Assignment : Probability and Numerical Methods

Subject Code: MATH2202

Module-I

1. Use **Bisection** Method to solve the following equations:
   (a) $f(x) = x + \log_e x - 2 = 0$, correct 3 significant figures. [Ans: 1.56]
   (b) $f(x) = xe^x - 1 = 0$, correct upto 2 decimal places. [Ans: 0.57]

2. Use **Regula-Falsi** Method to solve the following equations:
   (a) $f(x) = 2x - \log_{10} x - 7 = 0$ correct upto 3 decimal places. [Ans: 3.789]
   (b) $f(x) = \sin x + \cos x - 1 = 0,$ correct upto 4 significant figures. [Ans: 1.571]

3. Use **Newton-Rapshson** Method to solve the following equations:
   (a) $f(x) = x + \log_e x - 2 = 0$, correct upto 4 significant figures. [Ans: 1.557]
   (b) Evaluate $\sqrt[5]{3}$ correct upto 5 significant figures.

4. Solve the following system of linear equations by **Gauss Elimination** method:

   (a) $\begin{aligned} x + 4y - z &= 5 \\ x + y - 6z &= -12 \\ 3x - y - z &= 4 \end{aligned}$

   [Ans: x=181/71, y=89/71, z=188/71]

   (b) $\begin{aligned} 2x - y + 3z &= 4 \\ x + z &= 2 \\ 2y + z &= 3 \end{aligned}$

   [Ans: x=1, y=1, z=1]

5. Solve the following system of linear equations by **Gauss- Seidel** Method:

   (a) $\begin{aligned} 2x + 10y + z &= 13 \\ 10x + y + z &= 12 \\ 2x + 2y + 10z &= 14 \end{aligned}$ correct upto 2 decimal places. $\begin{bmatrix} x = 0.99 \\ Ans: y = 0.99 \\ z = 1.00 \end{bmatrix}$

   (b) $\begin{aligned} x + 4y + 2z &= 17 \\ x + 2y + 4z &= 16 \\ 6x - y + 4z &= 13 \end{aligned}$ correct upto 3 decimal places. $\begin{bmatrix} x = 1.091 \\ Ans: y = 2.818 \\ z = 2.318 \end{bmatrix}$

6. Solve the following system of linear equations by **LU-Factorization Method** :

   (a) $\begin{aligned} 3x - y + 2z &= 1 \\ 2x + 4y - z &= 3 \\ 7x + y + z &= 3 \end{aligned}$

   [Ans: x=1/4, y=3/4, z=1/2]

   (b) $\begin{aligned} 3x + 4y + 2z &= 15 \\ 5x + 2y + z &= 18 \\ 2x + 3y + 2z &= 10 \end{aligned}$

   [Ans: x=3, y=2, z=-1]

7. Find the **missing term** from the table

x	0	1	2	3	4
Y	1	3	9	--	81

[Ans. 31]

8. Find **missing terms** from the following table

x	0	1	2	3	4	5
y=f(x)	7	--	13	22	--	52

[Ans. f(1)=8, f(4)=35]

9. Find $\tan 0.12,\ \tan 0.26$ and $\tan 0.35,\ \tan 0.5$ from the following table

x	0.10	0.15	0.20	0.25	0.30
y=tan x	0.1003	0.1511	0.2027	0.2553	0.3093

[Ans. $\tan 0.12 = 0.1205, \tan 0.26 = 0.2662,\ \tan 0.35 = 0.365300\ , \tan 0.5 = 0.5543$]

11. Write down the interpolating polynomial expression using the following data and hence find f(0.5)

x	-1	0	1	2
y=f(x)	1	1	1	-3

[Ans. $-\frac{1}{3}(2x^3 - 2x - 3)$]

12. Find the **Lagrange interpolating** polynomial of degree 2 approximating the function $y = \ln x$ defined by the tabular values. Hence find $\ln 2.7$.

x	2	2.5	3.0
$y = \ln x$	0.69315	0.91629	1.09861

. [Ans. $f(x) = -0.08164x^2 + 0.81366x - 0.60761,\ \ln 2.7$ =0.9941164]

13. Evaluate $\int_0^1 \sqrt{1 - x^2}dx$ using **Trapezoidal and Simpson's 1/3 rule** for n=6.

[Ans. 0.765496, 0.777532]

14. Find from the table, the area under the curve & the x-axis from x=7.47 to x=7.52

x	7.47	7.48	7.49	7.50	7.51	7.52
f(x)	1.93	1.95	1.98	2.01	2.03	2.06

[Ans. 0.0996]

15. Evaluate $\int_1^5 log_{10} x\ dx$ taking n=8 by using suitable numerical method.

[Ans. 1.750505025]

17. Use **Euler's method** to compute $y(0.2)$ & take $h = 0.05,\ \frac{dy}{dx} = x^2 + 4y,\ y(0) = 1.$

[Ans. $y(0.5) = 1.82524, y(0.1) = 1.0933, y(0.15) = 1.7286,\ y(0.2) = 2.0754$]

18. Find $y(0.2),\ y(0.5)$ by **Modified Euler's method** for $\frac{dy}{dx} = \log_{10}(x + y),\ y(0) = 1,$ take $h = 0.2.$

[Ans. $y(0.2) = 1.0082,\ y(0.5) = 1.0490$]

19. Use **RK method** to find $y(0.5)$ and $y(1)$ for $\frac{dy}{dx} = \frac{1}{x+y}$, $y(0) = 1$ by taking h=0.5.

[Ans. y(0.5)=1.357, y(1)=1.584]