

2025

COMPUTER SCIENCE — MDC

Paper : MN-1

(Computer Fundamental and Digital Logic)

Full Marks : 75

The figures in the margin indicate full marks.

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

1. Answer **any five** questions : 2×5
- (a) Find the Octal representation of $(ABF.9E)_{16}$.
 - (b) Distinguish between combinational and sequential circuits.
 - (c) State and prove Distributive Law.
 - (d) What is the Principle of Duality?
 - (e) What is the difference between a latch and a flip-flop?
 - (f) What is multiplexer?
 - (g) State De Morgan's theorems.
 - (h) What is S-R flip-flop?

Answer **any three** questions.

2. (a) What do you mean by error detection code? Give an example.
(b) How Binary Coded Decimal (BCD) differ from Grey Code in terms of representation and application? 2+3
3. Simplify the Boolean function :
 $F(A, B, C, D) = (0, 1, 2, 5, 8, 9, 10, 14)$ using Karnaugh map and implement it using NOR gates. 2+3
4. What is a magnitude comparator? Design a 1-bit comparator using NAND Logic gates only and draw the appropriate Logic circuit diagram. 2+3
5. What is a half adder? Design a half adder using basic logic gates and draw the appropriate logic circuit diagram. 3+2
6. What is a register? Draw the circuit of a 2-bit Serial In Serial Out (SISO) register using D flip-flop. 2+3

Please Turn Over

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Answer *any five* questions.

7. (a) Prove that the NAND gate is a universal gate by implementing OR, AND and NOT logic operations.
(b) Perform 2's complement subtraction for (110111) base 2 – (101010) base 2 and explain the steps. 6+4
8. (a) Write a short note on Supercomputers.
(b) What is system software? What are the differences between system and applications software?
(c) What is virus? What are the steps that can be taken to detect and prevent it from affecting computer systems? 3+3+(1+3)
9. (a) Implement Boolean function $F(A, B, C) = (0, 2, 4, 7)$ using 4 : 1 multiplexer.
(b) Design 3 : 8 decoder using 2 : 4 decoder and other necessary logic gates. 5+5
10. (a) Explain a half subtractor.
(b) Design a circuit that multiplies A_1A_0 with B_1B_0 using basic logic gates. Draw the truth table. 2+8
11. (a) Design a MOD-6 Ripple UP counter.
(b) Draw the truth table and timing diagram. 5+(2+3)
12. (a) Write the difference between asynchronous and synchronous counters.
(b) Convert a D flip-flop into a T flip-flop. Draw the excitation table and logic diagram. 5+5
13. (a) Draw and explain the working of a Master-Slave J-K flip-flop with a truth table.
(b) What is the race-around condition? 5+5
14. (a) Define noise margin with respect to TTL logic gates.
(b) Draw the circuit diagram of a TTL NAND gate and explain its operation. 3+(4+3)
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