



US – 648

II Semester B.C.A. Examination, May 2017
(Y2K8 Scheme)
COMPUTER SCIENCE
BCA 203 : Mathematics

Time : 3 Hours

Max. Marks : 100

Instruction : Section A, B, C, D and E is compulsory to all students.

SECTION – A

I. Answer any 10 of the following.

(10×2=20)

- 1) Define transpose of a matrix. Give an example.
- 2) If $A = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 3 & 2 \end{bmatrix}$ then find $2A'$.
- 3) Define a group. Give an example.
- 4) Show that set of integers, Z with multiplication is not a group.
- 5) Derive n^{th} derivative of a^{bx} .
- 6) Write the n^{th} derivative of $\log(1 - 3x)$.
- 7) Find unit vector along $\hat{i} - 2\hat{j} + \hat{k}$.
- 8) Find $\vec{a} \cdot \vec{b}$ if $\vec{a} = 2\hat{i} + 4\hat{k}$ and $\vec{b} = 3\hat{j} + 2\hat{k}$.
- 9) Evaluate $\int \sqrt{1 + \sin 2x} \, dx$.
- 10) Evaluate $\int \frac{1}{\sqrt{9 - 4x^2}} \, dx$.
- 11) Verify for exactness of the equation $(2xy + 3y) \, dx + (x^2 + 3x) \, dy = 0$.

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- 12) Solve $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$.
- 13) Write the Cartesian equation of the straight line passing through the point (3, 4, 5) and parallel to vector $2\hat{i} + 2\hat{j} - 3\hat{k}$.
- 14) Find the angle between the lines whose direction ratios are (2, 3, 4) and (1, -2, 1).
- 15) Find the co-ordinates of the point which divides the join of (1, 2, 3) and (3, -4, 5) in the ratio 5 : 6.

SECTION - B

II. Answer **any 4** of the following.

(4x5=20)

- 16) Using Cramer's rule find the solution for the system of equation $5x + 3y = 1$ and $3x + 5y = -9$.
- 17) Find eigen values and eigen vectors of $A = \begin{bmatrix} 1 & 4 \\ 3 & 2 \end{bmatrix}$.
- 18) For $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. Compute A^3 using Cayley Hamilton theorem.
- 19) Find n^{th} derivative of $\sin(ax + b)$.
- 20) Find n^{th} derivative of $\frac{x-2}{6x^2+x-1}$.
- 21) If $y = e^{m \sin^{-1} x}$ then prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+m^2)y_n = 0$.

SECTION - C

III. Answer **any 4** of the following.

(4x5=20)

- 22) Prove that $G = \{3^n / n \in \mathbb{Z}\}$ is an abelian group under multiplication.
- 23) Prove that $G = \{1, 5, 7, 11\}$ is a group under multiplication modulo 12.
- 24) Prove that $H = \{0, 2, 4\}$ is a subgroup of a group $G = \{0, 1, 2, 3, 4, 5\}$ under \oplus_6 .
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- 25) Find the vector whose magnitude is 3 units and which is perpendicular to each of the vectors $\vec{a} = 3\hat{i} + \hat{j} - 4\hat{k}$ and $\vec{b} = 6\hat{i} + 5\hat{j} - 2\hat{k}$.
- 26) If the vectors $2\hat{i} - 3\hat{j} + m\hat{k}$, $2\hat{i} + \hat{j} - \hat{k}$ and $6\hat{i} - \hat{j} + 2\hat{k}$ are coplanar then find 'M'.
- 27) Find unit vector coplanar with \vec{a} and \vec{b} perpendicular to \vec{c} given $\vec{a} = 2\hat{i} - \hat{j} - \hat{k}$, $\vec{b} = \hat{i} + 3\hat{j} + \hat{k}$, $\vec{c} = -\hat{i} - 2\hat{j} + \hat{k}$.

SECTION - D

IV. Answer **any 4** of the following.

(4×5=20)

28) Evaluate $\int \frac{3x+2}{4x^2+4x+5} dx$.

29) Evaluate $\int \frac{x \sin^{-1} x}{\sqrt{1-x^2}} dx$.

30) Evaluate $\int_0^{\pi/2} \frac{\sin x}{1+\cos^2 x} dx$.

31) Solve $(x-y) dy - (x+y) dx = 0$.

32) Solve $(1+x^2) \frac{dy}{dx} + y = e^{\tan^{-1} x}$.

33) Solve $(5x^4 + 3x^2y^2 - 2xy^3) dx + (2x^3y - 3x^2y^2 - 5y^4) dy = 0$.

SECTION - E

V. Answer **any 2** of the following.

(2×5=10)

- 34) Show that the points (1, 3, 4), (-1, 6, 10), (-7, 4, 7) and (-5, 1, 1) are the vertices of a rhombus.
- 35) Find the ratio in which the line joining the points (2, 4, 5) and (3, 5, -4) is divided by xy plane and find the coordinate of the point.
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36) Find the value of k such that the lines $\frac{x-1}{2} = \frac{y-2}{2k} = \frac{z+1}{-1}$ and

$$\frac{x+1}{k} = \frac{y+1}{4} = \frac{z-2}{1} \text{ are}$$

- i) parallel and
- ii) perpendicular.

37) Find the equation of a line passing through the point of intersection of the lines $\frac{x-1}{2} = \frac{y-1}{2} = \frac{z+2}{3}$ and $\frac{x+2}{2} = \frac{y-5}{-1} = \frac{z+3}{2}$ and perpendicular to both of them.

SECTION – F

VI. Answer **any 2** of the following.

(2x5=10)

38) If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$, $\vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$, $\vec{c} = 3\hat{i} + \hat{j} + 2\hat{k}$ find $[\vec{a}, \vec{b}, \vec{c}]$.

39) Evaluate $\int \frac{dx}{5+4\cos x}$.

40) Solve $xdy - ydx = \sqrt{x^2 + y^2} dx$.

41) Find the image of the point $(1, 2, 3)$ in the plane $x + y + z = 9$.
