Dr. Babasaheb Ambedkar Technological University, Lonere

Department of Chemical Engineering

Question Bank

Subject: Professional Elective-II (Numerical Methods) **Subject Code: BTCHE405**

Academic Year / Semester: 2021 – 2022 / IV

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UNIT 1

Q.1) Solve the following set of linear algebraic equations by using Relaxation method correct upto 4 decimal places.

$$10x - 2y - 2z = 6$$
$$x - 10y + 2z = -7$$
$$x + y - 10z = -8$$

Q.2) Solve the following linear equations by using Crout's method.

$$2x - 6y + 8z = 24$$
$$3x + y + 2z = 6$$
$$5x + 4y - 3z = 2$$

Q.3) Solve the following set of linear algebraic equations by using Gauss Jordan method correct upto 4 decimal places.

$$10x + y + z = 12$$
$$2x + 10y + z = 13$$
$$x + y + 5z = 7$$

Q.4) Solve the following set of linear algebraic equations by using Gauss Elimination method correct upto 4 decimal places.

$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$-2x + 3y - z = 1$$

Q.5) Solve the following linear equations by using Gauss Seidel method correct upto 4 decimal points.

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35$$

Q.6) Determine the Dominant Eigen value and the corresponding Eigen vector of matrix using the Power Method and correct upto 4 decimal points.

$$\begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & 4 \end{bmatrix} \quad xo = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

Q.7) Carry out Householder's Transformation on the matrix in order to reduce it to a tridiagonal form.

$$\begin{bmatrix} 1 & 4 & 3 \\ 4 & 1 & 2 \\ 3 & 2 & 2 \end{bmatrix}$$

Q.8) Transformation the matrix in order to tridiagonal form by Given method. Also find the largest eigen value corresponding to eigen vector of tridiagonal matrix.

$$\begin{bmatrix} 1 & 2 & 4 \\ 2 & 1 & 2 \\ 4 & 2 & 1 \end{bmatrix}$$

Q.9) Determine the largest Eigen value and the corresponding Eigen vector of matrix using the Power Method and correct upto 4 decimal points.

$$\begin{bmatrix} 1 & 2 \\ 2 & 3 \end{bmatrix} \quad xo = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

Q.10) Find the characteristics polynomial and inverse matrix by using Faddeev Leverries method.

$$\begin{bmatrix} 2 & 3 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

UNIT 2

Q.1) Solve the following set of nonlinear algebraic equations by using Multivariable Newton Raphson method correct upto 4 decimal points. $x^2 + y = 11 \quad and\ y^2 + x = 7$ **using (x_0 , y_0) = (3.5, -1.8) for two iterations.**

Q.2) Find the real root of $x^3 + 2x - 5 = 0$ equation by using Newton Raphson Method. Correct upto 2 decimal places.

Q.3) Find the real root of nonlinear equation $x^2 - x - 1$, Solve by Fixed point method.

Q.4) Find the real root of $x^3 - x - 2 = 0$ equation by using Newton Raphson Method. Correct upto 4 decimal places.

Q.5) Find the real root of $x^3 - 4x - 9 = 0$ equation by using Fixed point method. Correct upto 2 decimal places.

UNIT 3

Q.1) Fit a straight line to the data by method of Least Square.

x	0	5	10	15	20
y	7	10	15	21	25

Q.2) Apply Newton's Forward difference Formula to find y(3.75) from the table.

x	2.5	3.0	3.5	4.0	4.5	5.0
y	24.14	22.04	20.22	18.64	17.26	16.04

Q.3) By means of Newton's divided difference interpolation formula find f(8)

x	4	5	7	10	11	13
F(x)	46	100	290	900	1200	2020

Q.4) Find a Parabola y= ax^2+bx+c by method of Least Square. Given,

x	0	5	10	15	20
y	7	10	15	21	25

Q.5) Find y(42) , y(85) from the following data,

x	40	50	60	70	80	90
y	184	204	226	250	276	304

Q.6) Determine a and b so that y=ae^{bx} best fits the following data,

x	1	2	3	4
y	7	11	17	27

Q.7) Fit a law of the type y=ae^{bx} to the the following data,

x	0	1	3	3
y	1.05	2.10	3.85	8.30

Q.8) From the following table, find y(0.5) using Cubic Spline, Assume MO= O AND M2=0

x	0	1	2
y	0	2	6

Q.9) Using Lagrange's interpolation formula, fit the polynomial to the data. Also find y at x=2

x	0	1	3	4
F(x)	-12	0	6	12

Q.10) Fit second order degree parabola to the following:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

UNIT 4

Q.1) Apply Runge Kutta method of fourth order to calculate y(0.2) given, $y' = x+y$,y(0)=1 taking h=0.1

Q.2) Find the value of y when x=0.1 and 0.2 given $dy/dx = x^2 + y^2$ y(0)=1. Using second order R.K.method

Q.3) By Finite difference method, solve $y'' + x^2 = 0$ with y(0) =0 and y(1)=1 ,h=0.25.

