ANNA UNIVERSITY QUESTIONS

BOOLEAN ALGEBRA

PART A

1. Why binary number system is used in digital system? **(April 2003)**

2. Represent the following numbers in 2's complement form:

$+3, +25, -5, -11$ **(April 2003)**

3. Define the laws of Boolean Algebra. **(April 2003)**

4. If A and B are boolean variables check if $(A\cdot\overline{A})\oplus(A\oplus\overline{A})=(B+\overline{B})\oplus(\overline{B}\oplus B)$. **(April 2003)**

5. For a switching function of '*n*' variables, how many distinct minterms and maxterms are possible? **(April 2003)**

6. Find the octal equivalent of the decimal number 64. **(April 2003)**

7. Find the hexadecimal equivalent of the octal number 153.4. **(April 2003)**

8. Show that the excess-3 code is self complenting. **(April 2003)**

9. Convert $(2101)_3$ to base 5 number. **(Nov. 2003)**

10. Subtract the unsigned number $(10101)_2$ from $(11011)_2$ using one's complement and two's complement method. **(Nov. 2003)**

11. Define canonical form. Express $F=B\overline{C}+AC$ in a canonical SOP form. **(Nov. 2003)**

12. If A and B are Boolean variables and if A = 1 and A + B = 0, find B. **(Nov. 2003)**

13. Express the switching function $f_{(BA)}$ = A in terms of minterms. **(Nov. 2003)**

14. Determine the decimal equivalent of binary 0.1101. **(April 2004)**

15. How is the letter A coded as in the ASCII code? **(April 2004)**

16. Apply De Morgan's theorems to simplify $\overline{A+B\overline{C}}$. **(April 2004)**

17. Plot the expression on K-map: $F(w, x, y) = \sum (0, 1, 3, 5, 6) + d(2, 4)$ **(April 2004)**

18. Find the decimal equivalent of $(123)_9$. **(April 2004)**

19. Express x + yz as the sum of minterms. **(April 2004)**

20. Convert the decimal number 214 to hexadecimal. **(April 2004)**

21. Define the following: minterm and maxterm. **(April 2004)**

22. Find the binary representation of decimal 125. **(Nov. 2004)**

23. Complement the expression: $X\left(\overline{Y}+\overline{Z}\right)$. **(Nov. 2004)**

24. Find the octal equivalent of decimal 200. **(Nov. 2004)**

25. Determine the product of all 2n maxterms of 'n' variables. **(Nov. 2004)**

26. Add $(1A8)_{16}$ and $(67B)_{16}$. **(Nov. 2004)**

27. State two absorption properties of Boolean Algebra. **(Nov. 2004)**

28. Perform 2's complement subtraction of 010110 - 100101. **(Nov. 2004)**

29. What is the advantage of biquinary code? **(Nov. 2004)**

30. Convert $(FACE)_{16}$ to base 8 number. **(April 2005)**

31. Add the decimals 67 and 54 using 8421 BCD code. **(April 2005)**

32. Simplify the following Boolean expression: $\overline{a}\,\overline{b}\,\overline{c}+a\,\overline{b}\,c+a\,b\,c$. **(April 2005)**

33. What is prime implicant ? **(April 2005)**

34. Find the value of $X=\overline{A}BC\left(\overline{A+D}\right)$ if A = 0; B = 1, C = 1 and D = 1. **(April 2005)**

35. State De Morgan's laws. **(April 2005)**

36. Simplify: $A+AB+\overline{A}+B$. **(April 2005)**

37. Realise OR gate using NAND gate. **(Dec. 2005)**

38. Show that $A+\overline{A}\cdot B=A+B$ using the theorems of Boolean algebra. **(Dec. 2005)**

39. Convert the following numbers with the indicated bases to decimal $(4310)_5$ and $(198)_{12}$. **(Dec. 2005)**

40. What bit must be complemented to change an ASCII letter from capital to lowercase and vice versa? **(Dec. 2005)**

41. Simplify the following Boolean expressions to a minimum number of literals:

(a) $\left(X+Y\right)\left(X+\overline{Y}\right)$ (b) $XY+\overline{X}Z+YZ$ **(Dec. 2005)**

