CBCS SCHEME

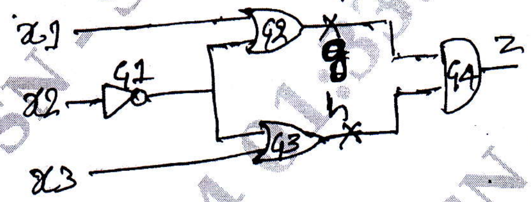
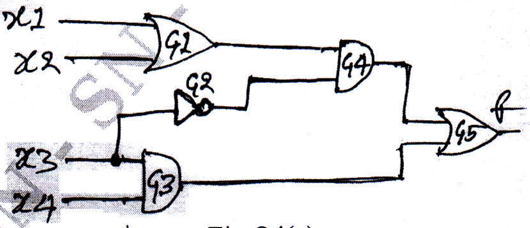
USN | | | | | | | | | | 22LEL/LDE14

First Semester M.Tech. Degree Examination, Dec.2023/Jan.2024

Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the different properties of threshold logic.	6	L2	CO1
	b.	Identify and realize the threshold function $f = x_1x_2\bar{x}_3x_4 + x_2\bar{x}_3\bar{x}_4$	10	L3	CO2
	c.	Explain the capabilities of Threshold logic.	4	L2	CO1
		OR			
Q.2	a.	Determine which of the following function is unate or not i) $F_1(x_1, x_2, x_3, x_4) = \Sigma(1, 2, 3, 8, 9, 10, 11, 12, 14)$ ii) $F_2(x_1, x_2, x_3, x_4) = \Sigma(0, 8, 9, 10, 11, 12, 13, 14)$ iii) $F_3(x_1, x_2, x_3, x_4) = \Sigma(2, 3, 6, 10, 11, 12, 14, 15)$	10	L3	CO2
	b.	Determine whether following functions are threshold or not i) $F_1(x_1, x_2, x_3) = \Sigma(0, 2, 4, 5, 6)$ ii) $F_2(x_1, x_2, x_3) = \Sigma(0, 3, 5, 6)$ If the given functions are the threshold, then write down the threshold gate.	10	L3	CO2
		Module – 2			
Q.3	a.	Using path sensitization method, derive the test vector for the s – a – 0 and s – a – 1 faults at 'g' and 'h' in the circuit shown in Fig Q3(a)  Fig Q3(a)	10	L3	CO4
	b.	Use the map method to find a minimal set of tests for multiple faults for the 2-level AND-OR realization of the function : $F(w, x, y, z) = w\bar{z} + x\bar{y} + \bar{w}x + w\bar{x}y$.	10	L3	CO4
		OR			
Q.4	a.	For the circuit shown in Fig Q4(a), find all the tests to detect the faults x_3 s – a – 0 and x_3 s – a – 1.  Fig Q4(a)	10	L3	CO4

b. Use the map method to find a minimal set of test for multiple faults for the 2-levels OR-AND realization of the function : $F(w, x, y, z) = (w + \overline{x})(x + \overline{z})(\overline{w} + y + \overline{z})$. — **10 | L3 | CO4**

Module – 3

Q.5 a. What is merger graph? Draw the merger graph and reduced graph for the machine given in Table Q5(a). — **10 | L3 | CO2**

PS	NS, Z			
	I_1	I_2	I_3	I_4
A	–	E, 1	B, 1	–
B	–	D, 1	–	F, 1
C	F, 1	–	–	–
D	–	–	C, 1	–
E	C, 0	–	A, 0	F, 1
F	D, 0	A, 1	B, 0	–

Table Q5(a)

b. Prove that the machine shown in Table Q5(b) is minimal. Also draw the compatibility graph. — **10 | L3 | CO2**

PS	NS, Z						
	I_1	I_2	I_3	I_4	I_5	I_6	I_7
A	F, 0	A, –	D, –	C, –	–	–	–
B	–, 1	–	–	–	C, –	D, –	E, –
C	C, –	E, –	–	–	F, 0	B, –	–
D	–	–	F, –	E, –	–, 1	–	A, –
E	A, –	–	A, 1	–	B, –	–	C, –
F	–	D, –	–, 0	B, –	–	E, –	–

