QP CODE: 26022397

26022397

Reg No : .....

Name : .....

M Sc DEGREE (CSS) EXAMINATION, MAY 2026

Second Semester

M Sc MATHEMATICS

CORE COURSE - ME010203 - NUMERICAL ANALYSIS WITH PYTHON

2019 ADMISSION ONWARDS

9954F0CF

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Define solve() function in Python.
2. Why do we use the argument, legend = True in plot() function?.
3. In the following program in which direction the limit is found? What will be the output? How can we change the direction of the limit? What will be the output when we change the direction of the limit?

```
from sympy import Limit, Symbol, pprint
x = Symbol('x')
I= Limit(1/x, x, 0).doit()
pprint(I)
```

4. Write a program to find the derivative of the function $f(x) = 3\sin x + x^2$.
5. Write a program to find the critical points of the function $f(t) = t^7 - 7t^5 + 7$.
6. Define Interpolation.
7. What are the roots (if exist) of the function $sinx - x$?
8. Obtain the formula for the number of bisections required in the bisection method.
9. Decompose $\begin{bmatrix} 3 & 1 \\ 4 & 2 \end{bmatrix}$ into L and U.
10. Briefly explain the Recursive trapezoidal rule.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. What is the use of *factor()* and *expand()* in python. Explain with examples

12. (a)What is the use of init_printing() in python? Explain with example.
    (b)What is the use of subs() function in Python programming?

13. (a) Write a program to find the indefinite integral $\int \sin x + \cos x \, dx$.
    (b) Write a program to find the definite integral $\int_0^3 3e^x + x^3 + 1 \, dx$.

14. Write a program to calculate the length of the curve $f(x) = \frac{e^{2x}+e^{-2x}}{4}$ between $x = 0$ and $x = 1$.

15. Write a note on Lagrange's method for polynomial interpolation.

16. Use Newton- Raphson method to obtain successive approximations of $\sqrt{5}$ as the ratio of two integers.

17. Derive augmented coefficient matrix.

18. What you mean by general problem of numerical integration? Derive Newton Cotes formula

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. (a.) Write a program to display the first 5 terms of the series expansion of $\log(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots$. Using this series display the value of $log2$.
    (b)Write a Python program to input the expressions
    $x^5 + 5x^4 + 3x + 1$ *and* $x^3 + 2x^2 + 3$. Calculate its product and display them

20. How can we find the global maximum and global minimum of a function using Python? Explain.

21. (a) Explain Newton's method for polynomial interpolation.
    (b) Use Newton's method to find the polynomial that fits the following points.

x	-3	2	-1	3	1
y	0	5	-4	12	0

22. (a) Write the algorithm for the elimination phase in Gauss elimination method.
    (b) Use Gauss elimination to solve the equation AX = B where

$$A = \begin{bmatrix} 6 & -4 & 1 \\ -4 & 6 & -4 \\ 1 & -4 & 6 \end{bmatrix} \text{ and } B = \begin{bmatrix} -22 \\ -18 \\ 7 \end{bmatrix}$$

(2×5=10 weightage)