42. What are prime implicants? **(Dec. 2005)**

43. What is the number of bits in ASCII code? What is the need for ASCII code? **(Dec. 2005)**

44. Prove that $A+A'B=A+B$, using Boolean Algebra. **(Dec. 2005)**

45. Add -176 (decimal) to -204 (decimal); do the arithmetic in binary using 2's complement notation. **(Dec. 2005)**

46. Construct the truth table of $F=\left(A\oplus B\right)\oplus\left(C\oplus D\right)$. **(Dec. 2005)**

47. State a single rule, which can be used to form the complement of a Boolean expression in one step. **(Dec. 2005)**

48. Find the minterm expansion of f (a, b, c, d)= $a'(b'+d)+acd'$. **(Dec. 2005)**

49. Explain how parity can be used for error detection. **(Dec. 2005)**

50. Find the 2's complement and 1's complement of 101101. **(May 2006)**

51. Simplify $x_1 + x_1 x_2$. **(May 2006)**

52. Find the standard sum for the following function:

$$f = x_1x_2x_3 + x_1x_3x_4 + x_1x_2x_4.$$ **(May 2006)**

53. Convert 1110011 into hexadecimal through octal. **(May 2006)**

54. What is the feature of Gray code? **(May 2006)**

55. What is the range of values that can be represented using n-bit 2's complement form of representation? What is the corresponding range with n-bit 1's complement form? **(May 2006)**

56. Obtain the complement of $f = w\bar{x}y + x\bar{y}$ = wxz using De Morgan's theorem. **(May 2006)**

57. Convert the following number front one base to other

$(354.52)_6$=( ) 10

$(100)_{10}$ = ( ) 16 **(Dec. 2006)**

58. What are the different ways to represent a negative number? **(Dec. 2006)**

59. Convert the binary number 1011_2 to gray code. **(May 2007)**

60. Convert $(AF3.15)_{16}$ to base 10. **(May 2007)**

61. Plot the following function by using a K-map and determine its minterm and maxterm lists:

f = AB+BC' **(May 2007)**

62. Convert 1011101010_2 to octal and hexadecimal numbers. **(May 2007)**

63. What is the BCD equivalent for the Gray code 1110 ? **(May 2007)**

64. Expand the function F (A,B,C) = A+ B'C to standard SOP form. **(May 2007)**

65. Using K-map find minimum sum of products for the function $f(a,b,c) = \sum m(0,1,5,6,7)$ **(May 2007)**

66. What is the advantage of gray codes over the binary number sequence? **(May 2007)**

67. Simplify the following Boolean function:

(a) $x(x'+y)$

(b) $xy + x'z+yz$ **(May 2007)**

68. What are error detecting codes? **(Dec. 2007)**

69. Find the complements for the following functions.

(a) $F_1 = xy' + x'y$

(b) $F_2 = (xy + y'z + xz)x$ **(Dec. 2007)**

70. What are the drawbacks of K-map method? **(Dec. 2007)**

71. What is the largest binary number that can be expressed with 12 bit? What is the equivalent decimal and hexadecimal? **(Dec. 2008)**

72. Simplify $(x+y)(x+y')$ to a minimum number of literals. **(Dec. 2008)**

73. Find the minterm of $xy+yz+xy'z$. **(Dec. 2008)**

74. Simplify the following Boolean expression to a minimum number of literals:

$\overline{AB} + \overline{A}\,\overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,D + \overline{AB}\,C\,\overline{D}$ **(May 2009)**

75. Simplify the following Boolean function by Karnaugh map method:

$F(A,B,C,D) = \sum m(1,5,9,12,13,15)$ **(May 2009)**

76. Find the octal equivalent of hexa decimal number AB.CD. **(Dec 2010)**

77. State and prove the consensus theorem. **(Dec 2010)**

78. Represent the decimal numbers - 200 and 200 using 2's complement binary form.

(April 2011)

79. Perform the following code conversions? **(Dec 2011)**

$(1010.10)_{16} \longrightarrow (?)_2 \longrightarrow (?)_8 \longrightarrow (?)_{10}$

80. State the different ways for representing the signed binary numbers. **(Dec 2011)**

81. Write the application of gray code. **(May 2012)**

82. The solution to the quadratic equation $x^2 - 11x + 22 = 0$ is $x = 3$ and $x = 6$. What is the base of the numbers? **(May 2012)**

