



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

FIRST YEAR SECOND SEMESTER EXAMINATION FOR

DIPLOMA IN INFORMATION COMMUNICATION TECHNOLOGY

DIT 109: DIGITAL ELECTRONICS

DATE: 6/5/2019

TIME: 11.00-1.00 PM

INSTRUCTIONS

Answer **question ONE** and any other **TWO** questions.

QUESTION ONE (30 MARKS)

- a) Describe the following number systems;
- Binary;
 - Octal;
 - Hexadecimal. (6 marks)
- b) Convert the following numbers to the respective number systems:
- 01010110_2 to X_{16}
 - 75354_{10} to X_8
 - 011101_2 to X_8
 - $2BC_{16}$ to X_{10} (8 marks)
- c) Prove the following Boolean algebra rules and laws actually work:
- Idempotency;
 - Distributive;
 - Absorption law. (6 marks)
- d) Draw the logic circuit for the Boolean equation below and construct a truth table for the equation. (8 marks)

$$X = AB \cdot B \quad \text{---}$$

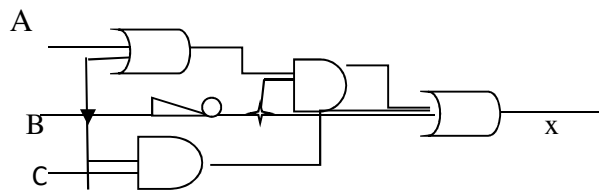
- e) Define the term *Minterm* as used in digital electronics. (2 marks)

QUESTION TWO (20 MARKS)

- a) Describe the steps followed while using the (r-1)'s compliment to subtract N from M. (6 marks)
- b) Using the r's compliment perform the following calculations:
- $1101.1101_2 - 110.101_2$
 - $754_8 - 634.56_8$ (8 marks)
- c) Perform the following arithmetic operations on the following number systems:
- $234_8 - 56_8$
 - $4327_{16} * 519_{16}$
 - $32180_{16} / 926_{16}$ (6 marks)

QUESTION THREE (20 MARKS)

- a) Consider my car which complains by sounding a buzzer (alarm) when I have left the lights on or left the car in gear (not in Park) and taken the keys out of the ignition. Using Karnaugh maps develop the simplified Boolean equation and draw the logic circuit. (10 marks)
- b) Consider the logic circuit below used to turn on a buzzer at X based on the input conditions of A, B and C. Write the equation of the circuit, simplify it and draw the logic circuit of the simplified equation. (10 marks)

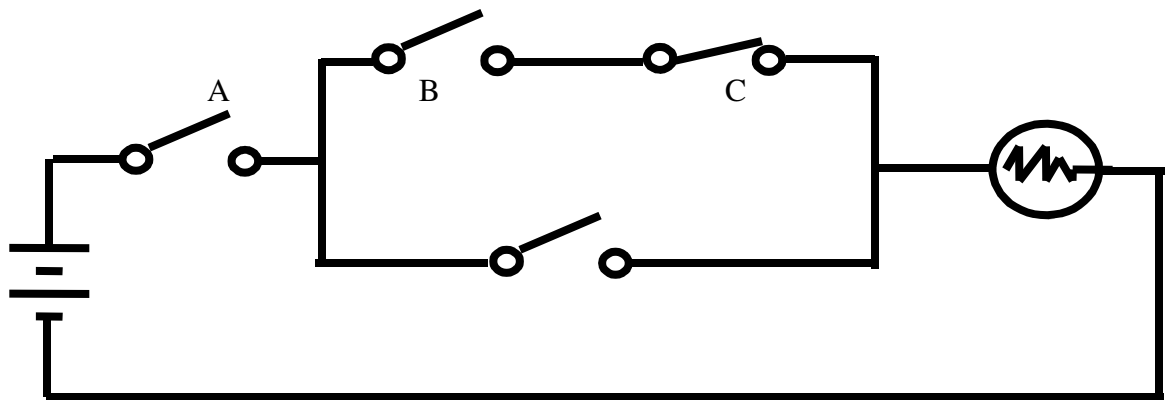


QUESTION FOUR (20 MARKS)

- a) Implement the following equation using NAND gates only. (6 marks)
$$F = ABCD + BC + CD$$
- b) Design a circuit that adds two numbers, given the representation is in binary. (6 marks)
- c) Design a circuit that detects multiples of five in a four bit word given the representation is in binary numbers. Use AND and XOR gates only. (8 marks)

QUESTION FIVE (20 MARKS)

- a) Design a Modulo 7 synchronous 84-2-1 BCD down counter using JK FF. (10 marks)
- b) Consider the switching circuit below:



- i. Develop the logic circuit that represents the scenarios where the Lamp lights and draw the circuit using logic gates. (4 marks)
- ii. Obtain the Minterm compact Form that represents the circuit. (6 marks)