

Roll No.

Total Pages : 6

4254/MJ

G-11/2051

NUMERICAL ANALYSIS

Paper–BHM-604

Semester–VI

Time allowed : 3 Hours] [Maximum Marks : 70

Note: The candidates are required to attempt two questions each from section A and section B carrying 10 marks each and the entire Section C consisting of 10 questions carrying 3 marks each is compulsory.

SECTION-A

1. (a) Compute the middle values of the numbers $a = 4.568$ and $b = 6.762$ using the four digit arithmetic.

(b) Find a real root of the equation

$$3x = \cos x + 1$$

correct to three decimal places using Newton-Raphson method.

2. (a) Perform three iterations of the Muller method to find the smallest positive root of the equation

$$f(x) = x^3 - 5x + 1 = 0$$

Use the initial approximations as $x_0 = 0$, $x_1 = 0.5$ and $x_2 = 1.0$.

(b) Find a real root of the equation

$$x \log_{10} x - 1.2 = 0$$

by Regular-Falsi method correct up to four decimal places.

3. (a) Solve the following linear system of equations by Gauss-Jordan method:

$$2x_1 + 3x_2 + 5x_3 = 5, 3x_1 + 4x_2 + 7x_3 = 6,$$

$$x_1 + 3x_2 + 2x_3 = 5.$$

- (b) Perform two iterations of the Gauss-Seidal method to solve the linear equations

$$20x_1 + x_2 - 2x_3 = 17, 3x_1 + 20x_2 - x_3 = -18,$$

$$2x_1 - 3x_2 + 20x_3 = 25$$

4. Find the largest Eigen value and the corresponding Eigen vector of the matrix

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

using Rayleigh's power method. Take $[1, 0, 0]^T$ as initial Eigen vector.

SECTION-B

5. (a) Given values

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

Evaluate $f(9)$ using Newton divided difference formula.

- (b) Obtain the least squares straight line fit to the following data

x	0.2	0.4	0.6	0.8	1.0
$f(x)$	0.447	0.632	0.775	0.894	1.0

6. Use Simpson's $1/3^{\text{rd}}$ rule to find

$$\int_0^{0.6} e^{-x^2} dx$$

by taking seven ordinates.

7. Using Modified Euler's method, obtain a solution of the equation

$$\frac{dy}{dx} = xy$$

in the range $1 \leq x \leq 1.4$ with step size 0.1. Take the initial approximation is $y(1) = 5$.

8. (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Trapezoidal rule.

- (b) Given $\frac{dx}{dy} = 3x + 0.5y$, $y(0) = 1$. Solve the equation for $x = 0.1$ using Runge Kutta fourth order method with step size 0.1.

SECTION-C

9. Attempt all the questions :

- (i) State Lagrange's formula for equally spaced data points.
- (ii) Write the Newton-Raphson formula for a function $f(x) = 0$
- (iii) Define Eigen value of a matrix.
- (iv) What is the difference between the Gauss-elimination and Gauss-Seidel methods.
- (v) Write the normal equation for the curve $y = a + bx$, for n points by the method of least squares.
- (vi) What is the difference between Simpson $1/3$ and Simpson $3/8$ rule.
- (vii) Write the Euler's method for solving the ordinary differential equation.
- (viii) Find the absolute and absolute errors in $\bar{6} + \bar{7} + \bar{8}$ correct to 4 significant digits.

- (ix) Write Newton-cote's quadrature formula.
- (x) What is the difference between Euler's and Runge-Kutta methods for solving the differential equations.

3×10 = 30