

# Faculty of Engineering

## End Semester Examination May 2025

### RA3CO26 Digital Electronics

<b>Programme</b>	:	B.Tech.	<b>Branch/Specialisation</b>	:	RA
<b>Duration</b>	:	3 hours	<b>Maximum Marks</b>	:	60

**Note:** All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.  
 Notations and symbols have their usual meaning.

<b>Section 1 (Answer all question(s))</b>				<b>Marks</b>	<b>CO</b>	<b>BL</b>
<b>Q1.</b> The Quine-McCluskey method is used for-				1	1	1
<input type="radio"/> Boolean function multiplication	<input checked="" type="radio"/> Boolean function minimization					
<input type="radio"/> Logic gate addition	<input type="radio"/> Karnaugh maps					
<b>Q2.</b> The simplified expression of the Boolean function $A + A'B$ is:				1	1	1
<input checked="" type="radio"/> $A + B$	<input type="radio"/> $A' + B$					
<input type="radio"/> $A \cdot B$	<input type="radio"/> B					
<b>Q3.</b> Which type of transistor is used in NMOS logic families?				1	1	1
<input type="radio"/> Only PMOS transistors	<input type="radio"/> Only NMOS transistors					
<input checked="" type="radio"/> Both NMOS and PMOS transistors	<input type="radio"/> Bipolar Junction Transistors (BJTs)					
<b>Q4.</b> Which logic family uses transmission gates for switching?				1	1	1
<input type="radio"/> TTL	<input type="radio"/> NMOS					
<input checked="" type="radio"/> CMOS	<input type="radio"/> ECL					
<b>Q5.</b> A 3-to-8 decoder has how many input and output lines?				1	1	1
<input type="radio"/> 3 inputs, 3 outputs	<input checked="" type="radio"/> 3 inputs, 8 outputs					
<input type="radio"/> 8 inputs, 3 outputs	<input type="radio"/> 2 inputs, 8 outputs					
<b>Q6.</b> A parity generator is used for-				1	1	1
<input type="radio"/> Arithmetic operations	<input checked="" type="radio"/> Error detection					
<input type="radio"/> Data conversion	<input type="radio"/> Multiplexing					
<b>Q7.</b> Which type of flip-flop is used to remove the race-around condition in JK flip-flops?				1	1	1
<input type="radio"/> SR Flip-Flop	<input type="radio"/> T Flip-Flop					
<input checked="" type="radio"/> Master-Slave JK Flip-Flop	<input type="radio"/> D Flip-Flop					
<b>Q8.</b> Which of the following statements is true for a Moore state machine?				1	1	1
<input type="radio"/> Output depends on both state and input	<input checked="" type="radio"/> Output depends only on the present state					
<input type="radio"/> Outputs change immediately with input changes	<input type="radio"/> It cannot be used in sequential circuits					
<b>Q9.</b> What is the major difference between PROM and EPROM?				1	1	1
<input type="radio"/> PROM can be erased and reprogrammed, while EPROM cannot	<input checked="" type="radio"/> EPROM can be erased using UV light, while PROM cannot be erased					
<input type="radio"/> PROM is faster than EPROM	<input type="radio"/> EPROM is a volatile memory					

**Q10.** Which of the following statements is true for PAL (Programmable Array Logic)?

1 1 1

- It has a fixed OR array and a programmable AND array
- It has both AND and OR arrays programmable AND array
- It is a volatile memory device
- It cannot be used in logic circuit implementation

### Section 2 (Answer all question(s))

**Marks CO BL**

4 3 3

**Q11.** Convert the following-

- (i) Decimal 247 to Binary, Octal, and Hexadecimal
- (ii) Binary 1011011 to Decimal

<b>Rubric</b>	<b>Marks</b>
Decimal 247 to Binary, Octal, and Hexadecimal	3
Binary 1011011 to Decimal	1

**Q12. (a)** Simplify the Boolean function  $F(A,B,C,D)=\sum m(0,2,5,7,8,10,13,15)$  using the Quine-McCluskey method and find the essential prime implicants.

