



UNIVERSITY EXAMINATIONS
**EXAMINATION FOR JANUARY/APRIL 2023/2024 DIPLOMA IN COMPUTER
SCIENCE/DIPLOMA IN INFORMATION TECHNOLOGY/DIPLOMA IN BUSINESS
INFORMATION TECHNOLOGY/DIPLOMA IN CYBER SECURITY**

COURSE CODE: **RCS 016**

COURSE TITLE: **INTRODUCTION TO DIGITAL
ELECTRONICS.**

DATE -- / -- / 2024

TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination question paper during examination time.

This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

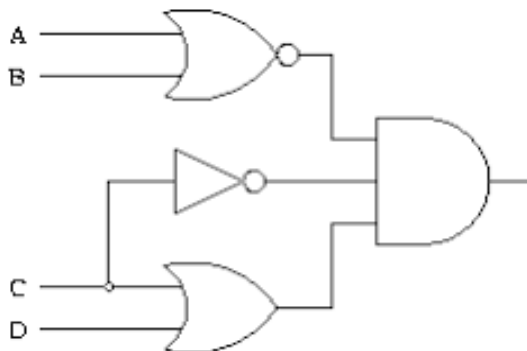
QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE start the answer to EACH question on a NEW PAGE.**
2. **Keep your phone(s) switched off at the front of the examination room.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material during the course of the examination.**
4. **ALWAYS show your working.**
5. **Marks indicated in parenthesis i.e. () will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions, write the number of the question on the answer booklet cover page in the order you answered them.**
8. **DO NOT use your PHONE as a CALCULATOR.**
9. **YOU are ONLY ALLOWED to leave the exam room 1 hour to the end of the Exam.**
10. **DO NOT write on the QUESTION PAPER. Use the back of your BOOKLET for any calculations or rough work.**
11. **Scientific CALCULATOR will be required.**

SECTION A (COMPULSORY)

Question (1) - (30Marks)

- a) Describe the following terms as used in digital logics. (12 Marks)
- i. A.D.C.
 - ii. D.A.C.
 - iii. Encoders.
 - iv. Decoders.
 - v. Multiplexer.
 - vi. De-multiplexer.
- b) Describe **FOUR** Number systems popularly used in computer systems and digital systems. (4 Marks)
- c) Compare the binary numbers system and gray code. (3 Marks)
- d) Express the circuit below as a Boolean function. (4 Marks)



- e) Considering the Boolean function shown below, draw an equivalent Logic circuit diagram. (5 Marks)

$$Y = \overline{[(\overline{A\overline{B}} + C)D] \oplus [(C\overline{D} + B) + A]}$$

- f) Name and draw any two Universal Logic gates. (2 Marks)

SECTION B (Answer Any Two Questions)

Question (2) - (15Marks)

- a) State the **De-Morgan's** theorems. **(1 Marks)**
- b) Using suitable truth tables **or** Boolean algebra, **prove** the De-Morgan's theorems. **(4 Marks)**
- c) Design a **half adder** from the **first principle** of digital circuit designing. **(4 Marks)**
- d) Convert the following binary numbers, into Decimal Number. **(3 Marks)**
11001101.1010101₂ Show all the working.
- e) Convert the following Decimal numbers, into Binary Number. **(3 Marks)**
246.579₁₀ Show all the working.

Question (3) - (15 Marks)

- a) Considering the Boolean function shown below, simplify it and hence implement the simplified logic circuit. **(5 Marks)**
$$Y = \overline{ABC} + \overline{(A + B + C)} + \overline{ABCD}$$
- b) Evaluate the following calculations / numbers Conversions, into the indicate formats.
NB: Show all the working, marks awarded on only working, not answers. (10 Marks)
- | | | |
|------|---------------------------------------|---------------------------------|
| i. | 1010101011001100_{bin} | into hexadecimal number. |
| ii. | 1111111_{bin} | into gray code. |
| iii. | 1101010100_{bin} | into decimal number. |
| iv. | F1E2D3_{hex} | into octal number. |
| v. | 10101_{dec} | into binary number. |

Question (4) - (15 Marks)

- a) Simplify the Boolean function below, using any technique of your choice. **(4 Marks)**
$$Y = \overline{ABC} + \overline{ABC} + \overline{ABC} + \overline{ABC} + ABC$$
- b) Design a **FOUR** Bits Binary to Gray code converter.
Follow the following procedures.
- | | | |
|------|---|------------------|
| i. | Draw truth table, hence Form a POS or a SOP . | (4 Marks) |
| ii. | Map outputs onto a suitable Karnaugh Map. | (1 Marks) |
| iii. | Simplify the K- Map into the simplest function. | (2 Marks) |
| iv. | Draw / implement the logic circuit. | (2 Marks) |

- c) Justify why designers simplify logic circuits before implementation. **(2 Marks)**

Question (5) - (15 Marks)

- a) Define the term universal logic gates. **(1 Marks)**
- b) Implement the following logic gates, using any universal logic gates.
- i. **OR** - logic gate. **(2 Marks)**
 - ii. **AND** - logic gate. **(2 Marks)**
 - iii. **X-OR** - logic gate. **(3 Marks)**
- c) Design, from the **first principle**, a four inputs logic circuit, such that the output will be high, only if three or more inputs are high. Simplify the logic circuit derived and implement the design. **(7 Marks)**

END