NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING DEGREE
DURATION 3 HOURS – JANUARY 2011

TEE 2111 DIGITAL ELECTRONICS

INSTRUCTIONS TO CANDIDATES
1. ANSWER **ALL QUESTIONS**
2. SHOW YOUR STEPS CLEARLY IN CALCULATIONS
3. START THE ANSWER FOR EACH QUESTION ON A FRESH PAGE

QUESTION ONE

Convert the following numbers:

a) 68780053_{10} into a binary number
b) 12375401_{8} into a hexa-decimal number
c) $111010101010011.11101_{2}$ into a decimal number
d) 0.84765_{10} into an octal number
e) $9DEC154_{16}$ into an octal number

[10 points]

QUESTION TWO

Perform the following binary arithmetic operations:

a) Add 1010111101_{2} and 11100111001_{2}
b) Divide $1001001[redacted]010010_{2}$ by 110010_{2}
c) Use 1s complements to subtract 1011011000101.101_{2} from 10101100110.111_{2}
d) Use 2s complements to subtract 10011001.11_{2} from 11000111000111.101_{2}

[16 points]

QUESTION THREE

Redraw the circuit shown in Figure 1 using 2-input NAND gates only.

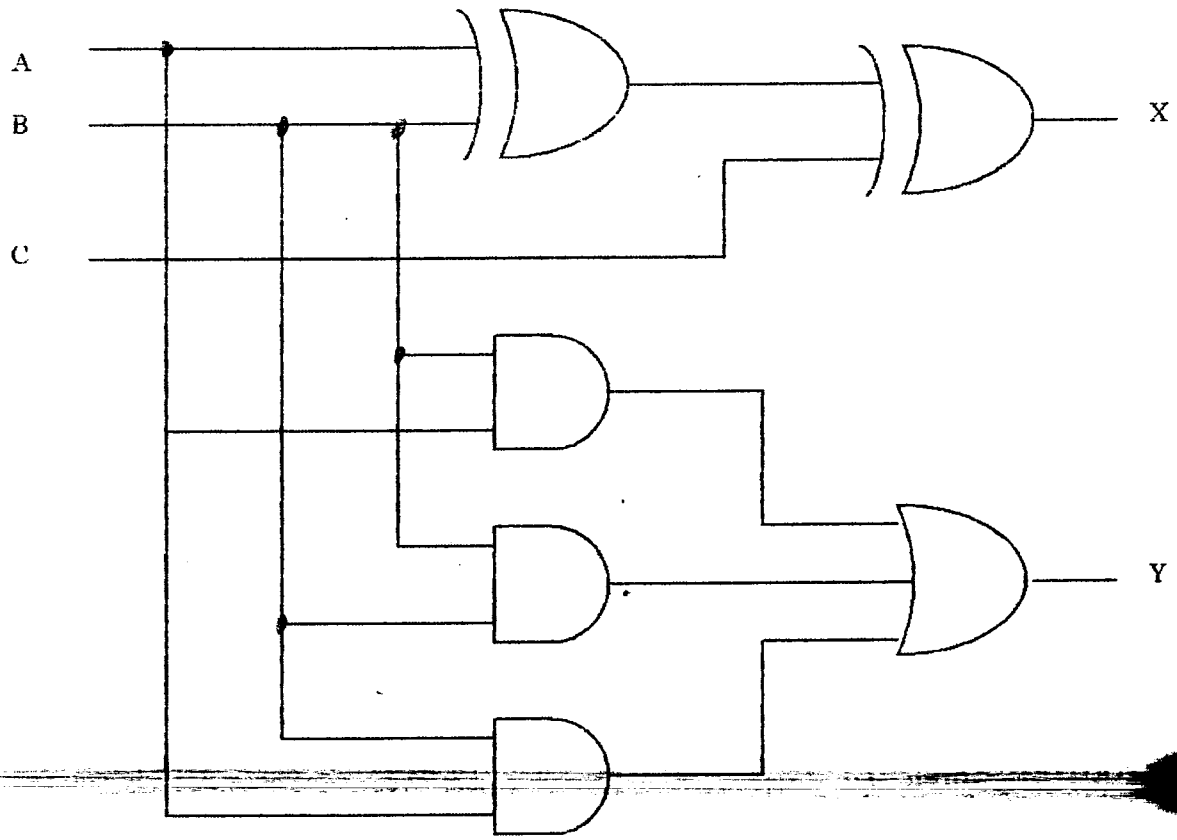

Figure 1

[8 points]

QUESTION FOUR

Consider the output **Y** in Table 1.

a) Write the logic equation for the function **Y** as logic sum of AND terms
b) Minimize the expression using Boolean algebra theorems.
c) Convert the minimized expression from (c) so that the circuit is implemented on NOR gates only.
d) Draw the circuit diagram

[20 points]

Table 1

A	B	C	D	Y	Z
0	0	0	0	1	0
0	0	0	1	1	1
0	0	1	0	0	1
0	0	1	1	0	0
0	1	0	0	1	1
0	1	0	1	0	0
0	1	1	0	1	X
0	1	1	1	0	0
1	0	0	0	1	1
1	0	0	1	0	X
1	0	1	0	1	1
1	0	1	1	1	0
1	1	0	0	0	0
1	1	0	1	1	X
1	1	1	0	0	0
1	1	1	1	1	1

QUESTION FIVE

Consider the output **Z** in Table 1.

a) Write the logic equation for the function **Z** in canonical form.
b) Transfer the expression for **Z** on a Karnaugh Map
c) Minimize the expression.
d) Convert the minimized expression from (c) so that the circuit is implemented on NAND gates only.
e) Draw the circuit diagram.

[16 points]

QUESTION SIX

Using the circuit diagram of a full adder, show the full circuit diagram of an adder that will add two 3-bit numbers.

[10 points]

QUESTION SEVEN

A logic function F is given with the following expression:

$$F(A,B,C,D) = \Sigma(0,1,2,4,6,8,13,14) .$$

Use a 4-to-one multiplexer to implement the logic function

[10 points]

QUESTION EIGHT

Design a binary-to-octal decoder circuit. Only one output at time should be at logic 1 indicating the binary code at the inputs. Draw the circuit diagram.

[10 points]