

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted during the academic year 2019-20 & thereafter)

SUBJECT CODE : 19MT/AC/MC15

B. Sc. DEGREE EXAMINATION, NOVEMBER 2022
BRANCH IV - CHEMISTRY
FIRST SEMESTER

COURSE : ALLIED – CORE
PAPER : MATHEMATICS FOR CHEMISTRY – I
TIME : 3 HOURS

MAX. MARKS : 100

SECTION – A
ANSWER ANY TEN QUESTIONS

(10 × 2 = 20)

1. State Cayley-Hamilton theorem.
2. Find the eigen values of the matrix $\begin{pmatrix} 8 & -4 \\ 2 & 2 \end{pmatrix}$.
3. Solve $x^3 - 12x^2 + 39x - 28 = 0$.
4. If α, β, γ are the roots of the equation $x^3 + px^2 + qx + r = 0$. Find the value of $\alpha^2 + \beta^2 + \gamma^2$.
5. If $y = \cosh^{-1}x$, find $\frac{dy}{dx}$.
6. Find the nth differential coefficients of $\cos(3x + 2)$.
7. Evaluate: $\int \sqrt{x^2 + 2x + 5} dx$.
8. Obtain the partial differential equation by eliminating a and b from $z = (x + a)(y + b)$.
9. Solve $pq = 1$.
10. If $y = \sin^{-1}x$, prove that $(1 - x^2)y_2 - xy_1 = 0$.
11. Evaluate: $\Delta(\tan^{-1}x)$.
12. Write Newton's forward and backward formulae for interpolation.

SECTION – B
ANSWER ANY FIVE QUESTIONS

(5 × 8 = 40)

13. Find the characteristic equation of the matrix $\begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$ and hence determine its inverse.
14. Solve the equation $x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$ given that two of its roots are equal in magnitude and opposite in sign.
15. Prove that if $y = \sin(m \sin^{-1}x)$, $(1 - x^2)y_2 - xy_1 + m^2y = 0$.
16. Evaluate: $\int \frac{1}{(x-1)\sqrt{x^2 + 2x - 8}} dx$.

17. Eliminate ϕ from $\phi(x^2 + y^2 + z^2, x + y + z) = 0$.

18. The following table gives the corresponding values of x and y . Prepare a forward difference table and express y as a function of x . Also obtain y when $x = 2.5$.

x	0	1	2	3	4
y	7	10	13	22	43

19. Determine by Lagrange's method the percentage number of patients over 40 years, using the following data.

Age over (x) years:	30	35	45	55
% number (y) of patients:	148	96	68	34

SECTION – C
ANSWER ANY TWO QUESTIONS

(2 × 20 = 40)

20. (a) Diagonalise the matrix $\begin{pmatrix} 2 & -2 & 3 \\ 1 & 1 & 1 \\ 1 & 3 & -1 \end{pmatrix}$.

(b) Solve the equation $6x^5 - x^4 - 43x^3 + 43x^2 + x - 6 = 0$.

(10+10)

21. (a) If $y = a \cos(\log x) + b \sin(\log x)$, Show that

(i) $x^2 y_2 + x y_1 + y = 0$.

(ii) $x^2 y_{n+2} + (2n + 1) x y_{n+1} + (n^2 + 1) y_n = 0$.

(b) Evaluate: $\int \sqrt{(x-3)(7-x)} dx$.

(15+5)

22. (a) Solve : $(y^2 + z^2) p - xyq = -xz$.

(b) The following are data from the steam table.

Temp $^{\circ}\text{C}$	140	150	160	170	180
Pressure Kg/ cm^2	3.685	4.854	6.302	8.076	10.225

Using Newton's formula, find the pressure of the steam for a temperature of 142°C .

(10+10)



