higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T670**(E)**(J31)T

NATIONAL CERTIFICATE

FAULT FINDING AND PROTECTIVE DEVICES N5

(8080115)

31 July 2019 (X-Paper)
09:00–12:00

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

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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. Write neatly and legibly.

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QUESTION 1

Design and draw only the control circuit of a sequence starter using the following information:

When the start button is pressed, motor A starts to rotate. 10 seconds after motor A has started rotating, motor B starts to rotate and after a further 10 seconds motor A stops rotating.

All coils are 380 V and the two timers are set at 10 seconds each. **[10]**

QUESTION 2

Complete the TABLE on the ANSWER SHEET (attached), regarding the possible faults that may occur in brushes in practice.

NOTE: Write your EXAMINATION NUMBER in the spaces provided on the ANSWER SHEET, detach it from the QUESTION PAPER and hand it in with the ANSWER BOOK. **[10]**

QUESTION 3

3.1 During the conversion of energy from one form to another, energy is lost.

Name THREE categories of energy loss that can occur in DC machines. (3)

3.2 Name TWO direct tests done on an electrical motor to determine the losses. (2)

3.3 Name TWO indirect tests done on an electrical motor to determine the losses. (2)

3.4 Give THREE reasons why three-phase induction motors are the most commonly used in industry. (3)

[10]

QUESTION 4

4.1 Draw a simple sketch to show the construction of a Martindale instrument. (6)

4.2 Explain the purpose of the following tests done on electrical machines:

4.2.1 Polarity test

4.2.2 Kick neutral test

(2 × 2) (4)

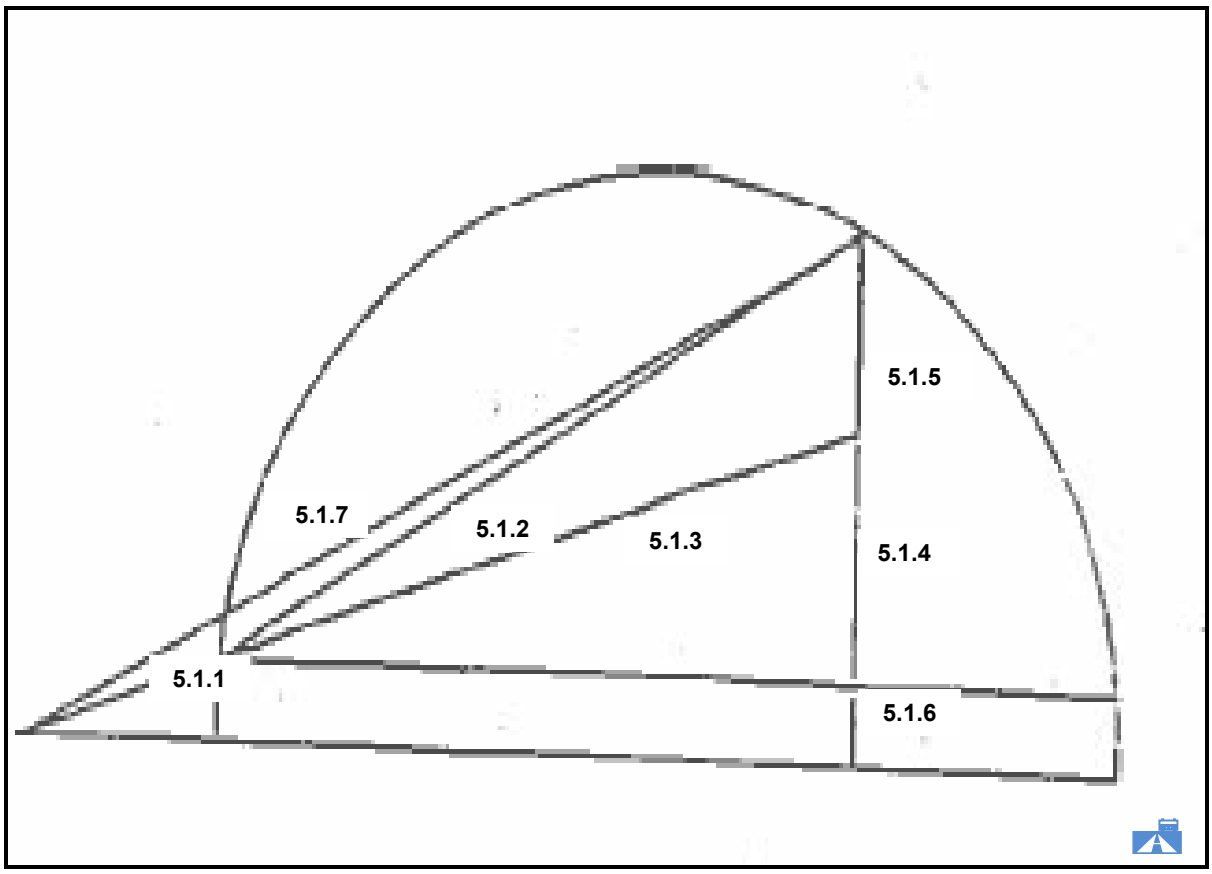
[10]

