Mount Kenya University

UNIVERSITY EXAMINATION 2013/2014

SCHOOL OF PURE AND APPLIED SCIENCES
DEPARTMENT OF NATURAL SCIENCES

BACHELOR OF EDUCATION
SCHOOL BASED

UNIT CODE: BPS 324 UNIT TITLE: DIGITAL ELECTRONICS

DATE: DECEMBER 2013 MAIN EXAM TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

Answer Question One in section A and Any other TWO questions in sections B

Section One COMPULSORY

Question one

(a) (i) Distinguish between combinational and sequential circuits (4 marks)

(ii) Define the term FLIP-FLOP as used in basic digital circuits (2 marks)

(b) Make truth table for a 3-input

(i) AND gate
(ii) OR gate
(iii) NAND gate
(iv) NOR gate (8 marks)

(c) Define the following terms as used in Looped circuits

(i) A Junction
(ii) A Mesh
(iii) A Loop
(iv) A Branch (4 marks)

(d) Find the decimal equivalent of Hex number 1A53 (4 marks)

(e) Define the following
   (i) Multiplexer
   (ii) De-multiplexer

(f) Prove the following Boolean identities using the laws of Boolean algebra
   (i) (A+B)(A+C) = A+BC
   (ii) $ABC + A\bar{B}C + AB\bar{C} = A(B + C)$ (4 marks)

Section Two Answer ANY two Questions from this Section

Question two

(a) For the logic expression
   $Y = A\bar{B} + \bar{A}B$
   (i) Obtain a truth table (4 marks)
   (ii) Name the operation performed (1 mark)
   (iii) Realize this operation using AND gate (3 marks)
   (iv) Realize this operation using only NAND gates (6 marks)

(b) A certain TTL gate has I_h = 20μA, I_k = 0.1mA, I_{oh} =0.4mA and I_{ol} = 4mA. Determine the input and output loading in the HIGH and LOW states in terms of UL. (6 marks)

Question three

(a) Find the Boolean expression for the logic circuit shown in the figure I below (8 marks)

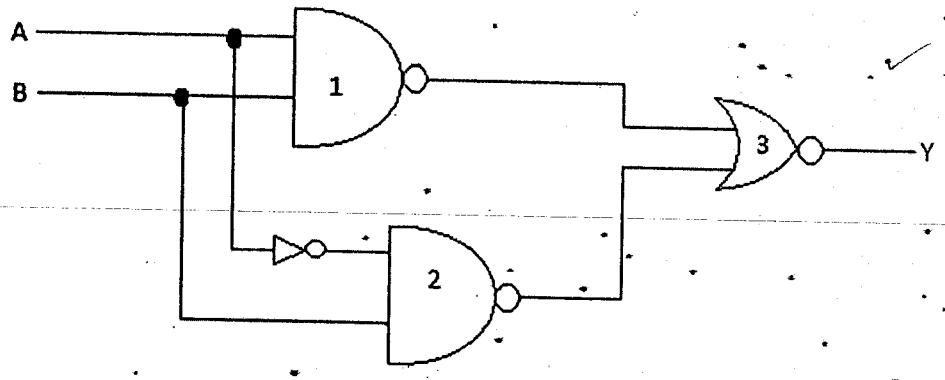

Figure I

(b) (i) What are Universal gates
   (ii) Construct a logic circuit using NAND gates only for the expression
   $X = A.(B + C)$ (6 marks)

(c) Convert a J-K FLIP-FLOP to an S-R FLIP-FLOP (6 marks)

Question Four

(a) State Kirchhoff's rules (2 marks)

(b) Find the three currents I1, I2 and I3 in the circuit diagram of the figure II given that $R_1 = 100\Omega$, $R_2 = 10\Omega$, $R_3 = 5\Omega$ and $\varepsilon_1 = 12V$ and $\varepsilon_2 = 6V$

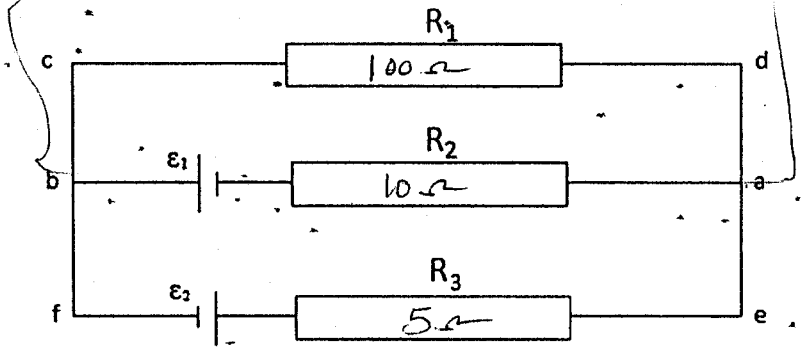

Figure II

$I_1 = 0$

$I_3 = 1.2$

$I_2 = -1.2$

Question Five

(a) Convert the following Binary Numbers into Decimal without the use of calculator

(i) 1101

(ii) 111000

(iii) 1001101

(iv) 1011010

(b) Convert the following Hexadecimal numbers to (i) Decimal (ii) Octal

(i) $(1A1)_{16}$

(ii) $(DB)_{16}$