

## Tutorial No. 5 for ECN-104

**Question 1:** A memory system has a total of 8 memory chip each with 12 address lines and 4 data lines. What will be the total size of the memory system?

**Question 2:** A combinational circuit is defined by the functions  $F1 = \sum (3, 5, 7)$ ,  $F1 = \sum (4, 5, 7)$ . Implement the circuit with a PLA having 3 inputs, 3 product terms and two outputs.

**Question 3:** A combinational logic is defined by the functions  $F1 = \sum m (3, 4, 5, 7, 10, 14, 15)$  and  $F1 = \sum (1, 5, 7, 11, 15)$ . Implement the circuit using a PLA with 4 inputs, 6 product terms and 2 outputs.

**Question 4:** Design a combinational circuit using a ROM that accepts a 3- bit number and generates an output binary number equal to the square of the given input number.

**Question 5:** Design the following Boolean function using PAL

- a)  $W(A, B, C, D) = \sum (2, 12, 13)$
- b)  $X(A, B, C, D) = \sum (7, 8, 9, 10, 11, 12, 13, 14, 15)$
- c)  $Y(A, B, C, D) = \sum (0, 2, 3, 4, 5, 6, 7, 8, 10, 11, 15)$
- d)  $Z(A, B, C, D) = \sum (1, 2, 8, 12, 13)$

**Question 6:** Implement the function  $F1 = \sum (0, 1, 2, 5, 7)$  and  $F2 = \sum (1, 2, 4, 6)$  using PROM.

**Question 7:** Implement a 2- bit multiplier using ROM.

**Question 8:** How many 128 x 8 RAM chips are needed to provide a memory capacity of 2048 bytes?

**Question 9:** A computer employs RAM chips of 256 x 8 and ROM chips of 1024 x 8. The computer system needs 2K bytes of RAM, 4K bytes of ROM. How many RAM and ROM chips are needed?

**Question 10:** A 32 – bit wide main memory unit with a capacity of 1 GB is built using 256M×4-bit DRAM chips. The number of rows of memory cells in the DRAM chip is  $2^{14}$ . The time taken to perform one refresh operation is 50 nanoseconds. The refresh period is 2 milliseconds. The percentage (rounded to the closest integer) of the time available for performing the memory read/write operations in the main memory unit is \_\_\_\_\_