Roll No. 2231123200007 Exam Code : D-23
Hari

Subject Code—60386

B. Sc. EXAMINATION

(Main) (Batch 2022 Onwards)

(Third Semester)

MATHEMATICS

CML-307, Course–VI

Numerical Analysis

Time : 3 *Hours* *Maximum Marks* : 80

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. 1 is compulsory. All questions carry equal marks.

(Compulsory Question)

1. (a) Define central difference operator.

(b) Evaluate $\Delta\left(x^2+\sin x\right)$ interval of difference being α.

(c) Write the iterative formula for finding the inverse of a number N.

(d) If $f(x)=\frac{1}{x^2}$, find the divided difference $f(a, b)$.

(e) What is the order of convergence of Bisection method and Regula-Falsi method ?.

(f) Prove that $\Delta^3_{y,z,t} x^3$ is constant.

(g) Compute $\nabla^2 y_5$ from the following table :

x	y
1	2
2	5
3	10
4	17
5	26

(h) Evaluate $\left(E^{-1}\Delta\right)x_1$, the interval of differencing is only.

Section I

2. (a) Find the lowest degree polynomial which satisfies the following data :

x	$f(x)$
0	0
1	3
2	8
3	15
4	24
5	35

(b) State and prove Newton-Gregory formula for Backward interpolation.

3. (a) Given $y_{-30} = 30$, $y_{-12} = 34$, $y_3 = 38$, $y_{18} = 42$, find the value of y_0.

(b) Find the polynomial of the lowest degree which assumes the values 3, 12, 15, – 21 when x has valus 3, 2, 1, – 1 respectively.

P.T.O.

Section II

4. (a) Apply Bessel's formula to obtain y_{25}, given $y_{20} = 2854$, $y_{24} = 3162$, $y_{28} = 3544$, $y_{32} = 3992$.

(b) Find the population of town in 1986, given that :

Year	Population in lakhs
1971	5
1981	20
1991	27
2001	39
2011	52

5. (a) Find $y'(0)$ and $y''(0)$ from the following table :

x	$y = f(x)$
0	4
1	8
2	15
3	7
4	6

(b) Calculate $\int_0^{\pi/2} \sin x \, dx$ by Trapezoidal rule.

Section III

6. (a) Find a real root of the equation $x^4 - x^3 - 10 = 0$ using secant method.

(b) Find the order of convergence of Regula-Falsi method.

7. (a) Solve the following equations by Gauss-Seidel method :

$$3x - 5y + z = 6$$
$$2x + 4y + z = 1$$
$$x + 2y + 2z = -2.$$

(b) Solve the following equations by using triangularization method :

$$x + y + z = 1$$
$$4x + 3y - z = 6$$
$$3x + 5y + 3z = 4.$$

Section IV

8. (a) Using Green's method, reduce the following matrix to tridiagonal form

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

(b) Find all the eigen values and eigen vectors of the following matrix using Jacobi's method :

$$\begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}.$$

9. (a) Given $\frac{dy}{dx} = 1 + y^2$, where $y(0) = 0$, find $y(0.2)$, $y(0.4)$, $y(0.6)$.

(b) Use Picard's method to find the third approximation of the following initial value problem :

$$\frac{dy}{dx} = 2 - \frac{y}{x}; \; y(1) = 2.$$