

**Q.P. Code : 15123**

**First Semester B.C.A. Degree Examination,  
November/December 2019**

*(CBCS – (Freshers & Repeaters)*

**Computer Science**

**Paper 105 T – DISCRETE MATHEMATICS**

*Time : 3 Hours]*

*[Max. Marks : 100*

*Instructions to Candidates : Answer all Sections.*

**SECTION – A**

- I. Answer any **TEN** of the following. Each question carries **2** marks : **(10 × 2 = 20)**
1. If  $A = \{2, 3, 4, 5\}$  and  $B = \{0, 1, 2, 3\}$  find  $A \cap B$ .
  2. If  $A = \{1, 2, 3\}$ ,  $B = \{3, 4, 5\}$  and  $C = \{0, 2, 3\}$ , find  $(A \cap B) \times C$ .
  3. Define Tautology.
  4. Define Scalar matrix with example.
  5. If  $A = \begin{bmatrix} 3 & 2 \\ -1 & 4 \end{bmatrix}$  and  $B = \begin{bmatrix} 3 & 5 \\ -2 & 4 \end{bmatrix}$ , find  $2A + 3B$ .
  6. Find the characteristic roots of the matrix  $A = \begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$ .
  7. If  $\log_7^x + \log_7 x_7^2 + \log_7 x_7^3 = 6$ , find  $x$ .
  8. Define permutation and combination.
  9. Define an abelian group.
  10. If  $\vec{a} = 2\hat{i} + 3\hat{j} - 4\hat{k}$ ,  $\vec{b} = 3\hat{i} - 4\hat{j} - 5\hat{k}$ , find  $|\vec{a} + \vec{b}|$ .
  11. Find the distance between the point  $A = (-7, 4)$  and  $B = (-5, -1)$ .
  12. Find the equation of the line whose  $y$ -intercept is  $-2$  and slope is  $\frac{3}{2}$ .

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SECTION – B

II. Answer any **SIX** of the following. Each question carries **5** marks : **(6 × 5 = 30)**

13. If  $A = \{1, 4\}$ ,  $B = \{2, 3, 6\}$ ,  $C = \{2, 3, 7\}$  then verify that

$$A \times (B - C) = (A \times B) - (A \times C).$$

14. Show that the function  $f : Q \rightarrow Q$  defined by  $f(x) = 2x + 3$  is both one-one and onto. Here  $Q$  is the set of all rational numbers.

15. Prove that  $p \vee (q \wedge r) \leftrightarrow [(p \vee q) \wedge (p \vee r)]$  is a Tautology.

16. Write the converse, inverse and contra-positive of the conditional. "If two integers are equal then their squares are equal".

17. Prove that  $(p \leftrightarrow q) \equiv (p \rightarrow q) \wedge (q \rightarrow p)$ .

18. Find the inverse of the matrix

$$A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$$

19. Using Cramer's rule solve :

$$5x - y - 4z = 5, \quad 2x + 3y + 5z = 2, \quad 7x - 2y + 6z = 5.$$

20. Verify the Cayley-Hamilton theorem for the matrix  $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ .

SECTION – C

III. Answer any **SIX** of the following. Each question carries **5** marks : **(6 × 5 = 30)**

21. If  $\log\left(\frac{a+b}{3}\right) = \frac{1}{2}(\log a + \log b)$ , show that  $a^2 + b^2 = 7ab$ .

22. How many three digit even numbers can be made using the digits 1, 2, 3, 4, 6, 7, if no digit is repeated?

23. If  $2nc_3 : nc_3 = 11:1$  find  $n$ .

24. Prove that the set  $G = \{1, -1, i, -i\}$  form an abelian group under multiplication.

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25. Show that  $H = \{0, 2, 4\}$  is subgroup of the group  $(G, +_6)$ , where  $G = \{0, 1, 2, 3, 4, 5\}$
26. If  $\vec{a} = 2\hat{i} - 3\hat{j} + \hat{k}$ ,  $\vec{b} = \hat{i} + \hat{j} - \hat{k}$ ,  $\vec{c} = 3\hat{i} - \hat{j} + 2\hat{k}$ , verify that  
 $\vec{a} \cdot (\vec{b} + \vec{c}) = \vec{a} \cdot \vec{b} + \vec{a} \cdot \vec{c}$
27. Find the area of the triangle whose vertices are  $A(3, 2, 1)$ ,  $B(4, -1, 2)$  and  $C(-1, 3, 2)$  using vector method.
28. Find the value of 'm', if  $\vec{a} = m\hat{i} - 3\hat{j} + 4\hat{k}$ ,  $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$  and  $\vec{c} = 2\hat{i} + \hat{j} + \hat{k}$  are co-planar.

SECTION - D

- IV. Answer any **FOUR** of the following. Each question carries **5** marks : **(4 × 5 = 20)**
29. Prove that the points  $(6, 4)$ ,  $(7, -2)$ ,  $(5, 1)$  and  $(4, 7)$  form the vertices of a parallelogram.
30. Find the ratio in which the points  $p(2, 7)$  divides the line joining the points  $A(8, 9)$  and  $B(-7, 4)$ .
31. Find the equation of the perpendicular bisector of the line joining the points  $A(3, -2)$  and  $B(4, 1)$ .
32. Find the value of  $k$  such that the line  $(k-2)x + (k+3)y - 5 = 0$  is perpendicular to the line  $2x - y + 7 = 0$ .
33. If the acute angle between the lines  $4x - y + 7 = 0$  and  $k_x - 5y - 9 = 0$  is  $45^\circ$ . Find the value of  $k$ .
34. Find the equation of the line passing through the point of intersection of the lines  $2x + 3y - 7 = 0$  and  $5x - 6y + 8 = 0$  and the point  $(4, 3)$ .