National University of Computer and Emerging Sciences

Lahore Campus

Digital Logic Design (EE1005)

Sessional-I Exam

Total Time (Hrs): 1
Total Marks: 45
Total Questions: 3

Date: 1st March, 2025

Course Instructor(s)

Ms. Tamania Javaid

Mr. Ahmad Hamza

Roll No _____ Section _____ Student Signature _____

- **Attempt all the questions.**
- **Show complete working of each question.**
- **Multiple solutions of the same question will carry zero credit.**
- **State your valid assumptions clearly if you have to take any.**

CLO #1: Describe various number systems and perform arithmetic operations and base conversions.

Q1: **[15 marks]**

a) **Convert** the decimal number $(-73)_{10}$ into 2's complement 8-bit number

b) Find the decimal equivalent of $(113.1)_5$

c) **Find** the unknown in the following expression.

$(2A4)_{16} + (111\ 1010\ 1101)_2 = (\ ?\ )_{16}$

(Perform addition in binary and get result in hexadecimal format. Show complete working)

CLO #2: Apply Boolean Algebra and K-map methods to optimize logic circuits

Q2: **[15 marks]**

a) **Apply** Boolean algebra to simplify the following function to minimum number of literals

$$F(W,X,Y,Z) = WX\overline{Y} + \overline{X + Y + \overline{Z}} + \overline{\overline{W}XZ + \overline{WXY}}$$

b) **Construct** a simplified logic diagram of the following expression using 2-input NAND gates only. Inputs are available in true form only.

$$F(A,B,C) = A\overline{B}C + A\overline{C} + AB\overline{C}$$

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CLO #2: Apply Boolean Algebra and K-map methods to optimize logic circuits

Q3: **[15marks]**

a) Design a magnitude comparator that compares two 2-bit numbers. The numbers are $A = (A_1A_0)$ and $B = (B_1B_0)$. The comparator has Three outputs G, L and E with $G = 1$ if $A > B$ and $L = 1$ if $A < B$ and $E = 1$ if $A = B$.

i. **Construct** the truth table of the system.

ii. **Write** the Boolean function representation of all the outputs, using "little m" notation?

iii. **Write** the Boolean function representation of the output G only, using "big M" notation?

b) **Use** K- map to find minimal POS (Product of sum) expression for the following Boolean functions

$$F(A, B, C, D) = \sum m(0, 2, 5, 8, 9, 10, 11, 12, 13)$$