Sixth Semester B.Sc., Degree Examinations

MAY/JUNE 2026

(NEP Syllabus)

MATHEMATICS

Paper: NSF 0580: NUMERICAL ANALYSIS

Time: 2 hrs] [Max. Marks: 60

Instructions to Students:

1. ***The Students should legibly write Section number along with question numbers within the margin ONLY.***
2. ***The answer without Section number and question numbers will not be valued.***
3. ***Draw neat and labelled diagram wherever necessary.***
4. ***Use of Scientific non programmed calculator is permitted.***
5. ***Section – I multiple Choice Questions should be answered in the first page of main answer book and same questions shall not be answered repeatedly.***
6. ***Any identifications like marking, ticking, dots etc., in the options of MCQ (Section – I) on the question paper is strictly prohibited. Do not write anything (except register number) on the question paper.***

SECTION – I

Select the most appropriate answer from the options provided: $10 \times 1 = 10$

I - 1) The root of the equation $x^3 - x - 1 = 0$ lies between

a) 1 and 2 b) 2 and 3 c) 3 and 4 d) None

I - 2) If $f(a)$ and $f(b)$ have opposite signs, then the approximation of the root of the equation $f(x) = 0$ by Regula falsi method is

a) $\dfrac{af(a) - bf(b)}{f(b) - f(a)}$ b) $\dfrac{bf(b) - af(a)}{f(b) - f(a)}$ c) $\dfrac{af(b) - bf(a)}{f(b) - f(a)}$ d) None

I - 3) $\Delta - \nabla =$

a) $\Delta + \nabla$ b) $\Delta\nabla$ c) $\nabla - \Delta$ d) None

I - 4) $\Delta^3\left[ax^3 + bx^2 + cx + d\right] =$ (take $h = 1$)

a) $6a$ b) $3a$ c) $2a$ d) None

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I - 5) The shift operator E=

a) $1-\Delta$ b) $1+\Delta$ c) $1+\nabla$ d) $1-\nabla$

I - 6) For the function $y=f(x)$, $\left(\frac{dy}{dx}\right)_{x=x_0}$ = is

a) $\frac{1}{h}\left[\nabla f(x_0)-\frac{1}{2}\nabla^2 f(x_0)+\frac{1}{3}\nabla^3 f(x_0)\mp.....\right]$

b) $\frac{1}{h}\left[\nabla f(x_0)+\frac{1}{3}\nabla^2 f(x_0)+\frac{1}{2}\nabla^3 f(x_0)+.....\right]$

c) $\frac{1}{h}\left[\nabla f(x_0)+\frac{1}{2}\nabla^2 f(x_0)+\frac{1}{3}\nabla^3 f(x_0)+.....\right]$

d) None

I - 7) Divide the interval $(0,3)$ into six equal parts, then the width $h=$

a) 0.2 b) 0.3 c) 0.4 d) 0.5

I - 8) Divide the interval $(0,1)$ with 9 ordinates, then the width $h=$

a) 0.123 b) 0.124 c) 0.125 d) 0.126

I - 9) By Euler's method to solve $\frac{dy}{dx}=f(x,y)$ where x_0, y_0 and h are given, y_1 at $x_1=x_0+h$ is given by

a) $y_1=y_0+\frac{h}{2}f(x_0,y_0)$ b) $y_1=x_0+hf(x_0,y_0)$

c) $y_1=y_0+hf(x_0,y_0)$ d) None

I - 10) To evaluate $\int_a^b f(x)dx$, the Simpson's $\frac{1}{3}^{rd}$ rule is

a) $\int_a^b f(x)dx=\frac{1}{3}h\left[(y_0+y_n)+4(y_1+y_3+....)+2(y_2+y_4+....)\right]$

b) $\int_a^b f(x)dx=\frac{1}{2}h\left[(y_0+y_n)+4(y_1+y_3+....)+2(y_2+y_4+....)\right]$

c) $\int_a^b f(x)dx=\frac{1}{3}h\left[(y_0+y_n)+2(y_1+y_3+....)+4(y_2+y_4+....)\right]$

d) None

Contd..... 3

SECTION – II

Answer any FIVE of the following: $5 \times 3 = 15$

II - 1) Find a real root of the equation $x^3 - 4x - 9 = 0$ using bisection method in two stages.

II - 2) Find the cube root of 24 correct to three places of decimal by using Newton – Raphson method.

II - 3) Prove that $\frac{\Delta^2 x^3}{Ex^3} = \frac{6h^2}{(x+h)^3}$

II - 4) By constructing the difference table find the 6^{th} term of the sequence 8, 12, 19, 29, 42

II - 5) Find $\frac{d^2y}{dx^2}$ at $x = 0.4$ given that

x	0.1	0.2	0.3	0.4
y	1.10517	1.22140	1.34986	1.49182

II - 6) Find $\int_0^1 e^x dx$ in steps of 0.2 by using Trapezoidal rule.

II - 7) Using Euler's method solve $\frac{dy}{dx} = 1 - y$ given that $y(0) = 0$ for $x = 0.1$ by taking $h = 0.1$

II - 8) Using Picard's method obtain second approximations to the solution of $\frac{dy}{dx} = 2x - 1 + y^2$ given that $y(0) = 1$.

SECTION – III

Answer any THREE of the following: $3 \times 5 = 15$

III - 1) Find a real root of the equation $x^3 - 4x + 1 = 0$ between 0 and 1 correct to 3 decimal places by Regula Falsi method.

III - 2) Find a polynomial of 3^{rd} degree which takes the values

x	3	4	5	6	7
y	6	24	60	120	210

using Newton's Gregory forward interpolation formula.

III - 3) The value of $\tan x$ for $0.1 \le x \le 0.3$ are given in the following table.

x (in radians)	0.1	0.15	0.2	0.25	0.3
$y = \tan x$	0.1003	0.1511	0.2027	0.2553	0.3093

Find $\tan(0.26)$ using Newton's backward interpolation formula.

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III - 4) Evaluate $\int_0^3 \frac{dx}{1+x}$ using Weddle's rule with 7 ordinates and hence obtain the value of $\log 2$.

III - 5) Using Euler's modified method solve $\frac{dy}{dx} = 1 + \frac{y}{x}$ for $x = 2.1$ by taking $h = 0.1$ given that $y(2) = 2$ upto 4 decimal places.

SECTION – IV

Answer the following: $2 \times 10 = 20$

IV - 1) a) Find the real root of the equation $x^3 - 2x - 5 = 0$ using bisection method upto 4 iterations.

b) Find the real root of the equation $\tan(x) = x$ near $x = 4.5$ correct to 4 decimal places by using Newton Raphson method.

OR

c) Apply Lagrange's interpolation formula to find $f(5)$ and $f(6)$ given that $f(1) = 2$, $f(2) = 4$, $f(3) = 8$ and $f(7) = 128$.

d) Using Newton's divided differences formula, find the value of $f(6)$ from the data

x	3	7	9	10
$f(x)$	168	120	72	63

IV - 2) a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1$ given that

x	1	2	3	4
y	3	7	9	13

b) Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ by Simpson's $\frac{3}{8}^{th}$ rule using 9 ordinates and hence obtain the approximate value of π.

OR

c) Solve $\frac{dy}{dx} = x + y$ by Picard's method for $x = 0.1$ given that $y(0) = 1$ upto 3rd approximation.

d) Solve $\frac{dy}{dx} = x + y^2$ using Runge Kutta method given that $y(0) = 1$ for $x = 0.2$ by taking $h = 0.2$

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