MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations 2013/2014

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

SIT 112: INTRODUCTION TO DIGITAL ELECTRONICS

Date: 15/12/2014 **Time: 11:00 – 1:00 pm**

INSTRUCTIONS
Answer all questions in section A and any two questions from section B

Section A (30 Marks)

QUESTION 1

α) Explain the following terms (3 Marks)

i. Byte.

ii. Integrated Circuit.

iii. Truth table

b) Convert the following numbers (4 Marks)

i. Binary 1101101_2 to its decimal equivalent.

ii. Binary 0.1011 to its decimal equivalent.

c) Convert the following numbers (4 Marks)

i. Octal 7256_8 to its Binary equivalent.

ii. Hexadecimal $10A4_{16}$ to its Binary equivalent. .

d) Using the 2's Complement, calculate the output of +16 and -24 (3 Marks)

e) Explain the term binary adder and differentiate between a half-adder and a full binary adder. (3 Marks)

f) Differentiate the functions performed by logic gates and flip-flops in digital electronics (4 Marks)

g) With the aid of a diagram, explain how an RS latch can be used to implement the concept of a switch debouncer (6 Marks)

h) Differentiate between positive level clocking and positive edge-triggering in flip-flops. (3 Marks)

Section B (40 Marks)

QUESTION 2 (20 MARKS)

a) With the aid of a diagram, explain how a 4-bit 2's complement adder-subtractor works. Which component of the microprocessor would you find such an adder-subtractor? (8 Marks)
b) With the aid of a diagram, explain how a 4-bit controlled shift left register with broadside loading works. Which component of the microprocessor would you find such a register and why? (7 Marks)
c) With the aid of a diagram, explain how a 4-bit controlled ripple counter works and where it is used in a microprocessor system. (5 Marks)

QUESTION 3 (20 MARKS)

a) Distinguish between odd parity and even parity. (2 Marks)

b) With the aid of a diagram, explain how a decimal to binary converter/ encoder that employs the use of OR gates works. (5 Marks)

c) With the aid of a diagram, explain how a binary-to-decimal decoder that uses AND gates works (7 Marks)

d) Using NAND and NOR gates and the corresponding truth-tables, illustrate De-Morgan's first and second Theorem. (6 Marks)

QUESTION 4 (20 MARKS)

a) Explain the concept of a gate/ logic circuit as used in digital electronics (2 Marks)
b) With the aid of a diagram, explain how a 4-bit ring counter works and where it is used in a microprocessor system. (6 Marks)
c) With the aid of a diagram, explain how a 8-bit register can be used to implement a controlled inverter circuit using exclusive-or gates. (4 Marks)
d) With the aid of a diagram, explain how a word comparator circuit can be implemented that compares the contents of two 8-bit registers called register A and register B. (8 Marks)

QUESTION 5 (20 MARKS)

a) Define a karnaugh map (2 Marks)

b) Given the equation Y = A'BCD + ABCD + ABCD' + ABC'D + ABC'D' + AB'CD + AB'CD' + AB'C'D

i. Simplify the equation using the karnaugh map method

ii. Draw the resulting logic circuit

iii. Implement the logic circuit using NAND gates

(10 Marks)

c) Given the equation

$$X = \overline{\overline{\overline{A + B\bar{C}} + D\overline{(E + \bar{F})}}}$$

i. Simplify the expression using De-Morgan's theorems

ii. Draw the resulting logic circuit (8 Marks)