



ST. FRANCIS DE SALES COLLEGE

A FRANSALIAN INSTITUTE OF HIGHER EDUCATION **AUTONOMOUS**

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Electronics City P.O., Bengaluru - 560 100, Karnataka, INDIA ☎ (+91) 8088140679 ✉ pro@sfscollege.in 🌐 www.sfscollege.in

END SEMESTER EXAMINATION – NOV/DEC 2025

COMPUTER SCIENCE – I SEMESTER BCA (F+R)

24BCA13: DISCRETE STRUCTURES

Time: 3 Hours

Max. Marks: 80

Instruction: Answer should be written completely in English.

SECTION - A

Answer any **FIVE** questions. Each question carries **TWO** marks.

(5X2=10)

1. Define domain and range of a relation.
2. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x) = 3x - 7$ prove that f is onto.
3. Construct the truth table $(p \rightarrow q) \leftrightarrow r$.
4. Find the values of i) 4P_3 ii) 6C_3
5. Find x if $\begin{vmatrix} 2 & 3 \\ 4 & 5 \end{vmatrix} = \begin{vmatrix} x & 3 \\ 2x & 5 \end{vmatrix}$.
6. Define Square matrix with an example.
7. What is the minimum cost of spanning tree?

SECTION - B

Answer any **SIX** questions. Each question carries **FIVE** marks.

(6X5=30)

8. Show that the relation "is congruent to" is an equivalence relation on set of triangles.
9. In a survey of 100 persons, it was found that 30 read magazine A, 40 read magazine B and 50 read magazine C, 10 read magazine A and B, 10 read magazine A and C and 5 read magazine B and C. Find the number of persons who read all the 3 magazines?
How many read only magazine B?
10. Let $A = \{1, 2, 3, 4, 6\}$ Let R be the relation on A defined by $\{(a, b)/a, b \in A, \text{ and } b \text{ is exactly divisible by } a\}$
 - i) Write the Relation R .
 - ii) Find the domain of relation R .
 - iii) Find the range of relation R .
 - iv) Find inverse of a relation R^{-1} .
11. Prove that $\sim(p \leftrightarrow q) \equiv \sim[(p \rightarrow q) \wedge (q \rightarrow p)]$.
12. Find Eigen values and Eigen vectors for $A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.
13. Solve $2x + 3y + z = 9$, $4x + y = 7$, $x - 3y - 7z = 6$ using Cramer's rule.
14. Define the following terms i) Path ii) Walk iii) Trail iv) Circuit v) Loop
15. Define Graph. Explain any three types of graphs.



SECTION - C

Answer any **FIVE** questions. Each question carries **EIGHT** marks.

(5X8=40)

16. a. If $A=\{1,2\}$, $B=\{2,3\}$, $C=\{3,4\}$.

Find i. $A \times (B \cup C)$ ii. $(A \times B) \cap (A \times C)$

b. Find the value of x and y if $(2x-y, 25) = (15, 2x+y)$.

17. a. Using the principle of Mathematical Induction prove that

$$1.2+2.3+3.4+\dots+n(n+1) = \frac{n(n+1)(n+2)}{3}.$$

b. Let $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by $f(x)=2x+5$. Prove that f is one to one and onto.

18. Find the number of arrangements of the letters of the word INDEPENDENCE. In how many of these arrangements:

- Do the word start with P?
- Do all the vowels occur together?
- Do the vowels occur together?
- Do the vowels begin with I and end with P?

19. Find n if ${}^{2n}C_3 : {}^nC_3 = 12:1$.

20. Find the inverse of the matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ -2 & 1 & 0 \\ 1 & 3 & 2 \end{bmatrix}$.

21. If $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$ prove that $A^2 - 4A - 5I = 0$.

22. Develop the minimum cost spanning tree using Kruskal's algorithm. Also compute the minimum cost of spanning tree.

