ME (ZTRD) SEMI CR) 30/5/69 I SINAM-UT-NKE JJ)igistal System Design (4 Hours) **BB-5673** Con. 3277-09. [Total Marks : 100 Pm. to 3 P.m. N.B.: (1) Question No. 1 is compulsory. (2) Attempt any four questions from remaining six questions. (3) Assume suitable additional data if required. (4) Figures to the right indicate full marks. 1. (a) Use Shanon's expansion theorem to design a 4 : 1 line multiplexer circuit to 12 implement each of the following function. The signal list for each function is F. x. v. z. Use gates and inverters if necessary. In each case obtain the expansion with respect to variable x and y. $F(x, y, z) = x \cdot y + \overline{x} \cdot z$ $F(x, y, z) = \Sigma m(0, 2, 4, 5)$ (b) Obtain three different equivalent implementation for each of the following function 8 using exclusive OR and exclusive NOR gates and inverters. $F = A \oplus B \oplus C \oplus D$ signal list F, A, B, C, D. (a) Find all the static hazard in the following circuit. For each hazard, specify 10 2. the values of input variable and which variable is changing when hazard occurs for one of the hazard specify the order in which the gate output must change.



(b) The Nand implementation of an exclusion OR gate is shown in figure. 10 Determine the complete fault detection test set for each of the following faults :—



3. (a) Draw the PAL equivalent for the following functions. Write the PAL nomen- 12 clature for the device hence explain the size of the device used.

$$a = X'Y + X'YZ$$
$$b = Z' + XY$$

(b) Following Three functions are to be realized using a suitable decoder (having active low output) and additional appropriate type, 2 input gates. What is the total chip count of the circuit ? Show realization diagram. $F_{1} = \pi M (0, 2, 3, 4)$ $F_2 = \pi M (0, 3, 4, 7) (00)$ (11) (01) (01) (01) $F_3^2 = \pi M (0, 2, 7)$ (01 to 10) (00) (11) (5)



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- 4. (a) With the help of block schematic, illustrate the fundamental differences between 4 different classes of sequential machines.
 - (b) Carry out detailed analysis (including state diagram) of the following 16 circuit :—

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5. Suppose that the Binary serial adder is required by a circuit and the four faults 20 of the circuit denoted by α , β , γ , δ are considerd. The transition tables for the normal and faulty circuit are shown below in table :

9	00	01	10	11
20	90,0	20,1	20,1	2,10
91	120,1	9,,D	9,0	9,,1

9 24 × 2	00	01	10	1)
90	90,0	90,0	2010	2,0
2,	2011	2,0	2,0	2,,1

Tme

Tmo

2 212	00	01	10	11
20	20,1	20,1	20,1	2,,1
9	20,1	9,0	2,0	2,1

Imb

				1
21,27	00	01	iD	1)
20	20,0	20,1	20,1	2,0
2,	2011	2,,0	2,0	2,0.
22	22,0	20	2,0	22,0
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Imd



Show that the optimum test sequences for detecting these four faults are : (1) (01 or 10), (11), (00) (2) (11), (00), (01 or 10) Also show that optimum test sequences for locating faults ψ and δ are (i) (00), (01 or 10) (ii) (11), (11).

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A state diagram for a sequential machine is shown. Recognise the type of the 20 machine. Identify the redundent states. Obtain the simplified state diagram. Design the machine.



7. In an ultrasonic distance measurement set-up, elapsed time between transmitted 20 signal and its echo is measured. This time is a measure of distance between transmitter and the reflecting surface. It is desired to design a digital system for the elapsed time measurement. The input-output signals of the system are listed below :

Input Signals :

TRANSMIT—Active high signal indicates that ultrasonic transmission is on.ECHO—Active high signal indicates the presence of ECHO signal.START—Command to the system to begin countingCLOCK—10 MHz system clock.

Output Signals :

16 bit data output as a measure of elapsed time. Propose a scheme (functional partition diagram) for the system. Make an ASM diagram for the system controller, specify approximate time range your system can measure.