

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

**B. Sc. DEGREE EXAMINATION, NOVEMBER 2024**  
**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 × 2 = 10) Answer ANY FIVE questions	CO	KL
1.	Find the eigen values of $\begin{pmatrix} 1 & 2 \\ 5 & 4 \end{pmatrix}$ .	1	1
2.	Find the $n^{\text{th}}$ differential coefficient of $\sin 3x$ .	1	1
3.	Find a partial differential equation by eliminating the arbitrary function from $z = f(x^2 + y^2)$ .	1	1
4.	Recall Cayley Hamilton theorem.	1	1
5.	Show $E = 1 + \Delta$ .	1	1
6.	Find the value of $\sum \alpha^2 \beta$ if $\alpha, \beta, \gamma$ are the roots of $x^3 - 6x^2 + 11x - 21 = 0$ .	1	1

Q. No.	SECTION B (10 × 1 = 10) Answer ALL questions	CO	KL
7.	Two matrices $A$ and $B$ are said to be similar if there exists a non-singular matrix $P$ such that (a) $P^{-1}BP = B$ (b) $P^{-1}AP = A$ (c) $P^{-1}AP = B$	2	2
8.	If $\lambda$ is the characteristic root corresponding to $X$ , the characteristic vector of $A$ , then _____ (a) $AX = \lambda X$ (b) $AX = \lambda$ (c) $X = \lambda A$	2	2
9.	The value of $\sum \alpha \beta \gamma$ of $x^4 - 8x^3 + 14x^2 - 8x - 15 = 0$ is (a) 8    (b) 14    (c) -8	2	2
10.	If $y = \sinh x$ then $\frac{dy}{dx} =$ (a) $\sinh x$ (b) $\cosh x$ (c) $\tanh x$	2	2
11.	$n^{\text{th}}$ derivative of $\sin(ax + b)$ is (a) $a^n \sin\left(\frac{n\pi}{2} + ax + b\right)$ (b) $b^n \sin\left(\frac{n\pi}{2} + ax + b\right)$ (c) $a^n \cos\left(\frac{n\pi}{2} + ax + b\right)$	2	2
12.	$\int \frac{dx}{\sqrt{x} + \sqrt{1+x}} =$ (a) $(1+x)^{3/2} - x^{3/2}$ (b) $\frac{3}{2}(1+x)^{3/2} - \frac{3}{2}x^{3/2}$ (c) $\frac{2}{3}(1+x)^{3/2} - \frac{2}{3}x^{3/2}$	2	2

13.	Eliminating $a$ and $b$ from $z = (x + a)(y + b)$ the partial differential equation is (a) $z = pq$ (b) $z = (p + 1)q$ (c) $z = p(q + 1)$	2	2
14.	Clairaut's form is: (a) $z = pq + f(p, q)$ (b) $z = px + qy + f(p, q)$ (c) $z = px + qy + c$	2	2
15.	For an unequal interval of $x$ we use _____ (a) Binomial method (b) Lagrange's interpolation formula (c) none of these	2	2
16.	The first differences of $y_n$ for $y = f(x)$ in forward differences is given as _____ (a) $\Delta y_n = y_{n+1} - y_n$ (b) $\Delta y_n = y_n - y_{n+1}$ (c) $\Delta y_n = y_{n+1} + y_n$	2	2

Q. No.	SECTION C ( $2 \times 15 = 30$ ) Answer ANY TWO questions	CO	KL																
17.	Find the characteristic equation of the matrix $A = \begin{bmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{bmatrix}$ and determine its inverse.	3	3																
18.	(a) Diminish the roots of the following equation by 1 and solve $x^4 - 4x^3 - 7x^2 + 22x + 24 = 0$ . (b) Solve the equation: $6x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0$ . (8+7)	3	3																
19.	Find the $n^{\text{th}}$ differential coefficient of $\cos^5 \theta \sin^7 \theta$ .	3	3																
20.	From the following table, find the value of $e^{1.17}$ using Newton's forward formula. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>x</math>:</td> <td>1.00</td> <td>1.05</td> <td>1.10</td> <td>1.15</td> <td>1.20</td> <td>1.25</td> <td>1.30</td> </tr> <tr> <td><math>e^x</math></td> <td>2.7183</td> <td>2.8577</td> <td>3.0042</td> <td>3.1582</td> <td>3.3201</td> <td>3.4903</td> <td>3.6693</td> </tr> </table>	$x$ :	1.00	1.05	1.10	1.15	1.20	1.25	1.30	$e^x$	2.7183	2.8577	3.0042	3.1582	3.3201	3.4903	3.6693	3	3
$x$ :	1.00	1.05	1.10	1.15	1.20	1.25	1.30												
$e^x$	2.7183	2.8577	3.0042	3.1582	3.3201	3.4903	3.6693												

Q. No.	SECTION D ( $2 \times 15 = 30$ ) Answer ANY TWO questions	CO	KL
21.	Diagonalise the matrix $\begin{pmatrix} 2 & 2 & 0 \\ 2 & 1 & 1 \\ -7 & 2 & -3 \end{pmatrix}$ .	4	4
22.	(a) Determine the roots of the equation: $6x^4 - 35x^3 + 62x^2 - 35x + 6 = 0$ . (b) Integrate the function: $\sqrt{(x-3)(7-x)}$ with respect to $x$ (8+7)	4	4

23.	(a) Solve: $p^2 + xp = q$ . (b) Solve: $(y^2 + z^2)p - xyq = -xz$ . (9+6)	4	4																						
24.	(a) Use Lagrange's interpolation formula to find the value of $y$ when $x = 10$ if the values of $x$ and $y$ are given below <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>x</math></td> <td>5</td> <td>6</td> <td>9</td> <td>11</td> </tr> <tr> <td><math>y</math></td> <td>12</td> <td>13</td> <td>14</td> <td>16</td> </tr> </table> (b) Estimate the missing term from the following table. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td><math>x</math></td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> </tr> <tr> <td><math>f(x)</math></td> <td>7</td> <td>?</td> <td>13</td> <td>21</td> <td>37</td> </tr> </table> (8+7)	$x$	5	6	9	11	$y$	12	13	14	16	$x$	1	2	3	4	5	$f(x)$	7	?	13	21	37	4	4
$x$	5	6	9	11																					
$y$	12	13	14	16																					
$x$	1	2	3	4	5																				
$f(x)$	7	?	13	21	37																				

Q. No.	SECTION E ( $2 \times 10 = 20$ ) Answer ANY TWO questions	CO	KL
25.	Eliminate the arbitrary function from $\varphi(x^2 + y^2 + z^2, x + y + z) = 0$ .	5	5
26..	Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 3 & 2 \\ 4 & 3 & 2 \\ 6 & 5 & -1 \end{bmatrix}$	5	5
27.	Find $y_n$ of (a) $y = \frac{3}{(x+1)(2x-1)}$ (b) $e^x \sin x$ (5+5)	5	5
28.	Solve the equation $x^3 - 12x^2 + 39x - 28 = 0$ given that the roots are in arithmetic progression.	5	5

