B.Sc./5th Sem/COS/25(NEP)

2025

5th Semester Examination (CCFUP : NEP)

COMPUTER SCIENCE

Paper : MJ 10-T (Single Core Major)

[Discrete Structure]

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. What is the power set of a set?
2. State the Principle of Inclusion-Exclusion for three sets.
3. What is a relation from set A to set B?
4. Define onto mapping with example.
5. State the Pigeonhole Principle.
6. State the principle of mathematical induction.
7. What is an equivalence relation?
8. What is regular graph with example?

P.T.O.

9. Find the generating function for the sequence $\{1, -1, 1, -1, \ldots\}$.

10. Define Tautology.

11. If $f(x)=2x+1$ and $g(x)=x^2$, find $(g \circ f)(x)$ and $(f \circ g)(x)$.

12. Define Big-O notation.

13. Define an uncountably infinite set with an example.

14. Arrange the following in increasing order of growth :

$n \log n$, n^2, $\log n$, n.

15. Find the domain and range of the relation R is given by :

$R = \{(x, y) : y = x + 6/x$, where $x, y \in N$ and $x < 6\}$.

Group - B

Answer any ***four*** questions : 5×4=20

16. Use mathematical induction to prove that $8^n - 3^n$ is multiple of 5 for all $n \geq 1$.

17. Prove that a tree with n vertices has $(n-1)$ edges.

18. To check that $((p-q) \wedge (q-r) \rightarrow (p-r)$ is tautology or not.

19. Solve the second-order recurrence $a_n = 2a_{n-1} - a_{n-2}$, $a_0 = 1$, $a_1 = 2$.

20. Define Reflexive, Symmetric and Transitive Relations with examples.

21. Let R be the relation on the set 'I' of integers defined by xRy, if $(x-y)$ is divisible by 4. Show that R is an equivalence relation.

Group - C

Answer any ***two*** questions : 10×2=20

22. Solve the difference equation by generating function $a_r = 3a_{r-1} + 1$, $r \geq 1$ with boundary condition $a_0 = 1$.

23. (a) In a class containing 50 students, 15 play tennis, 20 play cricket and 20 play hockey, 3 play tennis and cricket, 6 play cricket and hockey, 5 play tennis and hockey. 7 play no game at all. How many play cricket, tennis and hockey?

(b) With the help of an example to show that the two graphs are isomorphic. 6+4

24. (a) Prove that a simple graph with n vertices and k components can have at most $(n-k)(n-k+1)/2$ edges.

(b) Solve the difference equation $a_r - 4_{r-1} + 4a_{r-2} = 0$. 6+4

25. (a) Solve the difference equation $a_r = a_{r-1} + a_{r-2}$ for all $r >= 2$ where $a_0 = 1$ and $a_1 = 1$.

(b) Show that the maximum number of edges of simple graph with n vertices is $n(n-1)/2$. 6+4