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higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T440(E)(N19)T
NOVEMBER EXAMINATION

NATIONAL CERTIFICATE

DIGITAL ELECTRONICS N4

(8080354)

19 November 2013 (X-Paper)
09:00–12:00

Candidates may not be used.

This question paper consists of 5 pages.

ENGINEERING

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
DIGITAL ELECTRONICS N4
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. Keep subsections of questions together.
5. Rough calculations may be done at the back of the ANSWER BOOK.
6. Write neatly and legibly.

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QUESTION 1

Choose an item/word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–Y) next to the question number (1.1–1.25) in the ANSWER BOOK.

COLUMN A		COLUMN B	
1.1	Inequality gate	A	D-type master slave
1.2	Weighed self inverting code	B	asynchronous
1.3	Alpha-numeric number system using 4 binary bits	C	binary
1.4	Code which gives the binary equivalent for the decimal number system	D	R-S Master-slave flip flop
1.5	Another name for the 2421 code.	E	leading
1.6	Two's compliment of $10001{,}000_2$	F	hexadecimal.
1.7	Difference between a full adder and half adder	G	X-3 BCD
1.8	This is the faster type of binary counter	H	2421 Code
1.9	Radix of the octal system	I	$01111{,}000_2$
1.10	Number of select lines needed for a 4 : 1 multiplexer	J	JK master slave flip flop
1.11	This type of logic gate has multi-emitter input transistors	K	16
1.12	This counter shifts information through without losing it	L	NAND gate.
1.13	In this counter the clock pulse of the previous flip-flop clocks the next one	M	NOT gate
1.14	This type of counter first shifts a 1 through and then shifts a 0 through	N	ASCII code
1.15	A JK-Master-slave flip-flop clocks on this edge.	O	trailing
1.16	$\overline{AB} + \overline{XY} = \overline{ABXY}$ is an example of this law	P	octal
		Q	X-OR gate.
		R	NOR gate
		S	GRAY code.
		T	carry input

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1.17	Given: A B Q 0 0 0 0 1 0 1 0 0 1 1 1 is the truth table for this gate	U	T-type
		V	De-Morgan
		W	2
		X	TTL
		Y	ECL
1.18	$\overline{A}\overline{B} + AB$ is the Boolean expression of this type of gate		
1.19	This logic function is given by the single transistor common-emitter switching circuit		
1.20	This is a positional code only		
1.21	This code converts into groups of THREE binary bits.		
1.22	This code is used when data from the keyboard Is transferred into the computer		
1.23	This number system is used in computations by computers		
1.24	This flip-flop has only one input		
1.25	This gate will only provide an output when all inputs are at binary 0		

(25 × 1) **[25]**

QUESTION 2

2.1 Do the following calculations in the binary system. Show ALL conversions and calculations clearly:

$C,4_{16} - 7,5_8$

Make use of the one's compliment method and convert the final answer to the decimal system. (6)

2.2 $6,25_{10} \times 6,2_8$

Convert the final answer to the Hexadecimal system. (6)

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2.3 $A,D_{16} \div 5,25_{10}$

Convert the final answer to the octal system. (6)

2.4 Write $86,5_{10}$ in the following codes:

2.4.1 2421 BCD

2.4.2 Excess – 3 BCD

(3 × 2) (6)
[24]

QUESTION 3

3.1 Draw the circuit diagrams of the Boole expressions below without changing or simplifying them:

3.1.1 $\overline{(\overline{A+B}+\overline{C})(\overline{\overline{A}+\overline{B}+C})}$ = f (A,B,C)

3.1.2 $\overline{(A \oplus B \oplus C)(A \oplus \overline{B+C})}$ = F (A,B,C)

(5 × 2) (10)

3.2 Simplify the expressions below to their simplest forms. Convert the simplified answers to NAND gates and draw the circuits.

3.2.1 $\overline{(A+B\overline{C}+\overline{A}B)+(\overline{A}+BC+A\overline{B})}$ = F (A,B,C)

3.2.2 $\overline{(\overline{A}\overline{B}+\overline{A}BC)(\overline{A}\overline{B}C+\overline{A})(\overline{A}BC+A\overline{B})}$ = F(A,B,C)

(8 × 2) (16)
[26]

QUESTION 4

Make a neat, labelled sketch of a D-type master slave flip-flop consisting of NAND gates. Also give a short description of the switching actions on the four most important points on the clock pulse. **[12]**

QUESTION 5

Draw a 4-bit parallel BCD adder and show the contents of the different registers when the binary values of 2_{10} and 3_{10} are added. **[13]**

TOTAL: 100

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