

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF
BACHELOR OF COMPUTER SCIENCE**

COSC 211: DIGITAL ELECTRONICS

STREAMS:

TIME: 2 HOURS

DAY/DATE: MONDAY 4/12/2017

11.30 A.M – 1.30 P.M

INSTRUCTIONS:

- Answer all questions in section A and any other two questions from section B.
- No Reference Material is allowed in the exam Room.
- All Mobile phones should be switched off in the exam room.

SECTION A (COMPULSORY)

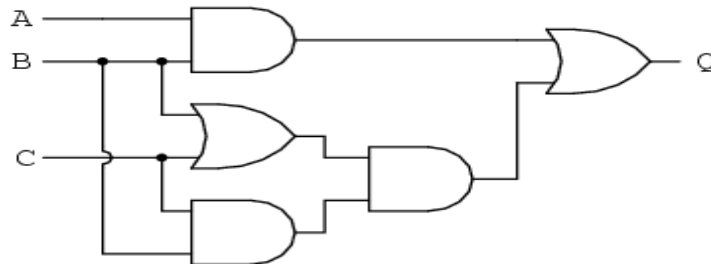
QUESTION 1(COMPULSORY) [30 MARKS]

- a) Use Karnaugh maps SOP to minimize the following circuit. (5 marks)

$$X = \overline{A}BCDE + \overline{A}BC\overline{D}\overline{E} + \overline{A}BCDE + \overline{A}BC\overline{D}E + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE + \overline{A}BCDE$$

- b) Using a circuit diagram, explain the operation of a J-K flip flop (6marks)

- c) Below is a digital circuit. Use it to answer the questions below: -



- i) Simplify the above circuit (show the simplification process) (5marks)
 ii) Draw a resultant circuit after the simplification. (2marks)

- d) Design a simple circuit incorporating three LEDs, such that each one of the three LEDs lights when inputs 00, 01 and 11 respectively are applied on the circuit's inputs A and B. (show the truth table but do not minimize circuit) (6marks)
- e) Draw a truth table of an XNOR with two inputs (2marks)
- f) Explain what is a hardware description language, hence outline the benefit of hardware description language. (4marks)

SECTION B (Answer two question from this section)

QUESTION 2 [20 MARKS]

- a) Use truth table to prove the following Boolean algebra.
 - i) $A + \bar{A}B = A + B$ (4 marks)
 - ii) $A + AB = A$ (4marks)
- b) With reference to counters
 - i) Draw the circuit of a single bit counter (5marks)
 - ii) Using a truth table, explain how a single bit counter works (7marks)

QUESTION 3 [20 MARKS]

- a) With reference to decoders
 - i) Draw a circuit diagram of a 2 to 4 decoder using INVERTERS and AND gates only (5marks)
 - ii) Draw a truth table of the above decoder (5 marks)
- b) Draw a truth table and a circuit diagram with two inputs A and B, such that the outputs are logic 1 when A=0 and B=0, and when A=0 and B=1. (6marks)
- c) Distinguish between sequential access and direct access methods of storage devices (4marks)

QUESTION 4 [20 MARKS]

With regard to the following POS logic algebra.

$$Y = (A+B+C)(A+B+\bar{C})(A+\bar{B}+C)(\bar{A}+B+C)(A+B+C)(A+B+\bar{C})(A+\bar{B}+C)(\bar{A}+B+C)$$

- i) Minimize the logic using Karnaugh map (4marks)
- ii) Minimize the logic using Boolean algebra (6marks)
- iii) Develop the resultant truth table of the minimized circuit (5marks)
- iv) Draw the resultant circuit (5marks)

QUESTION 5 [20 MARKS]

- a) Using a block diagram explain the basic parts of a computer architecture. (10marks)
- b) Explain the working principles of a shift register. (5marks)

c) Draw the symbol and Boolean logic of FIVE basic logic gates (5marks)

