a. Design of a counter circuit that will count binary 000 to 111.
b. Simplify the following Boolean function in (i) sum of products and (ii) product of sums.

$$F(A,B,C,D)=\Sigma(0,1,2,5,8,9,10)$$

c. Determine the prime implicants of the function: $F(w,x,y,z)=\Sigma(1,4,6,7,8,9,10,11,15)$
d. Design of a half subtractor circuit.

a. Design of a combinational circuit that will convert BCD into Excess-3 codes.
b. Design combinational circuit for odd parity generation and odd parity checker.
c. Design of a BCD adder circuit.
d. Design of a magnitude comparator circuit.
e. Implement the following function with a multiplexer: $F(A,B,C,D)=\Sigma(0,1,3,4,8,9,15)$
f. Define the following terms: Demultiplexers, Encoder, PLA
g. Draw switching circuits of two input NAND, NOR and AND operation.
e. Express the following function in a product of maxterm form. $F(w,x,y,z)=y'z+wxz'+w'x'z$

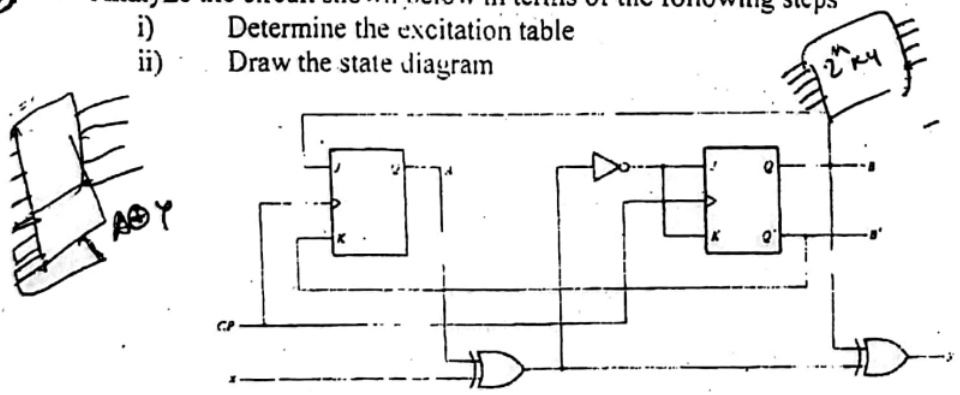
a. Define combinational logic circuit. Show that a full-subtractor can be constructed with two half-subtractors and an OR gate.
b. Design combinational circuit for even parity generation and even parity checker.
c. Implement the function $F=AB+CD+E$ using NAND gate only.
d. How can you determine the number of links in PLA?
e. Design of a 4 bit magnitude comparator circuit.
f. Implement a full adder circuit with a decoder and two OR gates.

a. A combinational circuit is defined by the following functions:

$F_1(A,B,C)=\Pi(0,1,3,5)$ $F_2(A,B,C)=\Sigma(0,3,4,5)$. Implement the circuit with a PLA.

BCD to excess-3 code converter using ROM.

a. Analyze the circuit shown below in terms of the following steps
   i) Determine the excitation table
   ii) Draw the state diagram



b. What do you mean by positive and negative logic? Show that a positive logic AND gate is equivalent to a negative logic OR gate?

a. What do you mean by ROM? Draw the logic construction of a 32×4 ROM. Also design a BCD to excess-3 code converter using ROM.

1	A	Design a BCD adder circuit.	
1	B	Implement the following function with a multiplexer: $F(P,Q,R,S)=\sum(0,2,5,6,8,12,14,15)$	
1	C	Design a combinational circuit using ROM which accepts a 3-bit binary number and generates an output binary number equal to the square of the input number.	
1	D	Write shot notes on Multiplexers.	
4	B		07
	I.	Design a full adder using half adder and necessary gates.	
	II.	Find the complement of the function $F_1=x'yz'+x'y'z$ and $F_2=x(y'z'+yz)$ applying De Morgan's theorem.	

a. Simplify the Boolean function $F=A'B'C'D+B'CD'+A'BCD'+AB'C'$ and implement the resultant using logic gates.

b. "An expression with the minimum number of literals is not necessarily unique"-Illustrate the significance of the above statement with appropriate example.

3. a. Design a BCD-to Excess-5 code converter. The inputs of BCD are A, B, C, D and outputs of excess-5 are w, x, y, z and use only basic gates for implementation. 4

b. Write down the differences between combinational and sequential circuit. Differentiate between synchronous and asynchronous counter. Which is easier to design? 5

c. Draw block diagram of BCD adder that is composed of two 4-bit binary adder and external gates. Explain how it manages the BCD addition. 5

4. a. Define decoder. Design a 3-input circuit that will output '1' when the majority of the inputs are 1. 4

b. Suppose you have some 2 to 4 line decoder. But you need 4 to16 line decoder. How can you built 4 to16 line decoder using your decoders? 5

c. Design a full-adder circuit with a decoder and two OR Gates. Functions for the sum and carry are as followings : 5

Sum: $S(x, y, z) = \sum(1,2,4,7)$

Carry: $C(x, y, z) = \sum(3,5,6,7)$

5. a. Implement the following boolean function using 4 to 1 multiplexer

$F = \sum(1,3,5,6)$

[4] a. Design of a 4 bit full adder circuit with look ahead carry.
b. Suppose P and Q are four digit number. Design of a magnitude comparator circuit which will compare P and Q.
c. Define the following terms: Demultiplexers, Encoder, PLA.

[5] a. Design a combinational circuit using a ROM. The circuit accepts a 3 bit number and generates an output binary number equal to the square of the input number.
b. Draw switching circuits of AND, OR and NOT operation.
c. What is duality principle? Prove $x(x+y)= x$ by duality.
d. Define combinational logic. Write down the design procedure of combinational circuit.
e. Obtain 1's complement and 2's complement of the following binary numbers: 1101011, 0111001, 0010001

[6] a. Simplify the following Boolean function in (i) sum of products and (ii) product of sums. $F(A,B,C,D)=\Sigma(0,1,2,5,8,9,10)$
b. Determine the prime implicants of the function: $F(w,x,y,z)=\Sigma(1,4,6,7,8,9,10,11,15)$
c. Express the Boolean function $F=AB+A'C$ in a product of maxterm form.
d. Define IC digital logic family. Classify digital IC gates according to logic operation. Write down some special characteristics of digital IC logic families. Also, give numerical value of each types.