NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF APPLIED SCIENCES
DEPARTMENT OF COMPUTER SCIENCE

FUNDAMENTALS OF DIGITAL ELECTRONICS
SCS 1112

Examination Paper

December 2024

This examination paper consists of 3 pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: **MR. SIBANGISO NGWENYA**

External Examiner: **DR CROSS GOMBIRO**

INSTRUCTIONS

1. Answer any four (4) questions
2. Each question carries 25 marks

MARK ALLOCATION

QUESTION	MARKS
1.	**25**
2.	**25**
3.	**25**
4.	**25**
5.	**25**
TOTAL FOR ANY FOUR QUESTION	100

QUESTION ONE

a) Differentiate between serial-in serial-out and parallel-in parallel-out shift registers. Give examples. [5]

b) Construct a 4-bit shift register using D flip-flops and explain its working. [5]

c) Discuss the S-R flip-flop and draw a truth table that corresponds to it. [5]

d) Describe the operation of a 4-bit shift register. Include a timing diagram for a right shift operation. [10]

QUESTION TWO

a) List out any 2 advantages of using digital circuitry. [2]

b) Differentiate between synchronous and asynchronous counters. [3]

c) Discuss the applications of shift registers in digital systems. [5]

d) Discuss the uses and limitations of the S-R latch. [5]

e) Construct an S-R latch using NAND gates. [10]

QUESTION THREE

a) Perform the following binary operations

i. $1011000_2 - 111000_2$ [5]

ii. 1000100_2 from 1011000_2 [5]

b) Explain the concept of two's complement and demonstrate how to find the two's complement of the binary number 1010 . [5]

c) Explain the working principle of a binary encoder. Draw the truth table for an 8-to-3 encoder. [10]

QUESTION FOUR

a) Describe a demultiplexer and explain how it differs from a multiplexer with a suitable example. [5]

b) If the output of a circuit is high (1) when both inputs are low (0), identify the type of gate and justify your answer with a truth table. [10]

c) Define a multiplexer and explain its working with a 4-to-1 multiplexer circuit diagram. [10]

QUESTION FIVE

a) What is the difference between an encoder and a decoder? Provide examples. [5]

b) Simplify the following Boolean expression using Boolean algebra: $F(A,B,C) = A.B + A.B' + A'.C$ [10]

c) Discuss the importance of binary arithmetic in digital electronics. [10]

END OF QUESTION PAPER