(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEARS 2024-2026) **(NO. OF PAGES: 02)**

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N.G.M COLLEGE (AUTONOMOUS): POLLACHI
END – OF - SEMESTER EXAMINATIONS: NOVEMBER 2024
COURSE NAME: B. Sc.- CHEMISTRY **MAXIMUM MARKS: 75**
SEMESTER: I **TIME: 3 HOURS**

PART-III

ANCILLARY MATHEMATICS FOR CHEMISTRY - I

SECTION – A (10 X1 =10 MARKS)

ANSWER THE FOLLOWING QUESTIONS:
MULTIPLE CHOICE QUESTIONS. **[K1]**

1. All diagonal elements in a skew symmetric matrix is ------.
   a) zero b) one c) scalar d) ∞
2. Every polynomial equation f (x) = ----- has at least one root real or complex.
   a) zero b) one c) two d) n
3. $1 + \frac{x}{1!} + \frac{x^2}{2!} + \ldots + \infty$ is ------ series.
   a) binomial b) exponential c) logarithmic d) none
4. The aim of Gauss elimination method to reduce the coefficient matrix to --------.
   a) diagonal b) identity c) lower triangular d) upper triangular
5. $\Gamma(n+1) =$ ------
   a) 1! b) 2! c) ∞ d) n!

ANSWER THE FOLLOWING IN ONE OR TWO SENTENCES. **[K2]**

6. Define orthogonal matrix.
7. Write the conjugate pair of $\alpha + i\beta$.
8. Find the coefficient of x^n in the expansion of e^{a+bx}.
9. In which method both sides of equation are multiplied by non – zero constant?
10. Write the relation formula for beta and gamma.

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. **[K3]**

11. a) Express $\begin{bmatrix} 6 & 8 & 5 \\ 4 & 2 & 3 \\ 9 & 7 & 1 \end{bmatrix}$ as the sum of a symmetric and a skew symmetric matrices.

[OR]

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

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

[OR]

b) Diminish by 2 the roots of the equation $x^4 + x^3 - 3x^2 + 2x - 4 = 0$. **(CONTD…..2)**

13. a) Prove that $\log\dfrac{n+1}{n-1}=\dfrac{2n}{n^2+1}+\dfrac{1}{3}\left(\dfrac{2n}{n^2+1}\right)^3+\ldots\infty$.

[OR]

b) Find the sum to infinity of the series $1+\dfrac{2}{6}+\dfrac{2.5}{6.12}+\dfrac{2.5.8}{6.12.18}+\ldots\infty$.

14. a) Solve the system of equations using Gauss elimination method:
$x+2y+z=3$; $2x+3y+3z=10$; $3x-y+2z=13$.

(OR)

b) Solve by Gauss Jordan method: $2x+3y-z=5$; $4x+4y-3z=3$; $2x-3y+2z=2$.

15. a) Evaluate $\displaystyle\int_0^\infty \frac{x}{1+x^6}dx$.

[OR]

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

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) Prove that the matrices A, B, C given below have the same characteristic values.

$$A=\begin{bmatrix}0 & a & b\\ a & 0 & c\\ b & c & 0\end{bmatrix},\ B=\begin{bmatrix}0 & b & a\\ b & 0 & c\\ a & c & 0\end{bmatrix},\ C=\begin{bmatrix}0 & c & b\\ c & 0 & a\\ b & c & 0\end{bmatrix}.$$

[OR]

b) Use Cayley Hamilton theorem to express $2A^5-3A^4+A^2-4I$ as a linear polynomial in A when $A=\begin{bmatrix}3 & 1\\ -1 & 2\end{bmatrix}$.

17. a) Solve the equation $x^4-4x^2+8x+35=0$ given that $2+i\sqrt{3}$ is a root.

[OR]

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

18. a) If a, b, c denote three consecutive integers show that

$$\log b=\frac{1}{2}\log a+\frac{1}{2}\log c+\frac{1}{2ac+1}+\frac{1}{3(2ac+1)^3}+\ldots\infty.$$

[OR]

b) Show that $1+\left(\dfrac{1}{2}+\dfrac{1}{3}\right)\dfrac{1}{4}+\left(\dfrac{1}{4}+\dfrac{1}{5}\right)\dfrac{1}{4^2}+\ldots.+\infty=\log\sqrt{12}$.

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]

b) Solve the following system by Gauss Jordan elimination method.
$x+y+z+w=2$; $2x-y+2z-w=-5$; $3x+2y+3z+4w=7$; $x-2y-3z+2w=5$.

20. a) Prove that $\displaystyle\int_{-1}^{1}(1+x)^m(1-x)^n dx=2^{m+n+1}\frac{\Gamma(m+1)\Gamma(n+1)}{\Gamma(m+n+2)}$.

[OR]

b) Evaluate $\displaystyle\int_0^{\frac{\pi}{2}}\sin^5\theta\cos^3\theta\, d\theta$.