| U.S.N. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

# B.M.S. College of Engineering, Bengaluru-560019

**Autonomous Institute Affiliated to VTU**

## January / February 2025 Semester End Main Examinations

**Programme: B.E.** **Semester: III**

**Branch: Artificial Intelligence and Machine Learning** **Duration: 3 hrs.**

**Course Code: 22AM3ESLDA** **Max Marks: 100**

**Course: Logic Design and Computer Architecture**

**Instructions**: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.





| | | UNIT - I | *CO* | *PO* | Marks |
|---|---|---|---|---|---|
| 1 | a) | Illustrate positive logic and negative logic using a truth table and corresponding logic diagrams. | *CO1* | *PO1* | **5** |
| | b) | Simplify the following Boolean expressions using a 4-variable Karnaugh map. Draw the K-Map and show the grouping of minterms step by step. Provide the final simplified expression.<br>i. F(A,B,C,D) = ∑m (0, 1, 3, 5, 7, 9, 11, 13)<br>ii. F(A,B,C,D) = ∑m (1, 2, 5, 6, 9, 12) | *CO1* | *PO3* | **8** |
| | c) | Implement a full adder using 3-to-8 decoder. | *CO2* | *PO2* | **7** |
| | | **OR** | | | |
| 2 | a) | Explain the working of basic logic gates and universal gates with truth tables and circuit diagrams. Discuss their significance in digital electronics. | *CO1* | *PO2* | **10** |
| | b) | Simplify the Boolean expression F(A,B,C,D)=∑m (1, 3, 7, 11, 15) + ∑d(0, 2) using the Quine-McCluskey method. Identify the prime implicants and essential prime implicants. | *CO1* | *PO3* | **10** |
| | | **UNIT – II** | | | |
| 3 | a) | Explain the working of an RS flip-flop with the help of its logic diagram, truth table, and timing diagram. What is the significance of the indeterminate state? | *CO1* | *PO3* | **8** |
| | b) | Explain the concept of edge triggering in flip-flops. Compare positive edge-triggered and negative edge-triggered flip-flops with suitable diagrams and timing diagrams. | *CO1* | *PO2* | **6** |
| | c) | With a neat diagram, explain 4-bit universal shift registers. | *CO1* | *PO3* | **6** |
| | | **OR** | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 4 | a) | Discuss the need for gated flip-flops in sequential circuits. Design a gated D flip-flop and explain its working with an example. | *CO1* | *PO3* | **7** |
| | | b) | Design a JK master-slave flip-flop using basic logic gates. Explain its behavior for all possible input combinations. | *CO1* | *PO3* | **7** |
| | | c) | Design a 3-bit synchronous up-counter as a synthesis problem. Derive the state transition table, simplify the logic, and implement the design using flip-flops. | *CO2* | *PO3* | **6** |
| | | | **UNIT - III** | | | |
| | 5 | a) | Elucidate the intricate components constituting the functional unit within a computer system. | *CO2* | *PO2* | **5** |
| | | b) | Elaborate the significance of the Accumulator register within computer architecture. | *CO3* | *PO2* | **5** |
| | | c) | Explain the concept of bus interconnection in computer systems. Discuss the types of buses used in a computer architecture, and explain their role in data communication between the CPU, memory, and I/O devices. | *CO3* | *PO3* | **10** |
| | | | **OR** | | | |
| | 6 | a) | Describe the role of the Control Unit (CU) in a computer system. How does it coordinate the operation of other components like the Arithmetic Logic Unit (ALU), memory, and I/O devices? | *CO3* | *PO2* | **10** |
| | | b) | Describe the different types of interconnection structures used in computer systems. Compare and contrast these structures in terms of scalability, cost, and performance. | *CO3* | *PO3* | **10** |
| | | | **UNIT - IV** | | | |
| | 7 | a) | Explain the working of a Carry Look-Ahead Adder (CLA). How does it improve the speed of binary addition compared to a conventional Ripple Carry Adder (RCA)? | *CO2* | *PO2* | **8** |
| | | b) | Perform carry save multiplier for: (1011 * 1101). | *CO2* | *PO3* | **4** |
| | | c) | Explain the concept of cache mapping in computer architecture. Describe and compare the three common types of cache mapping: direct-mapped, fully associative, and set-associative. | *CO2* | *PO2* | **8** |
| | | | **OR** | | | |
| | 8 | a) | Design a 4-bit Carry Save Adder (CSA) and explain its operation. How does it enhance the speed of multi-operand addition in digital circuits? | *CO3* | *PO2* | **10** |
| | | c) | Construct a Booth recoding table and implement the Booth multiplication algorithm to compute the product of +13 and -6. Additionally, execute carry-save addition (CSA) for the binary numbers 101101 (Multiplicand) and 111111 (Multiplier). | *CO3* | *PO3* | **10** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | **UNIT - V** | | | |
| | 9 | a) | Distinguish between hardware control unit and micro programmed control unit. | *CO2* | *PO2* | **6** |
| | | b) | Describe the different types of addressing modes commonly used in processors with an example. Discuss the importance of addressing modes in accessing data from memory. | *CO3* | *PO3* | **10** |
| | | c) | Illustrate the mechanism of the Hardwired control unit with a neat labelled diagram to ensure team comprehends the operation. | *CO3* | *PO2* | **4** |
| | | | **OR** | | | |
| | 10 | a) | Elaborate on the fundamental components inherent to a microprogrammed control unit. Provide an illustrative example to demonstrate their functionality within control unit architecture. | *CO2* | *PO2* | **10** |
| | | b) | How do basic instruction types operate within computer programming paradigms? Evaluate: (A+B) * (C+D) by considering 3 basic instruction addresses. | *CO1* | *PO1* | **10** |

**********