

GOVERNMENT OF KARNATAKA
DEPARTMENT OF TECHNICAL EDUCATION
TABLE OF SPECIFICATION
(BLUEPRINT FOR QUESTION PAPER)

Program		Computer Science and Engineering and Allied Programs																		
Course Name		Basics of Digital Logic and Computer Organization																		
Course Code		25CS11I																		
Revised Blooms Taxonomy Cognitive Level				Remember (21%)						Understand(58%)					Apply (21%)					Total Questions
Week No.	CO	Marks	Weightage	1M MCQ	1M FIB	2M	3M	5M	10M	1M MCQ	2M	3M	5M	10M	1M MCQ	2M	3M	5M	10M	
1,2	CO-01	22	15	2	1	2	-	-	-	1	-	2	1	-	-	-	-	-	-	9
3,4,5	CO-02	30	20	2	1	1	-	-	-	1	-	2	2	-	1	-	-	-	1	11
6,7	CO-03	35	23	2	1	1	-	-	-	1	-	1	1	-	1	-	-	-	2	10
8,9,10	CO-04	33	22	2	1	2	-	-	-	-	-	2	2	1	-	-	-	-	-	10
11,12,13	CO-05	30	20	2	1	2	-	-	-	-	-	1	2	1	-	-	-	-	-	9
Total Questions				10	5	8	0	0	0	3	0	8	8	2	2	0	0	0	3	49
Total Marks				15		16	-	-	-	3	-	24	40	20	2	-	-	-	30	150
Overall Breakup Percentage				10		11	-	-	-	2	0	16	27	13	1	0	0	0	20	100
Overall CL Percentage				21						58					21					100

**Government of Karnataka
Department of Technical Education
Board of Technical Examinations
Model Question Paper – 01**

Course: Basics of Digital Logic and Computer Organization

Course Code: 25CS11I

Time: 3 Hrs

Max Marks: 100

Instructions: For Part-A questions, only the first written answers will be considered for evaluation.

PART A

I. Select the correct answer from the choices given 15x1 = 15

1. Which of the following is a binary number?

- a) 1011 b) 1234 c) 8F d) 29

2. The truth table of a NOT gate has how many inputs?

- a) 0 b) 1 c) 2 d) 3

3. ASCII stands for:

- a) American Standard Code for Information Interchange
b) Automated System for Character Identification and Input
c) Analog Signal Code for Integrated Interfaces
d) Advanced Source Code for Internet Interaction

4. Which of the following is a universal gate?

- a) NAND b) OR c) XOR d) NOT

5. The output of a full-subtractor is:

- a) Difference and borrow b) Sum and carry c) Only borrow d) Only difference

6. A D flip-flop is also called:

- a) Delay flip-flop b) Double flip-flop c) Down counter d) Direct flip-flop

7. The main memory communicates directly with the:

- a) Monitor b) Keyboard c) CPU d) Hard disk

8. The register which holds the address of the next instruction is:

- a) IR b) MAR c) PC d) MDR

9. USB stands for:

- a) Universal Serial Bus b) United System Bus
c) Unique Serial Bridge d) Universal Signal Base

10. Which of the following connects internal components of the computer?

- a) Compiler b) Bus c) ROM d) SSD

11. What is the difference between NAND and NOR gates?

- a) NOR is faster b) NAND inverts OR, NOR inverts AND
c) NAND inverts AND, NOR inverts OR d) Both are same

12. A shift register moves data:

- a) Randomly b) Parallel only c) Bit by bit d) In analog form

13. Why is binary number system used in digital systems?

- a) It is easy to understand for humans b) It reduces memory usage
c) It can be represented using ON and OFF states d) It provides more colors in graphics

14. You want to simulate a circuit that counts from 0 to 7 repeatedly. Which circuit should be used?

- a) Half Adder b) Synchronous Counter c) Demultiplexer d) Decoder

15. You need to invert a signal before sending it to a microcontroller. Which logic gate is appropriate?

- a) AND b) OR c) NOT d) XOR

II. Fill in the blanks by choosing appropriate answer from those given in the bracket:

(one, output, current, real numbers, outputs)

5X1 = 05

1. Floating point representation is used to store ____.
2. The truth table of a logic gate shows all possible combinations of inputs and their corresponding ____.
3. A flip-flop stores ____ bit of data.
4. The Instruction Register (IR) holds the ____ instruction.
5. A printer is categorized as an ____ device.

