

2023

COMPUTER SCIENCE — GENERAL

Paper : DSE-B-3

(Computational Mathematics)

Full Marks : 50

*The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable.*Answer **question no. 1** and **any four** from the rest.

2×5

1. Answer **any five** questions :

- How does Newton's backward interpolation differ from Newton's forward interpolation?
- What is the rank of a coefficient matrix in a system of linear equations?
- What does it mean for a coefficient matrix to be singular in the context of a system of linear equations?
- Is there any limitation of the Newton-Raphson method? Explain your answer.
- How does the error depend on the number of intervals used in Trapezoidal rule?
- Differentiate between simple graphs and weighted graphs. Give examples of each type.
- Explain Euler paths and circuits.
- State the distinguishing feature of a planar graph.

2. (a) Define absolute error and relative error. Provide an example to illustrate their calculation.

(b) Using Newton's forward interpolation, interpolate at $x = 1.6$ from the following data :

$x = 1.0$	1.5	2.0	2.5	3.0
$y = 0.11246$	0.14032	0.16800	0.19547	0.22270

4+6

3. (a) Discuss the geometrical interpretation of Newton-Raphson method with diagram.

(b) Solve $x - 2 \sin x - 3 = 0$ correct to two significant figures by Newton-Raphson method correct up to five significant digits. 4+6

4. (a) Under what conditions does the bisection algorithm guarantee convergence to the root of a function? Explain with example.

(b) Using the Bisection method, compute the real root of $x^3 - 1.1x^2 + 4x - 4.4 = 0$ correct to two significant figures. 4+6

Please Turn Over

5. Calculate the value of $\int_0^1 \frac{x dx}{1+x}$ correct up to three significant figures taking six intervals by (i) Simpson's One-third Rule (ii) Trapezoidal Rule. Write the formulae also. 5+5

6. (a) Prove that the sum of the degrees of the vertices of any finite graph is even. 4+(3+3)
(b) Define Euler graph and Hamiltonian path with proper examples.

7. (a) Solve the following system of equations by Gauss elimination method :

$$x + y + z = 1$$

$$3x + y - 3z = 5$$

$$x - 2y - 5z = 10$$

correct up to two significant figures.

- (b) Discuss the limitations of the Simpson's 1/3rd Rule for solving definite integrals. 6+4
8. (a) Prove that number of vertices having odd degree in a graph is always even. 5+5
(b) When a graph is considered to be tree? List the various properties of tree.