higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N5

(8080115)

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

Drawing instruments may be used.

This question paper consists of 8 pages and 1 formula sheet.

088Q1E2218

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
FAULT FINDING AND PROTECTIVE DEVICES N5
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 a blue pen.
6. Write neatly and legibly.

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QUESTION 1

The contactor, M, in FIGURE 1 below does not pull back.

State FIVE possible faults and how each fault can be repaired.

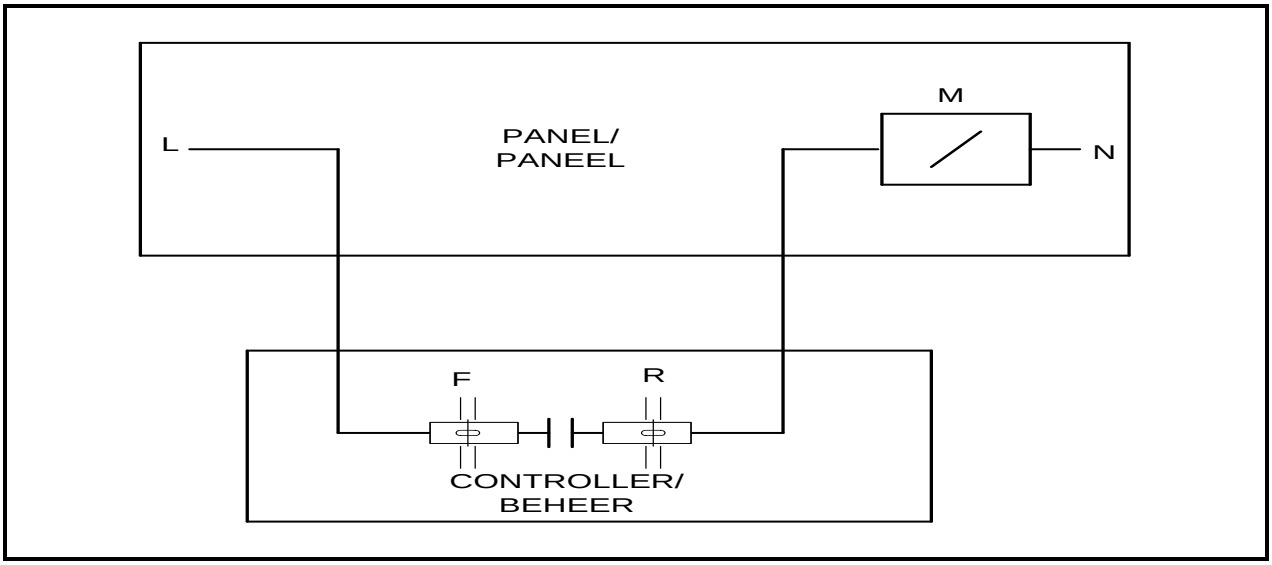


FIGURE 1

[10]

QUESTION 2

2.1 FIGURE 2 below is a DC machine. Identify the parts labeled A to F. Write only the answer next to the letter (A–F) in the ANSWER BOOK.

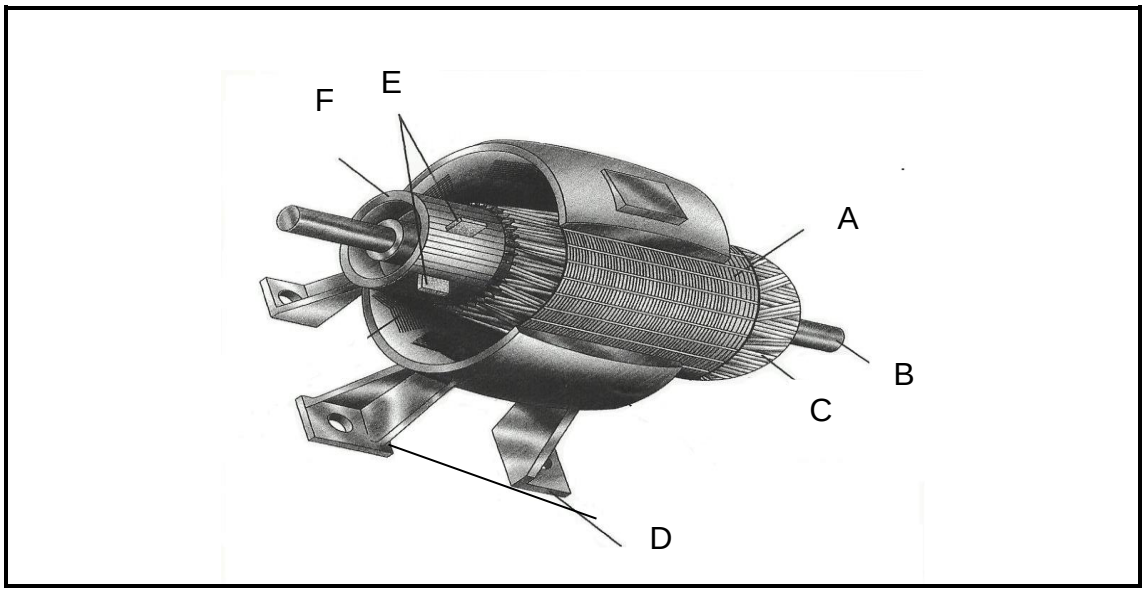


FIGURE 2

(6 × 1) (6)

2. 2 Squirrel-cage induction motor is the most common three-phase found in a mill or plant.

