NUMERICAL METHODS(MAT-221)

Question Bank-1/Problem Set-1/Assigment-1

Error and Error Propagation

1. **Round off values of 43.38256, 0.0326457 and 0.2537623 to four significant digits are……..**
2. **The relative error if 2/3 is approximated t0 0.667 is …….**
3. $\left(\sqrt{102}-\sqrt{101}\right)$ **correct to three significant digits is…….**
4. **If a number is rounded off to k decimal places, then the absolute error is:**
5. **If** x **is the true value of a quantity and** x_1 **is its approximate value. Then the relative error is:**

   (a) $\frac{1}{2}10^{k-1}$, **(b)** $\frac{1}{2}10^{-k}$, **(c)** $\frac{1}{3}10^{k}$, **(d)** $\frac{1}{4}10^{-k}$.

6. **Calculate round off , absolute and relative errors in the results of the following arithmetic operations, using four digit mantissa:**

   (a) 27.65+22.20, (b) 456.7-4.566, (c) 3543.0X16.78, (d) $25.68 \div 6.567$

7. **If** $u = \frac{4x^2y^3}{z^4}$ **and errors in** x, y, z **be 0.001, compute the relative maximum error in u when** $x = y = z = 1$

Solution of non-linear Equations

8. **Differentiate between polynomial and transcendental equations by giving two examples of each.**

9. **The interval in which a real root of** $x^3 - 2x - 5 = 0$ **lies is……**

10. **Newton's method is useful when the graph of the function while crossing the x-axis is nearly vertical.(True/False)**

11. **The Newton-Raphson method fails when :**

    (a) $f'(x)$ **is negative,** **(b)** $f'(x)$ **is too large,** **(c)** $f'(x)$ **is zero** **(d) Never fails**

12. **Write the iteration methods in the descending order of their order of convergence: Newton-Raphson method, Regula- Falsi method, Secant method.**

13. **Find a root of** $x^3 - x^2 - 1 = 0$ **using the bisection method correct to three decimal places.**

14. **Evaluate a root of** $e^{-x} - x = 0$ **by bisection method.**

15. **Solve problem 13 by Regula-Falsi method and comment on which method is preferable.**

16(i). **Using Regula-Falsi method , compute the real root of** $3x + \sin x = e^x$ **correct to three decimal places.**

16(ii). **Find the solution to** $(x-2)^2 - \ln x = 0$ **in the interval [1,2] accurate to within** 10^{-4} **using Regula-Falsi Method.**

17. **Find a root of the equation** $x \log_{10} x = 1.9$ **correct to four decimal places by secant method.**

18. Use the fixed point iteration method to find a root of the following equations:

(a) $x^3 - 9x + 1 = 0$ **(b)** $\tan x = x$

19. Solve problems13, 16, 17 using Newton-Raphson method.

20. The bacteria concentration in a reservoir varies as $C = 4e^{-2t} + e^{-0.1t}$**. Using Newton-Raphson method calculate the time required for the bacteria concentration to be 0.5.**

21. Derive the Iteration formulas to find (a) $\sqrt[k]{N}$ **, (b)** $1/\sqrt{N}$ **. Hence evaluate** $\sqrt[3]{24}$ **and** $1/\sqrt{14}$

22. Derive Iteration formulas for (a) Regula-Falsi method, (b) Newton-Raphson method.

23(i). Define order of convergence of an iteration method. Hence find order of convergence of (i) Bisection method, (ii) Regula-Falsi method, (iii) Secant Method , (iv) Newton-Raphson method.

23(ii).What is the convergence criteria for the Fixed Point method? Can the method be applied to find a real root of the equation $x = 4 - 10^x$ **?**

Solution of simultaneous linear Equations

24. Write the sufficient condition for the convergence of Gauss-Seidal Iteration method.

25. The difference between direct and iterative methods of solving simultaneous linear equations is……..

26. Show that Gauss-Jordan takes about 50% more operations Than Gauss elimination method for the case of three equations.

27.Solve the following equations by Gauss elimination method:

(i) $2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16$

(ii) $5x_1 + x_2 + x_3 + x_4 = 4, x_1 + 7x_2 + x_3 + x_4 = 12, x_1 + x_2 + 6x_3 + x_4 = -5, x_1 + x_2 + x_3 + 4x_4 = -6$

28. Solve Problem27 using Gauss-Jordan method.

29. Solve the following equation by Gauss-Seidel method:

(i) $2x + y + 6z = 9, 8x + 3y + 2z = 13, x + 5y + z = 7$

(ii) $3x_1 - 0.1x_2 - 0.2x_3 = 7.85, 0.1x_1 + 7x_2 - 0.3x_3 = -19.3, 0.3x_1 - 0.2x_2 + 10x_3 = 71.4$

Note1. Individual faculty should give a set of long answer type problems(5 to10) from this problem set as home assignment to be submitted by the student on and before the date announced by the faculty in the classroom.

Note2. Answers to selected no. of problems will be provided in Problem Set-2.