(T) Roll No. .....

PAPER ID—16013

B.Tech. Computer Science and Engineering (Cyber Security)

EXAMINATION, 2024

(Third Semester)

DIGITAL ELECTRONICS

Time : 3 *Hours* *Maximum Marks :* 70

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks.

1. (a) Convert the binary number 10110101_2 to hexadecimal. 2

(b) What is the standard representation of a logic function using Boolean algebra ? How is it useful for designing digital circuits ? 2

(c) Explain the concept of a parity bit and how is it used for error detection ? 2

(d) Explain the procedure for simplifying Boolean expressions using a Karnaugh map (K-map). 2

(e) What are don't care conditions in Boolean algebra ? How are they used in K-map simplification ? 2

(f) What is a Full Adder, show logic circuit ? 2

(g) What is a Multiplexer (MUX) and how does it differ from a De-Multiplexer (DEMUX), show with 2 : 1 MUX example ? 2

Unit I

2. (a) Explain the importance of Boolean algebra in simplifying digital circuits. Simplify the following Boolean expression step by step using Boolean algebra laws : 7

$Y = AB + A\overline{B} + \overline{A}B$.

After simplification, design a logic circuit for the simplified Boolean expression.

(b) Define one's and two's complement arithmetic. Perform the subtraction $(11010)_2 - (1011)_2$ using the two's complement method and verify the result. 7

3. (a) What is the significance of digital signals and digital circuits in modern electronics ? How do digital circuits manipulate these signals and what are their applications in real-life systems ? Provide a practical example. 7

(b) Explain the working principles of basic digital logic gates (AND, OR, NOT) and describe their truth tables. Illustrate with examples how these gates can be combined to create a NAND gate circuit. 7

Unit II

4. (a) Explain the Quine-McCluskey (Q-M) method for function realization and simplify the following Boolean function using this method : 7

$F(A, B, C) = \Sigma(0, 1, 2, 5, 6, 7)$

(b) What is a Demultiplexer (DMUX) ? Explain its operation with the help of a block diagram. Design a 1-to-4 demultiplexer using basic logic gates. 7

5. (a) Describe the operation of a Binary Coded Decimal (BCD) adder. How does BCD addition differ from binary addition and what correction is required when the sum exceeds 9 in BCD arithmetic ? 7

(b) Given the Boolean function F(A, B, C) = Σ(0, 1, 3, 4, 5, 7), simplify the expression using a Karnaugh Map (K-map) and state the simplified Boolean expression. 7

Unit III

6. (a) How do the operating principles of a S-R flip-flop ? Illustrate the working of

criterion ? Explain why the Nyquist criterion is important for accurate sampling and what happens if is it not met. 7

(b) If you have a 12-bit successive approximation ADC with a reference voltage of 3.3V, how can you find the number of different levels the ADC can differentiate ? Also, how do you calculate the resolution of this ADC ? Explain step by step. 7