83. Find the complement and dual of F = x(y'z' + yz). **(Dec 2012)**

84. Convert $(101101.1101)_2$ to decimal and hexadecimal form. **(May 2013)**

85. What are the limitations of Karnaugh map? **(May 2013)**

PART B

1. **(i)** Specify the radix and the symbols used in (1) binary, (2) ternary, (3) quinary, (4) octal, (5) hexadecimal number system. **(4)**

(ii) Convert $(329.678)_{10}$ to an equivalent number in base 6 having a conversion error less than 0.001. **(4) (April 2003)**

2. Use Quine McClusky method to obtain the minimal sum for the following function:

$$F(X_1X_2X_3X_4) = \sum (0, 1, 3, 6, 7, 14, 15)$$ **(16) (April 2003)**

3. Simplify the function using Karnaugh map.

(i) $F(A, B, C, D) = \sum (0, 1, 2, 4, 5, 7, 11, 15)$

(ii) $F(W, X, Y, Z) = \sum (2,3, 10, 11, 12, 13, 14, 15)$ **(8) (April 2003)**

4. **(i)** Find a minimal sum of products representation for $f(A,B,C,D,E)= \sum m(1,4,6,10,20,22,24, 26) + \sum d(0, 11, 16,27)$ using Karnaugh map method. Draw the circuit of the minimal expression using only NAND gates. **(11)**

(ii) Prove that $(x_1 + x_2)\cdot(x_1 \cdot \bar{x}_3 + x_3)(\bar{x}_2 + x_1x)_3 = \bar{x}_1x_2$ **(5)(April 2003)**

5. Distinguish between Boolean addition and Binary addition. **(5) (April 2003)**

6. **(i)** Explain how you will construct an (n + 1) bit Gray code from an n bit Gray code.

(ii) Determine the MSP form of the switching function, **(16) (April 2003)**

$F = \sum (0, 1, 4, 5, 6, 11, 14, 15, 16, 17, 20, 21, 22, 30, 32, 33, 36, 37, 48, 49, 52, 53, 59, 63)$.

7. **(i)** State and prove DeMorgan's theorem and expand the function $F = [(A + B)C + \overline{C}D]$. **(5)**

(ii) Simplify the following switching function using Karnaugh map,

$F(A, B, C, D) = \sum (0, 5, 7, 8, 9, 10, 11, 14, 15) + \sum (1, 4, 13)$. **(11) (Nov. 2003)**

8. Simplify the five variable switching function:

$f(A, B, C, D, E) = \sum m (3, 5, 6, 8, 9, 12, 13, 14, 19, 22, 24, 25, 30)$ **(16) (Nov. 2003)**

9. **(i)** State and prove De Morgan's law. **(5)**

(ii) Explain the term prime implicants. **(5) (Nov. 2003)**

10. **(i)** Determine the decimal equivalent of the excess-3 number.

0110 1001 1100 0111 **(6)**

(ii) Explain how a 8 bit binary string can be converted to 9 bit number with odd parity using a single 74180. **(10) (April 2004)**

11. Using the K-map determine the MSP and MPS forces of the function,

$$\sum (0, 2, 6, 7, 8, 10, 12, 14, 15).$$ **(16) (April 2004)**

12. Simplify using K-map to obtain a minimal POS expression:

$$\left(A+\overline{B}+C+D\right)\left(A+\overline{B}+C+D\right)\left(A+B+C+\overline{D}\right)$$ **(8) (April 2004)**

13. Simplify using tabulation method: F(w, x, y , z) = $\sum$ (1,4,6,7,8,9,10,11,15) **(April 2004)**

14. Find the MSP form of F(wxyz) = $\sum$ (1-3, 5-10, 12 - 14) using the Quine-McCluskey technique. **(16) (April 2004)**

