AR 22

GIET UNIVERSITY, GUNUPUR

B. Tech III Semester Question Bank

21BCSES23001/21BCMES23001/21BCDES23001 - Digital Electronics

CSE / CSE (AIML) / CSE (DS)

UNIT - 1

PART - A (2 Marks)

	Short Answer Questions.	CO #	Blooms Level
1.	Convert $(712)_8$ to binary, hexadecimal, and decimal.	CO1	2
2.	Convert the fractional binary number $(11101.0101)_2$ to octal and hexadecimal.	CO1	2
3.	Given that $(16)_{10} = (100)_b$, find the value of b.	CO1	1
4.	Find the radix of the number system where 24 + 17 = 40.	CO1	1
5.	Convert $(597)_{10}$ to BCD code.	CO1	2
6.	Which is called a self-complimenting code and why?	CO1	1
7.	What is Gray code? Convert $(100110101)_2$ into Gray code.	CO1	2
8.	State DeMorgan's theorem.	CO1	1
9.	Prove the Distributive law of Boolean algebra.	CO1	1
10.	Draw the truth table of 3-input universal logic gates.	CO1	1
11.	Draw the truth table and output expression of the 3-input exclusive-OR gate.	CO1	1
12.	Find the complement of $F = X + YZ$; then find the values of $F.\overline{F}$ and $F + \overline{F}$.	CO1	1
13.	Find the complement and dual of the Boolean function: $F = X(Y'Z' + YZ)$	CO1	1
14.	Show that the dual of the exclusive-OR is equal to its complement.	CO1	1

PART - B (15 Marks)

	Long Answer Questions.	Marks	CO #	Blooms Level
1. a.	Carry out the following additions: (i) (+13, -11) using 1's complement notation. (ii) (-15, +9) using 2's complement notation.	8	CO1	3
b.	Simplify the following Boolean functions to a minimum number of literals. (i) $x(x' + y)$ (ii) $xy + x'z + yz$	7	CO1	3
2. a.	Add the two numbers (-12, +7) using both 1's and 2's complement method.	8	CO1	3
b.	Establish the following identities of Boolean algebra: (i) $A(A + B) = A$ (ii) $AB + \overline{A}C = (A + C)(\overline{A} + B)$	7	CO1	3
3. a.	Subtract 101011_2 from 111001_2 using 1's complement and 2's complement methods.	8	CO1	3
b.	Establish the following identities of Boolean algebra: (i) $A + AB = A$ (ii) $(A + B)(A + C) = A + BC$	7	CO1	3
4. a.	Apply DeMorgan's theorem to prove that $\overline{A\overline{B} + \overline{C}D + EF} = (\overline{A} + B)(C + \overline{D})(\overline{E} + \overline{F})$	8	CO2	3

Draw the corresponding logic circuit.

b.	In a tabular form, write the "2421" code and "Excess-3" code of decimal digit "0 to 9". What are the special properties of these codes?	7	CO1	2
5. a.	Implement the following function: (i) $F = A(B + CD) + BC'$ using NAND gates (ii) $F = (A + B)(C + D)E$ using NOR gates	8	CO2	3
b.	Convert the decimal number 347.625 to a single-precision floating-point binary number.	7	CO1	2
6. a.	Construct logic circuit using AND, OR, and NOT gate for the following Boolean function: (i) $Y = (A + B)(A' + B')$ (ii) $Y = (A + B)(C' + D')(A' + C)$	8	CO2	3
b.	Find out the floating point number from the following representation. 1 1000 0001 011 0000 0000 0000 0000 0000	7	CO1	3
7. a.	Show the realization of all logic gates using universal logic gates.	8	CO2	3
b.	Express -3.75 as a floating point number using IEEE single precision.	7	CO1	2

UNIT - 2

PART - A (2 Marks)

Short Answer Questions.

