



Section – A (General Questions)

1. Why are digital systems superior compared to the analog systems? Explain with examples.
2. For the function $F = AB'C' + AB$, find the logic value of F under the conditions:
(a) $A = 1, B = 0, C = 1$ (b) $A = 0, B = 1, C = 1$
3. Simplify the following expressions:
(a) $AB'C' + A'B'C' + A'BC' + A'B'C$
(b) $ABC + A'BC + AB'C + ABC' + AB'C' + A'BC' + A'B'C'$
(c) $A(A + B + C)(A' + B + C)(A + B' + C)(A + B + C')$
(d) $(A + B + C)(A + B' + C')(A + B + C'')(A + B' + C)$
4. Reduce the Boolean expressions given below:
(a) $A + A' + B + C$ (b) $AB + BB + C + B'$
(c) $ABC(ABC + 1)$ (d) $AB + B + A + C$
(e) $AAB + ABB + BCC$ (f) $A(A' + B)$
5. Find the complements of the following expressions:
(a) $A + BC + AB$ (b) $(A + B)(B + C)(A + C)$
(c) $AB + BC + CD$ (d) $AB(C'D + B'C)$
(e) $A(B + C)(C' + D')$
6. Apply DeMorgan's theorem to each of the following expressions:
(a) $(AB' + C + D)'$ (b) $[AB(CD + EF)]'$
(c) $(A + B' + C + D')' + (ABCD)'$ (d) $(AB + CD)'$
(e) $[(A' + B + C + D')' + (AB'CD)]'$ (f) $[(AB)'(CD + E'F)((AB)' + (CD'))']'$
7. Simplify the following Boolean expressions:
(a) $AB + A(B + C) + B(B + C)$ (b) $AB(C + BD')(AB)'$
(c) $A + AB + AB'C$ (d) $(A' + B)C + ABC$
(e) $AB'C(BD + CDE) + AC'$ (f) $BD + B(D + E) + D'(D + F)$
8. Prove the following using Boolean theorems:
(a) $(A + C)(A + D)(B + C)(B + D) = AB + CD$
(b) $(A' + B' + D')(A' + B + D')(B + C + D)(A + C')(A + C' + D) = A'C'D + ACD' + BC'D'$
9. (a) Design a logic circuit having two inputs A, B. The output will be high only if A is 1 and B is 1, or if A is 0 and B is 0.

10. (a) Convert $Y = ABCD + A'BC + B'C'$ into a sum of minterms.
(b) Convert $Y = AB + B'CD$ into a product of maxterms.

Section – B

11. Prove that $(X + Y) \oplus (X + Z) = X' (Y \oplus Z)$.
12. Realize the following function using a multilevel NAND-NAND network and NOR-NOR network:
$$F = A'B + B(C + D) + EF'(B' + D')$$
13. Seven switches operate a lamp in the following way; if switches 1, 3, 5, and 7 are closed and switch 2 is opened, or if switches 2, 4, and 6 are closed and switch 3 is opened, or if all seven switches are closed the lamp will glow. Use basic gates to show how the switches are to be connected.
14. A corporation having 100 shares entitles the owner of each share to cast one vote at the shareholders' meeting. Assume that A has 60 shares, B has 30 shares, C has 20 shares, and D has 10 shares. A two-third majority is required to pass a resolution in a share-holders' meeting. Each of these four men has a switch which he closes to vote YES and opens to vote NO for his percentage of shares. When the resolution passed, one output LED is ON. Derive a truth table for the output function and give the sum of product equation for it.
15. Explain in detail about:
- Alphanumeric, ASCII and EBCDIC codes
 - IC digital logic families: TTL, ECL, MOS, CMOS, I²L. (Provide the basic introduction and special properties only)