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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA  
(An Autonomous Institute Affiliated to AKTU, Lucknow)  
B.Tech.

SEM: III - CARRY OVER THEORY EXAMINATION - JUNE (2021 - 2022)

Subject: Digital Logic & Circuit Design

Time: 3 Hours

Max. Marks: 100

**General Instructions:**

1. The question paper comprises three sections, A, B, and C. You are expected to answer them as directed.
2. Section A - Question No- 1 is 1 marker & Question No- 2 carries 2 mark each.
3. Section B - Question No-3 is based on external choice carrying 6 marks each.
4. Section C - Questions No. 4-8 are within unit choice questions carrying 10 marks each.
5. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

**SECTION A**

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1. Attempt all parts:-

- |      |                                                                         |   |
|------|-------------------------------------------------------------------------|---|
| 1-a. | The Gray code is called unit distance code. (CO1)                       | 1 |
|      | (a) TRUE                                                                |   |
|      | (b) FALSE                                                               |   |
| 1-b. | Hamming code is capable of (CO1)                                        | 1 |
|      | (a) Only detect single-bit error                                        |   |
|      | (b) Only correct single-bit error                                       |   |
|      | (c) Detect and correct single bit error                                 |   |
|      | (d) Detect and correct multiple bit errors                              |   |
| 1-c. | A half adder circuit has two inputs and (CO2)                           | 1 |
|      | (a) one output                                                          |   |
|      | (b) two output                                                          |   |
|      | (c) three output                                                        |   |
|      | (d) none of these                                                       |   |
| 1-d. | How many basic binary subtraction operations are possible? (CO2)        | 1 |
|      | (a) 2                                                                   |   |
|      | (b) 3                                                                   |   |
|      | (c) 1                                                                   |   |
|      | (d) 4                                                                   |   |
| 1-e. | What is one disadvantage of an S-R flip-flop? (CO3)                     | 1 |
|      | (a) It has no Enable input                                              |   |
|      | (b) It has a RACE condition                                             |   |
|      | (c) It has no clock input                                               |   |
|      | (d) Invalid State                                                       |   |
| 1-f. | The basic latch consists of _____ (CO3)                                 | 1 |
|      | (a) Two inverters                                                       |   |
|      | (b) Two comparators                                                     |   |
|      | (c) Two amplifiers                                                      |   |
|      | (d) Two adders                                                          |   |
| 1-g. | How many different states does a 3-bit asynchronous counter have? (CO4) | 1 |
|      | (a) 2                                                                   |   |
|      | (b) 4                                                                   |   |

