TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & IT

UNIVERSITY EXAMINATIONS 2012/2013
FOR THE DEGREE OF BACHELOR SCIENCE IN INFORMATION TECHNOLOGY
(BSIT/MAY 2011, BSIT/MAY 2012)

ICS 2205: DIGITAL LOGIC

SUPPLEMENTARY/SPECIAL EXAMINATIONS
SERIES: FEBRUARY 2013
TIME: 2 HOURS

INSTRUCTIONS:

- This paper consists of **FIVE** questions
- Answer questions **ONE** and any other **TWO** questions.

This paper consists of Four printed pages.

QUESTION 1

a) Highlight the characteristics of the octal number system. **(4 marks)**

b) Perform the following conversions. **(6 marks)**

i) 25.6251_0 to binary
ii) 103_{10} to Hexadecimal
iii) $1FB_{16}$ to octal

c) For the logic circuit shown in figure 1.0, obtain the expression for the output z and draw a truth table for the gate.

d) With the aid of a logic diagram and truth table, explain the operation of a clocked Rs flip flop. **(6 marks)**

e) Perform the following operations. **(6 marks)**

i) $100F.01_{16} - 275.32_{16}$ convert your answer to decimal

ii) $174_{18} - 1001100111_2$ convert your answer to hexadecimal

iii) $OCF_{16} + 235_{10}$

f) Differentiate between Asynchrous and synchronous sequential logic circuits. **(3 marks)**

QUESTION 2

a) Draw an electronic realization of an AND gatt and explain how it operates. **(4 marks)**

b) Perform the following operations:

i) 10010_2 AND (01101_2 OR 11001_2)

ii) 1101_2 XOR 01101_2. Determine the compliment of the result

iii) $010110_2 - 110010_2$ using the 2's compliment

c) Perform the following arithmetic operations. **(6 marks)**

i) 10101.11_2 x 1001_2

ii) $111100_2 \div 1010_2$ Convert your answer to hexadecimal

iii) $421_8 + 37A_{16}$ Convert your answer to decimal

d) Describe the NAND gate as a complimentary gats and draw its truth table. **(4 marks)**

QUESTION 3

a) Simplify the expressions using Boolean Algebra. **(3 marks)**

i) $A\overline{B}C\{BD + CDE\} + A\overline{C}$

ii) $\overline{A}\,\overline{B}C + B\overline{C} + \overline{A}BC + ABC$

b) Draw a logic circuit which will generate the function $F = B\overline{C}A + \overline{C}) + \overline{A}.\overline{B}$ using only NOR gates. **(5 marks)**

c) From the truth table below, determine the expression for the output x and draw the implementation of a simplified expression of x

A	B	C	C	X
0	0	0	0	1
0	0	1	1	1
0	1	0	0	0
0	1	1	1	1
1	0	0	0	0
1	0	1	1	0
1	1	0	0	1
1	1	1	1	1

d) The gate network in figure 2.0 has 3 inputs A, B and C. Find the expression for the output z and simplify this expression.

QUESTION 4

a) With the aid of a logic diagram explain the operation of a full adder. **(6 marks)**

b) Impliment the expression $y = ABC + AB + BC$ using an AND gate and an OR gate. **(4 marks)**

c) Explain the operation of an edge triggered flip flop. **(5 marks)**

d) Design a combinational logic circuit for binary to gray code conversion. **(5 marks)**

QUESTION 5

a) Obtain simplified logic expressions for the following k-maps and implement the expression

b) Minimize the following expressions using k-maps **(6 marks)**

i) $D = \overline{A}B\overline{C} + AB\overline{C} + A\overline{B}\overline{C} + \overline{A}\overline{B}\overline{C} + \overline{A}\overline{B}C + \overline{A}BC + ABC + A\overline{B}C$

ii) $X = AB\{\overline{B} + A(B + \overline{C})\} + BC$

c) Prove the following laws of Boolen Algebra **(4 marks)**

i) $A + \overline{A}B = A + B$

ii) $A + BC = (A + B)CA + C)$

d) Highlight the characteristics of the excess 3 number systems. **(3 marks)**