		CO #	Blooms Level
1.	Draw the truth table for the Boolean function: $F = A + BC$	CO1	1
2.	For the Boolean function $G(A, B, C) = \Pi(1, 3, 5, 7)$ write the truth table of this function.	CO2	1
3.	Convert the following expression into a canonical sum of products. $Y = AB + BC + AC$	CO2	2
4.	Convert the following expression into a standard product of sums. $Y = A(A + B + C)$	CO2	2
5.	Consider the function $f(x, y, z) = \sum(2, 3, 4, 6, 7)$. Derive the canonical sum of products for the function using minterm.	CO2	2
6.	Convert the following function into a sum of products. $Y = (B + D)(A^{'} + B^{'} + C)$	CO2	2
7.	Design Exclusive OR gate using only NAND gates.	CO2	2
8.	What do you mean by "prime implicants" in a Karnaugh map? Under what condition a min-term in a square is said to be essential?	CO2	1
9.	Draw the 4-bit Binary Parallel Adder/Ripple Carry Adder circuit.	CO2	2
10.	Design a combinational circuit that compares two 4-bit numbers *A* and *B* to check if they are equal. The circuit has one output *Y*, so that *Y* = '1' if *A* = *B* and *Y* = '0' if *A* ≠ *B*.	CO2	2
11.	Distinguish between decoder, encoder, and multiplexer in digital circuits.	CO2	2
12.	What is meant by priority encoder? How is it different from an encoder?	CO2	1

PART - B (15 Marks)

Long Answer Questions.

		Marks	CO #	Blooms Level
1. a.	Simplify the following Boolean function using a four-variable K-map: $F(A, B, C, D) = \sum(0, 1, 3, 4, 5, 7, 9, 11, 15)$	10	CO2	3

	and then, realize the simplified functions using logic gates.			
b.	Reduce the Boolean expression $A + B[AC + (B + \overline{C})D]$	5	CO1	3
2. a.	Simplify the following Boolean function using a four-variable K-map: $F(A, B, C, D) = \sum (4, 5, 6, 7, 12, 13, 14)$ and then, realize the simplified functions using logic gates.	10	CO2	3
b.	Reduce the Boolean expression $A\left[B + \overline{C}\left(\overline{AB + A\overline{C}}\right)\right]$	5	CO1	3
3. a.	Simplify the following Boolean function using K-map: $F(A, B, C, D) = \sum(4, 5, 6, 7, 12, 13, 14)$ and then, write the simplified function in SoP and PoS form.	10	CO2	3
b.	Express the Boolean function as a sum of minterms: $F = A + B'C$ Now, convert the sum of minterms to another canonical form.	5	CO2	3
4. a.	Simplify the following function using a 4-variable K-map and draw the simplified logic circuit using the universal gate. $F(A, B, C, D) = \sum m(1, 3, 4, 5, 8, 10, 11, 15) + \sum d(0, 2, 7, 14)$	10	CO2	3
b.	Express the Boolean function $f = xy + x'z$ in a product of maxterms.	5	CO2	3
5. a.	What is a full adder circuit? Draw its truth table. Design a full adder circuit using two half adder circuits and an 'OR' gate.	10	CO2	3
b.	Implement the following Boolean function with a multiplexer. $F(A, B, C, D) = \sum(1, 3, 4, 11, 12, 13, 14, 15)$	5	CO2	3
6. a.	Write the truth table and Boolean expression of a full adder. Draw its complete logic circuit.	10	CO2	3
b.	Implement the Boolean function $F(x, y, z) = \sum(1, 2, 6, 7)$ with a multiplexer.	5	CO2	3
7. a.	Draw the logic diagram of the full adder and full subtractor. Write its truth table and Boolean expression.	10	CO2	3
b.	Obtain the logic diagram for a 4-to-1-line multiplexer from its truth table. What will be the logic diagram for the corresponding 1-to-4-Iine de-multiplexer?	5	CO2	3

UNIT - 3

PART - A (2 Marks)

Short Answer Questions.	CO #	Blooms Level
1. Write the difference between a combinational circuit and a sequential circuit.	CO3	2
2. What do you mean by sequential circuit? Hence distinguish between synchronous sequential circuits and asynchronous sequential circuits.	CO3	2
3. State the difference between "latch" and "flip-flop".	CO3	2
4. Draw the logic diagram of *SR* latch using NOR gates.	CO3	2
5. Write the truth table of *SR* flip-flop and *JK* flip-flop.	CO3	1
6. Write a characteristic equation and excitation table for the *D* flip-flop.	CO3	1
7. Write a characteristic equation and excitation table for the *T* flip-flop.	CO3	1
8. Explain the use of preset and clear inputs in a flip-flop.	CO3	1
9. What is a race-around condition? How it is avoided?	CO3	1
10. Explain the difference between a state table, a characteristic table, and an excitation table.	CO3	1

PART - B (15 Marks)

Long Answer Questions.

