CMR
INSTITUTE OF
TECHNOLOGY

USN | | | | | | | | | | |

Internal Assesment Test - I

Sub:	**DIGITAL SYSTEM DSESIGN**							Code:	18EE35
Date:	17/12/2021	Duration:	90 mins	Max Marks:	50	Sem:	3rd	Branch:	EEE

Answer Any FIVE FULL Questions

		Marks	OBE	
			CO	RBT
1	Simplify the following expression using Quine- McCluskey method. F(a,b,c,d) =∑m(7,9,12,13,14,15)+∑d(4,11) and implement using only NAND gates .	10	CO1	L3
2	a.Define combinational circuits and list the various steps involved in the designing of combinational circuits.	5	CO1	L2
	b.Define Minterm,maxterm ,Literal,Canonical SOP and Canonical POS..	5	CO1	L2
3	Simply boolean expression using k-Map (a) F_1(a,b,c,d)= ∑m(2,3,4,5,13,15)+ ∑d(8,9,10,11) (b) F_2(a,b,c,d) = πM (1,4,5,11,12,13,15)+ πd(3,9,10)	10	CO1	L3
4	Implement f(a,b,c,d)=ad+bc'+bd using 4:1 MUX using a and b as select lines.	10	CO2	L3
5	Implement the following function i) F1 (A,B,C,D)= ∑m(0,2,6,10,11,12,13)+ ∑d(3,8,14) using 74LS151(8:1 MUX) considering lower order input as select inputs. ii) F2(A,B,C,D)= ∑m(0,2,3,4,6,7,9,11,13,15)+ ∑d(3,8,14) using 74LS153(4:1 MUX) considering higher order input as select inputs.	10	CO2	L3
6	a.Implement the following function pairs using 74138 decoder. i.f1=(a,b,c) = Σ(0,2,4); ii. f2(a,b,c)=Σ(1,2,4,5,7)	4	CO2	L3
	b.Design and implement a 2 Bit digital comparator using basic gates	6	CO2	L3

5	Implement the following function iii) F_1 (A,B,C,D)= ∑m(0,2,6,10,11,12,13)+ ∑d(3,8,14) using 74LS151(8:1 MUX) considering lower order input as select inputs. iv) F_2(A,B,C,D)= ∑m(0,2,3,4,6,7,9,11,13,15)+ ∑d(3,8,14) using 74LS153(4:1 MUX) considering higher order input as select inputs.	10	CO2	L3
6	a.Implement the following function pairs using 74138 decoder. i.f_1=(a,b,c) = Σ(0,2,4); ii. f_2(a,b,c)=Σ(1,2,4,5,7)	4	CO2	L3
	b.Design and implement a 2 Bit digital comparator using basic gates	6	CO2	L3

IAT-1

① $F(a,b,c,d) = \Sigma m(7,9,12,13,14,15) + \Sigma d(4,11)$

(2)

d_4	0100	0100
m_7	0111	0111
m_9	1001	1001
d_{11}	1011	1011
m_{12}	1100	1100
m_{13}	1101	1101
m_{14}	1110	1110
m_{15}	1111	1111

(2)

d_4 0100 ✓	(4,12) −100
m9 1001 ✓	(9,11) 10−1 ✓
m12 1100 ✓	(9,13) 1−01 ✓
m7 0111 ✓	(12,13) 110− ✓
d_{11} 1011 ✓	(12,14) 11−0 ✓
m13 1101 ✓	(7,15) −111
m14 1110 ✓	(11,15) 1−11 ✓
m15 1111 ✓	(13,15) 11−1 ✓
	(14,15) 111− ✓

(2)

(9,11,13,15) 1−−1 ✓

(12,13,14,15) 11−− ✓

(4,12) −100 ✓

(7,15) −111 ✓

$f = AD + AB + BCD$

(2)

	d_4	m7	m9	d_{11}	m12	m13	m14	m15
(9,11,13,15) ✓			✓	✓		✓		✓
(12,13,14,15) ✓					✓	✓	✓	✓
(4,12) ✓	✓				✓			
(7,15) ✓		✓						✓

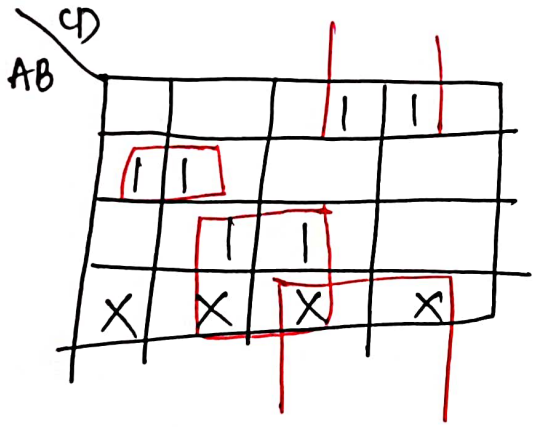
2 a) Defenition – 2

steps involved – 3

b) Each defenition 1 mark.

