5. (a) Solve the following equations : (7)

$10x + y - z = 11.19$

$x + 10y + z = 28.08$

$-x + y + 10z = 35.61$

by Jacobi's iteration method, correct to two decimal places. (7)

(b) Using Milne's predictor-corrector method to find the value of $y(4.5)$ given that

$5x\frac{dy}{dx} + y^2 - 2 = 0$ given $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.0143$, $y(4.4) = 1.0187$. (8)

6. (a) To prove that

(i) $1 + \delta^2\mu^2 = \left(1 + \frac{1}{2}\delta^2\right)$.

(ii) $\Delta - \nabla = \Delta\nabla = \delta^2$. (5)

(b) Derive the formula for Newton- Raphson's method and hence find the positive real root of $3x = \cos x + 1$ correct to four decimal places. (10)

7. Using Runge-Kutta method of order four to find the approximate value of y for $x = 0.1$, 0.2 and 0.3 if $\frac{dy}{dx} = xy + y^2$, given that $y = 1$ where $x = 0$. (15)

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321405

May, 2023

B.Sc. IV SEMESTER

Numerical Methods (OMTH-401A)

Time : 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Scientific calculator can be used.*

PART–A

1. (a) Represent the following numbers in normalized floating point form :

34000000, 0.00234, 32.7652. (1.5)

(b) Round-off the following numbers to four significant figures :

1.6583, 0.859378, 30.0567. (1.5)

(c) Find the difference $\sqrt{6.37} - \sqrt{6.36}$ correct to three significant figures. (1.5)

(d) Form the divided difference table for the following data : (1.5)

X	2	5	10
Y	5	29	139

(e) Which Interpolation formulae are used for central difference? Write down the formula for one of them. (1.5)

(f) Define algebraic and transcendental equations with examples. (1.5)

(g) Write down the formula for Adams-Bashforth method for finding the solution of the problem

$$\frac{dy}{dx} = f(x, y), y(x_0) = y_0.$$ (1.5)

(h) To prove that $\Delta^4 y_0 = y_4 - 4y_3 + 6y_2 - 4y_1 + y_0$. (1.5)

(i) Write down the expressions for $\frac{dy}{dx}$ at $x = x_n$ by Newton's backward difference formula. (1.5)

(j) $f(x)$ is given by

X	0	0.5	1
$f(x)$	1	0.8	0.5

Then using Trapezoidal rule, find the value of

$$\int_0^1 f(x)dx.$$ (1.5)

PART–B

2. (a) Find a real root of the equation $x^3 - 2x - 5 = 0$ by the method of Regula-Falsi method correct to three decimal places. (10)

(b) Evaluate the value of $\sqrt[3]{24}$ correct to four decimal places by Newton's iteration method. (5)

3. (a) From the given table, compute the value of sin 38°

x°	0	10	20	30	40
sin x	0	0.17365	0.34202	0.5	0.64279

(8)

(b) Find the polynomial $f(x)$ by using Lagrange's formula and hence find $f(3)$ for

X	0	1	2	5
$f(x)$	2	3	12	147

(7)

4. (a) From the following table of values of x and y,

x	1.0	1.2	1.4	1.6	1.8	2.0	2.2
y	2.7183	3.3201	4.0552	4.9530	6.0496	7.3891	9.0250

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.2$. (8)

(b) Evaluate the following integral by using Simpson's 1/3rd rule,

$$\int_0^{0.6} e^{-x^2} dx, \quad \text{(Take } h = 0.1\text{)}$$

by taking seven ordinates. (7)