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(University of Choice)

**MASINDE MULIRO UNIVERSITY OF
SCIENCE AND TECHNOLOGY
(MMUST)**

MAIN CAMPUS

**SPECIAL/SUPPLEMENTARY UNIVERSITY
EXAMINATIONS
2021/2022 ACADEMIC YEAR**

THIRD YEAR FIRST SEMESTER EXAMINATIONS

**FOR THE DEGREE
OF
BACHELOR OF SCIENCE IN ELECTRICAL AND
COMMUNICATIONS ENGINEERING**

COURSE CODE: ECE 316

COURSE TITLE: DIGITAL ELECTRONICS I

DATE: 28TH JULY 2022

TIME: 11:00 - 1:00 PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.
QUESTION ONE CARRIES 30 MARKS AND ALL OTHERS 20 MARKS EACH.

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over. 

QUESTION ONE**30 MARKS**

- a) State the main advantages of digital over analog systems. (4 marks)
- b) Perform the following conversions: (4 marks)
- the decimal number 430 to Excess-3 code
 - the binary number 10110 to Gray code
- c) Perform following subtraction: (6 marks)
- 11001-10110 using 1's complement
 - $(7)_{10} - (11)_{10}$ using 2's complement
- d) Prove the following equations using the Boolean algebraic theorems: (8 marks)
- $A + \bar{A}.B + A.\bar{B} = A + B$
 - $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = AB + BC + AC$
- e) Verify that the following operations are commutative but not associative: (8 marks)
- NAND
 - NOR

QUESTION TWO**20 MARKS**

- a) Distinguish between min terms and max terms. (2 marks)
- b) Minimize the following logic function using K-maps and realize using NAND and NOR gates.
 $F(A,B,C,D) = \sum m(1,3,5,8,9,11,15) + d(2,13)$ (8 marks)
- c) A staircase light is controlled by two switches one at the top of the stairs and another at the bottom of stairs.
- Make a truth table for this system.
 - Write the logic equation in SOP form.
 - Realize the circuit using AND-OR gates. (10 marks)

QUESTION THREE**20 MARKS**

- a) Reduce the following equation $Y = B\bar{C}\bar{D} + \bar{A}B\bar{C}D + AB\bar{C}D + ABCD + \bar{A}BCD$ using a k-map. (8 marks)
- b) With the help of a suitable diagram, explain how you would implement a JK flip-flop to T type flip-flop. (12 marks)

QUESTION FOUR**20 MARKS**

- a) What is a flip-flop? What is the difference between a latch and a flip-flop? List out the applications of flip-flops. (6 marks)
- b) With the help of clocked JK flip flops and waveforms, explain the working of a three bit binary ripple counter. Write truth table for clock transitions. (14 marks)
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