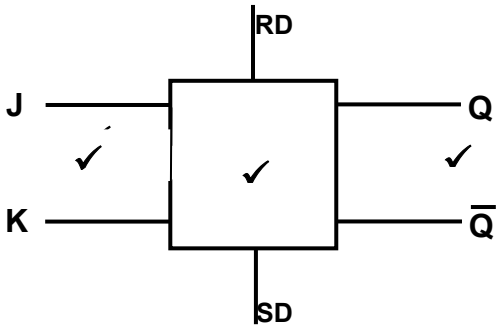
(5)
[10]

QUESTION 8

8.1
- It can be changed to any flip-flop easily.
- No non-permissible combination can be placed on the input.

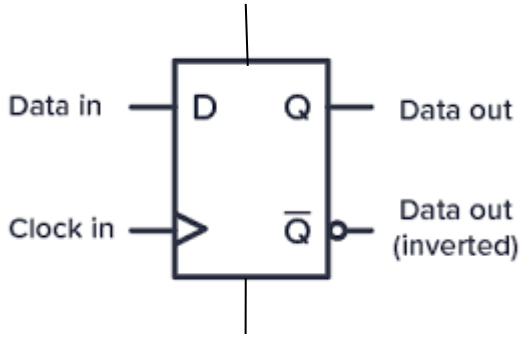
(Any 1 × 1) (1)

8.2.1



(3)

8.2.2



(3)

8.3
- Series-in series-out
- Series-in parallel-out
- Parallel-in parallel-out
- Parallel-in series-out

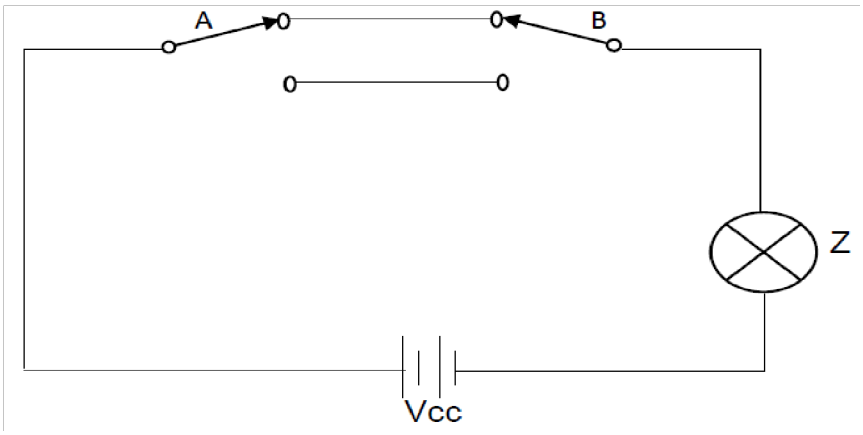
(Any 3 × 1) (3)
[10]

QUESTION 9

9.1
9.1.1 A
9.1.2 D
9.1.3 A
9.1.4 A
9.1.5 B
9.1.6 C

(6 × 1) (6)

9.2



(4)
[10]

QUESTION 10

10.1 $4A,6_{16}$✓✓
10.2 $3,6_{8}$✓✓
10.3 $10011001,01_{2}$✓✓
10.4 $7,25_{10}$✓✓
10.5 $10001010,0010_{2}$✓✓

(5 × 2) **[10]**

TOTAL: 100

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