Name any FOUR advantages of this motor. (4)
[10]

QUESTION 3

3.1 The field system is the stationary part of a DC machine.

State the functions of the following components that make up the field system:

3.1.1 Field coils

3.1.2 Pole shoes

(2 × 2) (4)

3.2 Bearings are used to support the rotating armature of a DC machine.

Name TWO types of bearings used in DC machines. (2)

3.3 Laminations are thin layers that are bound together.

Why are the field poles and the armature cores of DC machines laminated? (2)

3.4 There are two types of armature windings in a DC machine. State which winding is used in the case of a:

3.4.1 Low voltage, high current application.

3.4.2 High voltage, low current application.

(2 × 1) (2)
[10]

QUESTION 4

4.1 Explain how a load test is conducted on an electrical machine. (8)

4.2 Polarity test are one of the test need to be done during electrical installation, explain the main purpose of doing a polarity test on electrical equipment or installations. (2)
[10]

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QUESTION 5

5.1 Draw a neat, labelled circuit diagram of an SCR by using transistors only. (4)

5.2 Briefly describe how the circuit mentioned in QUESTION 5.1 operates when a positive signal is applied on the gate terminal. (4)

5.3 State any TWO advantages of using silicon controlled rectifier. (2)

[10]

QUESTION 6

6.1 An operational amplifier (op-amp) is an integrated circuit containing a number of transistors and other components. A typical op-amp is the 741.

6.1.1 Name the TWO different types of the 741 operational amplifier. (2)

6.1.2 Sketch a fully labelled circuit symbol for an operational amplifier. (5)

6.2 Name any THREE main characteristic of operational amplifier. (3)

[10]

QUESTION 7

7.1 FIGURE 3 below shows output waveforms as displayed on the oscilloscope screen.

Define the THREE waves in terms of rectification.

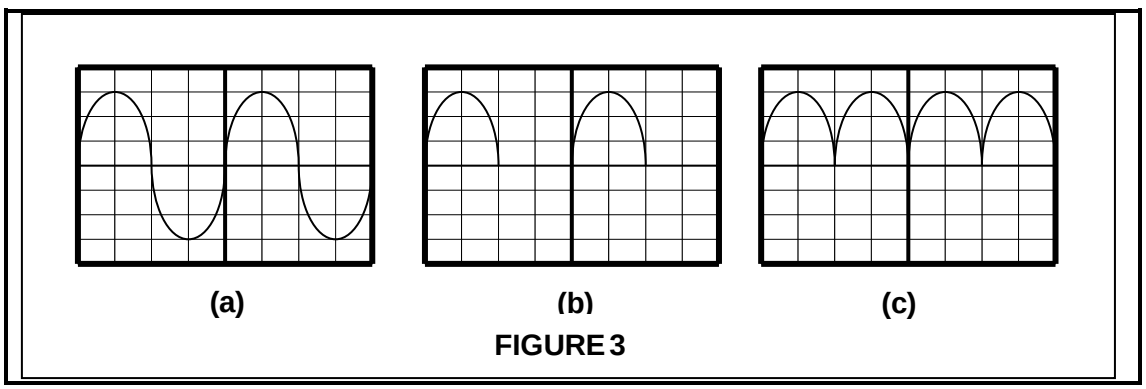


FIGURE 3

FIGURE 3

(3)

7.2 As a technician, for what reason will you use an oscilloscope and not a digital multi meter? (4)

7.3 If you do not plan to use a digital multi meter for a long time, how should you take care of it? (1)

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7.4 You have just purchased a new oscilloscope and want to use it.

