MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations for 2015/2016 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

FIRST SEMESTER EXAMINATION FOR DIPLOMA IN TELECOMMUNICATION ENGINEERING

EED 205: DIGITAL ELECTRONICS 1

DATE:5/8/2016 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

1. **You should have an examination booklet for this examination**
2. **Question ONE is compulsory**
3. **Answer ANY other TWO questions.**
4. **Maximum marks for each part of a question are as shown.**

QUESTION ONE COMPULSORY (30 Marks)

1. a) (i) Explain why binary numbering system is widely used in digital systems.

(4 marks)

(ii) With the aid of a full adder truth table prove that S = A EXCLUSIVE – OR B EXCLUSIVE - OR C_{in} and $C_o = C_{in}$(A EXCLUSIVE- OR B) OR AB . (6 marks)

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

- 67_8 to binary;
- $9C8_{16}$ to decimal.

(ii) Perform the following operations:

- Add BCD numbers 12 and 14;
- Convert gray code 111101 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 and reduce it using a K – map;
- Implement this control circuit using logic gates.

(10 marks)

2. a) (i) Express the following decimal number into 8421 BCD;

$(6347)_{10}$ (2 marks)

(ii) Using the 8421 BCD arithmetic, perform the following operation of decimal numbers 243 + 317 (4 marks)

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

1011011010010 (2 marks)

(iv) Perform the following conversions;

- 1011101011 binary to gray code
- 011001111000 BCD to XS – 3 (2 marks)

b) (i) With the aid of symbols, 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)

3. a) For the logic circuit in figure 1, prepare a truth table and hence obtain the output expression at Y. (10 marks)

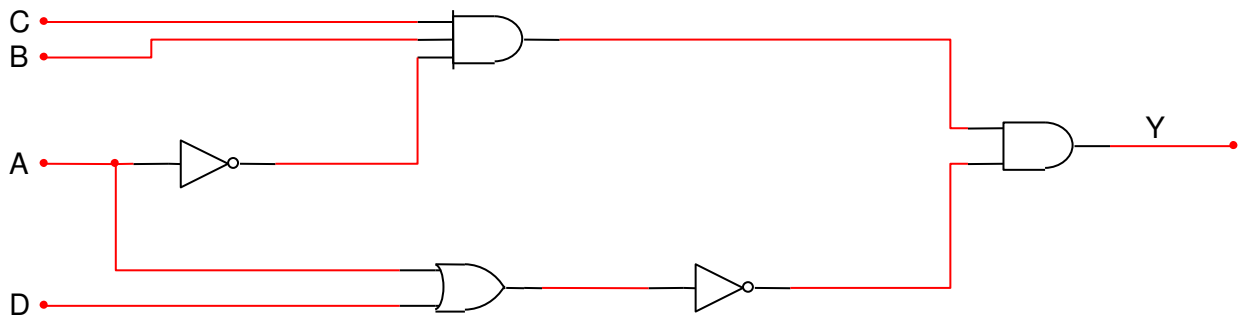

Figure 1

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)

4. 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
- ALL switches are ON

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

5. 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;

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