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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B. Tech(IT) (Full Time) - END SEMESTER EXAMINATIONS, NOV/DEC 2024

Information Technology
III Semester
IT5301 & Digital Logic Design
(Regulation 2019)

Time: 3hrs

Max.Marks: 100

CO 1	Simplify complex Boolean functions.
CO 2	Implement digital circuits using combinational logic ICs and PLDs.
CO 3	Understand the characteristics of various Flip-Flops.
CO 4	Design digital circuits with combinational and sequential components
CO 5	Use HDL to build digital systems
CO 6	Analyze digital system designs

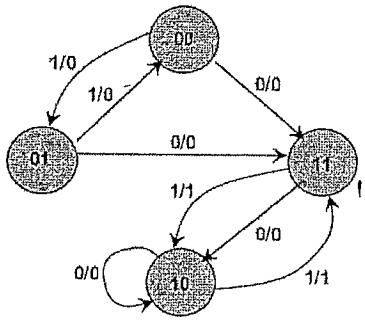
BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analysing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Express the following numbers in octal: $(FEFA.A)_{16}$	2	CO2	L3
2	State De morgan's Theorem	2	CO1	L3
3	Perform 10's complement subtraction of 991-643	2	CO2	L3
4	Write the design procedure of combinational circuit.	2	CO2	L4
5	What is the purpose of valid pin in Encoder	2	CO4	L2
6	Implement the Boolean function $F(W,X,Y) = \pi(0,3,5,6)$ using Nand gates.	2	CO1	L3
7	Differentiate synchronous and asynchronous counters.	2	CO4	L1
8	Write the characteristic equation and table of SR FF.	2	CO3	L2
9	Compare different PLDs.	2	CO6	L1
10	Draw the logic circuit of one bit memory cell.	2	CO2	L2

PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

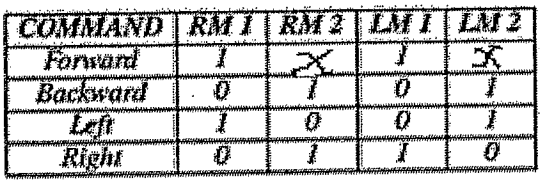
Q. No	Questions	Marks	CO	BL
11 (a) (i)	Convert decimal number +32 and +24 to binary, using the signed-2's-complement representation and enough digits to accommodate the numbers. Then perform the binary equivalent of (+32) + (-26), (-32) + (+26), and (-24) + (-16). Convert the answers back to decimal and verify that they are correct.	13	CO1 and CO4	L3
	OR			
11 (b) (i)	Consider the boolean expression f = xyz' + y'z + w'xz' + x'yz' and	13	CO1 and	L3

	Simplify and draw the logic circuit using two input NAND gate and also write the canonical form of the above expression		CO4	
12 (a) (i)	Simplify the below given functions using k map and draw the logic circuit using primitive gates: F1 = wxy + xy'z + wxy' F2(W,X,Y,Z) = □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ F3(W,X,Y,Z) = π(0,3,5,6,8,9,10,15)	13	CO1 and CO4	L3
	OR			
12 (b) (i)	Design a full adder and write the HDL code for the same circuit.	6	CO3 and CO5	L3
(ii)	Implement the following two Boolean expression using enough half Adder circuit and additional gates **D = A ⊕ B ⊕ C** **E= A'BC+AB'C**	7	CO1 and CO4	L3
13 (a) (i)	Design a 2421 to excess-3 code Converter. Draw the logic circuit using primitive gates.	13	CO6 and CO4	L3
	OR			
13 (b) (i)	Design a 3 x 8 decoder and Implement the following two Boolean expression using 3X8 Decoder and additional gates A(X,Y,Z) = Σ (0,1,5,7)	7	CO6 and CO4	L3
{ii)	Implement a Full substractor using only 4 X 1 mux	6	CO6 and CO4	L3
14 (a) (i)	Write the state table for the diagram fig 1 and identify the type of model it implements.  Figure 1 state diagram	6	CO6	L4
(ii)	Design and implement an Asynchronous Mod 12 up Counter using T FF	7	CO3 and CO4	L3
	OR			
14 (b) (i)	Design a synchronous Mod-10 up/down counter using JK FF which counts in the sequence of Even numbers.	13	CO3 and CO4	L3
15 (a) (i)	Tabulate the Truth Table (TT) for an 8 X 4 ROM that implements the Boolean functions. F(W,X,Y) = Σ(0,1,4,6,7) F(W,X,Y) = Σ(4,7).	9	CO2	L3

	Draw the logical construction of a 2X 2 RAM incorporating the binary cell with various input and output pins	4	CO2	L2
	OR			
15 (b) (i)	Tabulate the PLA programming table and implement the three boolean functions such that you minimize the number of product terms to draw the circuit. $A(X,Y,Z) = \Sigma (1,2,4,6)$ $B(X,Y,Z) = \Sigma (0,1,6,7)$ $C(X,Y,Z) = \Sigma (2,6)$ $D(X,Y,Z) = \Sigma (4,6)$	13	CO2	L3

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16. (i)	Design a wheel steering circuit to control the turns of a robot. The turning conditions are as given it he table. Here the Right Motor (RM) and Left Motor(LM) inputs are used to decide the turning. Design the digital circuit to generate the four commands to control the robot. Assume the inputs of all zeros is used for stopping the robot 	10	CO4	L3
(ii)	Sensors are used monitor the pressure and the temperature of chemical solution stored in a vat. The circuitry for each sensor produces a high voltage when specified maximum value is exceeded. An alarm requiring a low voltage input must be activated when either of the pressure or the temperature is exceeded. Design a circuit for this application.	5	CO1 and CO4	L4

COMMAND	RM 1	RM 2	LM 1	LM 2
Forward	1	X	1	X
Backward	0	1	0	1
Left	1	0	0	1
Right	0	1	1	0