# GURU NANAK INSTITUTE OF TECHNOLOGY
## An Autonomous Institute under MAKAUT
## 2021
## DIGITAL ELECTRONICS & CIRCUITS (Backlog)
## 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**

| | | | Marks | CO No |
|---|---|---|---|---|
| 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**

| | | | **Marks** | **CO No** |
|---|---|---|---|---|
| 2. | | Implement the following function using 8:1 MUX: $F(A,B,C,D) = \sum m(0,2,4,8,9)$ | 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 – $(1011.101)\ 2=(?)_{10}$<br>Convert decimal to octal- $(19.11)10 = (?)_8$<br>Convert hexadecimal to decimal $(81.21)\ 16 =(?)_{10}$ | 6 | CO1 |
| | (b) | Simplify the expression using Boolean algebra $\bar{A}B+AB+\bar{A}\bar{B}$ | 4 | CO1 |
| | (c) | Simplify the following expression using K Map for the 4 variables A, B, C, and D.<br>Y=m1+m3+m5+m7+m8+m9+m12+m13 | 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 |