STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2023-24)

B. Sc. DEGREE EXAMINATION, NOVEMBER 2023
BRANCH IV - CHEMISTRY
FIRST SEMESTER

COURSE : ALLIED – CORE
PAPER : MATHEMATICS FOR CHEMISTRY – I
SUBJECT CODE : 23MT/AC/MC15
TIME : 3 HOURS MAX. MARKS : 100

Q. No.	SECTION A ($5 \times 2 = 10$) Answer ANY FIVE questions	CO	KL
1.	State Cayley - Hamilton theorem.	1	1
2.	Solve the equation $x^3 - 12x^2 + 39x - 28 = 0$.	1	1
3.	If $y = sinh^{-1}x$ find $\frac{dy}{dx}$	1	1
4.	Find the n^{th} derivative of $y = (ax + b)^m$	1	1
5.	Eliminate the arbitrary function from $z = f(x^2 + y^2)$	1	1
6.	Prove that $E\nabla = \nabla E = \Delta$	1	1

Q. No.	SECTION B ($10 \times 1 = 10$) Answer ALL questions	CO	KL
7.	If 3 is the eigen value of the matrix A, then the eigen value of the matrix A^2 is _____ a) 6 b) 3 c) 9 d) none	2	2
8.	If the matrix B is similar to the matrix A, then A and B have the same _____ a) Diagonal b) Rank c) Trace d) Characteristic equation	2	2
9.	If $x^3 + px^2 + qx + r = 0$ then the sum of the roots $\alpha + \beta + \gamma =$ _____ $a)\ p$ b) $-p$ c) q d) none	2	2
10.	If an equation remains unaltered when it is changed into its reciprocal, it is called a _____ a) Reciprocal equation b) inverse equation c) algebraic equation d) none	2	2
11.	$sinhx =$ _____ $a)\ \frac{1}{2}(e^x - e^{-x})$ b) $\frac{1}{2}(e^x + e^{-x})$ c) $\frac{(e^x - e^{-x})}{(e^x + e^{-x})}$ d) none	2	2
12.	If $y = e^{ax}$ then $y_n =$ _____ $a)\ e^{ax}$ b) $a^n . e^{ax}$ c) $a . e^{ax}$ d) none	2	2
13.	Eliminating a and b from $z = (x + a)(y + b)$ then the resulting equation is _____ $a)\ z = pq$ b) $z = p$ c) $z = q$ d) none	2	2
14.	Solve the equation $xp + yq = z$ $a)\ \emptyset\left(\frac{x}{y}, \frac{y}{z}\right) = 0$ b) $\emptyset(xy, yz) = 0$ c) $\emptyset(x + y, y + z) = 0$ d) none	2	2
15.	$\Delta =$ _____ $a)\ 1 - E$ b) $1 - E^{-1}$ c) $1 + E$ d) none	2	2
16.	$\Delta y_n =$ _____ $a) y_n$ b) $y_n - y_{n-1}$ c) $y_n + y_{n-1}$ d) none	2	2

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Q. No.	SECTION C ($2 \times 15 = 30$) Answer ANY TWO questions	CO	KL
17.	Examine the eigen values and eigen vectors of the matrix $\begin{bmatrix} 7 & 0 & -2 \\ 0 & 5 & -2 \\ -2 & -2 & 6 \end{bmatrix}$	3	3
18.	(i) Solve $x^4 - 8x^3 + 14x^2 - 8x - 15 = 0$ given that the sum of two roots is equal to the sum of the other two. (ii) Diminish the roots of the equation $x^4 - 4x^3 - 7x^2 + 22x + 24 = 0$ by 1 and hence solve the equation. (8+7)	3	3
19.	(i) Evaluate the nth derivative of $y = \sin(ax + b)$ (ii) Evaluate y_n where $y = \frac{x^2}{(x-1)^2(x+2)}$ (5+10)	3	3
20.	(i) Solve $p(1 + q^2) = q(z - 1)$ (ii) Solve $z = px + qy + \sqrt{1 + p^2 + q^2}$ (7+8)	3	3

Q. No.	SECTION D ($2 \times 15 = 30$) Answer ANY TWO questions	CO	KL
21.	Diagonalize the matrix $\begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$	4	4
22.	Examine the nth differential coefficient of $cos^5\theta\ sin^7\theta$	4	4
23.	Evaluate (i) $\int \frac{dx}{(x+1)\sqrt{x^2+x+1}}$ (ii) $\int \sqrt{(x-3)(7-x)}\, dx$ (5+10)	4	4
24.	Examine using Lagrange's interpolation formula to find $f(x)$ when $x = 10$ x: 5, 6, 9, 11 $f(x)$: 12, 13, 14, 16	4	4

Q. No.	SECTION E ($2 \times 10 = 20$) Answer ANY TWO questions	CO	KL
25.	Analyse Cayley – Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{bmatrix}$	5	5
26.	Solve the equation $2x^5 - 15x^4 + 37x^3 - 37x^2 + 15x - 2 = 0$	5	5
27.	Find the general solution of $(y + z)p + (z + x)q = x + y$	5	5
28.	Use Newton's forward formula to find y when $x = 142$ given that x: 140, 150, 160, 170, 180 y: 3.685, 4.854, 6.302, 8.076, 10.225	5	5