2021

Time : 3 hours

Full Marks : 80

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

*Answer any **four** questions in which Q. No. 1 is compulsory.*

1. Answer **all** questions of the following : 2×10 = 20

(a) Define Transcendental equation.

(b) Write the successive iteration for $x = \phi(x)$.

(c) Find the integral value of x, in between the roots of the equation $x^2 - 3 = 0$ lies.

(d) Define forward differences for the function $y = f(x)$.

(e) Derive $\Delta^3 y_0$.

(f) Write the Lagrange's interpolation formula.

(g) Prove that :

$$\Delta \log x = \log\left(1 + \frac{h}{x}\right)$$

(h) Define the second forward difference $\Delta^2 f(x)$.

(i) Define the Shift Operator E.

(j) State the formula of the Trapezoidal Rule for $\int_a^b y\,dx$.

2. (a) Describe the Bisection Method to find the real roots of the equation $f(x) = 0$. 10

(b) Find the square root of 18 correct to three decimal places by iteration method. 10

3. solve the following equations by Gauss Elimination method : 20

$$x + y + z = 3$$

$$2x + 3y + 3z = 10$$

$$3x - y + 2z = 13$$

4. Establish the Newton's formula for Forward Interpolation. 20

5. (a) State and prove fundamental theorem of difference calculus. 10

(b) Evaluate : 10

$$\Delta^3(1 - x)(1 - 2x)(1 - 3x)$$

6. Derive Gauss' formula for central difference interpolation. 20

7. Establish the formula of Simpson's $\frac{1}{3}$ and $\frac{3}{8}$ rules of numerical integration. 20

8. (a) Discuss the Euler's method to solve the first order differential equation $\frac{dy}{dx} = f(x, y)$. 10

(b) Solve the equation : 10

$$\frac{dy}{dx} = x + y$$

with initial conditions $x_0 = 0$ & $y_0 = 1$.