REG.NO.:

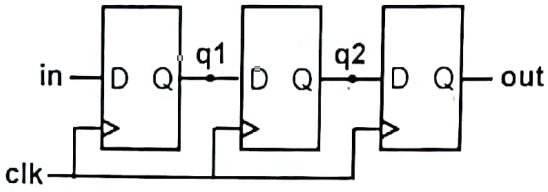
VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2025-2026

SLOT: G1+TG1

B.Tech ECE - BECE102L & Digital System Design - Maximum Marks: 50

Key for Evaluation

S.No.	Question	Marks
1.	Write the Verilog code in behavioural modeling for the circuit shown below: 	10

	module shiftregister(clk, in, out);
	input clk,in;
	output reg out;
	reg q1,q2;
	always @(posedge clk)
	begin
	q1<=in;
	q2<=q1;
	out<=q2;
	end
	endmodule	

2.	Implement the following Boolean function using 3-to-8 decoders: $F = \prod M(0, 5, 7, 11, 12, 14)$.	10
	F(A,B,C,D) = ∑m(1,2,3,4,6,8,9,10,13,15) Two 3-to-8 decoders (top & bottom) with an enable (En) pin are used. A' is connected to the top decoder and A is connected to the bottom decoder. B,C and D are connected to the inputs of both decoders. The minterms (0 to 7) are outputs of the top decoder and minterms (8 to 15 are the outputs of the bottom decoder. An OR gate inputs are connected with the (1,2,3,4,6,8,9,10,13,15) minterms to get the output F.	

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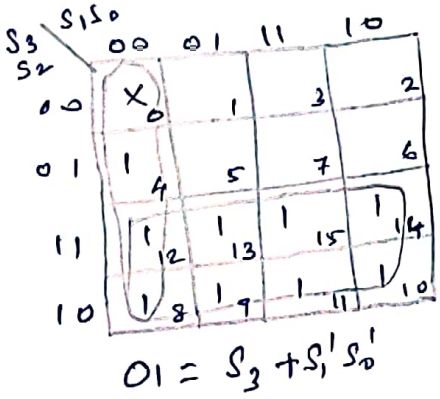
3.	A building's fire alarm system has sensors (S3, S2, S1, S0) installed on each floor. Design the circuit, if multiple sensors are triggered at the same time, they are prioritised based on the priority. The highest priority is with the top floor sensor (S3), followed by the ground floor (S0), the first floor (S1) and the lowest priority for the second floor (S2).	10

S3	S2	S1	S0	O1	O0	V
0	0	0	0	X	X	0
1	X	X	X	1	1	1
0	X	X	1	0	0	1
0	X	1	0	0	1	1
0	1	0	0	1	0	1

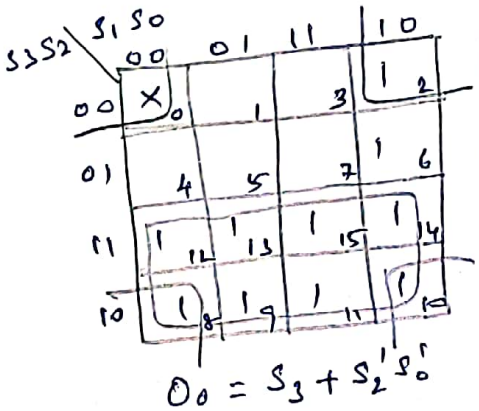
$O1 = \sum m(4,8,9,10,11,12,13,14,15) + \sum d(0)$

$O0 = \sum m(2,6,8,9,10,11,12,13,14,15) + \sum d(0)$

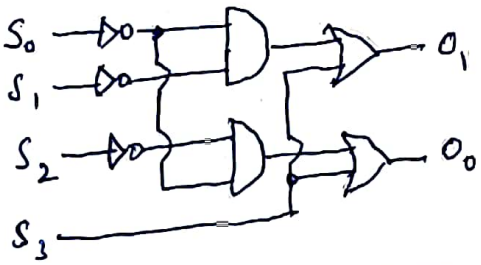
$V = S3 + S2 + S1 + S0$

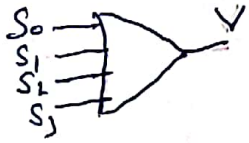


$O1 = S_3 + S_1' S_0'$

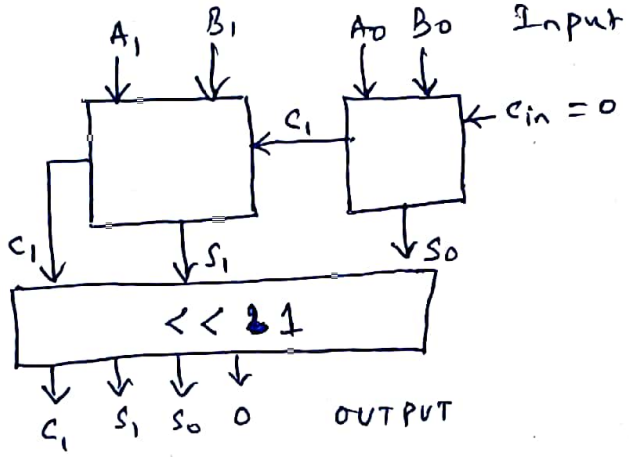


$O_0 = S_3 + S_2' S_0'$





4.	Design a Datapath circuit to perform the arithmetic operation Y = 2*(A+B) using adders. Assume A and B are 2-bit inputs to the circuit.	10



5.	In a smart home lighting system, a custom flip-flop is needed to turn the light ON and OFF. The function of the flip-flop is given below. a) Sets the output Q = 1 (light ON) when M = 1 and S=0 b) Resets Q = 0 (light OFF) when S = 0 and M =1 c) Holds the last state when neither M nor S is active d) Both are not active at the same time. 1. Write the characteristic table for this custom flip-flop. 2. Derive the characteristic equation of the custom flip-flop. 3. Implement the T flip-flop using this custom flip-flop.	10

Characteristic table

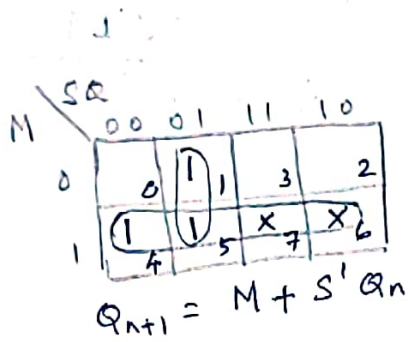
M	S	Q_{n+1}
0	0	Q_n
0	1	0
1	0	1
1	1	X

Excitation table

Q_n	Q_{n+1}	M	S
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

Characteristic Equation

M	S	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	X
1	1	1	X



$Q_{n+1} = M + S' Q_n$

Implementation table

T	Q_n	Q_{n+1}	M	S
0	0	0	0	X
0	1	1	X	0
1	0	1	1	0
1	1	0	0	1

$M = T' Q_n + T Q_n' = T \oplus Q_n$

$S = T' Q_n' + T Q_n = (T \oplus Q_n)'$