Date: 19.11.2019 Time : (2½Hours) Total Marks: 75

N.B. (1) All questions are compulsory.
(2) Figures to the right indicate marks for respective sub questions.
(3) Make suitable assumptions wherever necessary and state the assumptions made
(4) Answers to the same question must be written together.
(5) Draw neat labeled diagrams wherever necessary.
(6) Use of Non-programmable calculators is allowed.

Q.1) Attempt **any THREE** of the following. (15)

(a) Define digital signal. With expect to digital signal explain the terms – digits and bits. Also discuss active high and active low signal.

(b) What are different numbering system used? Convert following numbers to required numbering system.
(i) $(11001011.01110)_2 = (?\ )_{1o}$
(ii) $(1100110.011010)_2 = (\ ?\ )_{16}$

(c) Convert:
i) $(23)_{10} = (?)_2$
ii) $(34)_{16} = (?)_{10}$
iii) $(555)_8 = (?)_2$

(d) Convert :
i) $(101100)_2 = (?)_{gray}$
ii) $(456)_{10} = (?)_{bcd}$
iii) $(64)_{10} = (\ )_{excess\ 3}$

(e) Explain with an example to steps to find a two's complement of a number and write 5 the rules of two's complement subtraction in binary number system

(f) Solve :
i. $(1000100)_2 + (10010101)_2 = (\ ?\ )_2$
ii. $(10101010)_2 - (10100010)_2 = (\ ?\ )_2$ (use direct method)

Q.2) Attempt **any THREE** of the following. (15)

(a) Draw logic circuit and make truth table to prove the following Boolean theorem:
i. A.0=0
ii. (A.B).C=A.(B.C)

(b) What is meant by universal logic gate? Draw logic circuits showing construction of Ex-OR gate using NAND gate and using NOR gate

(c) Describe the AND gate and the XOR gate with the symbol, the logical statement, the boolean expression and its logical circuit diagram.

(d) State and proof De Morgan's Law

(e) Solve the SOP expression using Kmaps
$F(A,B,C,D) = \Sigma m\ (1,3,4,5,7,9,11,13,15)$

(f) Minimize expression using Quine Mc Cluskey method.
$F(W,X,Y,Z)=\sum M(2,6,8,9,10,11,14,15)$

Q.3) Attempt **any THREE** of the following. (15)

(a) Convert 4 bit binary to 4 bit gray. Draw the truth table, necessary k-maps and logic circuit.
(b) What is a combinational circuit? Build a combination circuit of a half adder.
(c) What is a Comparator? Explain
(d) Describe the working of 2 bit half subtractor.
(e) Convert 4 bit gray to 4 bit binary. Draw the truth table, necessary k-maps and logic circuit.
(f) Design the Full Subtractor using K-map. Draw the circuit diagram for the same.

Q.4) Attempt **any THREE** of the following. (15)

(a) Implement following function using 8:1 Mux
$F(A,B,C,D)=\sum M(2,4,5,7,10,14)$
(b) Explain the need of preset and clear pins in RS flip flop? With neat block dig and truth table explain the working of RS flip flop.
(c) Discuss various applications of flip flops.
(d) Describe with a truth table the working of JK flip flop
(e) What is race around condition? How can it be handled?
(f) Describe with a truth table the working of D-flip flop

Q.5) Attempt **any THREE** of the following. (15)

(a) Write truth table for mod 6 counter in IC 7492.
(b) Explain the difference between serial shifting and parallel shifting of data in shift register.
(c) Write a short note on shift registers.
(d) Write a short note on type of counters
(e) Implement synchronous counter using JK FF.
(f) Design 4 bit binary up/down counter with control input of up/down.