Code No: A109210503 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
DIGITAL LOGIC DESIGN
Computer Science And Engineering

Time: 3 hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain about Read only memory in detail? [15]

2. Explain about the following:
   (a) Merger diagrams
   (b) Flow and implication tables. [15]

3. Explain the differences among a Truth table, a state table, a characteristic table, and an Excitation table. Also explain the difference among a Boolean equation, a state Equation, a characteristic equation, and a Flip-flop input equation. [15]

4. Define BCD Counter and Draw its State table for BCD Counter? [15]

5. (a) Simplify to a sum of 3 terms:
   A'C'D' +AC' +BCD + A'CD' + A'BC + AB'C'
   (b) Given AB' + AB = C, Show that AC' + A'C = B
   (c) Factor to obtain a Product of Sums(simplify where possible) A'C'D' +ABD' + A'CD +B'D. [5+5+5]

6. (a) Design a 2 bit comparator using gates.
   (b) Use an 8-to-1 MUX to design the following combinational logic circuit There are four adjacent parking slots in the XYZ Inc executive parking area. Each slot is equipped with a special sensor whose output is asserted high when a car is occupying the slot. Design a decoding system that will signal the existence of two or more adjacent vacant slots. [10+5]

7. (a) A combinational circuit has 4 inputs(A,B,C,D) and three outputs(X,Y,Z)XYZ represents a binary number whose value equals the number of 1's at the input:
      i. Find the minterm expansion for the X,Y,Z
      ii. Find the maxterm expansion for the Y and Z
   (b) A combinational circuit has four inputs (A,B,C,D), which represent a binary-coded-decimal digit. The circuit has two groups of four outputs - S,T,U,V(MSB digit) and W,X,Y,Z.(LSB digit)Each group represents a BCD digit.The output digits represent a decimal number which is five times the input number. Write down the minimum expression for all the outputs. [15]

8. (a) Perform the subtraction with the following unsigned binary numbers by taking the 2's complement of the subtrahend:

i. 100 - 110000
ii. 11010 - 1101.

(b) Construct a table for 4 -3 -2 -1 weighted code and write 9154 using this code

(c) Perform arithmetic operation indicated below.Follow signed bit notation:

i. 001110 + 110010
ii. 101011 - 100110.

(d) Explain the importance of gray code. [4+4+4+3]

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1. Explain about the following:
   (a) Hazards in sequential circuits
   (b) Four row flow table
   (c) Maximal compatibilities. [15]

2. Explain about the Following
   (a) Serial addition in 4-bit shift register
   (b) BCD Ripple Counter
   (c) Universal Shift Register. [15]

3. Explain about
   (a) ROM
   (b) FPGA. [7+8]

4. (a) Design a circuit with three inputs(A,B,C) and two outputs(X,Y) where the outputs are the binary count of the number of "ON" (HIGH) inputs
   (b) Design a circuit with four inputs and one output where the output is 1 if the input is divisible by 3 or 7. [7+8]

5. Starting from state a, and the input sequences 01110010011,determine the output Sequence for
   (a) The state table below and
   (b) Also the reduced state table to the same state below and show that the same output sequence is obtained for both. [15]

Present state	Next state		output	
	X=0	X=1	X=0	X=1
a	f	g	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

6. Convert the following numbers:
   (a) 10101100111.0101 to Base 10
   (b) $(153.513)_{10} = (\ )_8$
   (c) Find $(3250 - 72532)_{10}$ using 10's complement
   (d) Divide 01100100 by 00011001
   (e) Given that (292)10 $=(1204)_b$ determine 'b' [3+3+3+3+3]

7. (a) Verify that NAND and NOR operations are Commutative but not Associative.
   (b) A certain 4 input gate called LEMON gate realizes the switching function LEMON(A,B,C,D) = BC(A+D)

   Assuming that the input variables are available in both primed and unprimed form:
   i. show a realization of the function f(w,x,y,z)= $\sum$(0,1,6,9,10,11,14,15) with only three LEMON gates and one OR gate.
   ii. Can all switching functions be realized with LEMON/OR logic. [5+5+5]

