

- (viii) A ring counter consisting of five Flip-Flops will have
  - (a) 5 states
  - (b) 10 states
  - (c) 32 states
  - (d) infinite states.
- (ix) Shift registers having four bits will enable shift control signal for
  - (a) 2 clock pulses
  - (b) 3 clock pulses
  - (c) 4 clock pulses
  - (d) 5 clock pulses.
- (x) Maximum no of inputs connected to gate is called
  - (a) fan
  - (b) fan in
  - (c) fan out
  - (d) outcome.

**Group - B**

- 2. (a) Subtract the following using binary signed magnitude representation:  
 $(23)_{10} - (38)_{10}$ .
- (b) Convert the following:
  - (i)  $(123.556)_8 = ( ? )_{16}$
  - (ii)  $(A2BF.CC5)_{16} = ( ? )_8$
- (c) (i) Find the IEEE 754 Floating point (32 bits) representation of  $(13.625)_{10}$ .  
 (ii) Find out the Decimal Number for which the IEE 754 Floating point representation is as follows:

S	E	M
0	10000010	101101

**4 + 3 + 5 = 12**

- 3. (a) Convert the decimal number 45678 to its hexadecimal equivalent number.
- (b) Convert  $(177.25)_{10}$  to octal.
- (c) Using 7's complement and 8's complement, obtain the difference:  
 $1023_8 - 424_8$ .

**4 + 3 + 5 = 12**

**Group - C**

- 4. (a) Reduce the following Boolean expression into four literals and draw the diagram using minimum number of NAND gates:  
 $(A+C+D)(A+C+D')(A+C'+D)(A+B')$ .
- (b) Simplify the Boolean function  
 $F(w,x,y,z) = \Sigma(1,3,7,11,15)$  with don't care conditions  $d(w,x,y,z) = \Sigma(0,2,5)$ .

What is the difference between K-Map and Quine McClusky's Method?

- (c) Simplify the following Boolean Function by Quine McClusky's method  
 $F = \Sigma(0,1,2,8,10,11,14,15)$ .

**4 + (3+1) + 4 = 12**

- 5. (a) Prove that the sum of minterms of a Boolean function of n variables is equal to 1.
- (b) Express the following as the POS form that is in the form of product of minterms:  
 $F(A,B,C,D) = D(A'+B)+B'D$ .

**6 + 6 = 12**

**Group - D**

- 6. (a) Draw the Diagram of BCD to excess-3 Code Converter with explanation.
- (b) Implement a Full adder with a Decoder and two OR Gates.
- (c) Show that a 4 x 16 decoder can be constructed with two 3 x 8 decoders.

**4 + 4 + 4 = 12**

- 7. (a) Design a 4:1 multiplexer using 2:1 multiplexer.
- (b) Design a 8 to 1 multiplexer by using the four variable function given by  
 $F(A,B,C,D) = \Sigma m(0,1,3,4,8,9,15)$ .

**5 + 7 = 12**

**Group - E**

- 8. (a) Design a sequential circuit whose state-table is listed below:

Present State		Input	Next State		Output
A1	A2	x	A1	A2	y
0	0	0	0	0	0
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	0	0	1
1	0	0	1	0	0
1	0	1	0	1	0
1	1	0	1	1	0
1	1	1	0	0	1

- (b) Convert a JK flip-flop to a D flip-flop. You can use additional circuitry if required.

**6 + 6 = 12**

9. (a) What is the difference between synchronous counter and asynchronous counter?

- (b) What is a shift register? Can a shift register be used as a counter? If yes, explain how?

- (c) With relevant diagram explain the working of a master-slave JK flip flop.

**3 + 3 + 6 = 12**

**DIGITAL LOGIC DESIGN  
(MCAP 1101)**

**Time Allotted : 3 hrs**

**Full Marks : 70**

*Figures out of the right margin indicate full marks.*

*Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.*

*Candidates are required to give answer in their own words as far as practicable.*

**Group - A  
(Multiple Choice Type Questions)**

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) Find the unknown base x from the relation  $(110101)_2 = (311)_x$   
 (a) 6 (b) 3 (c) 4 (d) 5.
- (ii) Find the Grey Code for decimal 12  
 (a) 1010 (b) 1100 (c) 0110 (d) 1001.
- (iii) When signed numbers are used in binary arithmetic, then which one of the following notations would have unique representation for zero?  
 (a) Sign-magnitude (b) 1's complement  
 (c) 2's complement (d) 9's complement.
- (iv) Floating point representation is the combination of  
 (a) integer and fraction (b) mantisa and exponent  
 (c) long integer and double (d) integer and double.
- (v) How many Flip-Flops are required for mod-16 counter?  
 (a) 5 (b) 6 (c) 3 (d) 4.
- (vi) Which of the following input combinations is not allowed in SR flip-flop?  
 (a) S=0, R=0 (b) S=0, R=1  
 (c) S=1, R=0 (d) S=1, R=1.
- (vii) Data can be changed from special code to temporal code by using  
 (a) shift registers (b) counters  
 (c) combinational circuits (d) A/D converters.