Assignment 1

Course Name: **Digital Logic Design**   Course Code: **CE 221**

Semester: **Fall 2025**   Class: **BS CE** (Batch 34)

Total Marks: **20**

Question 1: The state of a 16-bit register is 1000 0101 0011 1001. What is its content if it represents:

   a) Four decimal digits in BCD?
   b) Four hexadecimal digits in the Gray code?

Question 2: Perform the following number systems conversions.

   i. $(11100010)_2 = (?)_{10}$. Let the binary number is in signed 2's complement form.
   ii. $(5C7B.6)_{16} = (?)_2 = (?)_{10}$
   iii. $(367)_{10} = (?)_8$

Question 3: Determine the most simplified SOP form of the Boolean equation given in equation (1) using Boolean algebra. Also determine the most simplified SOP form using the K-map method. Do both methods yield the same result? Explain with reasoning.

$$f(A,B,C,D) = \bar{A}BCD + \bar{A}CD + ABCD + \bar{B}\bar{C}D + \bar{A}B \qquad (1)$$

Question 4: Determine the most simplified POS form of the Boolean function $f(A,B,C,D) = \sum(0,1,6,7,14,15)$ with don't care condition $d(2)$. Implement the simplified POS equation using NOR gates only.

Question 5: Design a logic circuit to implement a digital calendar. The circuit has 5-bit inputs as given below. The circuit should have four outputs that tell us whether the specified month has 28, 29, 30, or 31 days. Derive minimal expression for each of the four outputs using K-map. All the unused input combinations should result in don't care outputs. Implement the circuit using AND, OR, and NOT gates only. Assume that inputs and their complements are available.

   •   A 4-bit binary input representing months of year. Let January is represented by 0001 and December by 1100.
   •   A 1-bit input indicating whether or not the current year is a leap year.

Submission Deadline: 13 October 2025