QP CODE: 22000352

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Reg No : .....

Name : .....

MSc DEGREE (CSS) EXAMINATION , JANUARY 2022

Second Semester

CORE - ME010203 - NUMERICAL SOLUTION WITH PYTHON

M Sc MATHEMATICS,M Sc MATHEMATICS (SF)

2019 Admission Onwards

8A783184

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Explain the use of the function "subs" using a python program
2. Write a program to plot the function $f(x) = x^3 + 3$, $x \in \mathbb{R}, |x| \leq 5$
3. Write a program to evaluate the limit $\lim_{n\to\infty}(1 + \frac{1}{n})^n$.
4. Write a program to find the derivative of the function $f(p, q) = 2p + 3p^2q$ with respect to q.
5. Write a program to find the definite integral $\int_0^2 kx\ dx$, where k is a constant.
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. Write a short note on a system of algebraic equations.
10. Decompose $\begin{bmatrix} 1 & 4 \\ 5 & 4 \end{bmatrix}$ into L and U.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Write a program that will ask the user to input an expression, calculate its factors, and print them
12. Write a program to find the roots of the quadratic equation $x^2 + 5x + 4 = 0$
13. (a) Write a program to find the critical points of the function $f(x) = \sin x + \cos x$.
    (b) Write a program to find the second order derivative of the function $f(x) = 2x^{10} + x^5 + x^3 + 10$ at $x = 13$.

14. Write a program that will ask the user to input two functions of x and print the area enclosed between them.

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

16. What are the limitations for polynomial interpolation?

17. Derive Newton Cotes formula

18. Derive Simpson's rule from Newton-cotes formula.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. (a.) Write a Python program to print the series expansion of $\tanh^{-1}(x) = x + \frac{x^3}{3} + \frac{x^5}{5} + \frac{x^7}{7} + \dots$ where $x \in \mathbb{R}$ upto n terms, and to calculate the sum at the point $x = 0.25$, where n is taken as user input.
(b.) Write a Python program to input the expression $x^3 + 3x^2 + 3x + 1$, $x^3 + 3x + 3$, calculate its product and display them

20. How to find the global maximum and minimum of the function $f(x) = x^5 - 30x^3 + 50x$ on the interval $[-5, 5]$ using Python?

21. Using Newton-Raphson method, find the smallest positive zero of $f(x) = x^4 - 6.4x^3 + 6.45x^2 + 20.538x - 31.752$. Also write its algorithm.

22. (a) Write the algorithm for the elimination phase in Gauss elimination method.
(b) Solve the equation Gauss elimination method. $-5x + 34y + z = -3; 3x + 2y - z = 9; 3x - 3y + z = 1.$

(2×5=10 weightage)