PART B

III. Answer any FIVE questions:

5X2 = 10

1. Convert the hexadecimal number 2A to its binary equivalent.
2. State the base value of each of the following number systems: binary, octal, decimal, and hexadecimal.
3. State any two Boolean laws used in circuit simplification.
4. List any two examples of sequential circuits.
5. What is the function of the Control Unit in a computer?
6. State the function of the address bus.
7. Name any two types of memory used in a typical computer.
8. List any two commonly used I/O ports.

PART C

VI. Answer any FIVE questions:

5X3 = 15 .

1. Explain the need for data representation in digital systems.
2. Differentiate between binary and BCD number systems with suitable examples.
3. Describe how a NAND gate can be used to build an AND gate.
4. Compare SOP and POS (Product of Sums) expressions with examples.
5. What is a Multiplexer? List the applications of a multiplexer.
6. Explain the Von Neumann architecture and list its key components.
7. Compare the roles of data bus, address bus, and control bus in a computer system.
8. Differentiate between primary, secondary, and tertiary memory with one example for each.

PART D (Section I)

IV. Answer any FIVE questions:

5X5 = 25 0

1. Describe the purpose of BCD (Binary-Coded Decimal) in digital systems. Explain how the decimal number 59 is represented in BCD and compare it with its pure binary representation.
2. Explain the function of basic logic gates (AND, OR, NOT) with their symbols, truth tables, and one practical use for each.
3. Explain the step-by-step procedure to derive a Boolean expression in POS (Product of Sums) form from a given truth table with three input variables A, B, and C with one output Y.

A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

4. Describe the applications of Multiplexer and De-multiplexer.
5. Explain the instruction execution cycle in a CPU. What happens during fetch, decode, and execute stages?
6. Explain any three addressing modes used in CPU instruction execution. Give an example for each.
7. Explain memory hierarchy and how CPU interacts with different levels of memory during instruction execution.

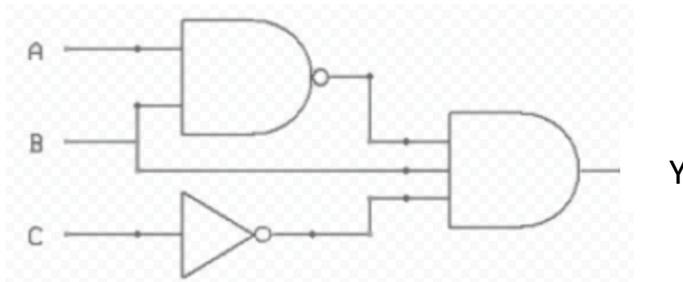
8. Compare parallel and serial bus architectures. Explain one advantage and disadvantage of each with suitable examples.

PART D (Section II)

V. Answer any THREE questions:

10X3 = 30

1. Given a logic circuit explain the procedure to construct its truth table. Apply this procedure to the given circuit diagram and present the complete truth table showing all possible input combinations and corresponding outputs.



2. You've been given a mysterious circuit that encodes or decodes a secret binary message using XOR gates. Your task is to figure out the input, the circuit logic, and the hidden message.

If The binary message $M=11001$ and the secret key $K=10101$ what is the encoded message X
To decode the message, the encoded message X is passed through the same XOR gate with the original key $K=10101$. What is the decoded message M.

3. You are designing the control system of a washing machine. The machine must go through a fixed sequence: Fill → Wash → Rinse → Spin → Stop. Each stage runs for a fixed amount of time and then automatically moves to the next.

a) Is this an example of a combinational or sequential circuit? Explain why.

b) Name any two digital components used to implement this sequence and describe their roles.

4. Explain the key CPU performance metrics such as clock speed, number of cores, and cache memory. Provide an example for each to show how it affects computer performance.

5. Differentiate between primary, secondary, and tertiary memory. Give two examples of each and their typical applications.

