MAY 2025 **U/ID 32514/UCM5C**

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Define set.

2. Compare finite set and infinite set with an example.

3. Find the cardinal number of $A = \{a, e, i, o, u\}$.

4. Quote the commutative law of axiom of Boolean Algebra.

5. Construct the table if $B = [0,1]$, define the operation + in Boolean Algebra.

6. Define switching circuit.

7. Construct the truth table of OR-gate.

8. What is called a recurrence relation?

9. Write down the generating function of a numeric function $a_0, a_1, a_2, \ldots a_n$.

10. Define walk.

11. Give an example for a cycle.

12. What is called an Euler Graph?

PART B — (5 × 5 = 25 marks)

Answer any FIVE questions.

13. Determine the power set of the given set $\{1, 2, 3\}$.

14. Show that
$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \ldots \frac{1}{n(n+1)} = \frac{n}{n+1}.$$

15. Find complete disjunctive normal form in two variable $x_1 x_2$ and show that its value is 1.

16. Show that the sets $B = \{0,1\}$ and define the operation + and • in Boolean Algebra by the following table

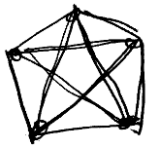
+	0	1
0	0	1
1	1	0

•	0	1
0	0	0
1	0	1

17. Discuss the positions of switches x and y are connected in parallel.

18. Prove that $C(n,r) = C(n-1,r) + C(n-1,r-1)$.

19. In the Petersen graph, find



(a) a trail of length 5

(b) a path length 9

(c) Cycle of length 5 and 9.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Show that $1 + 2 + \ldots + n = \dfrac{n(n+1)}{2}$, $n \geq 1$.

21. State and prove Boole's Expansion Theorem.

22. Draw the logic circuit for each of the following Boolean expression

(a) $x \circ y + y \circ z$.

(b) $a' \circ (a \circ b' + a' \circ c)$.

23. Solve the following Recurrence relationship between $16a_r - 8a_{r-1} + a_{r-2} = 0$.

24. If G is a graph in which the degree of every vertex is atleast two then prove that G contains a cycle.