		Marks	CO #	Blooms Level
1. a.	Draw the circuit diagram of a 2-bit by 2-bit binary multiplier using half-adders and logic gates. Explain its operation.	8	CO2	3
b.	What is an encoder? Design octal-to-binary encoder.	7	CO2	3
2. a.	Design a combinational circuit that will convert a 4-bit binary number to a 4-bit Gray code.	8	CO2	3
b.	Construct a 4-to-16-line decoder with two 3-to-8-line decoders with enable.	7	CO2	3
3. a.	A magnitude comparator is a combinational circuit that compares two numbers *A* and *B*, and determines their relative magnitudes. The outcome of the comparison is specified by three binary variables that indicate whether $A > B$, $A = B$ or $A < B$. Determine the algorithm to implement this comparator and draw a 2-bit magnitude comparator using the combinational circuit.	8	CO2	3
b.	Construct the 3×8 decoder using 2×4 decoders.	7	CO2	3
4. a.	What is the race-around condition? How is it eliminated in a master-slave *JK* flip-flop?	8	CO3	2
b.	Explain how a *J-K* can be constructed using *D* flip-flop.	7	CO3	3
5. a.	Describe the construction and operation of a master-slave flip-flop.	8	CO3	3
b.	A *PN* flip-flop has four operations: no change, clear to '0', set '1', and complement; when inputs *P* and *N* are 00, 01, 10, and 11 respectively. Write the excitation table and characteristics equation of the *PN* flip-flop and realize the flip-flop using logic gates.	7	CO3	3
6. a.	What is a master-slave *JK* flip-flop? Why it is needed? Explain its operation.	8	CO3	2
b.	With a neat logic diagram explain how a *T* flip-flop can be converted to a *D* flip-flop.	7	CO3	3
7. a.	A *PN* flip-flop has four operations: clear to 0, no change, complement, and set to 1, when inputs *P* and *N* are 00, 01, 10, and 11, respectively. (i) Tabulate the characteristic table. (ii) Derive the characteristic equation. (iii) Tabulate the excitation table. (iv) Show how the *PN* flip-flop can be converted to a *D* flip-flop.	8	CO3	3
b.	Convert *D* flip-flop to *JK* flip-flop.	7	CO3	3

UNIT - 4

PART - A (2 Marks)

Short Answer Questions.

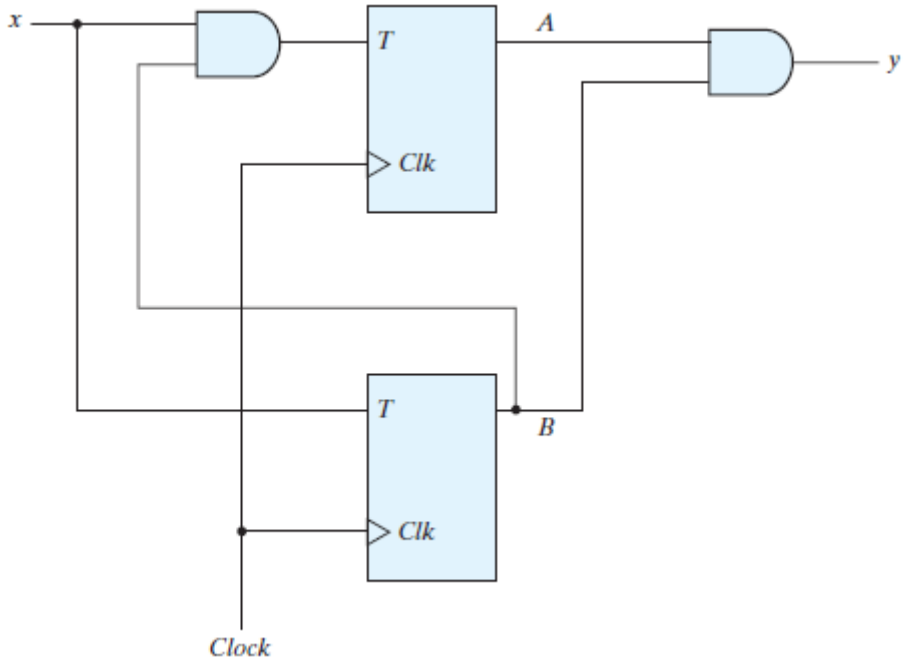
		CO #	Blooms Level
1.	What is the difference between Mealy and Moore models?	CO3	2
2.	How many clock pulses are required to shift eight bits of data into and out of an eight-bit serial-in serial-out shift register?	CO3	2
3.	What is the basic difference between a counter and a shift register?	CO3	1
4.	Distinguish between synchronous and asynchronous counters.	CO3	2
5.	What is a binary counter? How many *D* flip-flops are required to design the MOD-9 counter?	CO3	2
6.	How many flip-flops are required to make a mod-32 binary counter?	CO3	2
7.	Draw the state diagram of a decade counter.	CO3	1