**Government of Karnataka
Department of Technical Education
Board of Technical Examinations
Model Question Paper – 02**

Course: Basics of Digital Logic and Computer Organization

Course Code: 25CS111

Time: 3 Hrs

Max Marks: 100

Instructions: For Part-A questions, only the first written answers will be considered for evaluation.

PART A

I. Select the correct answer from the choices given 15x1 = 15

1. Why do we convert decimal numbers to binary in digital systems?
a) To increase memory usage b) Because binary is easier to visualize
c) Because digital circuits understand only binary d) To avoid use of ASCII
2. Which of the following best describes a synchronous counter?
a) All flip-flops are triggered at different times
b) Flip-flops are connected in series
c) All flip-flops are triggered by the same clock pulse
d) Only one flip-flop is used
3. Why are Boolean expressions simplified before circuit design?
a) To increase size b) To slow down circuit
c) To reduce complexity and cost d) To make it complicated
4. A logic circuit outputs high only when one and only one of two sensors is activated. Which gate should be used?
a) AND b) NOR c) XOR d) NOT
5. The 1's complement of binary number 1100 is _____.
a) 0011 b) 1100 c) 1111 d) 1011
6. You are simulating a flip-flop and observe that the output toggles on every clock pulse when inputs are high. What type of flip-flop are you testing?
a) SR b) D c) T d) JK
7. Which of the following is not a basic logic gate?
a) AND b) OR c) NAND d) NOT
8. How many symbols are used in the octal number system?
a) 4 b) 6 c) 8 d) 10
9. A NAND gate is equivalent to:
a) OR + NOT b) AND + NOT c) XOR + NOT d) NOT + OR
10. Registers are used to:
a) Store large files b) Store addresses permanently
c) Store data temporarily during processing d) Control external devices

11. A half adder is used to perform:

- a) Binary division b) Binary multiplication
- c) Addition of two bits d) Subtraction of two bits

12. A multiplexer is also known as a:

- a) Data distributor b) Data selector c) Comparator d) Decoder

13. The Program Counter (PC) is used to:

- a) Store user passwords b) Count the number of instructions
- c) Store the address of the next instruction d) Store input data

14. The main memory of a computer is also called ____.

- a) Hard disk b) RAM c) ROM d) Cache

15. A device used to store data permanently is ____.

- a) RAM b) Cache c) Hard Drive d) Register

II. Fill in the blanks by choosing appropriate answer from those given in the bracket:

(XOR , same memory, eight, non-volatile, asynchronous)

5X1 = 05

1. A byte consists of ___ bits
2. A logic gate that produces HIGH only when inputs are different is ____
3. A ripple counter is a type of ___ counter.
4. In Von Neumann architecture, both program and data are stored in ____.
5. ROM is a type of ___ memory.

PART B

III. Answer any FIVE questions:

5X2 = 10

1. What is the octal equivalent of binary number 111010?
2. Define Unicode. What is its advantage over ASCII?
3. Define an AND gate with its symbol and basic truth table.
4. Name any two combinational circuits.
5. Expand ALU and state its primary function.
6. Name any two registers used in the CPU.
7. Name the three types of system buses used in computers.
8. What is the function of a GPU?

PART C

IV. Answer any FIVE questions:

5X3 = 15

1. Explain the difference between 1's complement and 2's complement with an example.
2. Describe the structure of a floating-point number in binary, mentioning sign, exponent, and mantissa.
3. Explain the difference between AND, OR, and NOT gates with their truth tables.

4. Describe how a NAND gate can be used to build an AND gate.
5. List any three practical applications of a decoder in digital systems.
6. Describe the fetch-decode-execute cycle of instruction execution in a CPU.
7. Compare CPU and GPU in terms of architecture and typical applications.
8. Explain any three units of memory and arrange them in ascending order of size.

PART D (Section I)

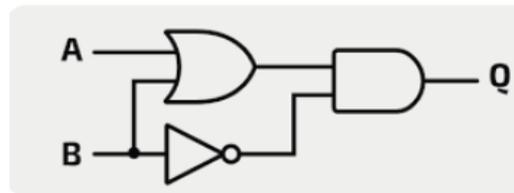
V. **Answer any FIVE questions:**

5X5 = 25

1. Describe the process of performing binary addition in digital systems. Demonstrate with an example of adding two 5-bit binary numbers, 10110 and 00111
2. Explain the step-by-step procedure to derive a Boolean expression in Sum of Products (SOP) form from a given truth table with three input variables A, B, and C.

