

# TECHNICAL UNIVERSITY OF MOMBASA

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## FACULTY OF ENGINEERING AND TECHNOLOGY

### DEPARTMENT OF MEDICAL ENGINEERING UNIVERSITY

#### EXAMINATION FOR:

#### DIPLOMA IN MEDICAL ENGINEERING

#### EHL 2204: DIGITAL ELECTRONICS

#### END OF SEMESTER EXAMINATION

SERIES: AUGUST 2019

TIME: 2 HOURS

DATE: Pick DateAug2019

#### Instructions to Candidates

You should have the following for this examination

-Scientific calculator

This paper consists of FIVE questions. Attempt any THREE questions. Do not write on the question paper.

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#### QUESTION ONE a)

i) Perform 1-7 by 2's complement ii) Design a parity generator to generate an Even parity bit for a 4-bit word using NAND gates only. (8 marks)

b)

i) Design a HALF SUBTRACTOR using NOR gates ONLY ii) Explain RTL iii) Explain the need for coding in digital systems

(12 marks)

#### QUESTION TWO

a) Perform the following conversions

i) 6.37610 to binary, correct to 3 b.p.

11110001111<sub>2</sub> to decimal

(5 marks)

b) Minimize the equation below using k-maps and hence implement using NOR gates only

$$X = BCD + ABCD + ABD + ABCD$$

(4 marks)

c) Using suitable diagrams, explain the operation of a NGT edge detector

(6 marks)

d) Design an BCD-to-excess-3 code-converter using minimum number of gates

(5 marks)

### QUESTION THREE

a)

i) Convert 3803.1110 to binary, correct to 6 binary points (use any method) ii) Explain importance of forbidden numbers in the design of BCD digital circuits

iii) Simplify  $A + \beta AC + \beta + \ddot{e} D$  iv) Explain the race around condition as applied to JK flip-flops

(12 marks)

b)

i) Draw a circuit diagram of a 4 bit serial - in /serial - out shift register using D-type flip-flops ii) Use a truth table to show how the binary number 1011 can be loaded and unloaded by the circuit of (i) above

(8 marks)

### QUESTION FOUR

a) Design, using the minimum number of logic gates, an electronic circuit to replace an interlock system in a certain dialysis machine controlled by sensors A, B, C and D. Switch (S) should put ON the machine when;

- i) and D are LOW, and C is HIGH, or ii)
- B, C and D are HIGH, and A is LOW, or iii)
- B, C and D are LOW, and A is HIGH, or iv)
- All sensors are HIGH

(12 marks)

b)

i) Convert 24916 to octal ii) Explain CMOS iii) Explain TWO advantages and disadvantages of divide by N counter compared to Johnson counter

(8 marks)

### QUESTION FIVE

a)

i) Explain how lightening can cause error in digital data transmission systems ii) Design a FULL ADDER using NOR gates ONLY iii) Explain the DTL logic family

(10 marks)

b) Perform the following

i)  $16410 + 35210$  using binary coded decimal.

ii)  $2435 - 9786$  by 9's complement

(10 marks)