Machakos University College

End of the semester Examination – 2014

Bachelor of Information Technology

Year 1 Semester 1

SIT 112: Introduction to Digital Electronics

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

Section A (30 Marks)

Question 1

a) Explain the following terms (3 Marks)

i. Multiplexer

ii. Integrated Circuit.

iii. Truth table

b) Convert the following numbers (6 Marks)

i. Octal 7256_8 to its Binary equivalent.

ii. Binary 0.11001 to its decimal equivalent.

iii. Hexadecimal $CF8E_{16}$ to its Binary equivalent.

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

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

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

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

g) With the aid of a diagram and a truth table, explain how a positive edge-triggered JK-Flip-Flop works (8 Marks)

Section B (40 Marks)

Question 2 **(20 Marks)**

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

b) With the aid of a diagram, explain how a 4-bit controlled buffer register works with input control signal called LOAD, a CLR signal that reset's the register and an output control signal called ENABLE. (8 Marks)

c) With the aid of a diagram, explain how the 4-bit controlled buffer register in a) can be used to implement bus-organized computer architecture between 4 general-purpose registers called A, B, C and D. (7 Marks)

Question 3 **(20 Marks)**

α) 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)

β) 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)

χ) 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)

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

d)

Question 4 **(20 Marks)**

a) Explain the concept of a gate/ logic circuit as used in digital electronics (2 Marks)

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

d) Define a karnaugh map (2 Marks)

e) 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)

f) Given the equation

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

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

ii. Draw the resulting logic circuit (8 Marks)