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

3. Derive the truth table for the below circuit.



4. Explain the applications of Encoder and Decoder.
5. What is Instruction Set Architecture (ISA)? Describe different types of instructions used in a typical ISA.
6. Differentiate between primary memory and secondary memory in terms of function, speed, and volatility. Give two examples for each.
7. How do I/O ports and buses facilitate communication between CPU and external devices?
8. Describe how different types of memory are used in a computer system. Give one real-world example for each type.

PART D (Section II)

VI. Answer any THREE questions:

10X3 = 30

1. Which gates would you use to design a circuit for these scenario, justify your selection.
 - a. The output should be 1 only when at least one input is 1.
 - b. The output is 1 only when the two inputs are the same.
 - c. In a control system, you need an output of 1 only when all inputs are 0.
 - d. For a security system, if you want the output to be 1 only when both switches are in the off position.
 - e. Output is 1 if and only if the inputs are different.

2. You are designing a smart home lighting system that operates in four modes:

Mode 0 – All lights OFF

Mode 1 – Bedroom light ON

Mode 2 – Living room light ON

Mode 3 – All lights ON

The system should allow selection between these modes using two control signals (S1 and S0). Propose a suitable digital logic solution that can implement this selection system efficiently. Justify your solution.

3. Explain with block diagram how an 8:1 multiplexer can be constructed using two 4:1 multiplexers.
4. List the major components of the CPU and explain their roles.
5. Identify each of the following components and briefly explain their role in a computer system:

Keyboard, HDMI Port, Monitor, Ethernet Port, Projector, Microphone, PCI and SATA

**Government of Karnataka
Department of Technical Education
Board of Technical Examinations
Model Question Paper - 03**

Course: Basics of Digital Logic and Computer Organization

Course Code: 25CS111

Time: 3 Hrs

Max Marks: 100

Instructions: For Part-A questions, only the first written answers will be considered for evaluation.

PART A

I. Select the correct answer from the choices given 15x1 = 15

1. What is the binary equivalent of decimal 13?

- a) 1101 b) 1010 c) 1110 d) 1001

2. Which encoding system supports more characters than ASCII?

- a) Unicode b) BCD c) Octal d) Binary

3. What does a NAND gate output when both inputs are 1?

- a) 1 b) 0 c) Undefined d) Same as input

4. A Full Adder has how many inputs and outputs?

- a) 3-in, 2-out b) 2-in, 1-out c) 1-in, 1-out d) 2-in, 2-out

5. What type of memory is volatile?

- a) RAM b) ROM c) HDD d) SSD

6. Which code is used to represent numbers and characters in most modern computers?

- a) BCD b) ASCII c) Octal d) Binary

7. The output of an AND gate is 1 only when:

- a) All inputs are 1 b) All inputs are 0 c) Any one input is 1 d) Inputs are different

8. Which of the following is a combinational circuit?

- a) Flip-Flop b) Counter c) Multiplexer d) Shift Register

9. In the Von Neumann architecture, instructions and data share:

- a) Different memory units b) A common bus only c) Separate CPUs d) The same memory and bus

10. An interrupt is a:

- a) Sequential execution block b) Type of software
c) Signal that stops the CPU temporarily d) Memory unit

11. The unit that communicates with input and output devices is:

- a) ALU b) Control Unit c) Memory d) Register

12. What is the main purpose of using logic gates in digital circuits?

- a) Store data b) Perform logical operations c) Measure voltage
d) Transmit sound

13. What is the key difference between combinational and sequential circuits?

a) Input type b) Use of memory c) Power supply d) Number of gates

14. A lamp should turn ON if either switch A or switch B is ON. What logic gate would you use?

a) NOR b) NAND c) AND d) OR

15. A technician is building a data selector that chooses one of 4 input lines based on 2 control bits. Which device is suitable?

a) Encoder b) Flip-Flop c) Multiplexer d) Decoder

II. Fill in the blanks by choosing appropriate answer from those given in the bracket:

(ALU, ASCII, adder, bus protocols, flip-flops)

5X1 = 05

1. The Unicode standard supports more characters than ____.
2. A _____ takes two binary numbers and adds them to produce a sum and carry.
3. A register is made up of a group of ____.
4. The component that executes arithmetic and logical operations is ____.
5. SATA and PCI are examples of ____.