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QUESTION 5

5.1 The FIGURE below shows a circle diagram of a three-phase induction motor.

Name what each line represents by writing only the answer next to the number (5.1.1–5.1.6) in the ANSWER BOOK. Example: (5.1.7) short-circuit stator current.



(6)

5.2 Dynamic braking is the method used to slow down a motor before applying mechanical brakes.

State FOUR requirements for dynamic braking. (4)

[10]

QUESTION 6

6.1 A CRT has its screen 300 mm from the center of the deflecting plates that are 25 mm long and 42 mm apart. The beam voltage is 1 kV and the deflecting voltage is 15 V.

Determine the deflection on the screen. (4)

6.2 State THREE factors that influence the deflection sensitivity in a cathode-ray tube. (3)

6.3 Give THREE uses of a cathode-ray oscilloscope. (3)
[10]

QUESTION 7

7.1 Draw a neat, labelled characteristic curve of an SCR. (6)

7.2 Define the term *holding current*. (2)

7.3 State TWO methods used to switch off an SCR in an SCR circuit. (2)
[10]

QUESTION 8

8.1 State FOUR functions of a register. (4)

8.2 How many flip-flops are required to construct a shift register that is capable of storing a six-bit binary number? (2)

8.3 Develop a truth table for the R-S flip-flop. (4)
[10]

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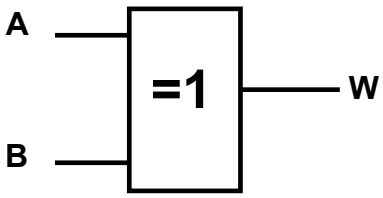
QUESTION 9

9.1 How many possibilities exist for the truth table of a two-input OR gate? (1)

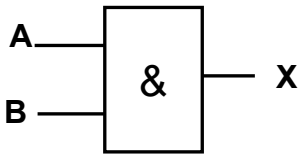
9.2 Draw the switching circuit of an NOR gate using two inputs. (3)

9.3 Study the following IEC symbols of a logic gate and give the name of each gate:

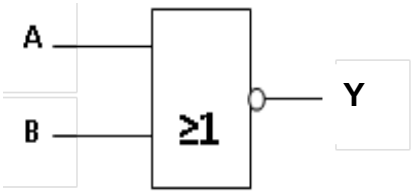
9.3.1



9.3.2



9.3.3



(3 × 2) (6)
[10]

QUESTION 10

Convert the following numbers to the base shown in the brackets:

10.1 $1011100, 100_2$ (10)

10.2 236_8 (2)

10.3 $3BF, A_{16}$ (2)

10.4 $1010001,001_2$ (10)

10.5 143_{10} (8)

(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*
	$\forall\ cu$	=	*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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ANSWER SHEET EXAMINATION NUMBER: | | | | | | | | | | | | | |

Complete the following table regarding problems that might be experienced with brushes:

PROBLEMS	POSSIBLE CAUSES	POSSIBLE SOLUTIONS
Gradual wear of brushes		
Brushes wear rapidly		
Wear, hot shunt and arcing		
Sparking		
Vibration of brushes		

NOTE: Write your EXAMINATION NUMBER in the spaces provided on the ANSWER SHEET, detach it from the QUESTION PAPER and hand it in with the ANSWER BOOK.

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