GIET UNIVERSITY, GUNUPUR – 765022

Ph.D. (Second Semester) Examinations, April – 2024

PPEMT2036 – Numerical Analysis

(Mathematics)

Time: 3 hrs Maximum: 70 Marks

The figures in the right-hand margin indicate marks.

Answer ANY FIVE Questions **(14 x 5 = 70 Marks)**

Marks

1.a. Find a real root of the equation $2x = \cos x + 3$ correct to three decimal places using fixed point iteration method. Show that $\phi(x) = \frac{\cos x + 3}{2}$ is an approximate iteration function. 7

b. Solve the following system by Gauss-elimination method 7

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

$$3x + 2y + 3z = 18$$

$$x + 4y + 9z = 16$$

2.a. Find a real root of walli's equation $x^3 - 2x - 5 = 0$ by regula falsi method correct up-to two decimal places. 7

b. Solve the following system of equations by Jacobi iteration method starting with initial guess $x_1 = 0, x_2 = 0, x_3 = 0$ 7

$$10x_1 + x_2 + x_3 = 12$$

$$x_1 + 10x_2 + x_3 = 12$$

$$x_1 + x_2 + 10x_3 = 12$$

3.a. Find the unique polynomial od degree 2 or less such that $f(0) = 1, f(1) = 3, f(3) = 5$ using the Lagrange interpolation. 7

b. For the following data calculate the differences and obtain the forward difference polynomial interpolate at $x = 6$ 7

X	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.00	2.28

4.a. Solve the following system of equations: 7

$$4x + y + 2z = 4$$

$$3x + 5y + z = 7$$

$$x + y + 3z = 3$$

By the Jacobi method and Gauss- Seidel method in each case continue the iteration up-to 3-steps starting with initial approximation $x = 0, y = 0, z = 0$.

b. Given x *and* $f(x)$ in the following table. Find $f(x)$ when $x = 2$ using Newton's divided difference formula 7

X	1	3	4	6
f(x)	-3	9	30	132

5.a. For the following data calculate the differences and obtain the backward difference polynomials interpolate at $x = 0.25, and\ x = 0.35$ 7

X	0	1	2	3	4	5
f(x)	1	5	31	121	341	781

b. Construct Newton's divided difference table for the following data and hence find the interpolating polynomial from the given data 7

X	-1	0	2	5
f(x)	-11	-5	-5	55

6.a. Evaluate the integral $I(f) = \int_0^1 \frac{dx}{1+x}$ by dividing the interval [0, 1] into two equal parts and then applying the Gauss- Legendre 3-point rule to each part. 7

b. Evaluate approximately the integral $I(f) = \int_0^1 \frac{dx}{1+x}$ by using 1-point, 2-point, 3-point Gauss Legendre rules. 7

7.a. Evaluate the integral $I(f) = \int_0^6 \frac{dx}{1+x^2}$ by using 7

(a) Compound Trapezoidal Rule

(b) Compound Simpson's $\frac{3}{8}th$ rule

(c) Compound Simpson's $\frac{1}{3}rd$ rule.

b. Find the approximation to $y(0.4)$ using the Taylor method of order two with h=0.2 for the initial value problem: $\frac{dy}{dx} = x - y + 1, y(0) = 0, 0 \leq x \geq 1.$ 7

8.a. Solve: $\frac{dy}{dx} = x + y\ ; y(0) = 1$, 2nd approximation by Picard's method. 7

b. Determine y for h=0.1, 0.2, 0.3, 0.4. Where y is the solution of the differential equation $\frac{dy}{dx} = 2(y + 1)\ ; y(0) = 0$ by using Euler's method with h=0.1. 7

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