(FOR THE CANDIDATES ADMITTED IN 2023 ONWARDS)

DURING THE ACADEMIC YEARS 2023 -2025 **(NO. OF PAGES: 02)**

SUB CODE: 23UCY1A1

N.G.M COLLEGE (AUTONOMOUS): POLLACHI

END–OF –SEMESTER EXAMINATIONS: NOVEMBER 2023

COURSE NAME: B. SC CHEMISTRY **MAX. MARKS: 75**

SEMESTER: I **TIME: 3 HOURS**

MATHEMATICS FOR CHEMISTRY - I

SECTION – A **(10 X 1 =10 MARKS)**

ANSWER THE FOLLOWING QUESTIONS: [K1]

1. All diagonal elements are zeros the matrix is known as ------.
   a) square b) scalar c) symmetric d) skew symmetric
2. The successive coefficients can be determined by the method of -------.
   a) division b) synthetic division c) square root d) multiple root
3. The coefficient of x^n in the expansion of e^{a+bx} is **------**.
   a) $\frac{a^e.b^n}{n!}$ b) $\frac{e^a.b^n}{n!}$ c) $\frac{b^n.a^{-e}}{n!}$ d) $\frac{e^{-a}.b^n}{n!}$
4. The Gauss Jordan method reduces a original matrix into a ------- .
   a) identity matrix b) null matrix
   c) skew symmetric matrix d) non symmetric matrix
5. $\Gamma(1) =$ **--------**.
   a) 0 b) 1 c) e^x d) e^{-x}

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES [K2]

6. Define characteristic root.
7. In a polynomial equation with real coefficients how the imaginary roots are occurs?
8. Define binomial series.
9. What method we use in the Gauss elimination method to solve?
10. Define Beta function.

SECTION –B **(5 X 5 = 25 MARKS)**

ANSWER ALL THE QUESTIONS: [K3]

11. a) Show that the matrix $\frac{1}{3}\begin{bmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{bmatrix}$ is orthogonal.

(OR)

b) Find the characteristic roots of the orthogonal matrix $\begin{bmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{bmatrix}$ and verify that they are of unit modulus.

12. a) Solve the equation $x^3 - 12x^2 + 39x - 28 = 0$ whose roots are in A.P.

(OR)

b) Solve $6x^5 + 11x^4 - 33x^3 - 33x^2 + 11x + 6 = 0$.

13. a) Find the sum to infinity of the series $\frac{2.4}{3.6} + \frac{2.4.6}{3.6.9} + \frac{2.4.6.8}{3.6.9.12} + \ldots\infty$.

(OR)

b) Show that $2\left[1 + \frac{(\log_e n)^2}{2!} + \frac{(\log_e n)^4}{4!} + \ldots\right] = n + \frac{1}{n}$.

14. a) Solve the system by Gauss Elimination method: x +2y +z =3, 2x +3y +3z = 10 and 3x –y+2z = 13.

(OR)

b) Solve the system by Gauss Jordan Elimination method: 2x +3y –z =5, 4x +4y –3z = 3 and 2x –3y+2z = 2.

15. a) Show that $\int_0^{\frac{\pi}{2}} \sqrt{\tan x}\, dx = \frac{1}{2}\Gamma\left(\frac{1}{4}\right)\Gamma\left(\frac{3}{4}\right)$.

(OR)

b) Show that $\int_0^1 \frac{x^{m-1} + x^{n-1}}{(1+x)^{m+n}} dx = \frac{\Gamma m \Gamma n}{\Gamma(m+n)}$.

SECTION –C **(5X8 = 40 MARKS)**

ANSWER ALL THE QUESTIONS:

16. a) Show that $\begin{bmatrix} \frac{1+i}{2} & \frac{-1+i}{2} \\ \frac{1+i}{2} & \frac{1-i}{2} \end{bmatrix}$ is unitary.

(OR) [K4]

b) Given A = $\begin{bmatrix} 2 & -1 \\ 1 & 3 \end{bmatrix}$ express $A^4 - 4A^3 - A^2 + 2A - 5$ as a linear polynomial in A and hence evaluate it.

17. a) Increase by 7 the roots of the equation $3x^4 + 7x^3 - 15x^2 + x - 2 = 0$.

(OR) [K5]

b) Transform the equation $x^4 - 4x^3 - 18x^2 - 3x + 2 = 0$ into an equation with the third term absent.

18. a) Show that $\frac{3}{10}\left[\log e10 + \frac{1}{2^7} + \frac{1}{2}.\frac{3}{2^{14}} + \frac{1}{3}.\frac{3^2}{2^{21}} + \ldots\infty\right] = \log 2$.

(OR) [K4]

b) Sum to infinity of the series $\frac{1^2}{3!} + \frac{2^2}{5!} + \frac{3^2}{7!} + \ldots\infty$.

19. a) Find by Gaussian elimination method, the inverse of A = $\begin{bmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -2 & 2 \end{bmatrix}$

(OR) [K5]

b) Solve the system of equations by Gauss Jordan method: x + y + z + w = 2, 2x –y +z –w = –5, 3x + 2y + 3z + 4w = 7, x –2y –3z + 2w = 5.

20. a) Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

(OR) [K4]

b) Evaluate $\int_0^\infty e^{-x^2} dx$.

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