



2025

3rd Semester Examination (CCFUP : NEP)

BCA

Paper : M] 4-T (Single Core Major)

(Discrete Mathematics)

Full Marks : 60

Time : Three Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

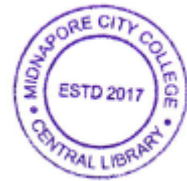
Group - A

Answer any *ten* questions : $2 \times 10 = 20$

1. Define Tautology and Contradiction.
2. Define the Cayley-Hamilton theorem.
3. Define the rank of a matrix.
4. Find the generating function for the sequence 1,1,1,1,.....
5. Define Big-O notation.
6. Define an uncountably infinite set with an example.
7. What is a spanning tree?
8. How many ways can five books be arranged on a shelf?

P.T.O.

9. State the principle of mathematical induction.
10. Define contradiction and contingency with examples.
- ✓ 11. What is an equivalence relation?
- ✓ 12. Define graph isomorphism.
- ✓ 13. Briefly describe Hamiltonian path and circuit.
- ✓ 14. If $A = \{1,2,3\}$, $B = \{3,4,5\}$ and $C = \{0,2,3\}$, find $(A \cap B) \times C$.
15. What is an eigenvector?



Group - B

Answer any *four* questions : $5 \times 4 = 20$

16. Prove that there is one and only one path between every pair of vertices in a tree, T .
- ✓ 17. Prove that the following is a Tautology $((P \rightarrow R) \wedge (Q \rightarrow R)) \rightarrow ((P \vee Q) \rightarrow R)$.
18. Define a well-formed formula (WFF). State its rules of formation.
- ✓ 19. Solve the recurrence relation :
 $a_n = 5a_{n-1} - 6a_{n-2}, a_0 = 1, a_1 = 4. (-1 \cdot 2^n + 2 \cdot 3^n)$
- ✓ 20. State and explain Euler paths and Euler circuits. What is a planar graph?



(3)

21. Show that the mapping $f: R \rightarrow R$ defined by $f(x) = 3x + 5, x \in R$ is bijective. Determine f^{-1} .

Group - C

Answer any two questions : $10 \times 2 = 20$

22. (a) Using mathematical induction prove that $(n^3 + 2n)$ is divisible by 3. 5

- (b) Using generating function solve the following recurrence relation : $a_r + 3a_{r-1} - 4a_{r-2} = 0, r \geq 2$ with $a_0 = 3, a_1 = -2$. 5

23. Derive the formula for permutations of n objects taken r at a time. Find the number of integers between 1 and 100 that are divisible by 2 or 3.

24. (a) Show the following equivalence :

$$\neg(P \supset Q) \Leftrightarrow (P \wedge \neg Q) \vee (\neg P \wedge Q). \quad 4$$

- (b) Write short notes on :

Bipartite Graph, Complement of a graph. 6

25. Find the values of x such that the matrix $\begin{bmatrix} 1 & x \\ -x & 1 \end{bmatrix}$ is orthogonal. Solve the system of equations using the matrix inverse method : $x + y = 3, 2x + 3y = 7$.