

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Third Semester

Electronics and Communication Engineering

24ECPC303 - DIGITAL CIRCUITS

Regulations -2024

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

	<i>Marks</i>	<i>K – Level</i>	<i>CO</i>
1. Gray code is used to (a) Detect errors (b) Prevent errors during transition (c) Encode ASCII (d) Reduce power	1	K1	CO1
2. The Boolean expression for De Morgan's first theorem is: (a) $(A + B)' = A' + B'$ (b) $(A + B)' = A'B'$ (c) $(AB)' = AB$ (d) $(AB)' = A' + B'$	1	K1	CO1
3. Which of the following circuits has its output dependent only on the present input? (a) Sequential Circuits (b) Combinational Circuits (c) Memory Circuit (d) Feedback Circuit	1	K1	CO2
4. The output of a 2-to-1 multiplexer depends on: (a) Inputs only (b) Select line only (c) Inputs and Select line (d) Clock line	1	K1	CO2
5. Which of the following is a memory element? (a) Flip-flop (b) Logic gate (c) Multiplexer (d) Encoder	1	K1	CO3
6. A ripple counter is an example of: (a) Synchronous counter (b) Asynchronous counter (c) Mod-n counter (d) Ring counter	1	K1	CO3
7. In asynchronous circuits, changes occur: (a) Only at clock edges (b) Immediately after input changes (c) Periodically (d) Randomly	1	K1	CO4
8. Which of the following can cause instability in asynchronous circuits? (a) Hazards (b) State reduction (c) Race conditions (d) Both (a) and (c)	1	K1	CO4
9. Which library is commonly used in VHDL designs? (a) IEEE (b) STD_LOGIC (c) VHDL_LIB (d) DIGITAL_LIB	1	K1	CO5
10. The register Transfer Level represents (a) Physical Layer Design (b) High Level Algorithm (c) Data flow between registers (d) Power Optimization	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

11. Convert $(125)_{10}$ into binary, octal, and hexadecimal equivalents.	2	K2	CO1
12. Explain the Sum of Products (SOP) and Product of Sums (POS) forms.	2	K2	CO1
13. Draw a 2-bit binary adder for the input A = 10 and B = 01.	2	K2	CO2
14. Discuss the use of an encoder and decoder.	2	K2	CO2
15. Differentiate between synchronous and asynchronous counters.	2	K2	CO3
16. What is a modulo-n counter? Give an example.	2	K1	CO3
17. Compare fundamental mode and pulse mode circuits.	2	K2	CO4
18. Explain the term 'essential hazard'.	2	K2	CO4
19. Write the syntax of an ENTITY declaration in VHDL.	2	K2	CO5
20. Define signal and variable with examples.	2	K1	CO5
21. List out the purpose of Programmable Logic Array (PLA).	2	K1	CO6

22. Give any advantages of CMOS Logic Circuits. 2 K2 CO6

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23. a) Discuss Boolean Algebra and explain Boolean postulates, laws, and De Morgan's theorems. Construct the Principle of Duality with examples. 11 K2 CO1

OR

b) Minimize the Boolean function $F(A, B, C, D) = \Sigma(1, 3, 7, 11, 15) + d(0, 2, 5)$ using Quine–McCluskey method. 11 K2 CO1

24. a) Develop full adder design with diagram. Prove its truth table and Examine for $A = 1, B = 0, C_{in} = 1$. 11 K2 CO2

OR

b) Design a 4-to-1 multiplexer using logic gates. For select lines $S_1S_0 = 01$ and inputs $I_0 = 0, I_1 = 1, I_2 = 1, I_3 = 0$, what is the output? 11 K2 CO2

25. a) Discuss the operation of different types of shift registers. Derive the timing diagram for a 4-bit serial-in serial-out shift register. 11 K2 CO3

OR

b) Explain the design and operation of ring counters and modulo-4 synchronous counter with neat diagrams. 11 K2 CO3

26. a) Describe the procedure for constructing the state diagram and excitation table of an asynchronous sequential circuit with 2 inputs X and Y and with one output Z. Whenever Y is 1 input X is transferred to Z. When Y is 0, output does not change for any change in X 11 K2 CO4

OR

b) Elaborate on various types of hazards in asynchronous sequential circuits. Explain essential hazards in detail. 11 K2 CO4

27. a) Inspect the three modeling styles of VHDL: Dataflow, Behavioral, and Structural with examples. 11 K2 CO5

OR

b) Examine in details about the implementation of sequential logic circuits such as D flip-flop and 2 bit up counter using VHDL. 11 K2 CO5

28. a) Enumerate brief on working principle, types and applications of ROM with suitable diagram. 11 K2 CO6

OR

b) (i) Compare and Contrast Various logic circuit families: RTL, TTL and CMOS. 5 K2 CO6
(ii) Explain the operation of CMOS logic gates. 6 K2 CO6

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