15. Simplify the following Boolean function by using the tabulation method.

$$F = \sum (0, 1, 2, 8, 10, 11, 14, 15)$$ **(16) (April 2004)**

16. State and prove the postulates of Boolean expression. **(16) (April 2004)**

17. Perform the following arithmetic using $\overline{9}_s$ arithmetic. Compare them.

(i) 835 - 274, (ii) 429 - 476 using BCD and Excess 3 codes. **(16) (Nov. 2004)**

18. What are codes? Explain the different codes with examples. **(16) (Nov. 2004)**

19. Simplify the following function using K-map and tabular methods. Compare the methods.

F(A, B, C, D) = $\sum$ (4, 5, 6, 7, 8) ; d(A, B, C, D) = $\sum$ m (11, 12, 13, 14, 15)

Implement using NAND gates. **(16) (Nov. 2004)**

20. **(i)** Find the MSP form using a Karnaugh map.

$$F = \sum (0, 1, 6, 7, 9, 13\text{-}17, 32, 33, 38, 39, 46\text{-}49, 57, 61)$$ **(12)**

(ii) What are the advantages of tabular methods over the Karnaugh map? **(4) (Nov. 2004)**

21. **(i)** Express $x + yz$ as the product of maxterms. **(6)**

(ii) Minimize the switching function: $F(x_1\, x_2\, x_3\, x_4) = \sum (1, 4, 5, 7, 13) + \sum f (0, 6, 14 , 15)$ on a 4 variable Karnaugh map. **(10) (Nov. 2004)**

22. Convert $(1010111.101)_2$ to octal and hexadecimal. **(4) (April 2005)**

23. **(i)** Express the function f(x, y, z) = $XY + X\overline{Z}$ as a product of sum terms form. **(4)**

(ii) Express the following function as the minimal sum of products, using a K-map.

$$f(a, b, c, d) = \sum (0, 2, 4, 5, 6, 8, 10, 15) + \sum f (7, 13, 14).$$ **(12) (April 2005)**

24. **(i)** Simplify the following using the Quine-McClusky minimisation technique.

$$D = f (a, b, c, d) = \sum (0, 1, 2, 3, 6, 7, 8, 9, 14, 15) \}$$

Does Quine McClusky take care of don't care conditions? In the above problem, will you

consider any don't care conditions? Justify your answer **(8)**

(ii) List also the prime implicants and essential prime implicants for the above case. **(8) (April '05)**

25. $F_3 = f(a, b, c) = \sum (2, 4, 5, 6)$, $F_2 = f(a, b, c) = \sum (2, 3, 6, 7)$, $F_1 = f(a, b, c) = \sum (2, 5, 6, 7)$

Implement the above Boolean functions: (1) When each is treated separately and (2) When sharing common term. **(12) (April 2005)**

26. Minimize the following using Karnaugh map. Implement the resultant function using NOR gates only $f(A, B, C, D, E) = \sum m(2, 4, 7, 9, 26, 28, 29, 31)$ **(12) (April 2005)**

27. **(i)** Simplify the following function using tabulation procedure. Implement the reduced function using NAND gates only.

$$f = \sum m(0, 1, 3, 5, 6, 9, 11, 14, 21, 23, 24, 31) + \sum d(25, 30).$$ **(12)**

(ii) Define maxterms and minterms. Give examples. **(4) (April 2005)**

28. Simplify the following Boolean function using tabulation method

$$F(A, B, C, D) = \sum m(0, 2, 3, 6, 7, 8, 10, 12, 13)$$ **(16) (Dec. 2005)**

29. **(i)** Perform each of the following computations using signed, 8 bit words in 1's complement and 2's complement binary arithmetic: **(10)**

(1) $(+95)_{10} + (-63)_{10}$ (2) $(+42)_{10} + (-87)_{10}$

(3) $(-13)_{10} + (-59)_{10}$ (4) $(+38)_{10} + (-38)_{10}$ (5) $(-105)_{10} + (-120)_{10}$.

(ii) Design a parity circuit that will assign a parity bit to the 8421 BCD code in an odd parity system. **(6) (Dec. 2005)**

30. **(i)** Simplify the following Boolean function in (1) Sum of products and (2)Product of sums.

