K.L.E Society's
S. Nijalingappa College
II BLOCK RAJAJINAGAR, BENGALURU -10

PG Department of Mathematics
QUESTION BANK

Numerical Analysis-I

1. Define relative error and round off error. Find a real root of the equation by fixed point iterative method $f(x) = x^6 - x - 1 = 0$ with an accuracy of 10^{-4}.
2. Describe Aitken's process to accelerate the convergence for finding the root of $f(x) = 0$ and hence find the root for $x^3 + x^2 - 1$.
3. Using Newton-Raphson method find the root of the equation $x^2 - a = 0$ for some real number a and find the rootfor $\sqrt{12}$.
4. Obtain the smallest root of the equation $x^3 - 9x^2 + 26x - 24 = 0$.
5. Find the number of real roots of $x^3 - 5x + 1 = 0$ using Sturm sequences.
6. Compute, to four decimal places, the root between 0 and 1 of the equation$x^3 - x - 1$ by Muller's method
7. Use Gauss elimination to solve the system
   $2x + y + z = 10, 3x + 2y + 9z = 16, x + 4y + 9z = 16.$
8. Solve the system of equations using Crout's method.
   $2u + 3v - w = 4,\ u - 2v + w = 6, u - 12v + 5w = 1$
9. For the system of equations $AX = b$using Jacobi iterative method, show that $X^{k+1} = -D^{-1}(L + U)X^k + D^{-1}b$.
10. Solve the system by Newton Raphson method by taking $x_0 = 0.5 = y_0$,
    $f(x, y) = 3yx^2 - 10x + 7 = 0,\ g(x, y) = y^2 - 5y + 4 = 0$(Perform 2 iterations
11. Establish Lagrange interpolating polynomial of degree n in its standard form.
12. Using natural cubic spline interpolation for the function defined by the data given by the following, estimate the value of $f(2.5)$.

13. Obtain a linear polynomial approximation to the function on the [0,1] using the least square approximation method.

14. Evaluate the integral using Gauss-Laguerre method $\int_0^{\infty} \frac{e^{-x}}{1+x^2} dx$.

15. Establish Gauss-Hermite one and two point formulae. Determine the error term for each.

16. Solve by Simpson's rule $\int_{1}^{1.5} \int_{1}^{2} \frac{dxdy}{x+y}$ with $h = 0.5,\ k = 0.25$.

17. Describe Newton-Raphson method for finding a root of equation $f(x) = 0$. Show that the condition for convergence is $|\varphi'(x)| < 1$.

18. Find the real root of the equation $x = 2\,e^{-x}$ with $x_0 = 0.8$ using Aitken's process with an accuracy of 10^{-3}.

19. Extract the quadratic factor of the form $x^2 + px + q$ from the polynomial p(x) and hence find the quadratic factor for $(x) = x^3 - x - 1$.

20. Obtain the number of real roots of $x^4 - 3\,x^2 + x - 2 = 0$ using Sturm sequence.

21. Establish Muller's method for a nonlinear equation $f(x) = 0$

22. Use Gauss-elimination to solve the system

$$4x + y + z = 8, 2x + 5y + 2z = 3, x + 2y + 4z = 11.$$

23. Solve the system of equations using Cholesky method.

$$4x + 2y + 14z = 14, 2x + 17y - 5z = -101, 14x - 5y + 83z = 155.$$

24. Give the generalization of Gauss–Seidel method for the system of equations $AX = b$.

25. Solve the system by Newton Raphson method by taking $x_0 = 1, y_0 = 0$,

$x^2 + y^2 = 1.12,\ xy = 0.23$ (Perform 2 iterations)

x	-1	0	1
$f(x)$	1	1	3
$f'(x)$	-5	1	7

26. Establish Quadratic spline interpolation for the equally spaced roots.

27. Find the Hermite interpolating polynomial for the data points

28. Obtain a rational approximation $R_{3,3}(x)$ for e^x.

29. Evaluate the integral using Gauss-Legendre one point, two point, three pointformulae for $\int_0^1 \frac{1}{1+x}\, dx$.

30. Establish Gauss-Chebyshev one and two point formulae. Determine the error term for each.

31. Solve by Simpson's rule $\int_{\mathbf{1}}^{\mathbf{1.5}} \int_{\mathbf{1}}^{\mathbf{2}} \frac{2xy}{(1+x^2)(1+y^2)}\, dxdy$ with $h = k = 0.5$.