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GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

M. Sc. (Third Semester) Regular Examinations, December– 2024

22MTPC301– Numerical Analysis

(M.Sc.- Mathematics)

Time: 3 hrs | Maximum: 60 Marks

(The figures in the right-hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

Q.1. Answer ***ALL*** questions

		CO #	Blooms Level
a.	Define Interpolation. Explain briefly.	CO1	K1
b.	Prove that $\delta = \nabla(1-\nabla)^{-1/2}$.	CO1	K2
c.	Construct the divide difference table for following data: x: 0.5 1.5 3.0 5.0 6.5 8.0 $f(x)$: 1.625 5.875 31.00 131.00 282.125 521.0	CO1	K1
d.	What are the normal equations used to find least square straight line and quadratic fit for discrete data?	CO2	K1
e.	State Weierstrass theorem for approximation.	CO2	K1
f.	Write the formula for Trapezoidal formula.	CO3	K1
g.	Find the approximate value of $I = \int_0^1 \frac{dx}{1+x}$ using Simpson's rule with 5 subintervals.	CO3	K2
h.	Evaluate $I = \int_0^1 \frac{dx}{1+x^2} dx$ by two-point Gaussian quadrature formula.	CO3	K2
i.	Write the formula for modified Euler's method.	CO4	K1
j.	Solve $\frac{dy}{dx} = 1-y, y(0) = 0$ using Euler's method. Find $y(0.1)$.	CO4	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ANY FIVE*** questions

		Marks	CO #	Blooms Level
2. a.	Given that $f(0)=1, f(1)=3, f(3)=55$. Find the Lagrange's interpolating polynomial of degree 2 or less.	5	CO1	K3
b.	Calculate $f\left(\frac{\pi}{12}\right)$ using Newton's divide difference interpolation for the data x: 0.1745 0.3491 0.5236 $f(x)$: 1.1585 1.2817 1.3660	5	CO1	K3
3.a.	Apply Gauss forward interpolation formula to find $y(25)$ for the following data	5	CO1	K3

x	20	24	28	32
y	2854	3162	3544	3992

b. Using Gauss backward interpolation formula to find $y(15)$ from the table — 5 CO1 K3

x	0	10	20	30	40	50
y	0.51	0.55	0.57	0.59	0.62	0.67

4. a. Obtain a linear polynomial approximation to the function $f(x) = x^3$ on the interval $[0,1]$ using the least squares approximation with weight function $W(x) = 1$. — 5 CO2 K4

b. Find the linear least square polynomial approximation to the data — 5 CO2 K4

x: 0.2 0.4 0.6 0.8 1

$f(x)$: 0.108 0.164 0.316 0.612 1.1.

5. Given the following values of $f(x) = \ln x$, find the approximate value of $f'(2.0)$ using linear and quadratic interpolation and $f''(2.0)$ using quadratic interpolation. — 10 CO3 K4

6. a. Evaluate $\int_0^5 \frac{dx}{4x+5}$ by Trapezoidal rule with 10 Trapezoids. — 5 CO3 K2

b. Evaluate the integral $\int_0^{\frac{\pi}{2}} Sinx\ dx$ using Gauss-Legendre 2-point and 3-point quadrature rules. — 5 CO3 K2

7.a. Evaluate the integral $\int_1^2 \frac{2xdx}{1+x^4}$ using Gauss-Legendre 2-point and 3-point quadrature rules. — 5 CO3 K2

b. Find y(1.2) by modified Euler's method given $\frac{dy}{dx} = \frac{2y}{x} + x^3$, y(1)=0.5 — 5 CO4 K3

8. Using Taylor's method solve $\frac{dy}{dx} = 1 + xy$ with $y_0 = 2$. Find $y(0.1), y(0.2), y(0.3)$ and $y(0.4)$. — 10 CO4 K3