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

(ii) Plot the following Boolean function on a Karnaugh map and simplify it.

$$F(w, x, y, z) = \sum (0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$$ **(6) (Dec. 2005)**

31. Determine the prime implicants of the given function using Tabulation method.

$$F(w, x, y, z) = \sum (1, 4, 6, 7, 8, 9, 10, 11, 15).$$ **(10) (Dec. 2005)**

32. What is biquinary code? Where is it used? Tabulate the code for decimal numbers 0 to 9. **(8) (Dec. 2005)**

33.(i) Illustrate the following codes with an example: Binary, BCD, 2421, Gray and Excess 3. **(5)**

(ii) Consider decimal number 14 and write the equivalent for this in all the above. **(5)**

(iii) Write a note on ASCII code. **(6) (Dec. 2005)**

34. Reduce the following switching function using tabulation method:

$$\sum m(1, 3, 4, 7, 8, 10, 11, 13, 15)$$ **(8) (Dec. 2005)**

35. Reduce the following switching functions using Karnaugh map:

(i) $\sum m(0, 1, 2, 6, 7, 9, 12, 28, 29, 31)$ **(8)**

(ii) $PM(2, 3, 7, 9, 11, 12)$ **(8) (Dec. 2005)**

36. Simplify the following function using tabulation method:

$$f(a, b, c, d) = \sum m(1, 2, 3, 5, 9, 12, 14, 15) + \sum d(4, 8, 11)$$ **(12) (Dec. 2005)**

37. Find the reduced POS form of the following equation

$$f(a, b, c, d) = \sum m(1, 3, 7, 11, 15) + d(0, 2, 5).$$

Implement using NAND logic. **(8) (Dec. 2005)**

38. (i) Prove the De Morgan's laws using Boolean algebra. **(8)**

(ii) Find the minimal sum of product form for the following switching function:

$$f(x_1, x_2, x_3, x_4, x_5) = \sum m(2, 3, 6, 7, 11, 12, 13, 14, 15, 23, 28, 29, 30, 31)$$ **(8) (May 2006)**

39. (i) Simplify the following Boolean expression: $(x_1 + x_2)(x_1x_3' + x_3)(x_2' + x_1x_3)'$ **(6)**

(ii) Find the minimal sum-of-product expression for the following switching function:

$$f(x_1, x_2, x_3, x_4, x_5) = \sum m(1, 2, 3, 6, 8, 9, 14, 17, 24, 25, 26, 27, 30, 31) + \sum d(4, 5)$$

(10) (May 2006)

40. (i) Prove by perfect induction:

(1) $A + AB = A$ (2) $A(A + B) = A$

(3) $A + \overline{A}B = A + B$ and (4) $A(\overline{A} + B) = AB$. **(12)**

(ii) Reduce the following function using K map: $f = AB\overline{C} + \overline{A}\,\overline{B}C + ABC + A\overline{B}C$ and realize using NAND gates only. **(8) (May 2006)**

41. (i) Simplify the Boolean function $F = \sum m(0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$

using Karnaugh map and obtain the minimum SOP form(s). **(8)**

(ii) Illustrate the rules for binary addition and subtraction using 2's complement arithmetic. Give examples. **(8) (May 2006)**

42. What is advantage of using Tabulation method? Determine the prime implications of the following function using Tabulation method.

$$F(w,x,y,z) = \sum(1,4,6,7,8,9,10,11,15)$$ **(16) (Dec. 2006)**

43. (i) Explain about common postulates used to formulate various algebraic structures. **(12) (Dec. 2006)**

(ii) Given the following Boolean function.

$F = A'C+A'B+AB'C+BC$

Explain it in sum of minterms and find the minimal SOP expression **(4) (Dec. 2006)**

44. Find the minimum sum of products expression using K-map for the function F=£m (7,9,10,11,12,13,14,15) and realize the minimized function using only NAND gates.**(16)(May '07)**

45. Simplify using Quine-McClusky method F = $\sum$ m(0,1,2,3,10,11,12,13,14,15). **(16) (May 2007)**

46. **(i)** Convert 0.95 decimal number to its binary equivalent. **(6)**

(ii) Perform $(756)_8 - (637)_8 + (725)_{16}$. Express the answer in octal form. **(10) (May 2007)**

47. **(i)** Perform the addition in excess-3 code 16 + 29. **(6)**

(ii) Write short notes on error detection and error correction codes. **(10) (May 2007)**

