MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SIT112 : INTRODUCTION TO DIGITAL ELECTRONICS

DATE: 25/9/2019 **TIME: 2:00 – 4:00 PM**

INSTRUCTIONS

1. Question **ONE** is compulsory
2. Answer **ANY** other **TWO** questions.
3. Maximum marks for each part of a question are as shown.

QUESTION ONE COMPULSORY (30 MARKS)

a) (i) With the aid of block diagrams, state the difference between a multiplexer and a demultiplexer combinational logic circuit. (4 marks)

(ii) With the aid of a full adder truth table prove that $S = A \oplus B \oplus C_{in}$ and $Co = Cin(A \oplus B) + AB$. (6 marks)

b) (i) Convert the following numbers as instructed;

71_8 to binary and $8A3_{16}$ to decimal.

(ii) Perform the following operations;

Add BCD numbers 17 to 15 and convert gray code 1001011 to binary.

(10 marks)

c) A chemical processing plant uses four sensors A, B, C, and D to control the conveyor belt at the packing bay. The conveyor belt will move when any of the following conditions are met.

(i) ALL sensors are low;

(ii) ONLY one sensor output is high;

(iii) Sensor A and D are low; B C are high;

(iv) Sensor A and D are high; B C are low.

Draw a truth table to represent these conditions, Deduce a Boolean expression from the truth table, reduce it using a K – map and Implement this control circuit using logic gates.

(10 marks)

QUESTION TWO (20 MARKS)

a) (i) Express the following decimal number into 8421 BCD; $(8752)_{10}$ (2 marks)

(ii) Using the 8421 BCD arithmetic, perform the following operation of decimal numbers

125 + 235 (4 marks)

(iii) Express the following XS – 3 number in decimal;

1110111100 (2 marks)

(iv) Perform the following conversions; 1101011 binary to gray code and 01100000 BCD to XS – 3 (2 marks)

b) (i) Name the **seven** logic gates used in digital systems.

(7 marks)

(ii) Table 1 shows the classification of logic families:

Table 1

Category	Number of equivalent basic logic gates on a single chip
1	12 – 99
2	100 – 999
3	10,000 and above

Name the corresponding category of the logic families. (3 marks)

QUESTION THREE (20 MARKS)

a) For the logic circuit in figure 1, prepare a truth table and hence obtain the output expression at Y.

(10 marks)

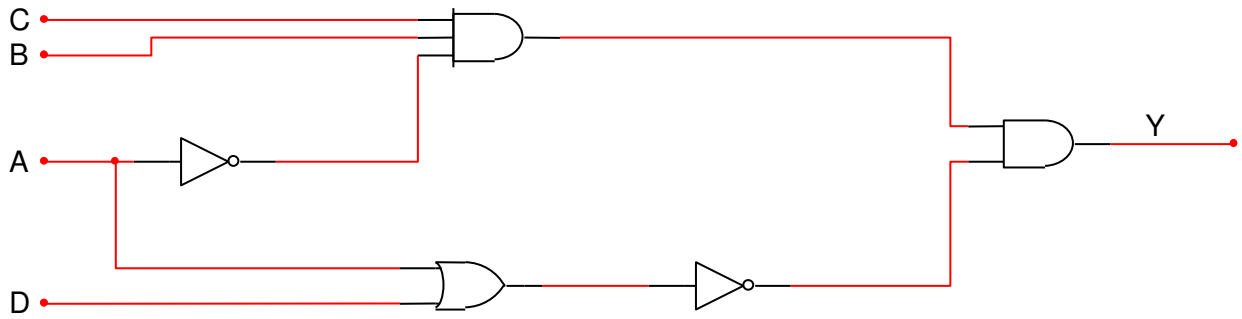

Figure 1

b) Differentiate between even and odd parity as used in error detection codes.

(4 marks)

c) Simplify using K map the following Boolean expression;

$f(A,B,C,D) = \sum(0,1,2,3,4,5,6,7,8,9,12,13)$

(6 marks)

QUESTION FOUR (20 MARKS)

a) Design a binary to gray code decoder. (10 marks)

b) A digital system is to be designed with three switches ABC to control the operation of a motor.

The motor can run when; Switches A and B are ON, Switches A and C are ON and ALL switches are ON

c) Draw a simplified logic circuit diagram to facilitate this operation. (10 marks)

QUESTION FIVE (20 MARKS)

a) With the aid of a truth table, verify that $M.(D + F) = M.D + M.F$ (4 marks)

b) Design a full adder logic circuit using a 8-to-1 multiplexer. (6 marks

c) Use Quine MC Clusky method to minimize the function given by;

$f(A, B,C,D) = \sum(0,5,6,9,10,13,14,15,7)$ (10 marks)