6 3 3

<b>Rubric</b>	<b>Marks</b>
Grouping the minterms in the table (Pairing terms based on 1-bit difference) - <ul style="list-style-type: none"> <li>• Organizing minterms into groups based on the number of 1s in their binary representation.</li> <li>• Identifying and grouping adjacent minterms</li> </ul>	2
Finding Prime Implicants - (2 Marks) <ul style="list-style-type: none"> <li>• Repeatedly combining groups to form prime implicants.</li> <li>• Creating a Prime Implicant Table.</li> </ul>	2
Selecting Essential Prime Implicants & Writing the Final Simplified Expression - (2 Marks) <ul style="list-style-type: none"> <li>• Identifying essential prime implicants.</li> <li>• Writing the minimized Boolean expression.</li> </ul>	2

**(OR)**

**(b)** Find the minimal expression using a 4-variable K-map for the Boolean function:  $(A,B,C,D)=\sum m(0,1,2,8,9,10,11)$ . Also make the digital circuit of the expression obtained.

<b>Rubric</b>	<b>Marks</b>
Constructing the 4-variable K-map and Correctly Placing Minterms <ul style="list-style-type: none"> <li>-</li> <li>• Drawing a <math>4 \times 4</math> K-map and correctly placing the given minterms (0,1,2,8,9,10,11).</li> </ul>	2
Grouping Minterms and Finding the Simplified Expression - <ul style="list-style-type: none"> <li>• Identifying groups of 1s (Pairs, Quads, or Octets).</li> <li>• Writing the simplified Boolean expression from the K-map.</li> </ul>	2
Drawing the Digital Logic Circuit - (2 Marks) <ul style="list-style-type: none"> <li>• Designing the digital circuit using AND, OR, and NOT gates based on the simplified expression.</li> </ul>	2

### Section 3 (Answer all question(s))

**Q13.** Draw and explain the working of CMOS inverter.

**Marks CO BL**

4 2 2

<b>Rubric</b>	<b>Marks</b>
Circuit Diagram of CMOS Inverter	2
Explanation of Working with Truth Table	2

**Q14. (a)** What are logic families? Classify different types of logic families based on their characteristics.

6 2 2

Rubric	Marks
Definition of Logic Families	1
Broad Classification of Logic Families	2
characteristics and description	3

**(OR)**

- (b)** Explain these electrical characteristics of logic families-
- Propagation delay
  - Operating frequency
  - Power dissipated per gate

Rubric	Marks
propagation delay	2
, operating frequency	2
dissipated per gate	2

#### Section 4 (Answer all question(s))

**Q15.** Describe the working principal of look ahead carry generator.

Marks CO BL

4 2 2

Rubric	Marks
Introduction to Look-Ahead Carry Generator	1
Working Principle	3

**Q16. (a)** Construct a 3 input Full Adder using Karnaugh Map (K-Map) simplification. Also, draw its truth table and circuit diagram.

6 3 3

Rubric	Marks
Full Adder using Karnaugh Map (K-Map) simplification.	3
truth table	1
circuit diagram.	2

**(OR)**

- (b)** What is decoder ? Name the various types of decoders. Also construct a 2-to-4 decoder using basic logic gates and explain its implementation.

Rubric	Marks
Definition of Decoder	1
Types of Decoders	1
2-to-4 decoder using basic logic gates	2
explanation and equations	2

#### Section 5 (Answer all question(s))

Marks CO BL

**Q17.** Describe Moore and Mealy state machines with suitable examples.

4 2 2

Rubric	Marks
description of Moore machines	2
description of Mealy machines	2

**Q18. (a)** What are registers? Classify different types of registers and explain any one types of register with the help of a circuit diagram.

6 2 2

Rubric	Marks
what are registers	1
types of registers	1
circuit diagram	2
explanation with truth table	2

**(OR)**

**(b)** What are flip flops, what are its types. Explain JK flip flop based on its truth table, characteristic equation and circuit diagram.

Rubric	Marks
What are Flip-Flops?	1
Types of Flip-Flops	1
Truth Table of JK Flip-Flop	1
Characteristic Equation of JK Flip-Flop	1
Circuit Diagram of JK Flip-Flop	2

### Section 6 (Answer any 2 question(s))

**Marks CO BL**

**Q19.** Define RAM and explain its types.

5 2 2

Rubric	Marks
Definition of RAM	1
Explanation of types of RAM	4

**Q20.** What are PAL and PLA? Enlist 3 differences between PAL and PLA.

5 2 2

Rubric	Marks
What is PAL	1
What is PLA?	1
Differences Between PAL and PLA	3

**Q21.** Write a short note on FPGA.

5 2 2

Rubric	Marks
Explanation	5

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