48. Find the minimum sum of product function using Quine-McClusky method

f(a,b,c,d) = $\sum$ (0,3,4,6,11) + $\sum$ d (0,8,10,12,13) **(16) (May 2007)**

49. Using Tabulation method simplify the Boolean function

$F(w,x,y,z) = \sum(1,2,3,5,9,12,14,15)$ which has the don't care conditions $d(4,8,11)$. **(16) (May 2007)**

50. Reduce the Boolean function using K-map technique and implement using gates $F(w,x,y,z) = \sum(0,1,4,8,9,10)$ which has the don't care conditions $d(w,z,y,z) = \sum(2,11)$. **(16) (May 2007)**

51. Using Tabulations method simplify the Boolean function.

$F(w,x,y,z) = \sum(2,3,4,6,7,11,12,13,14)$ which has the don't care conditions $d(1,5,15)$. **(16) (Dec. 2007)**

52. Simplify the Boolean function using Variable Entered Mapping method and implement using gates.

$F(w,x,y,z) = \sum(0,2,4,6,8,10,12,14)$. **(16) (Dec. 2007)**

53. Find the prime implicants for the following function and determine which are essential.

$F(w,x,y,z) = \sum(0,2,4,5,6,7,8,10,13,15)$ **(10) (Dec. 2008)**

54. Simplify the following Boolean function F together with don't care condition using Karnaugh map method.

(i) $F(A,B,C,D) = \sum m(0,6,8,13,14)$, $d(A,B,C,D) = \sum m(2,4,10)$ **(6)**

(ii) $F\,(A,B,C,D) = \sum m(0,2,4,5,8,14,15)$, $d\,(A,B,C,D) = \sum m(7,10,13)$ **(5)**

(iii) $F\,(A,B,C,D) = \sum m(4,6,7,8,12,15)$, $d\,(A,B,C,D) = \sum m(2,3,5,10,11,14)$ **(5)**

(May 2009)

55. Simplify the following Boolean expressions to a minimum number of literals.

(i) $ABC + AB\overline{C} + \overline{A}\,B$ **(3)**

(ii) $\overline{A}BC + AC + \overline{B}$ **(3)**

(iii) $\left(\overline{A+B}\right)\left(\overline{A}+\overline{B}\right)$ **(3)**

(iv) $BC(AD + A\overline{D}) + A\overline{B}$ **(3)**

(v) $\left(A+\overline{B}+A\overline{B}\right)\left(AB+\overline{A}C+BC\right)$ **(4) (May 2009)**

56. Simplify the following 5 variable Boolean expression using McCluskey method.

F = ∑ m(0,1,9,15,24,29,30) + d(8,11,31). **(16) (Dec. 2010)**

57. Determine the minterm sum of product form of the switching function.

F = ∑ (0,1,4,5,6,11,14,15,16,17,20,22,30,32,33,36,37,48,49,52,53,59,63) **(16) (Dec. 2010)**

58. (i) Convert $(1947)_{10}$ into its equivalent octal and hexadecimal representations. **(10)**

(ii) Perform (147-89) using 2's complement binary arithmetic. **(6) (May 2011)**

59. (i) Minimize the following expression using Karnaugh map.

Y = A′BC′D′ + A′BC′D + ABC′D′ + AB′C′D + A′B′CD′. **(10)**

(ii) State and prove the De Morgan's theorems. **(6) (May 2011)**

60. Simplify the following Boolean function F using Karnaugh map method.

(i) $F(A,B,C,D) = \sum(1,4,5,6,12,14,15)$ **(4)**

(ii) $F(A,B,C,D) = \sum(0,1,2,4,5,7,11,15)$ **(4)**

(iii) $F(A,B,C,D) = \sum(2,3,10,11,12,13,14,15)$ **(4)**

(iv) $F(A,B,C,D) = \sum(0,2,4,5,6,7,8,10,13,15)$ **(4) (Dec. 2011)**

61. Simplify the following Boolean expression to a minimum number of literals:

(i) $\overline{AC} + ABC + A\overline{C}$ **(2)**

(ii) $XYZ + \overline{X}Y + XY\overline{Z}$ **(2)**

(iii) $XY + YZ + XY\overline{Z}$ **(2)**

(iv) $A\overline{B} + ABD + AB\overline{D} + \overline{ACD} + \overline{A}B\overline{C}$ **(5)**

