



**MAULANA ABUL KALAM AZAD UNIVERSITY OF
TECHNOLOGY, WEST BENGAL**

Paper Code : EC-402

**DIGITAL ELECTRONICS AND INTEGRATED
CIRCUITS**

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

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

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the
following : $10 \times 1 = 10$

i) If $\sqrt{71} = 8$; the base (radix) of the number
system is

- a) 5 b) 4
c) 9 d) 10.

ii) The value of x for which $(732)_{10} = (1003)_x$ is

- a) 6 b) 9
c) 8 d) 7.

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iii) In 2's complement sign magnitude form - 51 can be
represented as

- a) 1001101 b) 1101110
c) 1100110 d) none of these.

iv) The minimum number of NAND gates required to
design one full adder circuit is

- a) 8 b) 9
c) 10 d) none of these.

v) The number of comparators required in a 8-bit
flash type A/D converter is

- a) 256 b) 255
c) 64 d) 8.

vi) Asynchronous counter differs from a synchronous
counter in

- a) the mode number
b) the method of clocking
c) the type of flip-flop used
d) the number of states in a sequence.

vii) Number of flip-flops required for a mod 12 ripple counter is

- a) 3 b) 5
- c) 4 d) 6

viii) The number of full addresses required to construct an m -bit parallel adder is

- a) $m/2$ b) $m - 2$
- c) m d) $m + 1$

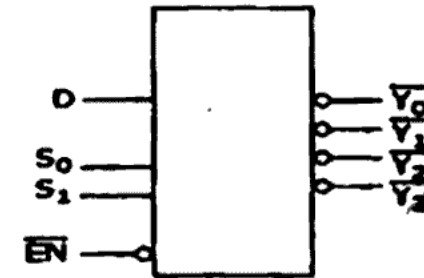
ix) A 3-bit synchronous counter uses flip-flops with propagation delay of 20 ns each. The maximum possible time required for change of state will be

- a) 60 ns
- b) 40 ns
- c) 20 ns
- d) none of these.

x) A code used for labelling the cells of a K -map is

- a) Hexadecimal b) Gray
- c) 8-4-2-1 d) Octal.

xi) For the device shown here, assume the D input is Low, both S inputs are High and the \overline{EN} input is High. What is the status of the \overline{Y} outputs?



- a) All are High
- b) All are Low
- c) All but \overline{Y}_0 are Low
- d) All but \overline{Y}_0 are High.

xii) Which of the following is the most widely used alphanumeric code for computer input and output?

- a) Gray
- b) ASCII
- c) EBCDIC
- d) Parity.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Design full adder circuit using 4×1 multiplexers.
3. Simplify the following expressions using *K-map* :
$$F = m(2, 3, 5, 6, 11, 15) + d(1, 0, 13)$$
$$F = m(0, 1, 2, 5, 6) + d(3, 7, 8)$$
4. Show the 8-bit subtraction of the decimal numbers 25 and - 89 in 2's complement representation. What is excess-3 code ? $3 + 2$
5. a) Define the following terms related with digital IC :
 - i) Propagation delay
 - ii) Noise margin
 - iii) Fan-in and Fan-out.b) Write down the characteristic equation of *JK* and *D* flip-flops. $3 + 2$
6. Write short notes on weighted and non-weighted codes.
7. Briefly describe Johnson counter with proper diagram.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Design the following function using suitable MUX : *h*
$$F(A, B, C, D) = \sum(1, 3, 4, 11, 12, 13, 14, 15)$$
b) Design a 16 : 1 MUX using 4 : 1 MUX.
c) Design a full subtractor using two half subtractors.
 $5 + 5 + 5$
9. Write short notes on any *three* of the following : 3×5
 - a) Even parity generator and checker
 - b) *R-2R* ladder type DA converter
 - c) EEPROM
 - d) PLD
 - e) TTL.
10. What is ripple counter ? Design a presettable 4-Bit up asynchronous counter using *J-K* flip-flop. A binary ripple counter is required to count up to $(16383)_{10}$. How many flip-flops are required ? If the clock frequency is 8.192 MHz, what is the frequency at the output of the MSB ? $2 + 7 + 6$

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11. a) Design MOD 13 asynchronous UP/DOWN counter with JK flip-flop.
- b) Write down the difference between combinational circuit and sequential circuit. 12 + 3
12. a) Using K-map method, simplify the following function :
- $$F(w, x, y, z) = \sum (1, 3, 4, 5, 6, 7, 9, 12, 13)$$
- b) What do you mean by SOP and POS ?
- c) What do you mean by Maxterm and Minterm ?
- d) State De Morgan's theorem. 6 + 4 + 2 + 3

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