Biyani Girls college ,Jaipur

Model Paper-B (M.Sc. Final)

Subject:Mathematics

Paper : Advance Numerical Analysis(XII)

Max Marks: 100 **Max Time: 2:30 hrs**

Attempt any five questions in all selecting at least one question from each unit.

UNIT-I

1. Describe the iteration method for finding root of the equation $f(x)=0.$ Explain merits and demerits of the method.Explain Aitken's Δ^2-method for the acceleration of convergence. Hence find the root of the equation $e^x \tan x = 1$ correct upto four decimal places .Apply Δ^2-method. 20

2.(a) Perform two iterations of Muller's method to find the root of the equation:- $x^3 - x - 1 = 0$

Take $x_0 = -1, x_1 = 0.5, x_2 = 1$ as initial approximations. 10

b. Discuss Newton Raphson method for simultaneous non-linear equations and use it to solve the following equations:- $x^2 - y^2 = 4$ *and* $x^2 + y^2 = 16$. 10

UNIT-II

3a. Perform two iterations of Birge – Vieta method to compute a root of the equation

$x^3 - 5x^2 - 17x + 20 = 0$ 10

b. Use Graeff's root squaring method to compute all the roots of the equation $x^3 - 3x^2 - 6x + 8 = 0$ 10

4a. Solve the given system of equations using Choleskey method:-

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 8 & 22 \\ 3 & 22 & 82 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 5 \\ 6 \\ -10 \end{bmatrix}$$

10

b. Solve the given system of equations by the conjugate gradient method (perform two iterations only):-

$$\begin{bmatrix} 2 & -1 & 0 \\ 1 & 6 & -2 \\ 4 & -3 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -2 \\ -4 \\ 5 \end{bmatrix}$$

10

UNIT-III

5a. Reduce the following matrix to tridiagonal from by Given's method:- $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & -1 \\ 2 & -1 & 1 \end{bmatrix}$ and use Sturm sequence to find the eigen values. 10

b. Find the eigenvalues of the matrix A= $\begin{bmatrix} 2 & -4i & 0 \\ 4i & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ **10**

6a. Determine the least squares approximation of the type $ax^2 + bx + c$ to the function:-

$\frac{1}{1+x^2}$ *in the range* $-1 \le x \le 1$ **10**

b. Using the Chebyshev polynomials, obtain the least squares approximations of second degree for the function $f(x) = x^3 + x^2 + 3, where\, x \in [-1,1]$. 10

UNIT-IV

7a. Derive Taylor's series approximation formula and hence find out the solution of the equation ;-

$xy' = x - y,\ y(2) = 2\, at\ x = 2.1$ 10

b. Apply Fourth order Runge- Kutta method to:

$\frac{dy}{dx} = -xy^2,\ y(0) = 1$ take h=0.02 and determine approximation to y(0.2) and y(0.4). 10

8a. Solve the following equation by Milne's predictor –corrector method :-

$\frac{dy}{dt} = \frac{t}{y'},\ y(1) = 2\ ,\ t \in [1,1.4]$ 10

b.Discuss stability analysis of multistep method to solve differential equation of first order. 10

UNIT-V

9a. Soleve the boundary value problem :-

$\frac{d^2y}{dx^2} = -8(\sin^2 \pi x)y$, $x \in [0,1]$ y(0)=y(1)=1 using second order finite difference method with step size h=0.25. 10

b. Write a brief note on finite difference approximation to solve the boundary value problems. 10

10a. Solve the boundary value problem

$\frac{d^2y}{dx^2} = xy, \quad x \in [0,1] \quad y(0) + y'(0) = 1, \quad y(1) = 1 \quad (take\ h = 1/3)$ 10

b. Explain the essence of shooting method to solve a boundary value problem:-

$\frac{d^2y}{dx^2} = f(x,y), x \in [a,b] \quad y(a) = A, \quad y(b) = B$ 10