MATHEMATICS : PAPER III

(Numerical Analysis)

Time Allowed : Three Hours **Maximum Marks : 30**

Note : (i) Attempt any *five* questions in all, selecting at least *two* questions from each Section.

(ii) Use of scientific non-programmable calculator is allowed.

SECTION – A

1. (a) Using five iterations of Secand method. find a root of $f(x) = \cos x - xe^x = 0$ upto four decimal places.

(b) Show that :

$$\Delta + \nabla = \frac{\Delta}{\nabla} - \frac{\nabla}{\Delta}$$ 3,3

2. (a) From the table given below,estimate the number of student who obtained marks between 75 and 80.

Marks	No. of Students
35 – 45	18
45 – 55	40
55 – 65	64
65 – 75	50
75 – 85	28

(b) Prove that the *n*th divided differences of a polynomial of degree *n* are consecutive. 3,3

3. (a) Using four point Gauss Quadrature formula, evaluate $\int_{0.2}^{2.6} e^{-x}\,dx$.

(b) Evaluate :

$$\nabla^n\left(e^x\right)$$ 4,2

4. From the following table of value of x and y, obtain $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.6$ using Stirling 's Formula :

x	y
1.0	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

6

SECTION – B

5. (a) Solve the system of linear equations by Gauss-Elimination method:

$$6x_2 + 13x_3 = 61$$
$$6x_1 - 8x_3 = -38$$
$$13x_1 - 8x_2 = 79$$

(b) Compute eigen values and eigen vectors of the matrix $\begin{bmatrix} -2 & 2 \\ 2 & -2 \end{bmatrix}$ using Jacobi's method. 3,3

6. Solve the system of linear equations by Gauss-Seidel method :

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

6

7. (a) Apply Cholesky Decomposition method to solve the system of equations :

$$x + y + z = 1$$
$$x + 2y + 4z = 2$$
$$x + 4y + 8z = 3$$

(b) Find an approximate value of y when $x = 0.1$ if $\frac{dy}{dx} = x - y^2$ and $y(0) = 1$, using Taylor's series method. 4,2

8. Apply Runge -Kutta's method of fouth order to find approximate value of y at $x = 0.2$ for $\frac{dy}{dx} = x + y^2$, $y(0) = 1$ taking $h = 0.1$. 6