

KENYA METHODIST UNIVERSITY
FIRST TRIMESTER EXAMINATION
April 2007

FACULTY : **SCIENCES**
DEPARTMENT : **MATHEMATICS AND COMPUTER SCIENCE**
COURSE CODE : **COMP 302**
COURSE TITLE : **Digital Electronics**
TIME : **3 HRS**

Instructions: Attempt Question 1 in **Section A** and any other two questions in **Section B**.

SECTION A

QUESTION 1 (30 Mks)

1. Convert the following binary numbers into decimal without the use of a calculator:
(a) 1101 (b) 111000 (c) 1001101 (d) 1011010 **4 Mks**

2. Convert the following decimal numbers into binary:
(a) 354 (b) 129 (c) 87 (d) 255 **4 Mks**

3. Perform the following additions/subtractions where the numbers are all positive:
(a) 1011 (b) 10110110 (c) 1011011 (d) 11010 **3 Mks**
+0111 +01110110 -0110101 -10001

4. Convert the following hexadecimal numbers to (i) binary (ii) decimal and (iii) octal:
(a) 3416 (b) 1A116 (c) DB16 **3 Mks**

5. Convert the following 8 bit 2's complement numbers to decimal:
(a) 10011011 (b) 11111111 (c) 01111110 (d) 00000010 **4 Mks**

6. Convert the following 16 bit 2's complement numbers to decimal and also to hexadecimal:
(a) 1000 1010 0110 1101 (b) 1000 0000 0000 0000 **4 Mks**
(c) 1000 0000 0000 0001 (d) 0000 1010 0110 1101

7. If a certain computer has 128 Kbytes of memory, how many bits (binary digits) of information can it store? **2 Mks**

8. Perform the following binary multiplications (You must show your calculation working):
(a) 1001 \square 1110 (b) 10010111 \square 10011000 **2 Mks**

9. Implement the following Boolean functions using simple AND, OR and NOT logic gates (do not simplify the functions):
(a) $F = AB + ABC + CD$ **4 Mks**
(b) $F = A BC + ABC + A B$

SECTION B

QUESTION 2 (20 Mks)

- 1) Define the term flipflop **(1 Mk)**
- 2) Differentiate between simple and clocked flipflops **(2 Mks)**
- 3) Briefly discuss the type of flipflops and draw their truth tables **(15 Mks)**
- 4) List any two uses of flipflops **(2 Mks)**

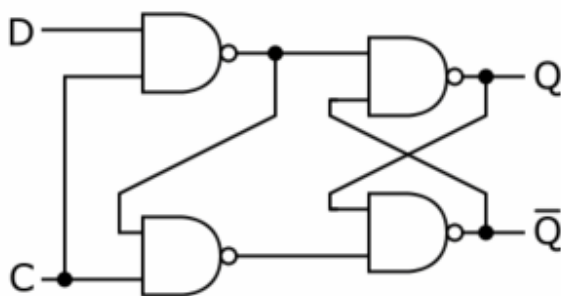
Question 3 (20 Mks)

- 1) Fill in the following truth tables for Digital logic basic gates **(8 Mks)**

A	B	AND	OR	XOR	NAND	NOR	NXOR
0	0						
0	1						
1	0						
1	1						

A1+A2	= Sum with carry
0 0	
0 1	
1 0	
1 1	

- 2) With the aid of the diagram below describe how a D-Latch functions. **(4 Mks)**



- 3) Give a brief description of the following shift registers. What are they used for?**(8 Mks)**
 - i. Destructive Readout
 - ii. Non-destructive readout
 - iii. Serial-In, Parallel-Out
 - iv. Parallel-In, Serial-Out
 - v. Parallel-In, Parallel-Out

Question 4 (20 Mks)

1) Prove the following axioms using set theory or truth tables. **(10 Mks)**

$a \vee (b \vee c) = (a \vee b) \vee c$	$a \wedge (b \wedge c) = (a \wedge b) \wedge c$	associativity
$a \vee b = b \vee a$	$a \wedge b = b \wedge a$	commutativity
$a \vee (a \wedge b) = a$	$a \wedge (a \vee b) = a$	absorption
$a \vee (b \wedge c) = (a \vee b) \wedge (a \vee c)$	$a \wedge (b \vee c) = (a \wedge b) \vee (a \wedge c)$	distributivity
$a \vee \neg a = 1$	$a \wedge \neg a = 0$	complements

2) Define the term Karnaugh map and subsequently arrange the following two variable problem to correspond to one. **(5 Mks)**

A	B	F
0	0	a
0	1	b
1	0	c
1	1	d

3) Differentiate between Digital to Analog conversion and Analog to Digital conversion giving any relevant applications. **(5 Mks)**