(v) $BD + BC\overline{D} + \overline{ABCD}$ **(5) (Dec. 2011)**

62. Minimize the expression using Quine McCluskey (Tabulation) method $Y' = A'B'C'D' + A'BC'D + ABC'D' + ABC'D + AB'C'D + A'B'CD'$. **(16) (May 2012)**

63. (i) Simplify F(A, B, C, D) = $\sum$ (0, 1, 2, 5, 8, 9, 10) in sum of products and product of sums using K-map. **(12)**

(ii) Write notes on negative and positive logic. **(4) (Dec. 2012)**

64. (i) Simplify the expression F(A, B, C, D) = $\sum$ (1, 4, 6, 7, 8, 9, 10, 11, 15) using Quine-McClusky method. **(12)**

(ii) Check if NOR operator is associative. **(4) (Dec. 2012)**

65. (i) Reduce the following function uisng map technique:

(a) f(A, B, C) = $\sum$m(0, 1, 3, 7) + $\sum$d(2, 5)

(b) F(w, x, y, z) = $\sum$(0, 7, 8, 9, 10, 12) + $\sum$d(2, 5, 13) **(16) (May 2013)**

66. Simplify the Boolean function using Quine McCluskey method:

F(A, B, C, D, E, F) = $\sum$m(0, 5, 7, 8, 9, 12, 13, 23, 24, 25, 28, 29, 37, 40, 42, 44, 46, 55, 56, 57, 60, 61) **(16) (May 2013)**

LOGIC GATES

PART A

1. Obtain the following operations using only NAND gates *(a)* NOT *(b)* AND. **(April 2003)**
2. If a manufacturer specifies the minimum logical 1 at a gate output a 4.0 V and also specifies that any voltage down upto 3.6 V will be considered as logical 1, find the noise margin. **(April 03)**
3. How will you use a 4 input NOR gate as a 2 input NOR gate? **(April 2003)**
4. Show that the NAND connective is not associative. **(April 2003)**
5. State and Prove DeMorgan's theorem. **(April 2003)**
6. Show that a positive logic NAND gate is same as a negative logic NOR gate. **(April 2003)**
7. Implement EXOR gate using only NAND gate. **(April 2003)**
8. Define noise margin. **(Nov. 2003)**
9. Show that a bubbled AND gate works like a NOR gate. **(April 2004)**
10. How can a NAND gate be used as an inverter? **(April 2004)**
11. Determine the fanout given $I_{IH(max)} = 40\ \mu A$ and $I_{OH(max)} = 400\ \mu A$. **(April 2004)**
12. Show that the NOR connective is not associative. **(April 2004)**
13. Show that how NAND gates can be used to implement the basic Boolean functions. **(April 04)**
14. How many inputs are needed for the expression, $W = A\overline{B}D + AC\overline{D} + EF$ **(Nov. 2004)**
15. Define noise margin. **(Nov. 2004)**
16. What are universal gates? **(Nov. 2004)**
17. Obtain 3 level NOR-NOR implementation of $f(a, b, c) = [ab + cd]ef$. **(Nov. 2004)**
18. Define fan-in. **(Nov. 2004)**
19. What is tri-state logic? **(Nov. 2004)**
20. Define V_{IH}(min) and V_{IL}(max) of an IC. **(Nov. 2004)**
21. Show that a positive logic NAND gate is the same as a negative logic NOR gate. **(Nov. 2004)**
22. Define noise margin and noise immunity. **(April 2005)**
23. Realize the function $f(A, B) = \overline{A}B + A\overline{B}$ by using only NAND gates. **(April 2005)**
24. Define power dissipation and propagation delay. **(April 2005)**
25. What is meant by multilevel gates networks? **(April 2005)**
26. What is noise margin? **(Dec. 2005)**
27. What is fan-out of a gate? **(Dec. 2005)**
28. What is a tristate gate? **(Dec. 2005)**
29. Realize $f = A'B + AB'$ using minimum universal gates. **(Dec. 2005)**

30. Draw a tristate inverter and draw its truth table. **(Dec. 2005)**

31. Define fan-in. **(Dec. 2005)**

32. Draw the internal circuit of a NOR gate latch and derive the truth table. **(May 2006)**

33. Construct a combinational circuit to convert given binary coded decimal number into an Excess-3 code. For example when the input to the gate is 0110 then the circuit should

