higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N5

(8080115)

29 July 2021 (X-paper)
09:00–12:00

Drawing instruments and nonprogrammable calculators may be used.

This question paper consists of 6 pages and 1 formula sheet.

092Q1G2129

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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 question on a new page.
5. Only use a black or blue pen.
6. Write neatly and legibly.

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QUESTION 1

1.1 Describe the method you would use to design a motor control circuit. (7)

1.2 It is important to note that when designing an electrical circuit, there are many aspects to consider such as safety, electrical components and symbols.

Name any THREE protective devices which will break the circuit or cut out the supply during unwanted conditions or faults. (3)

[10]

QUESTION 2

2.1 State FOUR requirements for dynamic braking. (4)

2.2 Dynamic braking is the method used to reduce the rotating speed of an armature or rotor in an induction motor before applying mechanical brakes.

State TWO ways that dynamic breaking can be applied in AC motors. (2)

[6]

QUESTION 3

3.1 Give ONE function of each of the following with regards to a DC machine:

3.1.1 Laminated plates

3.1.2 Carbon brushes

3.1.3 Thin mica

(3 × 2) (6)

3.2 Name TWO methods which could be used to reverse the direction of rotation in a DC motor. (2)

3.3 What is the purpose of starting resistance in a DC machine? (2)

[10]

QUESTION 4

4.1 Name any THREE types of brushes used in DC machines. (3)

4.2 The construction of a DC motor is similar to that of a DC generator. With respect to these machines:

Draw a neat, labelled diagram of a DC machine. (7)

[10]

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QUESTION 5

5.1 State FOUR faults that may be detected with an induction test. (4)

5.2 Explain how the load test is performed on an electrical motor. (6)

[10]

QUESTION 6

Inching circuit can be used where accurate hoisting and lowering is required from overhead cranes.

Make a neat, labelled diagram of an inching circuit. **[6]**

QUESTION 7

7.1 Give any THREE main advantages of operational amplifiers. (3)

7.2 Draw a neat, labelled block diagram of an open-loop motor speed control system and explain the function of each block. (7)

[10]

QUESTION 8

FIGURE 1 below shows a block diagram of a cathode ray oscilloscope. Label the parts marked A–J by writing only the answer next to the letter (A–J) in the ANSWER BOOK.

