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*National Institute of Technology, Hamirpur (HP)*  
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Name of Examination: B.Tech. & Dual Deg Dec. 2022

Branch: ECE

Course Name : Digital Electronics & Logic Design

Time: 3Hours

Note: All questions are compulsory.

Semester: 3<sup>rd</sup> semester

Course Code: EC-211

Maximum Marks: 50

Q.No. 1 (a) The solution to the quadratic equation  $x^2 - 11x + 22$  is  $x = 3$  and  $x = 6$ . What is the base of the number system?

(b) (i) Find the sixteen complement of AF3B.

(ii) Convert AF3B to binary.

(iii) Find the 2's complement of the result in (ii).

(iv) Convert the answer in (iii) to hexadecimal and compare with the answer in (i).

(c) Express the following in sum of min terms and product of max terms:

$$F(a,b,c,d) = b\bar{d} + \bar{a}d + \bar{b}d$$

(d) List all sixteen functions of two binary variables in tabular form showing detail of Boolean expression, operator symbol, function name and comments.

Q.No. 2 (a) Simplify  $F(a,b,c,d) = \sum m(1,3,5,7,15) + \sum d(4,6,12,13)$  by using Karnaugh-map and implement with minimum number of NAND gates.

(b) A majority circuit is a combinational circuit whose output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise. Design a 3-input majority circuit.

Q.No.3 (a) Design and explain magnitude comparator circuit which can compare two four bit binary numbers.

(b) Find the minimal function using Quine Mcklusky method:

$$F(a,b,c,d) = \sum m(0,1,2,3,4,7,9,14) + \sum d(13,15)$$

Q.No.4 (a) Design a 3-bit up- down synchronous counter circuit using j-k flip-flop.

(b) Draw and explain the logic circuit of Inverter, NAND and NOR gate using CMOS.

Q.No.5(a) Write short note on Multiplexer and Demultiplexer and hence realize the following function using one 8 : 1 multiplexer while connecting variable a , b and c to the select lines:

$$F(a,b,c,d) = \sum m(1,3,4,6,7,8,10,11,14,15)$$

(b) List the PLA programming table for the following two Boolean functions and implement in PLA:

$$F_1(a,b,c) = \sum m(1,2,4,6), \quad F_2(a,b,c) = \sum m(0,1,6,7)$$