8.	What are the differences between RAM and ROM?	CO4	2
9.	Differentiate between static and dynamic RAM.	CO4	2
10.	How many 16K × 4 RAM chips are required to provide a memory capacity of 256K bytes?	CO4	3
11.	How many 16K × 1 RAMs are required to obtain a memory with a word capacity of 64K? The word length is eight bits.	CO4	3

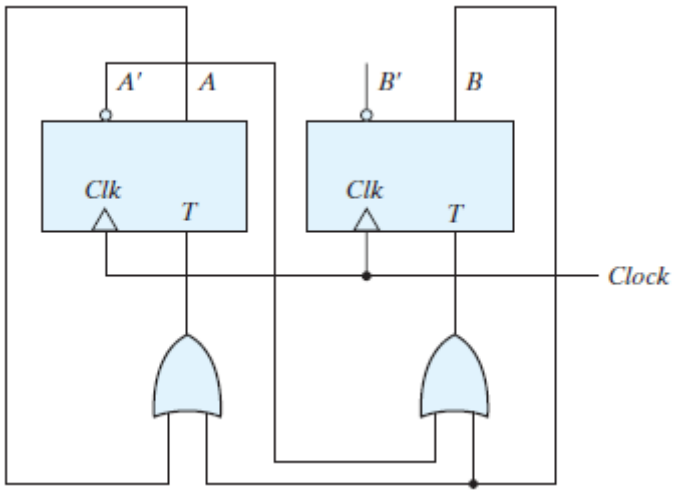
PART - B (15 Marks)

Long Answer Questions.

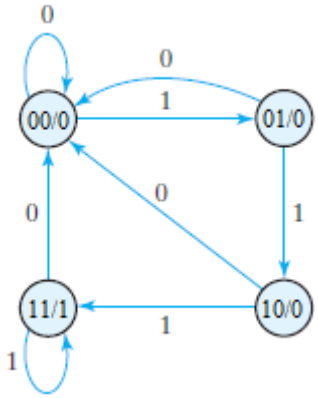
		Marks	CO #	Blooms Level
1. a.	Design a counter with the following repeated binary sequence: 0, 1, 2, 4, 6. Use *D* flip-flops.	10	CO3	3
b.	What is a shift register? Explain the principle of a 4-bit serial-in, parallel-out, shift register.	5	CO3	2
2. a.	Design a 3-bit synchronous binary counter.	10	CO3	3
b.	What is a shift register? Explain the principle of a 4-bit serial-in, serial-out, shift register.	5	CO3	2
3. a.	Design a synchronous counter for the following sequence using *T* flip-flops: 1, 3, 5, 6, 1, . . .	10	CO3	3
b.	What is a shift register? Explain the principle of a 4-bit parallel-in, parallel-out, shift register.	5	CO3	2
4. a.	Derive the state table and the state diagram of the sequential circuit shown in the figure.	10	CO3	3



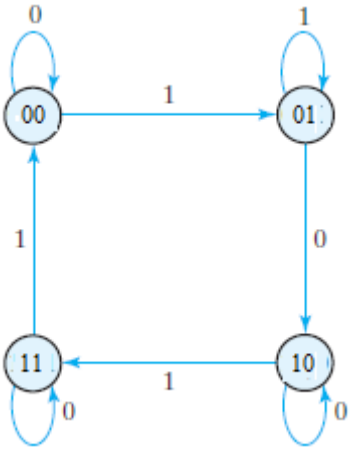
b.	How many 32K × 8 RAM chips are needed to provide a memory capacity of 256K bytes? How many lines of the address must be used to access 256K bytes? How many of these lines are connected to the address inputs of all chips? How many address lines must be decoded for the chip select input? Specify the size of the decoder.	5	CO4	3
5. a.	Derive the state table and the state diagram of the sequential circuit shown in the figure.	10	CO3	3



b.	Design a combinational circuit using a ROM. The circuit accepts a 3-bit binary number and generates an output binary number equal to the square of the input number.	5	CO4	3
6. a.	Design the sequential circuit specified by the state diagram of the figure using *D* flip-flops.	10	CO3	3



b.	A 3-input majority circuit produces the output as '1' when the number of 1's is more than the number of 0's at the input. Implement it using ROM.	5	CO4	3
7. a.	Design the sequential circuit specified by the state diagram of the figure using *JK* flip-flops.	10	CO3	3



b.	Design a combinational circuit using a ROM that accepts 3-input and produces its 1's complement as output.	5	CO4	3