

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

## PART- A

[25 Marks]

- 1.a) Determine the possible base of the numbers in the operation  $302/20=12.1$ . [2]
- b) Reduce the expression  $A'B(D'+C'D)+B(A+A'CD)$  to one literal. [3]
- c) What are static hazards? [2]
- d) Construct full adder using decoder. [3]
- e) What is the difference between characteristic table and excitation table? [2]
- f) Show the characteristic equation for the true output of JK flip-flop is  $Q(t+1)=JQ'+K'Q$  [3]
- g) How many bit counter is needed to provide a clock with cycle time of 50ns if the clock generator produces pulses at a frequency of 80 MHz? [2]
- h) Compare Synchronous and Asynchronous counters. [3]
- i) What are compatible states? [2]
- j) Explain the difference between ASM and conventional flow chart with respect to timing. [3]

## PART- B

[50 Marks]

- 2.a) State De-Morgan laws.
  - b) Perform the following arithmetic operations in binary using signed 2's complement representation for negative numbers (i)  $(+62) + (-23)$  (ii)  $(-62) - (-23)$ .
  - c) Encode the information character 01101110101 according to the 15 bit Hamming. [2+4+4]
- OR
- 3.a) Obtain the 1's and 2's complement of the binary numbers 10000000 and 0000001.
  - b) Show that a positive logic NAND gate is a negative logic NOR gate and vice versa.
  - c) Obtain the truth-table of the function  $(xy+z)(y+xz)$  and express the function in sum of min terms and product of max terms. [2+4+4]
- 4.a) For the function  $F(w,x,y,z)=\sum(1,2,3,5,13) + \sum\phi(6,7,8,9,11,15)$ , find the minimal sum of products and product of sums expression.
  - b) Implement the function  $F(A,B,C,D)=\sum(0,1,3,4,6,8,15)$  using 4x1 MUX. [5+5]
- OR
- 5.a) Design a 3-input majority circuit using Multiplexer whose output is equal to 1 if the input variables have more 1's than 0's. The output is 0 otherwise.
  - b) Find the min terms of the function  $wxy+x'z'+w'xz$  by plotting the function in a map. [5+5]
- 6.a) Compare Sequential and Combinational circuits.
  - b) Design a JK flip-flop using D flipflop, 2-to-1 line MUX and inverter. [4+6]

OR

- 7.a) What is the difference between a latch and flip-flop?  
 b) Explain the positive edge triggered D flip-flop with asynchronous reset. [4+6]

- 8.a) A sequential circuit with two D flip-flops A and B, two inputs x and y; and one output z is specified by  $A(t+1) = x'y + xA$ ,  $B(t+1) = x'B + xA$ ,  $z = B$ . Draw the logic diagram and list the state table. Draw the state diagram.

- b) What is a universal shift register? [8+2]

OR

- 9.a) Design a counter using T flip-flops with repeated sequence 0,1,3,7,6,4.

- b) Show that a Johnson counter with n flip-flops produces a sequence of  $2n$  states. [5+5]

- 10.a) Draw the multilevel NAND circuit for expression  $F = (AB' + CD')E + BC(A+B)$

- b) Reduce the given expression to a minimum number of literals:

i)  $(BC' + A'D)(AB' + CD')$

ii)  $AB' + CD(A+B)$ .

[5+5]

OR

- 11.a) Find the equivalence partition and corresponding reduced machine in standard form.

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

- b) Explain the control implementation using MUX. [6+4]

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