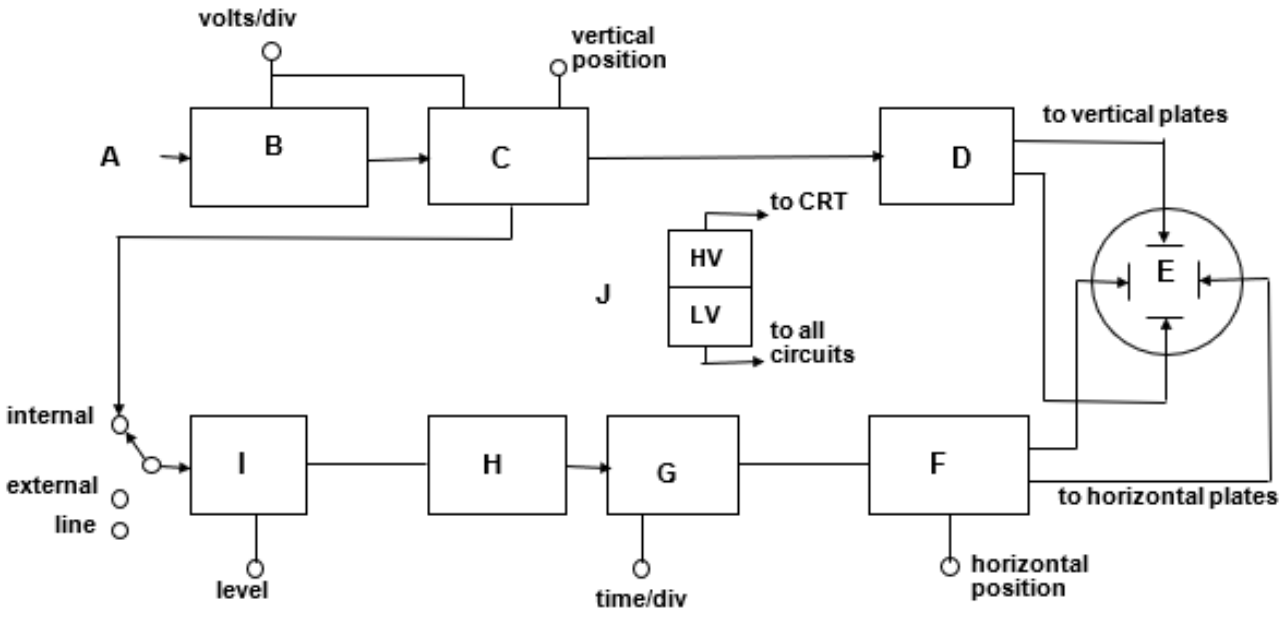


FIGURE 1 **[10]**

QUESTION 9

9.1 Study the switch circuits in FIGURE 2 below and answer the questions.

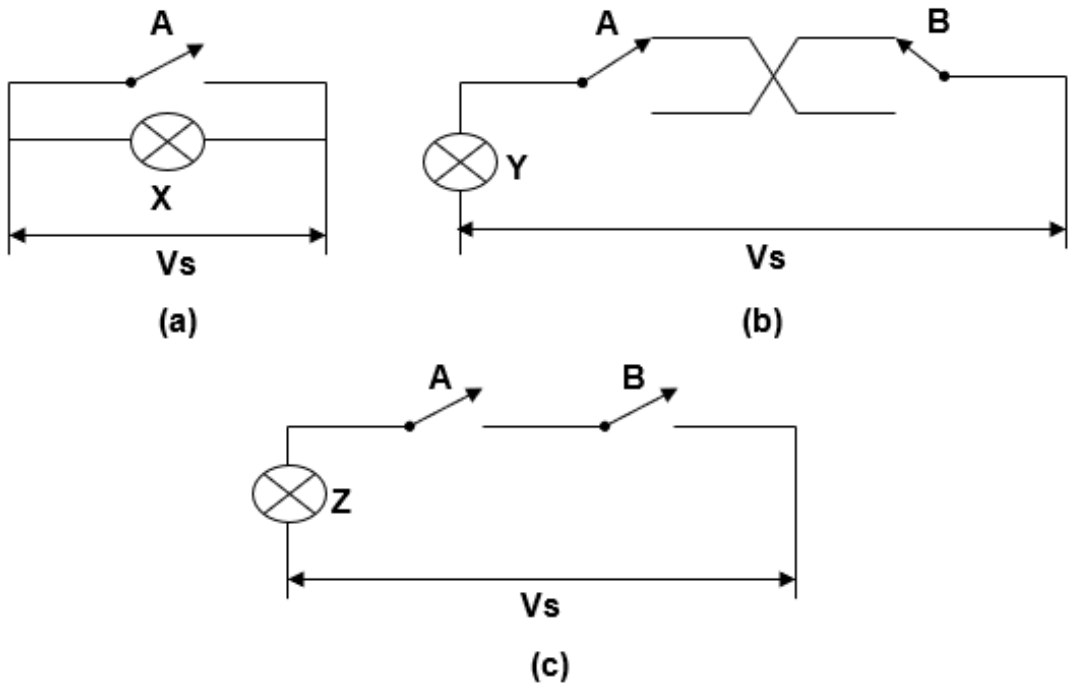


FIGURE 2

9.1.1 Identify the gates in FIGURE 2 and write down the names. (3)

9.1.2 Draw the IEC symbol for the gate in FIGURE 2(b) above. (3)

9.1.3 Complete the table below by making use of the gates in FIGURE 2 above.

Inputs		Outputs	
A	**B**	**Y**	**Z**
0	0		
0	1		
1	0		
1	1		

(4)

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9.2 Study FIGURE 3 below and answer the questions.

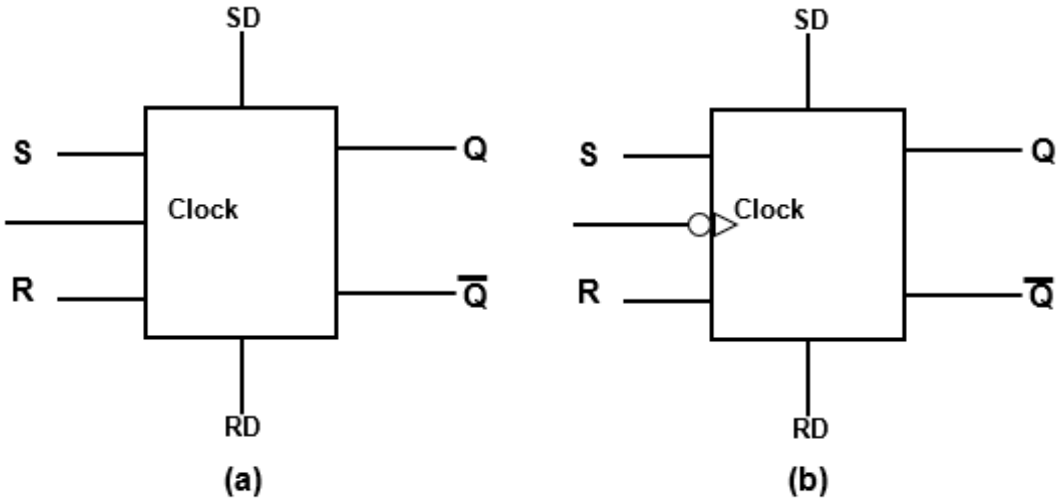


FIGURE 3

9.2.1 What types of flip-flop are represented by the TWO IEC symbols in FIGURE 3 above? (2)

9.2.2 Draw the truth table for the flip-flop in FIGURE 3(b) above. (4)

9.2.3 What is the meaning of the input SD in FIGURE 3 above? (1)

9.2.4 What is the meaning of the input RD in FIGURE 3 above? (1)

[18]

QUESTION 10

Convert the following numbers to the base shown in brackets:

10.1 $3{,}375_{10}$ (2)

10.2 483_{10} (8)

10.3 $111{,}101_{2}$ (10)

10.4 $1010\ 0001\ 1100{,}1110_{2}$ (16)

10.5 $55{,}7_{8}$ (2)

(5 × 2) **[10]**

TOTAL: 100

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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*
	$\forall\ cu$	=	*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* *Consine of phase angle between applied voltage and current*
Electron charge	*E*	=	$1,602 \times 10^{-19}$ *coulombs*
Mass of electron	*Me*	=	$9,11 \times 10^{-31}$ *kg*
Mass of proton	*Mp*	=	$1,673 \times 10^{-27}$
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*	=	$T\mu \times 2\pi u$ *Joule per second*
	u	=	*Revolutions per second*
	Tμ	=	*Friction torque in Nm*
	Tμ	=	$\mu \times P \times R$
	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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