|                                              |                                                                                                                                                                                           |    |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                                              | (c) 8                                                                                                                                                                                     |    |
|                                              | (d) 16                                                                                                                                                                                    |    |
| 1-h.                                         | How many types of resets are there in hardware design? (CO4)                                                                                                                              | 1  |
|                                              | (a) One                                                                                                                                                                                   |    |
|                                              | (b) Two                                                                                                                                                                                   |    |
|                                              | (c) Three                                                                                                                                                                                 |    |
|                                              | (d) Four                                                                                                                                                                                  |    |
| 1-i.                                         | The full form of PROM is _____ (CO5)                                                                                                                                                      | 1  |
|                                              | (a) Previous Read Only Memory                                                                                                                                                             |    |
|                                              | (b) Programmable Read Out Memory                                                                                                                                                          |    |
|                                              | (c) Programmable Read Only Memory                                                                                                                                                         |    |
|                                              | (d) Previous Read Out Memory                                                                                                                                                              |    |
| 1-j.                                         | Which is a reprogrammable gate array _____ (CO5)                                                                                                                                          | 1  |
|                                              | (a) EPROM                                                                                                                                                                                 |    |
|                                              | (b) FPGA                                                                                                                                                                                  |    |
|                                              | (c) Both EPROM and FPGA                                                                                                                                                                   |    |
|                                              | (d) ROM                                                                                                                                                                                   |    |
| 2. Attempt all parts:-                       |                                                                                                                                                                                           |    |
| 2.a.                                         | Perform the Hexadecimal subtraction of F827-ABCD. (CO1)                                                                                                                                   | 2  |
| 2.b.                                         | Define Multiplexer. (CO2)                                                                                                                                                                 | 2  |
| 2.c.                                         | What is race around condition in J-K flip-flop. (CO3)                                                                                                                                     | 2  |
| 2.d.                                         | What is State Assignment? (CO4)                                                                                                                                                           | 2  |
| 2.e.                                         | Why dynamic RAM is more preferable than static RAM? (CO5)                                                                                                                                 | 2  |
| SECTION B                                    |                                                                                                                                                                                           | 30 |
| 3. Answer any <u>five</u> of the following:- |                                                                                                                                                                                           |    |
| 3-a.                                         | Construct the Hamming code for the 4 bit data 1010. Consider the even parity. (CO1)                                                                                                       | 6  |
| 3-b.                                         | Convert the Boolean expression (i) $Y = [(A+B'+C)'] \cdot (A'+B)'$ to its minterm form (ii) $Y = [(A'B') + (BC)]$ to its maxterm form. (CO1)                                              | 6  |
| 3-c.                                         | Implement the SUM and CARRY Boolean functions of full adder using multiplexers. (CO2)                                                                                                     | 6  |
| 3-d.                                         | Explain BCD Adder with proper logic circuit diagram. (CO2)                                                                                                                                | 6  |
| 3.e.                                         | Explain Universal Shift Register with proper logic diagram. (CO3)                                                                                                                         | 6  |
| 3.f.                                         | Define critical race and non-critical race. What is hazard? Also explain the elimination of hazard. (CO4)                                                                                 | 6  |
| 3.g.                                         | Differentiate and compare FPGA and CPLD. (CO5)                                                                                                                                            | 6  |
| SECTION C                                    |                                                                                                                                                                                           | 50 |
| 4. Answer any <u>one</u> of the following:-  |                                                                                                                                                                                           |    |
| 4-a.                                         | Minimize the four variable logic function and realize the simplified expression using NOR gates.<br>$f(A, B, C, D) = (A+B+C'+D')(A'+C+D')(A'+B+C'+D')(B'+C)(B'+C')(A+B')(B'+D')$<br>(CO1) | 10 |
| 4-b.                                         | Simplify the function $F = \sum m(1, 2, 3, 6, 7, 8, 10, 11, 12, 14, 17, 18, 20, 21, 22, 24, 28, 29, 31)$ using Quine Mc-Cluskey method. (CO1)                                             | 10 |
| 5. Answer any <u>one</u> of the following:-  |                                                                                                                                                                                           |    |
| 5-a.                                         | Design a 32-to-1 multiplexer using 8-to-1 multiplexer having active-LOW Enable input. (CO2)                                                                                               | 10 |
| 5-b.                                         | Design a combinational circuit that will compare two 4-bit numbers. (CO2)                                                                                                                 | 10 |

6. Answer any one of the following:-
- 6-a. Explain ring counter in detail. (CO3) 10
- 6-b. Explain the Master-Slave Flip-Flop. How it overcome the race condition of J-K flip-flop? Use proper logic diagram. (CO3) 10
7. Answer any one of the following:-
- 7-a. Describe the working of asynchronous decade counters. (CO4) 10
- 7-b. Design a sequence detector circuit to detect a serial input sequence of 1010. It should produce an output 1 when the input pattern has been detected. (CO4) 10
8. Answer any one of the following:-
- 8-a. Implement the following functions using PLA (CO5) 10
- i)  $A(x,y,z)=\sum m(1,2,4,6)$
- ii)  $B(x,y,z)=\sum m(0,1,6,7)$
- iii)  $C(x,y,z)=\sum m(2,6)$
- 8-b. Draw the basic circuit diagram of static RAM and explain its operation. (CO5) 10