8. (a) Simplify to a sum of 3 terms:
   A'B'C' +ABD+A'C +A'CD' +AC'D + AB'C'
   (b) As part of an aircraft's functional monitoring system, a circuit is required to indicate the status of the landing gears prior to landing. Green LED display turns on if all three gears are properly extended when the "gear down" switch has been activated in preparation for landing. Red LED display turns on if any of the gears fail to extend properly prior to landing. When a landing gear is extended, its sensor produces a LOW voltage. When a landing gear is retracted, its sensor produces a HIGH voltage. Implement a circuit to meet this requirement.
   (c) In a certain chemical processing plant, a liquid chemical is used in a manufacturing process. The chemical is stored in three different tanks. A level sensor in each tank produces a HIGH voltage when the level of chemical in the tank drops below a specified point. Design a circuit that monitors the chemical level in each tank and indicates when the level in any two of the tanks drops below the specified point. [5+5+5]

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1. (a) Define the following
   i. Preset
   ii. Clear
   iii. Race condition
   iv. Race around condition

   (b) Draw the schematic circuit of T-Flip-flop. Give its truth table. Justify the entries in the truth table? [7+8]

2. (a) Implement Half adder using 4 NAND gates
   (b) Implement full subtractor using NAND gates only. [5+10]

3. Explain about Sequential Programming Devices in detail? [15]

4. (a) Find the possible terms which could be added to the expression using the consensus theorem.Then reduce to a minimum SOP
   A'C'D' + BCD + AB'C' +A'BC

   (b) In a board of directors meeting 4 resolutions A,B,C,D are up to a vote. The vote must be governed by the following rules:
   i. Those who vote for resolution B must also vote for resolution C.
   ii. It is possible to vote for both resolutions A& C, only if a vote for either B or D is also cast.
   iii. Those who vote for either resolution C or D or vote against resolution A must vote for resolution B. Each member of the board has 4 switches A,B,C,D which he presses or releases, depending on whether he is in favor of or against the resolution under the consideration. The switches of each member are the inputs to a circuit associated with that member. Design such a circuit with as few gates as possible. [5+10]

5. (a) What is the gray code equivalent of the Hex Number 3A7
   (b) Find the biquinary of number code for the decimal numbers from 0 to 9
   (c) Find 9's complement $(25.639)_{10}$
   (d) Find (72532 - 03250) using 9's complement. [4+3+4+4]

6. Compare the merits and demerits of ripple and Synchronous Counters? [15]

7. Explain about the Derivation of Latch circuit from Transition table? [15]

8. (a) Design a BCD to Excess-3 code converter using minimum number of NAND gates
   (b) Design a BCD to Gray code converter using 8:1 multiplexers. [10+5]

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1. (a) Design a circuit with four inputs and one output where the output is 1 if the input is divisible by 3 or 7.

   (b) A safe has 5 locks:v,w,x,y,all of which must be unlocked for the safe to open.The keys to the locks are distributed among five executives in the following manner: Mr.A has keys for locks v& x
   Mr.B has keys for locks v& y
   Mr.C has keys for locks w& y
   Mr.D has keys for locks x& z
   Mr.E has keys for locks v& z

      i. Determine the minimal no. of executives required to open the safe.

      ii. Find all the combinations of executives that can open the safe, write an expression f(A,B,C,D,E) which specifies when the safe can be opened as a function of which executives are present

      iii. Who is the 'essential executive' without whom the safe cannot be opened. [7+8]

2. Explain about 4-bit binary Ripple Counters? [15]

3. Explain about the following:

   (a) latch excitation table

   (b) Merging of flow tables. [15]

4. Explain about PLA in Detail? [15]

5. Design a Excess-3 to BCD code converter using minimum number of NAND gates. [15]

6. Reduce the number of states in the following state table and tabulate the reduce state Table [15]

Present state	Next state		output	
	X=0	X=1	X=0	X=1
a	f	g	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

7. (a) Show the weights of three different 4 bit self complementing codes whose only negative weight is - 4 and write down number system from 0 to 9

   (b) Decimal system became popular because we have 10 fingers. A rich person on earth has decided to distribute Rs.one lakh equally to the following persons from various planets. Find out the amount each one of them will get in their respective currencies:

   A from planet VENUS possessing 8 fingers
   B from planet MARS possessing 6 fingers
   C from planet JUPITER possessing 14 fingers
   D from planet MOON possessing 16 fingers [7+8]

8. A Communication system is designed to transmit just two code words A(x1,x2,x3,x4) = 0010 and B(x1,x2,x3,x4)=1101.However, due to noise in the system, the received word can have as many as two errors. Design a combinational circuit such that output f1will be equal to 1 if the received word is A; output f2 will be equal to 1 if the received word is B and output f3 will be equal to 1 if the word received none of these two.

   [15]

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