



# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF .....

UNIVERSITY ORDINARY EXAMINATION

2023/2024 ACADEMIC YEAR

..... YEAR ..... SEMESTER EXAMINATION FOR

.....

EET 300 – DIGITAL ELECTRONICS

DURATION: 2 HOURS

### **INSTRUCTIONS TO CANDIDATES:**

1. Answer question one and any other two questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

**SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION**

**QUESTION ONE (30 MARKS)**

- a. Convert the following into binary
- i.  $2/3$  to six places of decimals (1<sup>1/2</sup>marks)
  - ii. .... to octal and hexadecimal (1<sup>1/4</sup>marks)
  - iii. Convert  $110010_2$  to BCD. (1<sup>1/2</sup>marks)
  - iv. Convert  $110010_2$  to grey code (1<sup>1/2</sup> marks)
- b. Express the following in Decimal:
- i.  $1011.0101_2$  (2marks)
  - ii.  $16.5_{16}$  (2marks)
  - iii.  $26.24_8$  (2marks)
- c. Given  $A = 1100_2$  and  $B = 111_2$ , perform:-
- i.  $A + B$  (1<sup>1/2</sup>marks)
  - ii.  $A - B$  – Using one’s complement, (2marks)
  - iii.  $A - B$  – Using two’s complement (2marks)
  - iv.  $B - A$  (1<sup>1/2</sup>marks)
- d. Simplify the Boolean function to the minimum number of literals:-
- i.  $AB + AB^1$  (1<sup>1/2</sup>marks)
  - ii.  $ABC^1 + AB + ABC$  (2marks)
- e. A RAM has 10 address lines and 16 data input/output lines, Determine the capacity of this RAM in K Bytes. (2marks)
- i. Name three properties of a memory. (3marks)
  - ii. Determine the base of the following operations to be time  $\frac{54}{4} = 13$   
 $-24 + 17 = 40$  (2marks)

**SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION**

**QUESTION TWO (20 MARKS)**

- a. .
- i. What is the difference between: term and a literal (2marks)
  - ii. Canonical form of a Boolean function. (2marks)
- b.
- i. Simplify the following Boolean functions using k-map  
 $T_1 = ABC^1 + A^1B^1C + A^1B^1C = A^1BC^1$  (3marks)  
 $T_2 = AB^1C^1 + ABC + ABC + ABC$  (3marks)

- ii. Implement the simplified Boolean expressions for  $T_1$  and  $T_2$  as functions A, B, C.
- c. A MUT student can register for a specific course only if that student satisfy the following conditions:-
- 1) Has completed at least 15 units AND is an Engineering student, AND in good standing, OR
  - 2) Has completed at least 15 units AND and Engineering student, AND has departmental approval OR
  - 3) Has completed fewer that 15 units AND an Engineering Student, AND met of good standing, OR
  - 4) Is of good standing AND has department approval, OR
  - 5) Is an Engineering student AND does not have departmental approval.
- i. Come up with overall expressions that satisfy all those conditions. (2marks)
  - ii. Simplify the Boolean expressions in (i) above, in order that the student can meet the optimal conditions to register for the course. (3marks)

**QUESTION THREE (20 MARKS)**

- a. .
- i. Simplify the following expression, using ....  

$$f(x, y, z) = \sum (5,6,7 \text{ and } x (3, 4)$$

Where x – Don't care.
  - ii. Construct a 8 x 1 MUX, using ... 4 x 1 MUX and one 2 x 1 MUX. (2marks)
  - iii. Implement a Boolean function using multiplexer.  
 $f(A_1 A_2 A_3) = \sum(3, 5, 6, 7)$  Using:-  
 – 8 x 1 MUX  
 – Two 4X1 and one 2 x 1 MUX (3<sup>1/2</sup>marks)
- b. With the help of a neat diagram, design and construct a two bit com.... (4marks)
- c. Figure Q (3c) is an udder..... Explain how it works.. (2marks)  
 Insert diagram.....

**QUESTION FOUR (20 MARKS)**

- a. Explain the difference between the following terms as used in sequential and combinational logic circuits:- (Use sketches),
  - i. Combinational circuits from sequential circuits. (1/2marks)
  - ii. Set-up time from hold time and propagation delay. (1 1/2marks)
- b. Consider the circuit shown in fig Q 4b, below..  
Insert diagram.....
- c. Realize a D flip flop from SR flip-flop. (3marks)
- d. Determine the resolution for:-
  - i. An 8-bit  $\frac{D}{A}$  converter (2marks)
  - ii. A 12-bit  $\frac{D}{A}$  converter (2marks)
- e. Differentiate between .... Unit from logic unit. (2marks)
  - i. With the help of neat sketch, explain basic operation of an ALU (Arithmetic Logic Unit). (2marks)
  - ii. Design a 3-bit up/down counter. (3 1/2marks)