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Student Name _____ Roll No _____ Section _____ Student Signature _____

CLO # 1: Identify and explain fundamental concepts of digital logic design including basic and universal gates, number systems, binary coded system, basic components of combinational and sequence circuits.

Q1. [= 10 marks]

Alice and Bob are competing in a mathematics quiz where each participant's score is represented by a 2-bit binary number. They want to know who has the higher score without revealing their exact scores to each other. Design a circuit that takes Alice's and Bob's scores as inputs and outputs a signal indicating who has the higher score, or if they are tied.**Show complete working.**

CLO # 2: Demonstrate the acquired knowledge to apply techniques related to the design and analysis of digital electronics circuits, including Boolean Algebra and Multi-variable Karnaugh map methods.

Q2. [15 = 7.5+7.5 marks]

a) Design a 3x2 Multiplier by first deriving the complete equation for the circuit. Show the output on a 7-Segment display, use the first 4 outputs for one display while the remaining output should be connected to in such a way that final output shows 88.

b) Complete the truth table below for a Boolean Function which is defined to be true, output in the table is 1, when all or at least two of input variables are 0. Complete the truth-table and draw a Karnaugh map for the output F. The Boolean expression should be a (sum of products) expression, but implement the circuit using all NAND-NAND Logic gates. Draw a diagram of your circuit.

A_2	A_1	A_0	F
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

CLO # 3: Analyze small –scale combinational digital circuits.

Q3: [7.5+7.5 =marks]

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0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

CLO # 3: Analyze small –scale combinational digital circuits.

Q3: [7.5+7.5 =marks]

a. You're a robotics engineer working on a modular robot system. The robot can be configured with three different modules (Module A, Module B, and Module C), each with two operational modes (Mode X and Mode Y). Your task is to design a logic circuit on Logic works that efficiently displays the chosen configuration using LEDs, allowing users to see which modules are active and in which mode they are operating.

b) Using the BCD to Seven Segment Decoder implement a circuit that displays the **LAST four** Digits of your roll number, the implementation should also eliminate trailing zeros. **(The digits should be on screen when the file is opened else no marks will be given)**

CLO # 4: Design small-scale combinational and synchronous sequential digital circuit using Boolean Algebra and K-map.

Q4: [5+5= 10 marks]

a) Implement JK flip-flop using **ICs** on logic works also make truthtable.

Note: You have to Sh

that efficiently displays the chosen configuration using LEDs, allowing users to see which modules are active and in which mode they are operating.

b) Using the BCD to Seven Segment Decoder implement a circuit that displays the **LAST four** Digits of your roll number, the implementation should also eliminate trailing zeros. **(The digits should be on screen when the file is opened else no marks will be given)**

O # 4: Design small-scale combinational and synchronous sequential digital circuit using Boolean gebra and K-map.

: [5+5= 10 marks]

a) Implement JK flip-flop using **ICs** on logic works also make truthtable.
Note: You have to Show the set, reset and toggle states through timing diagram attach the screenshots for the timing diagram in the Word file with comments to explain each output.

b) Design 16 by 1 multiplexer circuit on Logic works by using 4 by 1 multiplexer.