THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering and Technology

DEPARTMENT OF ELECTRICAL & ELECTRONIC ENGINEERING

CEPE 2

UNIT CODE: _____

DIGITAL ELECTRONICS I

SEMESTER EXAMINATION

SERIES: FEBRUARY 2011 SERIES

TIME: 2 HOURS

Instructions to Candidates:

Answer Question **ONE (COMPULSORY)** and any other **TWO** Questions.

(COMPULSORY)

Question ONE

a) i) Define the following terms:
   I) radix
   II) weight
   ii) Perform the following conversions:
   I) 0.5625_{10} to binary
   II) 101101.0110_2 to decimal
   III) 111110100010_2 to hexadecimal
   IV) 243_{10} to octal
   V) $4F_{16}$ to binary then to octal. (13marks)

b) Perform the following arithmetic operations
   i) DB + F5
   ii) $15_8 + 44_8$
   iii) 11011 ÷ 11
   iv) 110 x 1001 (8 marks)

c) Perform the following operations
   i) 100000- 101111 using 1s complement
   ii) $16_{10} - 14_{10}$ using 2s complement
   iii) -6 + 5 using 1s complement (9 marks)

Question TWO

a) i) Distinguish between weighted and unweighted code and give an example of each.
   ii) State any TWO differences between gray and straight binary.
   iii) State any TWO advantages and any ONE disadvantage of binary coded decimal.
   (7 marks)

b) i) Use the ASCII table attached to decode the following sequence
   0110111 1000011 1000001 1010100 1010011 0111111
   ii) Encode the following using ASCII table
   I) @ II) &

c) Perform the following code arithmetic
   i) 88 + 52 in BCD
   ii) 8 – 2 in excess 3 BCD (6 marks)

Question THREE

a) i) State Demorgan's theorem

ii) Prove by truth table that **1 + A = 1** (4 marks)

b) i) Simplify the following expressions using Boolean Algebra

I) $F = \overline{A}\overline{C} + AB\overline{C} + \overline{A}BC + A\overline{B}\overline{C}$

II) $F = (A+B)(A+\overline{B}+C)$

ii) Implement the logic circuit to produce the following output

$F = \overline{B}\overline{C} + \overline{A}\overline{B} + A\overline{C}$

iii) Determine the function F in fig 1 (11marks)

Fig 1

c) i) Implement the following logic function using NOR gates only

$F = (A+\overline{B})\overline{C}$

ii) Prove that $\overline{\overline{A+B}+C} = (A+B)\overline{C}$ (5 marks)

Question FOUR

a) i) From table 1, determine the

I) min-term expression

II) max-term expression

Table 1

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

table 2

	$\overline{C}\,\overline{D}$	$\overline{C}D$	CD	$C\overline{D}$
$\overline{A}\,\overline{B}$	0	0	0	0
$\overline{A}B$	1	0	1	1
$A\overline{B}$	1	0	0	1
AB	0	0	0	0

ii) From the K-map of table 2, determine:
   I) The complete Boolean expression
   II) The minimized expression (10marks)

b) Minimize the following Boolean expressions using Karnaugh maps

i) $F = \overline{A}\,\overline{C} + AB\overline{C} + \overline{A}BC + A\overline{B}\,\overline{C} + \overline{A}\,\overline{B}C$

ii) $F = \overline{A}C + A\overline{C} + AC$ (10marks)

Question FIVE

a) Three sensors are used to monitor pressure (P), Temperature (T) and voltage (V) of an industrial plant. An alarm should sound for the following conditions:

- If both temperature and voltage sensors are OFF
- If temperature sensors is ON and voltage sensor is OFF
- If pressure sensor is OFF and voltage sensor is ON.

Take sensor ON = logic 1 and OFF = logic 0

i) Develop a truth table for the problem

ii) Derive the Boolean expression for the sum of products. (6 marks)

b) i) Find the canonical form of

$F = A\overline{B} + \overline{C}$

ii) Write the expression in the form $\Sigma(a,b,c)$ (6 marks)

c) Design a 3 bit odd parity generator. (8 marks)