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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 $\lim_{\theta \to 0} \frac{\cos 2\theta}{2\theta}$ 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 $tanx - x$?
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.
13. (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 x3 - 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 expnasion of $\tan^{-1}(x) = x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \ldots$ 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)