

B.SC. SIXTH SEMESTER (PROGRAMME) EXAMINATIONS, 2021

Subject: Mathematics

Course ID: 62110

Course Code: SP/MTH/604/SEC-4

Course Title: Numerical Analysis with Practical (Theory)

Full Marks: 25

Time: 1 Hour 15 Minutes

The figures in the margin indicate full marks

Symbols and Notations have their usual meaning

1. Answer any five of the following questions:

1 × 5 = 5

- a) If $x = 3.21$ and $y = 5.32$ have absolute errors $\Delta x = 0.004$ and $\Delta y = 0.007$. Find the relative error in $x + y$.
- b) What do you mean by the degree of precision of a quadrature formula?
- c) Calculate $\Delta^2(ax^2 + bx + c)$ and $\Delta \tan^{-1} x$ considering h as the length of interval of differencing.
- d) Find the correct number of significant figures of $V_A = 11.2461$, given its absolute error is 0.25×10^{-2} .
- e) What is the condition of convergence of Newton-Raphson method?
- f) Find a real root of the equation $x^3 + 2x - 1 = 0$ by fixed point iteration method correct up to two places of decimals.
- g) Define complete pivoting and partial pivoting of Gaussian elimination method.
- h) Show that divided differences are symmetric functions of their arguments.

2. Answer any two of the following questions:

5 × 2 = 10

- a) (i) If a number 0.000012 is approximated to 0.000009, find the number of significant digits for such approximation.
(ii) If N is a function of different measurable quantities u, v, w, x, y and is given by $N = \frac{u^p v^q w^n}{x^s y^t}$, find an upper limit of the relative error in the measure of N . **3 + 2**
- b) Why does the regular Falsi method call a method of linear interpolation? Explain the Newton-Raphson method for computing a real root of an equation $f(x) = 0$. Show that this method has a quadratic convergence. **1 + 3 + 1**
- c) (i) Find by Euler's method, the value of y for $x = 0.6$ from the differential equation

$$\frac{dy}{dx} = x + y \text{ with } y(0) = 0 \text{ and } h = 0.2.$$

(ii) Deduce Trapezoidal rule from 2nd order R-K method.

3 + 2

3. Answer any one of the following questions:

10 × 1 = 10

a) (i) Compute $f(0.4)$ and $f(2.7)$ using the following table.

x	0	1	2	3
$f(x)$	1	2	11	34

(ii) Prove that $\sum_{r=0}^n \frac{\omega(x)}{(x-x_r)\omega'(x_r)} = 1$, symbols have their usual meanings.

(iii) Evaluate the first three divided difference of $f(x) = x^3$ considering the length of differencing as h .

4+3+3

b) (i) Solve the following system of equations by Gauss-Elimination method:

$$x_1 + 2x_2 - x_3 = 29$$

$$3x_1 - x_2 + 3x_3 = 43$$

$$x_1 + x_2 + x_3 = 17$$

(ii) Find out the missing term in the following table:

x	0	1	2	3	4
$f(x)$	1	3	-	31	81

(iii) Is Simpson's 1/3 rule gives exact result for polynomial of degree less than or equal to three?

Justify your answer.

5+3+2