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First Semester B.C.A. Degree Examination, August/September 2021

(CBCS Scheme — Freshers and Repeaters)

Computer Science

Paper BCA105T — 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. Define Power Set. Illustrate with an example.

2. If $A = \{1, 2, 4, 8\}$, $B = \{1, 3, 4\}$ and $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$ verify $A - B = A \cap \overline{B}$.

3. Construct the truth table for $\sim p \wedge q$.

4. Define Scalar matrix with example.

5. If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 3 \\ 4 & 5 \end{bmatrix}$ find AB.

6. Find the characteristic equation of the matrix $\begin{bmatrix} 3 & 1 \\ 1 & 4 \end{bmatrix}$.

7. Show that $\log_{10}^{200} + \log_{10}^{5} = 3$.

8. If $^{n}C_7 = {}^{n}C_5$ find 'n'.

9. On the set of integers Z, the binary operation '*' is defined by $a * b = \dfrac{ab}{3}$, $\forall\, a, b \in Z$. Find Identity element.

10. If $\vec{a} = 3i - 4j$, $\vec{b} = 2i + j$ find $\left| \vec{a} + \vec{b} \right|$.

11. Find the distance between the points (2, 3) and (1, 3).

12. Write the slope, x-intercept and y-intercept of the line $\sqrt{3}x + y + 2 = 0$.

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SECTION – B

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

13. In a college of 400 students, 180 students take Mathematics as major subject, 160 take Physics as major subject and 150 take neither. Find

    (a) how many students take both Mathematics and Physics as major subjects?

    (b) how many take Mathematics as major but not Physics?

14. If $f : R \to R$ is defined by $f(x) = 5x - 7$, show that f is one-one and onto.

15. Show that the proposition $(p \to q) \leftrightarrow \sim p \vee q$ 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. Show that $[p \vee (q \wedge r)] \equiv [(p \vee q) \wedge (p \vee r)]$.

18. Find the inverse of the matrix $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & -1 & 3 \\ -3 & -2 & 4 \end{bmatrix}$.

19. Solve using Cramer's rule $2x + 5y + z = -1$, $x + 7y - 6z = -18$, $3y + 6z = 9$.

20. Find the eigen values and the eigen vectors of the matrix $\begin{bmatrix} 1 & 2 \\ 3 & 2 \end{bmatrix}$.

SECTION – C

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

21. If $\log_8^x + \log_4^x + \log_2^x = 11$ find 'x'.

22. (a) Find 'n' if $^n P_4 = 10 \cdot {}^n P_3$.

    (b) Find 'n' if $^n C_{n-4} = 5$.

23. A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee of (a) exactly 3 girls (b) atleast 3 girls (c) atmost 3 girls?

24. Show that $G = \{1, 2, 3, 4\}$ is an abelian group under multiplication modulo 5.

25. Find the number of 4 digit numbers can be formed using the digits 1, 2, 3, 4, 5 if no digit is repeated. How many of these will be even?

26. Show that the points whose position vectors are $2i - j + k$, $i - 3j - 5k$ and $3i - 4j - 4k$ form a right angled triangle. Also find the remaining angles of the triangle.

27. Show that the points A(1, 2, 3), B(2, 3, 1) and C(3, 1, 2) are vertices of an equilateral triangle.

28. Find the area of the parallelogram whose diagonals are $\vec{a} = 3i + 2j - 2k$ and $\vec{b} = i - 3j + 4k$.

SECTION – D

IV. Answer any **FOUR** of the following. Each question carries **5** marks : **(4 × 5 = 20)**

29. Show that the points (2, –2), (8, 4), (5, 7) and (-1, 1) are the vertices of a triangle.

30. Find the area of the quadrilateral whose vertices are A(1, 1), B(3, 4), C(5, -2) and D(4, –7).

31. Find the equation of the locus of the point which moves such that its distance from the point (2, 3) is twice its distance from (-2, 2).

32. Show that the line joining the points (2, –3) and (-5, 1) is parallel to the line joining the points (7, –1) and (0, 3).

33. Find the equation of the line passing through (-2, 1) and making an angle of 135° with the positive direction of X axis.

34. Find the equation of the line passing through (-2, 2) and the sum of the intercepts on the co-ordinate axes is 3.

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