Total Pages : 3

2025

3rd Semester Examination (CCFUP : NEP)

BCA

Paper : MJ 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 : 2×10=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 : 5×4=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 $((P \to R) \wedge (Q \to R)) \to ((P \vee Q) \to R)$.

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?

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

Group - C

Answer any *two* questions : 10×2=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 :

$$\sim (P \rightleftharpoons Q) \Leftrightarrow (P \wedge \sim Q) \vee (\sim P \wedge Q).$$ 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 : $x + y = 3,\ 2x + 3y = 7$.