What must be done first before using it? (2)

[10]

QUESTION 8

8.1 Logic gates form part of the building blocks of electronic-memory circuitry such as flip-flops.

Explain what a flip-flop is. (2)

8.2 Study the diagram below and then answer the questions that follow:

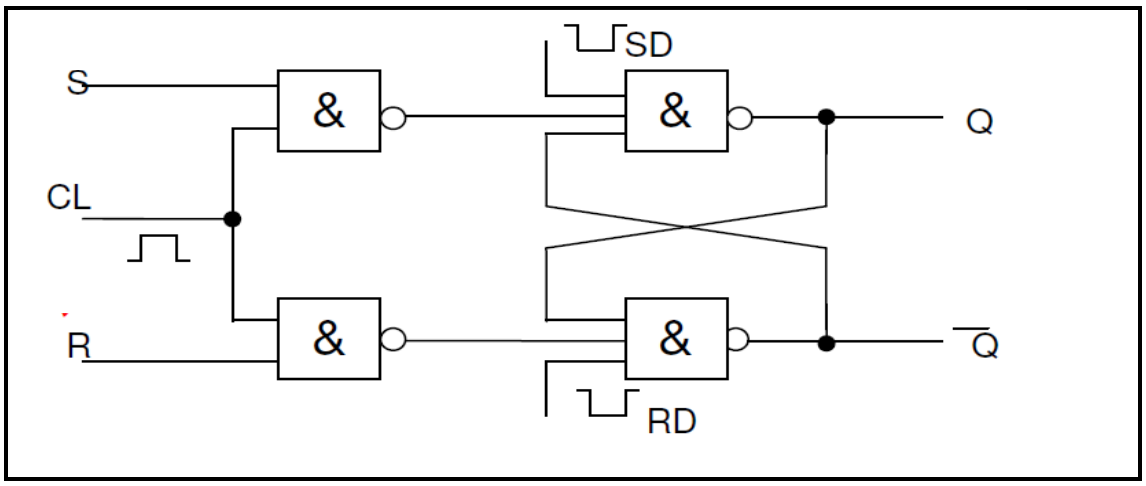


FIGURE 4

8.2.1 Name the flip flop that is represented by the diagram in FIGURE 4. (1)

8.2.2 Complete a truth table and IEC symbol for the flip-flop in QUESTION 8.2.1 above. (7)

[10]

QUESTION 9

9.1 Various options are given as possible answers to the following questions. Choose the correct answer and write only the letter (A–D) next to the question number (9.1.1–9.1.6) in the ANSWER BOOK.

9.1.1 An AND logic gate will produce a HIGH output if …

A all inputs are HIGH.
B at least one input is HIGH.
C all inputs are LOW.
D at least one input is LOW.

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9.1.2 The … is a basic logic gate with an output that complements the input.

A INVERTER gate
B Comparator
C OR gate
D AND gate

9.1.3 The … is a logic gate that will have HIGH or '1' at its output when any one of its inputs is HIGH.

A NOT gate
B NOR gate
C OR gate
D AND gate

9.1.4 When one or more inputs in a(n)…are zero, the output will be LOW for any case.

A OR gate
B NOT gate
C AND gate
D NAND gate

9.1.5 A NAND gate has …

A LOW inputs and a LOW output.
B LOW inputs and a HIGH output.
C HIGH inputs and a HIGH output.
D None of the above.

9.1.6 If a signal passing through a gate is inhibited by sending a LOW into one of the inputs and the output is HIGH, it is a(n)…gate.

A AND
B NOR
C OR
D NAND

(6 × 1) (6)

9.2 Draw the truth table for a THREE input NAND gate. (4)
[10]

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QUESTION 10

Convert the following numbers to the base shown in brackets:

10.1 $01001010,0110_2$. (16)

10.2 $011,11_2$. (8)

10.3 $76,25_{10}$. (2)

10.4 111.01_2. (10)

10.5 $8A,2_{16}$. (16)

(5 × 2) **[10]**

TOTAL: 100

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FAULT FINDING AND PROTECTIVE DEVICES N5

FORMULA SHEET

$\frac{R_a}{R_2} = \frac{(1 + \alpha\ cu\ ta)}{(1 + \alpha\ cu\ t_2)}$	*Ra*	=	*Resistance of motor windings at ambient temperature before test in ohms*
	∀ cu	=	*Temperature coefficient of resistance of copper (0,004)*
	ta	=	*Ambient temperature in °C*
	R_2	=	*Resistance of hot windings after test in ohms*
	t_2	=	*Temperature of hot windings after test in °C*
P = VI Cos ø	*P*	=	*Power in watts in single-phase AC circuit*
	V	=	*Applied voltage in volts*
	I	=	*Current in circuit in amperes*
	Cos ø	=	*Power factor* *Cosine of phase angle between applied voltage and current*
Electron charge	*E*	=	*1,602 × 10^{-19} coulombs*
Mass of electron	*Me*	=	*9,11 × 10^{-31} kg*
Mass of proton	*Mp*	=	*1,673 × 10^{-27}*
Deflection	*Defl*		$\frac{E \times L \times I}{2 \times d \times V_a}$
Heat energy due to friction between shaft journal and bearing	*Eμ*	=	*Tμ × 2π u Joule per second*
	u	=	*Revolutions per second*
	Tμ	=	*Friction torque in Nm*
	Tμ	=	*μ × P × R*
	μ	=	*Coefficient of friction*
	P	=	*Normal load on bearing in Newton*
	R	=	$\frac{D}{2}$ *in metres*
	D	=	*Journal diameter in metres*

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