(b) Using Modified Euler's method to find the value of $y(0.2)$ and $y(0.4)$ given that $\frac{dy}{dx} = y + e^x$, $y(0) = 0$. (8)

6. (a) To prove that

(i) $\mu\delta = \frac{1}{2}(\Delta + \nabla)$

(ii) $\delta(E^{1/2} + E^{-1/2}) = \Delta E^{-1} + \Delta$. (5)

(b) Explain Regula-False Position method and hence find a real root of the equation $x \log_{10} x = 1.2$ correct to four decimal places. (10)

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

Roll No. ....

321411

May 2023

B.Sc. - IV SEMESTER

Numerical Methods (OMTH-401)

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

38.46235, 0.70029, 0.0022218. (1.5)

(b) Explain the term 'round-off error' and round-off the following numbers to two decimal places :

52.275, 2.3742. (1.5)

(c) What is normalized floating point representation? Find the multiplication of 0.1234 E-10 and 0.1111 E-4 in normalized floating point form. (1.5)

(d) If $y(1) = 4$, $y(3) = 12$, $y(4) = 19$ and $y(x) = 7$, then find x using Lagrange's formula. (1.5)

(e) Given $f(1) = 3, f(2) = 8, f(3) = 15$, then find the value of $\Delta^2 f(1)$. (1.5)

(f) Write the finite difference formula for $y'(x)$ and $y''(x)$. (1.5)

(g) Write down the formula for Milne' 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 $\Delta^3 y_0 = y_3 - 3y_2 + 3y_1 - y_0$. (1.5)

(i) Write down the Newton's iterative formula for finding the value of $\sqrt{N}$. (1.5)

(j) Form the divided difference table for the following data :

X	5	15	22
Y	7	36	160

(1.5)

PART–B

2. (a) Find a real root of the equation $x^3 - 3x + 1 = 0$ by Newton's-Raphson method correct to three decimal places. (8)

(b) Find the root of the equation $xe^x = \cos x$ correct to four decimal places by Secant method. (7)

3. (a) Find $f(22)$ from the Gauss forward formula : (8)

x	20	25	30	35	40	45
$f(x)$	354	332	291	260	231	204

(b) Using Newton's divided difference formula, find the missing value from the table : (7)

x	1	2	4	5	6
y	14	15	5	–	9

4. (a) Given the following table of values of x and y, (8)

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.000	13.625	24.000	38.875	59.000

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.5$.

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

$$\int_0^{\pi} \sin x \, dx,$$

by taking eleven ordinates.

5. (a) Solve the following equations

$$28x + 4y - z = 32$$
$$x + 3y + 10z = 24$$
$$2x + 17y + 4z = 35$$

by Gauss-Seidal method, correct to three decimal places. (7)