PART B

III. Answer any FIVE questions

5X2 = 10

1. Find the 1's and 2's complement of binary number 00010101.
2. Convert the decimal number 255 to hexadecimal.
3. What is a universal gate? Name any two universal gates.
4. Name any two types of flip-flops used in sequential circuits.
5. Define the term instruction cycle.
6. Name any three basic components of Von Neumann architecture.
7. Name any two examples of output devices.
8. Define interrupt in computer systems.

PART C

IV. Answer any FIVE questions

5X3 = 15.

1. Given a BCD number 01000011, convert it to decimal and explain the process.
2. Describe how digital systems represent negative numbers using binary formats.
3. Explain the significance of Boolean expressions in designing digital logic circuits.
4. Draw the truth table for the Boolean Expression $Y = A \cdot B + \bar{A} \cdot C$ and explain its logic.

5. Define a Register. List the applications of shift registers.
6. Describe how an interrupt is handled by the CPU in a simple computing system.
7. What is the role of the Program Counter (PC) and Instruction Register (IR) during instruction execution?
8. Explain the function of common I/O ports - USB, HDMI, and Ethernet.

PART D (Section I)

V. Answer any FIVE questions:

5X5 = 25

1. Explain the differences between signed magnitude, 1's complement, and 2's complement representations for negative numbers. Illustrate how -25 is represented in an 8-bit format for each method.
2. Explain the step-by-step procedure to derive a Boolean expression in Sum of Products (SOP) form from a given truth table with three input variables A, B, and C and one output Y.

A	B	C	Y
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	0
1	1	1	1

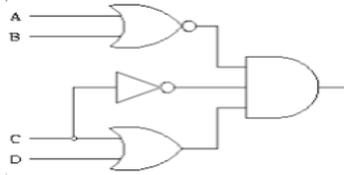
3. Explain the working of NAND and NOR gates with truth tables.
4. Explain the applications of counters in digital systems.
5. Describe the functions of the Control Unit and Arithmetic Logic Unit (ALU) in a CPU. How do they work together?
6. What are specialized processors - GPU, TPU, and NPU? How do they differ from the general-purpose CPU?
7. Describe the types of system buses and their roles in instruction execution.
8. List any three input and three output devices and explain their role in a computer system.

PART D (Section II)

VI. Answer any THREE questions:

10X3 = 30

1. Given a logic circuit explain the procedure to construct its truth table. Apply this procedure to the given circuit diagram and present the complete truth table showing all possible input combinations and corresponding outputs.



2. Your school is building a digital scoreboard for a quiz competition. It should be able to store scores, count rounds, and move data between displays.

Answer the following based on this:

- a) Should the scoreboard use a combinational or sequential circuit to store and update scores? Give one reason for your answer.
 - b) Which digital components are required to build this system (e.g., for storing, counting, and shifting data)? List them and justify your selection.
3. Design a full-adder using two half-adders (block diagram) and an OR gate.
4. A simple computer system is designed to perform basic operations like adding numbers, moving data, and accessing memory. Below are some sample instructions used in the system:
- a. MOV R1, #5
 - b. MOV R2, [1000]
 - c. ADD R3, [R1]
 - d. MOV R4, [R2 + 4]
 - e. MOV R5, R3

Based on these instructions, identify the addressing mode used in each instruction.

5. A user is building a digital storage system for a personal media library. The collection includes:
- a. 500 HD movies, each of 5 GB
 - b. 1,000 songs, each of 8 MB
 - c. 2,000 photos, each of 3 MB

Answer the following:

- a) Calculate the total storage needed for:
 - i) All movies in gigabytes (GB) and then convert to terabytes (TB)
 - ii) All songs in megabytes (MB) and convert to gigabytes (GB)
 - iii) All photos in megabytes (MB) and convert to gigabytes (GB)
- b) What is the total storage required for the entire media library in gigabytes and terabytes?
