Bangabandhu Sheikh Mujibur Rahman Science & Technology University, Gopalganj.
Department of Computer Science and Engineering
1st Year 2nd Semester B. Sc. Engineering Examination-2013
Course: CSE160 (Introduction to Digital Electronics)

Full Marks: 70   **Time:** 3 hours

N.B.: Instruction for Candidates:
  i) The figures in the right margin indicate full marks.
  ii) Answer any **SIX** questions, taking any **THREE** from each section.
  iii) Use separate answer script for each section.

Section - A

1. a) Subtract $(01101)_2$ from $(11011)_2$ using 1st complement method.   3
    b) Use 2's complement method to subtract $(1101)_2$ from $(1010)_2$.   3
    c) What is a logic gate? Why NOR and NAND gates are called universal gate?   5.67

2. a) What do you mean minterm and maxterm?   3
    b) Simplify the following expression to a minimum number of gates: 3
        i) $ABC + \bar{A}B + AB\bar{C} + AC$
        ii) $\bar{A}B(\bar{D} + CD) + B(A + \bar{A}CD)$
    c) Minimize the following switching function using Quine –McClusky method: 5.67
        $$f(w,x,y,z) = \sum m(0,1,2,4,5,6,8,9,12,13,14)$$

3. a) State and Prove De-Morgan's theorem.   3
    b) What are the advantages of encoding a decimal number in BCD rather than in straight
        binary number? What is a disadvantage?   2
    c) State the steps involved in Gray to binary conversion. Convert the gray code
        10101101 into its binary equivalent.   3
    d) Design a logic circuit that has three inputs A, B and C, and whose output will be HIGH
        only when a majority of the inputs are high.   3.67

4. a) Describe TTL low state circuit operation with appropriate figure.   5
    b) Given $I_{OL} = 8\ mA, I_{IL} = 0.2\ mA,\ I_{OH} = 0.5\ mA$ and $I_{IH} = 22\ \mu A$. Drive fan-out at
        different state.   2
    c) Draw the circuit diagram and truth table of a CMOS NAND gate.   4.67

Section - B

5. a) Prove the following Boolean identities: 5
       i) $(A + B)(A + C) = A + BC$
       ii) $A + \bar{A}B = A + B$
    b) Design and draw the circuit diagram of full subtractor.   4.67
    c) Simplify the expression: $(AB + C)(AB + D)$.   2

6. a) What do you mean by a number system?   2
    b) Discuss hexadecimal number system.   3
    c) Convert   4
       i) $(777)_8$ to decimal
       ii) $(10101.11)_2$ to octal
       iii) $(43.875)_{10}$ to hexdecimal
       iv) $(11001.101)_2$ to decimal
    d) What is CMOS technology? What are the advantages of it?   2.67

7. a) Design a logic circuit for expression: $F = A(B + CD) + B\bar{C}$ 5
       i)   Using NAND gates only.
       ii) Using NOR gates only.
    b) What are called don't care conditions?   2
    c) To simplify the following switching function using K-map and draw logic circuit.   4.67

    $$F(a, b, c, d) = \sum m(0,2,6,8,12,13,15) + d(3,9,10)$$

8. a) What do you mean by digital ICs? Describe different levels of ICs based on   3
       complexity.
    b) What are bipolar and unipolar digital ICs? What is the main advantage of CMOS over   2
       TTL?
    c) Draw the figure for input voltage ranges for TTL and CMOS.   2
    d) What is fan-out? What do you mean by propagation delay? Explain with example.   2.67
    e) Given $V_{OL} = 0.3, V_{IL} = 0.8$, $V_{OH} = 2.6$ and $V_{IH} = 1.8$. Find out maximum amplitude noise   2
       spike at high and low output are driving an input.