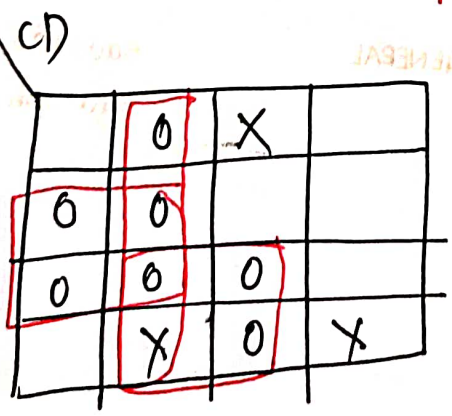
3) (a) $F_1(a, b, c, d) = \Sigma m(2, 3, 4, 5, 13, 15) + \Sigma d(8, 9, 10, 11)$

$F_1 = A'BC' + B'C + AD$



(5 marks)

(b)



$F_2 = (C + D')(B' + C)(A' + D')$

(5 marks)

4) $f(a,b,c,d) = ad + bc' + bd$

~~$a'bc'd' + a'bcd' +$~~

~~$ad(b+b')(c+c') + (a+a')bc'(d+d') + (a+a')b(c+c')d$~~

~~$= (ad + bb' + cc')'$~~

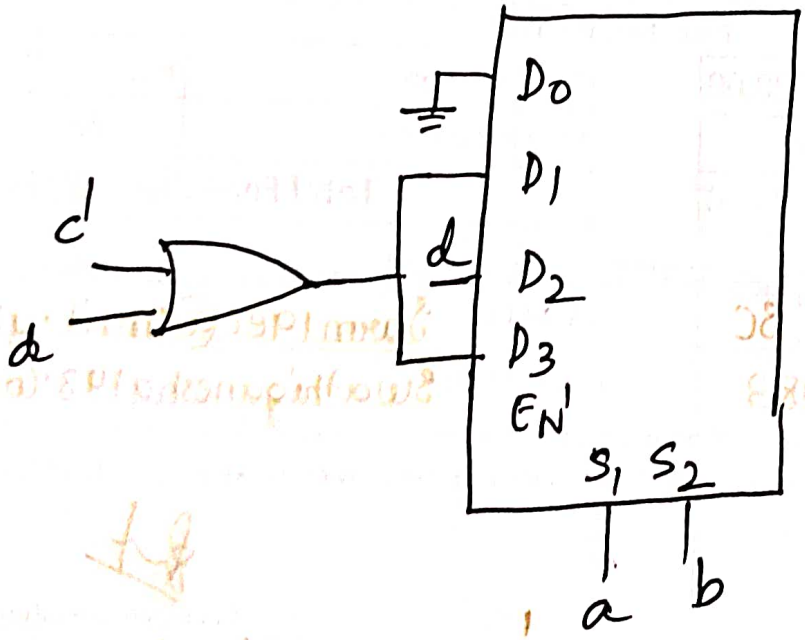
$= ab'c'd + ab'cd + abc'd + abcd + a'bdd' +$

$a'bc'd + abc'd' + a'bcd$ (2)

$= \sum(4,5,7,9,11,12,13,15)$

	$c'd'$	$c'd$	cd'	cd	
D_0	0	1	2	3	0
D_1	4	5	6	7	$c'd' + c'd + cd = c' + d$
D_2	8	9	10	11	$c'd + cd = d$
D_3	12	13	14	15	$c'd' + c'd + cd = c' + d$

(4)



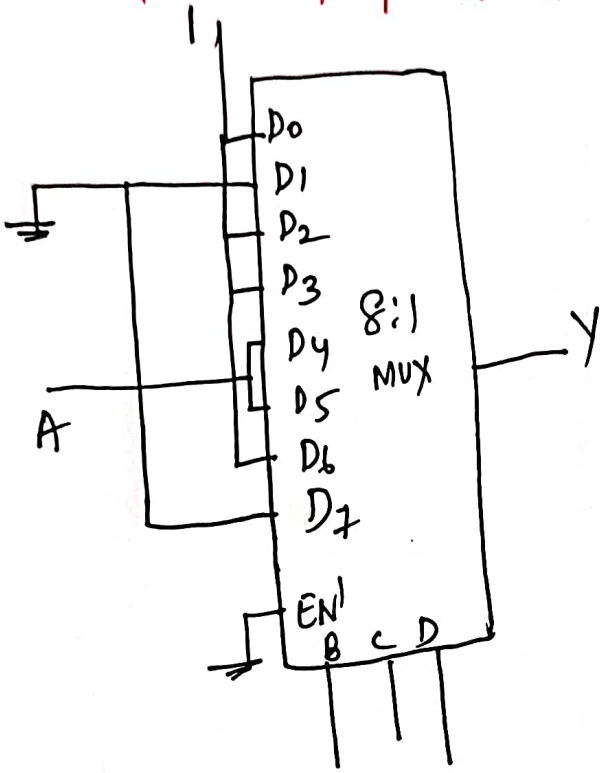
(2)