Table Q5(b)

OR

Q.6 a. Explain different types of fault location experiments with example. — **10 | L3 | CO2**

b. Explain the present type of fault location experiment by considering fault table as shown in table Q6(b). Write down corresponding i) Reduced table ii) Fault dictionary, Also find out different sets of faults. — **10 | L3 | CO4**

	F_1	F_2	F_3	F_4	F_5	F_6
T_1					1	1
T_2	1		1		1	
T_3				1	1	
T_4		1	1			
T_5	1					1
T_6	1		1			1

Table Q6(b)

Module – 4

Q.7 a. For the machine given in Table Q7(a), give the circuit diagram and two possible state assignments with their logical equations. — **10 | L3 | CO2**

PS	NS		Z	
	Z = 0	Z = 1	Z = 0	Z = 1
A	A	D	0	1
B	A	C	0	0
C	C	B	0	0
D	C	A	0	1

Fig Q7(a)

			Marks	Level	CO
	b.	For the machine shown in Fig Q7(b), list all closed partitions by considering input and outputs consistent partitions : $\lambda_i = \{\overline{A,E,F}\ ;\ \overline{B,C,D,G}\}$ $\lambda_o = \{\overline{A,E,F}\ ;\ \overline{B,D}\ ;\ \overline{C,G}\}$	10	L3	CO4

PS	NS X = 0	NS X = 1	Z X = 0	Z X = 1
A	B	C	0	0
B	A	F	1	1
C	F	E	1	0
D	F	E	1	1
E	G	D	0	0
F	D	B	0	0
G	E	F	1	0

Table Q7(b)

OR

			Marks	Level	CO
Q.8	a.	For the machine given in Table Q8(a). Find : i) Closed partition ii) Give the functional relationship based on the $r_1 = \{\overline{A,B,C,D}\ ;\ \overline{E,F,G,H}\}$ $r_2 = \lambda_0 = \{\overline{A,C,E,G}\ ;\ \overline{B,D,F,H}\}$ iii) Write down the Schematic diagrams π – lattice for machine given in Table Q8(a)	10	L3	CO4

PS	NS X = 0	NS X = 1	Z
A	G	D	1
B	H	C	0
C	F	G	1
D	E	G	0
E	C	B	1
F	C	A	0
G	A	E	1
H	B	F	0

Table Q8(a)

			Marks	Level	CO
	b.	For the machine shown in Table Q8(b), determine the π-lattice and basic partitions.	10	L3	CO4

PS	NS X = 0	NS X = 1
A	E	B
B	E	A
C	D	A
D	C	F
E	F	C
F	E	C

Table Q8(b)

Module – 5

			Marks	Level	CO
Q.9	a.	Explain synchronizing experiments. Find the shortest sequence for the machine given in Table Q9(a)	10	L3	CO5

PS	NS, Z	
	X = 0	X = 1
A	B, 0	D, 0
B	A, 0	B, 0
C	D, 1	A, 0
D	D, 1	C, 0

Table Q9(a)

			Marks	Level	CO
	b.	Explain the second algorithm by taking the examples of machine given in Table Q9(b).	10	L3	CO5

PS	NS, Z	
	X = 0	X = 1
A	B, 01	D, 00
B	A, 00	B, 00
C	D, 10	A, 01
D	D, 11	C, 01

Table Q9(b)

OR

			Marks	Level	CO
Q.10	a.	Find the shortest Homing sequence and the shortest synchronizing sequence for the machining given in Table Q10(a)	10	L3	CO5

PS	NS,Z	
	X = 0	X = 1
A	A, 1	E, 0
B	A, 0	C, 0
C	B, 0	D, 1
D	C, 1	C, 0
E	C, 0	D, 0

Table Q10(a)

			Marks	Level	CO
	b.	Explain the different steps involving in machine identification with the help of following data :	10	L3	CO5

Time	:	$t_1 - t_2$	$t_2 - t_3$	$t_3 - t_4$	$t_4 - t_5$	$t_5 - t_6$	$t_6 - t_7$	$t_7 - t_8$
Input	:	1	1	1	0	1	0	1
Output	:	0	1	0	0	1	0	0

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