34. Minimize the function using Boolean algebra f=x(y+w'z) + wxz. **(May 2007)**

35. Define propagation delay. **(May 2007)**

36. Write the truth tables of logical AND and XOR gates. **(April 2011)**

37. Realize OR gate using only NAND gates. **(Dec 2012)**

38. Write an HDL behavioral description of a 4-bit comparator with a 6-bit output y[5;0]. Bit 5 of y is for equal, bit 4 for unequal, bit 3 for greater than, bit 2 for less than, bit 1 for greater than or equal, and bit 0 for less than or equal to. (**May 2012**)

PART-B

1. Implement the following function with either NAND or NOR gates. Use only 4 gates. Only the normal inputs are available.(i) $d = WYZ$, (ii) $F = \overline{W}XZ + \overline{W}YZ + \overline{X} + WX\overline{Y}Z$ **(8) (April 2003)**

2. Show that if all the gates in a two level OR-AND gate network are replaced by NOR gates, the output function does not change. **(8) (April 2003)**

3. Implement the switching function whose octal designation is 274 using NOR gates only. **(16) (April 2003)**

4. **(i)** Compare the performance of any five logic families, based on any five suitable parameters. **(8)**
(ii) Define the terms fan out, tristate gates, fan in. **(8) (Nov. 2003)**

5. Obtain a 4-level NAND network for $f(A, B, C, D) = (\overline{A}B + C)D + EF$. **(8) (April 2004)**

6. Show that the NAND operation is not associative. **(6) (Nov. 2004)**

7. **(i)** Explain how an EX-OR gate can be built by using four NAND gates. **(4)**
(ii) The output of a NAND gate network is $F(A, B, C) = \Rightarrow (3, 6, 7, x)$. The output of the gate network does not change if all the gates are replaced by NOR gates. Determine the value of x. **(12) (Nov. 2004)**

8. Design a logic circuit to simulate the function f(A, B, C) = A(B + C) by using only NAND gates. **(4) (April 2005)**

9. Realize the functions of NOT, AND, OR gates only with NOR gates. **(4) (April 2005)**

10. Convert a NOR with an equivalent AND gate. **(4) (April 2005)**

11. Prove that NOR gate is a universal gate. Also prove the same for NAND gate. **(16) (Dec. 2005)**

12. Implement the following function with NAND gates

$F(x, y, z) = \Rightarrow (0, 6)$ **(6) (Dec. 2005)**

13. Implement the following function using a quad 2–input NOR gates:

$f = (A'B + C) \cdot D'$ **(8) (Dec. 2005)**

14. Design a network with four inputs and three outputs which realizes the following functions:

$F_1(a, b, c, d) = \sum m(11, 12, 13, 14, 15)$

$F_2(a, b, c, d) = \sum m(3, 7, 11, 12, 13, 15)$

$F_3(a, b, c, d) = \sum m(3, 7, 12, 13, 14, 15)$ **(8) (Dec. 2005)**

15. Draw the symbol, truth table and the equation of the three basic gates and two universal gates and realize all the five gates using either of the universal gates. **(16) (May 2006)**

16. Design a 4 bit magnitude comparator to compare two 4 bit numbers. **(16) (Dec. 2006)**

17. Draw a NAND logic diagram that implements the complement of the function.

$F(A,B,C,D) = \sum(0,1,2,3,4,8,9,12)$ **(6) (Dec. 2008)**

18. Given the Boolean function $F=xy+x'y'+y'z$.

(i) Implement it with AND, OR and inverter gates **(4) (Dec. 2008)**

(ii) Implement it with OR and inverter gates **(6) (Dec. 2008)**

(iii) Implement it with AND and inverter gates **(6) (Dec. 2008)**

19. (i) Define Prime Implicant and Essential Prime Implicant. **(4)**

(ii) Write the procedure for obtaining the logic diagram with NAND gates from a Boolean function. **(4)**

(iii) Implement the switching function.

$F(x, y, z) = \sum m(1,2,3,4,5,7)$ with NAND gates. **(8) (May 2012)**