Q.4) Using Runge Kutta method of fourth order, solve $dy/dx = \frac{y^2 - x^2}{y^2 + x^2}$ given, y(0) at x=0.2 take h=0.2.

Q.5) Find y(1.1), y(1.2) using Euler method $10y' = x^2 + y^2$ y(0) =1.

UNIT 5

Q.1) Solve the following system of equations by using LU decomposition method.

$$x + y - z = 4$$
$$x - 2y - z = -6$$
$$2x + 3y + z = 7$$

Q.2) Solve the following system of equations by Gauss Jacobi's method.

$$8x + y + z = 8$$
$$x + 4y + z = 4$$
$$x + 3y + 3z = 5$$

Q.3) Using Newton's divided difference interpolation formula find f(6) from the following data,

x	1	2	7	8
F(x)	1	5	5	4

Q.4) Solve the following set of linear algebraic equations by using Gauss Jordan method correct upto 4 decimal places.

$$x + 2y + z = 3$$
$$2x + 3y + 3z = 10$$
$$3x - y + 2z = 13$$

Q.5) Determine the Dominant Eigen value and the corresponding Eigen vector of matrix using the Power Method and correct upto 4 decimal points.

$$\begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$$

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1. Solve x+2y+z=3; 2x+3y+3z=10; 3x-y+2z=13 by gauss elimination method.
2. Solve the following system by Gauss-seidel method:
   10x-5y-2z=3, 4x-10y+3z= -3, x+6y+10z= -3
3. Solve by LU decomposition method of following system:
   x+y+z=1,4x+3y-z=6 , 3x+5y+3z=4

4. 10x-2y-2z=6; -x+10y-2z=7; -x-y+10z=8 by Relaxation method**.**
5. Solve the following system by Gauss-Jacobi method:
   10x-5y-2z=3, 4x-10y+3z= -3, x+6y+10z= -3
6. Solve the following system by Gauss-Elimination method:
   2x+3y-z=5; 4x+4y-3z=3; 2x-3y+2z=2

7. Find the dominant eigen value of A=[1 2; 3 4] by Power method**.**

8. Find the dominant eigen value of A=[25 1 2; 1 3 0; 2 0 -4] by Power method**.**

9. Determine the coefficient of characteristics polynomial of the system

$$(-1-\lambda)x_1 = 0$$
$$x_1 + (-2-\lambda)x_2 + 3x_3 = 0$$
$$2x_2 + (-3-\lambda)x_3 = 0$$

using Fadeeve- Laverrier Method

10. Find the dominant eigen value of A=[1 6 1; 1 2 0; 0 0 3] by Power method**.**
11. Find the dominant eigen value of A=[5 0 1; 0 -2 0;1 0 -5] by Power method**.**
12. Find the dominant eigen value of A=[-4 -5; 1 2] by Power method**.**

13. Solve $x^3+x^2-1=0$ by method of Fixed point/Iteration/Successive substations. .
14. Using Newton's method, find the root of $2x^3-3x-6=0$correct to 5 decimal places.
15. Using Newton's Rahson method, find the root between 0 and 1of $x^3=6x-4$ correct to 5 decimal places.
16. Using Newton's method, find the positive root of x=cosx.
17. Solve $e^x-3x=0$ by method of Fixed point/Iteration/Successive substations.
18. Using Newton's method, find the positive root of 3x-cosx-1=1.

19. By the method of Least Square method find the best fitting straight line to the data given below:

x: 5	10	15	20	25
y:15	19	23	26	30

20. By the method of Least Square method find the best fitting straight line and y at 4=2.5 to the data given below:

x: 0	1	2	3	4
y:1 1.8	3.3	4.5	6.3	

21. Find the value of y at x=21 from the following data by Newton's interpolation formula:

x:	20	23	26	29
y:	0.3420	0.3907	0.4384	0.4848

22. Using Newton's divided difference formula find the values of f(2) and f(8) from the following table:

x:	4	5	7	10	11	13
f(x):		48	100	294	900	1210	2028

23. Using Lngrnges interpolation formula, Find y(10) from this data:

x:	5	6	9	11
y:	12	13	14	16

24. By the method of Least Square method find the best fitting straight line of y=a+bxy to the data given below:

x:	-4	1	2	3
y:	4	6	10	8

25. Apply Fourth Order Runge Kutta method to find y(0.2)given that $y'=x+y$, $y(0)=1$.

26. Apply Fourth Order Runge Kutta method to find y(0.2)given that $y'= -y$, $y(0)=1$.

27. Apply Fourth Order Runge Kutta method to find y(0.8)given that $y'=y-x^2$, $y(0.6)=1.7379$

28. Compute y(0.3) given $dy/dx+y+xy^2=0$, $y(0)=1$ by RK Method.