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QP CODE: 20000644

Reg No : .....

Name : .....

MSc DEGREE (CSS) EXAMINATION , NOVEMBER 2020

Second Semester

CORE - ME010203 - NUMERICAL SOLUTION WITH PYTHON

M Sc MATHEMATICS, M Sc MATHEMATICS (SF)

2019 Admission Onwards

15F24FB2

Time: 3 Hours

Weightage: 30

**Part A (Short Answer Questions)**Answer any **eight** questions.Weight **1** each.

1. Write a python program to factorize the expression  $x^2 - y^2$  also print the factors as the output
2. How can we plot graphs in Python?
3. Write a program to evaluate the limit  $\lim_{\theta \rightarrow 0} \frac{\cos 2\theta}{2\theta}$  from the negative side.
4. Write a program to find the critical points of the function  $f(x) = x^5 - 10x^3 - 19$ .
5. Write a program to evaluate the definite integral  $\int_0^5 x^2 + 2x + 4 dx$ .
6. Explain the concept of curve fitting.
7. What is the recurrence relation to calculate  $P_n(x)$  in Newton's method?
8. What are the roots (if exist) of the function  $\tan x - x$ ?
9. Which procedure is known as backward substitution for 3x3 matrix?
10. Briefly explain the Trapezoidal rule.

(8×1=8 weightage)

**Part B (Short Essay/Problems)**Answer any **six** questions.Weight **2** each.

11. Write a program that define a symbolic expression  $x^2 + 2xy + y^2$  and simplify it when  $x$  is  $1 - y$ . What will be the output of this program?
12. Describe about solving a system of linear equations in Python with example.
  - (a) Write a program to find the derivative of the function  $f(x) = x^2 e^{2x} + \sin 3x$ .
  - (b) Write a program to find the partial derivatives of the function  $f(x, y) = \cos xy + 3xy$  with respect to  $x$  and  $y$ .
14. Write a program to calculate the length of the curve  $f(x) = \sqrt{1 - x^2}$  between  $x = 0$  and  $x = 1$ .
15. Find the root of the equation  $x^3 - x - 11 = 0$  using bisection method.
16. Explain Newton-Raphson method.





17. Find the LU decomposition of the matrix  $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 2 & 1 \end{bmatrix}$
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 Python program to print the series expansion of  $\tan^{-1}(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots$  where  $-1 \leq x \leq 1$  upto  $n$  terms, and to calculate the sum at the point  $x = 0.5$ , where  $n$  is taken as user input.
- (b.) Write a Python program to input two expressions, calculate its product and display them
20. (a) Consider a car moving along a road. It accelerates uniformly such that the distance travelled,  $S$ , is given by the function  $S(t) = 5t^2 + 2t + 8$ . Write a program to find the instantaneous speed of the car at time  $t_1$ , using the Limit ( ) function.
- (b) Write a program to calculate the derivative of an input function with respect to an input variable.
21. (a) Derive Lagrange's Interpolation formula.
- (b) Using Lagrange's interpolating formula, find the form of the function  $y(x)$  from the following table:

|   |     |   |    |
|---|-----|---|----|
| x | 0   | 1 | 3  |
| y | -12 | 0 | 12 |

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)

