B. Tech 6th Semester Examination
Numericals Statistical Method & Scientific Computing
AS-6001

Time : 3 Hours                      Max. Marks : 100

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all selecting one question from each of sections A, B, C and D. Question 9 in E is compulsory. All questions carry equal marks.

SECTION - A

1. (a) Derive bisection formula to solve algebraic equations. Also discuss convergence and rate of convergence of this method. (10)

(b) Find a root of \( x^3 - 5x + 3 = 0 \) (correct to three decimal places) by Newton-Raphson's method. (10)

2. (a) Calculate the value of \( (x^2 - y^2) (x + y) \) with \( x = 0.4845 \) and \( y = 0.4800 \), using normalized floating point arithmetic. Compare with the value of \( (x + y) \). Determine the relative error of the former. (10)

(b) Using Newton-Raphson's method solve the following system of non-linear equations

\[
\begin{align*}
x^2 - 3xy + 7 &= 0 \\
y - 2 (x + 1) &= 0
\end{align*}
\]

(10)
SECTION - B

3. (a) The following values are taken from table of cubes

<table>
<thead>
<tr>
<th>x</th>
<th>6.1</th>
<th>6.2</th>
<th>6.3</th>
<th>6.4</th>
<th>6.5</th>
<th>6.6</th>
</tr>
</thead>
<tbody>
<tr>
<td>x^3</td>
<td>226.981</td>
<td>238.328</td>
<td>250.047</td>
<td>262.144</td>
<td>274.625</td>
<td>287.496</td>
</tr>
</tbody>
</table>

Find (6.13)^3 and (6.61)^3.  

(b) Find y' (1.96) and y'' (1.96) from the following table

<table>
<thead>
<tr>
<th>x</th>
<th>1.96</th>
<th>1.98</th>
<th>2.00</th>
<th>2.02</th>
<th>2.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>0.7825</td>
<td>0.7739</td>
<td>0.7651</td>
<td>0.7563</td>
<td>0.7473</td>
</tr>
</tbody>
</table>

4. (a) Calculate the value of \[ l = \int_0^1 \frac{1}{1 + x^2} \, dx \] by Simpson’s 1/3 rule with 8 strips.  

(b) Using Lagrange’s interpolating formula, find y(2) for the data:

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>3</th>
<th>4</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>-3</td>
<td>9</td>
<td>30</td>
<td>132</td>
</tr>
</tbody>
</table>

SECTION - C

5. (a) Using Taylor series method find y(0.1) correct to four decimal places if y(x) satisfies \[ \frac{dy}{dx} = x + y^2, \] \[ y(0) = 1 \]

(b) Solve the following system of linear equations by Gauss-Seidal’s method correct up to three decimal places:
\[ 3x + y + z = 3; \]  \[ 2x + y + 5z = 5; \]  \[ x + 4y + z = 2. \]
6. (a) Use predictor-corrector method for tabulating a solution of
\[ 10 \frac{dy}{dx} = x^2 + y^2, \quad y(0) = 1 \] for the range 0.5 ≤ x ≤ 1.0.

(b) Use Gauss-Jordan method to find the inverse of the following matrices
\[
\begin{pmatrix}
1 & 2 & 3 \\
3 & 2 & 1 \\
2 & 1 & 3
\end{pmatrix}
\]  

SECTION - D

7. (a) Fit a parabola \( Y = a + bx + cx^2 \) (by method of least squares) to the following data:

<table>
<thead>
<tr>
<th>x</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>8</td>
<td>10</td>
<td>15</td>
<td>21</td>
<td>30</td>
</tr>
</tbody>
</table>

(b) Use Jacobi’s method to diagonalize the matrix
\[
\begin{pmatrix}
2 & 3 & 1 \\
3 & 2 & 2 \\
1 & 2 & 1
\end{pmatrix}
\]

8. (a) A die is thrown 264 times with the following results. Show that the die is biased

<table>
<thead>
<tr>
<th>No. appeared on the die</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>40</td>
<td>32</td>
<td>28</td>
<td>58</td>
<td>54</td>
<td>60</td>
</tr>
</tbody>
</table>

(given \( \chi^2 \) for 5 degree of freedom at 5% level = 11.07).

(10)

[P.T.O.]
(b) Outlines the procedure of Monte-Carlo technique in Numerical integration. (10)

SECTION - E

9. (a) Explain inherent error, rounding error, truncation error and relative error.

(b) Discuss propagation of error in difference table.

(c) Derive Newton-Raphson formula.

(d) Write error estimate for Simpson 1/3 and 3/8 rule.

(e) Prove that (i) \( E = 1 + \Delta \) (ii) \( \nabla = 1 - E^{-1} \).

(f) Derive expression for maximum error in trapezoidal rule.

(g) Explain unitary transformation.

(h) Write a short note on generation of pseudo-random numbers.

(i) Discuss briefly Euler’s method.

(j) Explain Chi-Square Test. (2*10=20)