(5) (i) $F(A,B,C,D) = \Sigma M(0,2,6,10,11,12,13) + \Sigma d(3,8,14)$

In A, B, C, D, [B, C, D is select lines]

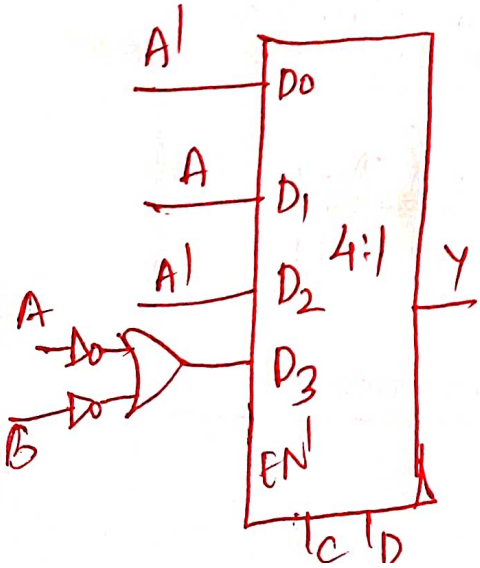
	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
A'	0	1	2	3	4	5	6	7
A	8	9	10	11	12	13	14	15

1 0 1 1 A A 1 0



(5 marks)

(ii) $F_2(A,B,C,D) = \Sigma M(0,2,3,4,6,7,9,11,13,15) + \Sigma d(3,8,14)$



	$A'B'$	$A'B$	AB'	AB
D_0	0	4	8	12
D_1	1	5	9	13
D_2	2	6	10	14
D_3	3	7	11	15

$A'B' + A'B = A'$

$AB' + AB = A$

$= A'B' + A'B = A'$

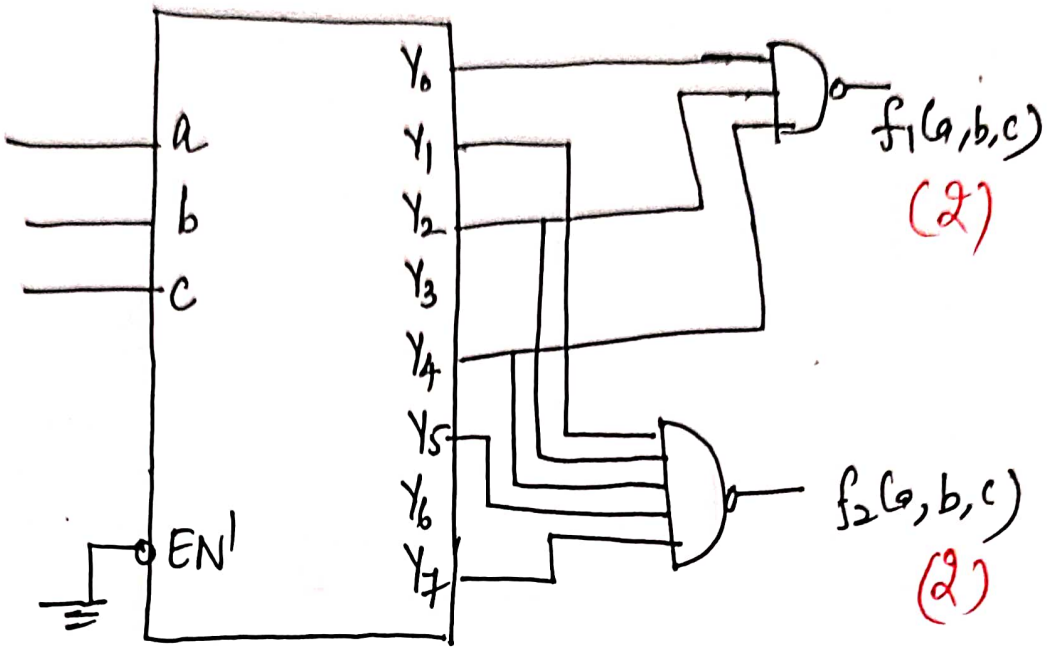
$A'B' + A'B + AB' + AB$

$A' + B'$

(5 marks)

6) a] $f_1(a,b,c) = \Sigma(0,2,4)$

$f_2(a,b,c) = \Sigma(1,2,4,5,7)$



b] $A > B = A_0 B_1' B_0' + A_1 B_1' + A_1 A_0 B_0'$ (2)

$A = B = (A_0 \odot B_0)(A_1 \odot B_1)$ (2)

$A < B = A_1' A_0' B_0 + A_0' B_1 B_0 + A_1' B_1$ (2)