

(2½ Hours)

[Total Marks: 75]

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

1. Attempt any three of the following:

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- a. Convert:
- $(100011)_2 = (?)_{10}$ 2
 - $(2F)_{16} = (?)_{10}$ 2
 - $(011000)_2 = (?)_8$ 1
- b. Convert :
- $(62)_{10} = (?)_{\text{excess3}}$ 2
 - $(577)_{10} = (?)_{\text{bcd}}$ 2
 - $(100110000111)_{\text{bcd}} = (?)_{10}$ 1
- c. Explain with an example to steps to find a two's complement of a number and write the rules of two's complement subtraction in binary number system. 5
- d. Solve :
- $(1000100)_2 + (10010101)_2 = (?)_2$ 2
 - $(10101010)_2 - (10100010)_2 = (?)_2$ (use direct method) 3
- e. Solve:
- $(122)_{10} = (?)_2 = (?)_8$ 3
 - $(110101001)_2 = (?)_{16}$ 2
- f. Solve:
- $(AFD1)_{16} + (1292)_{16} = (?)_{16}$ 2
 - $(AFD1)_{16} - (129A)_{16} = (?)_{16}$ 3

2. Attempt any three of the following:

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- a. Describe the NAND and the OR gate with the symbol, the logical statement, the Boolean expression and its logical circuit diagram
- b. State and prove the commutative and associative law in Boolean algebra.
- c. Prove the following
- $A + \bar{A}B = \bar{A} + B$
 - $(\bar{A} + B)\bar{A}\bar{B}\bar{C} = \bar{A} + B + \bar{C}$
- d. Simplify the expression and draw circuit diagram
 $Y = (X + Y)(\bar{X} + Y + Z)$
- e. Solve the SOP expression using Kmaps $F(A,B,C,D) = \sum m(1,3,4,5,7,9,11,13,15)$
- f. Solve the POS expression using Kmaps
 $F(A,B,C,D) = \pi M(4,6,8,9,10,12,13,14) + d(0,2,5)$

3. Attempt any three of the following:

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- a. Design a 4-bit full adder using 3 Full adders.
- b. With the help of K-Maps build a 2-bit half adder and describe its working.
- c. Explain with an example code conversion from binary to gray.

- d. Design a combinational circuit for the following description. The circuit had 4 inputs and 2 output. One of the outputs is true if the major inputs are true, the other output is true if there is a tie between the 4 input.
- e. Describe the working of a comparator.
- f. Describe the working a BCD subtractor.

4. Attempt any three of the following:

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- a. Draw the logical circuit diagram and describe the working of a 4:2 decoder.
- b. Draw the logical circuit diagram and describe the working 4:1 multiplexer using 2:1 multiplexers.
- c. Difference between multiplexer and demultiplexer,
- d. Describe with a truth table the working of D-flip flop.
- e. Describe with a truth table the working of T- flip flop.
- f. Describe the working of the JK Flip Flop.

5. Attempt any three of the following:

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- a. Short note on synchronous counters .
- b. Describe working of 4 bit binary counter
- c. Explain the terms busing and perset of a counter
- d. Write a short note on Bidirectional shift registers .
- e. Describe the working of the Johnson counter.
- f. What are parallel and shift registers ? Explain