

**GURU NANAK INSTITUTE OF TECHNOLOGY**  
**An Autonomous Institute under MAKAUT**  
**2021**  
**DIGITAL ELECTRONICS & CIRCUITS**  
**EC403**

TIME ALLOTTED: 3 HOURS

FULL MARKS: 70

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable***GROUP – A****(Multiple Choice Type Questions)**Answer any **ten** from the following, choosing the correct alternative of each question: **10×1=10**

|    |                                                                                                                                                                                                                                                       | <b>Marks</b> | <b>CO No</b> |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| 1. | (i) The Boolean expression for a 3-input AND gate is _____<br>a) $X = AB$<br>b) $X = ABC$<br>c) $X = A + B + C$<br>d) $X = AB + C$                                                                                                                    | 1            | CO1          |
|    | (ii) The output of a NOR gate is HIGH if _____.<br>a) all inputs are HIGH<br>b) any input is HIGH<br>c) any input is LOW<br>d) all inputs are LOW                                                                                                     | 1            | CO1          |
|    | (iii) When used with an IC, what does the term "QUAD" indicate?<br>a) 2 circuits<br>b) 4 circuits<br>c) 6 circuits<br>d) 8 circuits                                                                                                                   | 1            | CO1          |
|    | (iv) The NOR logic gate is the same as the operation of the _____ gate with an inverter connected to the output.<br>a) OR<br>b) AND<br>c) NAND<br>d) none of the above                                                                                | 1            | CO1          |
|    | (v) Which of the following expressions is in the sum-of-products form?<br>a) $(A + B)(C + D)$<br>b) $(AB)(CD)$<br>c) $AB(CD)$<br>d) $AB + CD$                                                                                                         | 1            | CO1          |
|    | (vi) A decoder can be used as a demultiplexer by _____.<br>a) tying all enable pins LOW<br>b) tying all data-select lines LOW<br>c) tying all data-select lines HIGH<br>d) using the input lines for data selection and an enable line for data input | 1            | CO2          |

|        |                                                                                                                                                                                                                              |   |     |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-----|
| (vii)  | How many data select lines are required for selecting eight inputs?<br>a) 1<br>b) 2<br>c) 3<br>d) 4                                                                                                                          | 1 | CO2 |
| (viii) | If both inputs of an S-R flip-flop are low, what will happen when the clock goes HIGH?<br>a) An invalid state will exist<br>b) No change will occur in the output<br>c) The output will toggle.<br>d) The output will reset. | 1 | CO3 |
| (ix)   | If an input is activated by a signal transition, it is _____.<br>a) edge-triggered<br>b) toggle triggered<br>c) clock triggered<br>d) noise triggered                                                                        | 1 | CO3 |
| (x)    | Which is not characteristic of a shift register?<br>a) Serial in/parallel in<br>b) Serial in/parallel out<br>c) Parallel in/serial out<br>d) Parallel in/parallel out                                                        | 1 | CO3 |
| (xi)   | A Flip-Flop can Store _____ of information.<br>a) 4 bit<br>b) 1 byte<br>c) 1 bit<br>d) 8 bit                                                                                                                                 | 1 | CO3 |
| (xii)  | A MOD 8 asynchronous counter needs _____ no of flip flops<br>a) 2<br>b) 3<br>c) 4<br>d) 5                                                                                                                                    | 1 | CO3 |

**GROUP – B****(Short Answer Type Questions)**Answer any **three** from the following: 3×5=15

|    |                                                                                                                                                                 | <b>Marks</b> | <b>CO No</b> |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| 2. | Implement the following function using 8:1 MUX:<br>$F(A,B,C,D) = \sum m(0,2,4,8,9)$                                                                             | 5            | CO2          |
| 3. | (a) What is the difference between Half Adder and Full Adder?                                                                                                   | 1            | CO2          |
|    | (b) Design a Full Adder circuit using 2 half adder.                                                                                                             | 4            | CO2          |
| 4. | Simplify the following function using Karnaugh map and realize the expression using basic logic gates:<br>$F(A,B,C,D) = \sum m(2,4,5,13,14) + \sum d(0,1,8,10)$ | 5            | CO2          |
| 5. | Draw and explain the operation of a Master Slave flipflop.                                                                                                      | 5            | CO3          |
| 6. | Describe Successive approximation ADC.                                                                                                                          | 5            | CO4          |

## GROUP – C

## (Long Answer Type Questions)

Answer any **three** from the following: 3×15=45

|     |                                                                                                                                                                                                                                        | Marks  | CO No |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|
| 7.  | (a) Convert binary to decimal –<br>(1011.101) <sub>2</sub> = (?) <sub>10</sub><br>Convert decimal to octal-<br>(19.11) <sub>10</sub> = (?) <sub>8</sub><br>Convert hexadecimal to decimal<br>(81.21) <sub>16</sub> = (?) <sub>10</sub> | 6      | CO1   |
|     | (b) Simplify the expression using Boolean algebra<br>$\bar{A}B + AB + \bar{A}\bar{B}$                                                                                                                                                  | 4      | CO1   |
|     | (c) Simplify the following expression using K Map for the 4 variables A, B, C, and D.<br>$Y = m_1 + m_3 + m_5 + m_7 + m_8 + m_9 + m_{12} + m_{13}$                                                                                     | 5      | CO1   |
| 8.  | (a) Explain De-Morgan's laws for simplification of Boolean expression                                                                                                                                                                  | 2      | CO1   |
|     | (b) If $A\bar{B} + \bar{A}B = C$ , show that $A\bar{C} + \bar{A}C = B$                                                                                                                                                                 | 4      | CO1   |
|     | (c) Simplify the Boolean function using K Map<br>$F(A,B,C,D) = \sum m(1,3,7,11,15) + \sum d(0,2,5)$                                                                                                                                    | 5      | CO1   |
|     | (d) Design a 8 X 1 Multiplexer using two 4 X 1 Multiplexer and a basic logic gate.                                                                                                                                                     | 4      | CO2   |
| 9.  | (a) What is a decoder circuit?<br>Construct a 5x32 decoder with four 3x8 decoders and a 2x4 decoder, show the block diagram only.                                                                                                      | 6      | CO2   |
|     | (b) Why De Multiplexer is also known as Data Distributor?<br>Implement the following Boolean function<br>$F(A,B,C,D) = \sum (0,1,3,4,8,9,15)$ using a 8 : 1 Multiplexer                                                                | 6      | CO2   |
|     | (c) Draw and explain the State diagram for S-R flip flop                                                                                                                                                                               | 3      | CO3   |
| 10. | (a) What is shift register?<br>Mention the types of different shift registers.                                                                                                                                                         | 3      | CO3   |
|     | (b) Draw and explain a Serial In- Parallel Out (SIPO) left shift register.                                                                                                                                                             | 5      | CO3   |
|     | (c) Why asynchronous Counters are also known as Ripple Counters?<br>Design a three-bit asynchronous binary up counter.                                                                                                                 | 7      | CO3   |
| 11. | Write short notes on any three of the following                                                                                                                                                                                        | 3X5=15 |       |
|     | (a) Parity Generator and Checker                                                                                                                                                                                                       | 5      | CO2   |
|     | (b) Controlled Inverter                                                                                                                                                                                                                | 5      | CO2   |
|     | (c) Excitation table for J-K flip flop                                                                                                                                                                                                 | 5      | CO3   |
|     | (d) R-2R Digital-to-Analogue Converter                                                                                                                                                                                                 | 5      | CO4   |
|     | (e) Ring Counter.                                                                                                                                                                                                                      | 5      | CO3   |