CBCS SCHEME

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20ELD14

First Semester M.Tech. Degree Examination, Jan./Feb. 2023
Digital Circuits and Logic Design

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define threshold function and unite function. **(10 Marks)**

b. Given the switching function:
$f(x_1, x_2, x_3, x_4) = \Sigma(2, 3, 6, 7, 10, 12, 14, 15)$. Find a minimal threshold logic realization. **(10 Marks)**

OR

2 a. Find whether function $f(x_1, x_2, x_3, x_4) = \Sigma(0, 8, 9, 10, 11, 12, 13, 14)$ is unite. If it is find its minimal true and maximal false vertices. Write the linear equations. **(10 Marks)**

b. Consider the switching function 'f' $f(x_1, x_2, x_3, x_4) = \Sigma(3, 5, 7, 10, 12, 14, 15)$. Find a minimal threshold logic realization. **(10 Marks)**

Module-2

3 a. Explain with an example a fault detection by path sensitizing method. **(10 Marks)**

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 Marks)**

OR

4 a. Find all the static hazards in the circuit shown in Fig.Q.4(a). How will you eliminate those static hazards? **(10 Marks)**

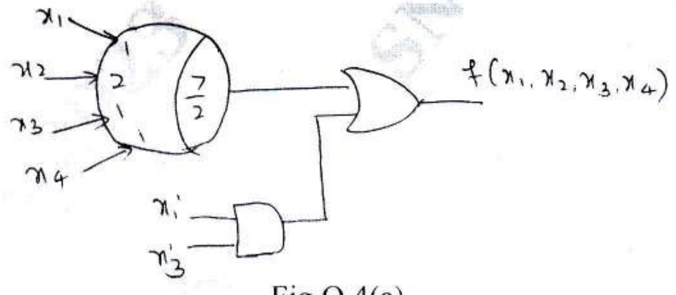

Fig.Q.4(a)

(10 Marks)

b. Use the map method to find a minimal set of tests for multiple faults for the 2-level OR-NAND realization of the function $f = (A + B)\ (B + C + \bar{D})(\bar{A} + \bar{B} + \bar{C} + \bar{D})$.

Module-3

5 a. Find the equivalence partition for machine shown in Table Q.5(a), draw the reduced machine and show a standard form of a corresponding reduced machine.

Table Q.5(a)

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

(10 Marks)

b. Find the tests to detect the faults at x_3, s-a-0 and s-a-1 for the circuit shown in Fig.Q.5(b).

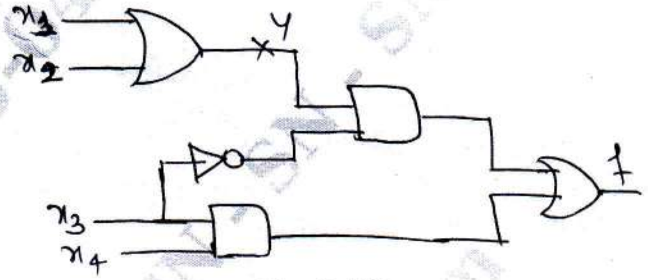

Fig.Q.5(b)

(10 Marks)

OR

6 a. Draw the merger graph and its minimal form for the machine in Table Q.6(a). Also write its merger table.

Table Q.6(a)

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

(10 Marks)

b. Explain the adaptive 4-level tree and 3-level tree by considering T_2 and T_6 as initial test for the fault table shown in Table Q.6(b).

Table Q.6(b)

Tests	f_0	f_1	f_2	f_3	f_4	f_5	f_6	o/p of fault free circuit
T_1						1	1	0
T_2		1		1		1		1
T_3					1	1		0
T_4			1	1				1
T_5		1					1	0
T_6		1		1			1	1

(10 Marks)

Module-4

7 a. For the machine in Table Q.7(a), determine the π-lattice and basic partitions. Also show the derivation of the basic partitions.

Table Q.7(a)

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

(10 Marks)

b. Explain: i) Input-Consistent ii) Output-Consistent iii) Closed partitions. (10 Marks)

OR

8 a. For the machine given in Table Q.8(a), Find:
   i) Closed partitions
   ii) Given the functional relationship based on the
   $\tau_1 = \{\overline{A,B,C,D}; \overline{E,F,G,H}\}$, $\tau_2 = \lambda_0 = \{\overline{A,C,E,G}; \overline{B,D,F,H}\}$.
   iii) Write down the schematic diagram and π-lattice for machine given in Table Q.8(a).

Table Q.8(a)

PS	NS		Z
	x = 0	x = 1	
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

(10 Marks)

b. For the machine shown in Table Q.8(b), find:
   i) π - lattice and schematic diagram
   ii) Non-trivial closed partitions
   iii) Parallel decompositions.

Table Q.8(b)

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

(10 Marks)

Module-5

9 a. Explain the Homing Experiment. Write down the Homing tree for the machine M shown in Table Q.9(a).

Table Q.9(a)

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

(10 Marks)

b. i) What is the main feature of the second algorithm for the design of fault detection experiments?

ii) Write down the general procedure of the second algorithm. **(10 Marks)**

OR

10 a. Explain and write down the successor tree for the machine shown in Table Q.10(a).

Table Q.10(a)

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

(10 Marks)

b. Explain the adaptive distinguishing experiment by considering the machine shown in Table Q.10(b).

Table Q.10(b)

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

(10 Marks)

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