



24018743

QP CODE: 24018743

Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION , APRIL 2024
Second Semester
CORE - ME010203 - NUMERICAL ANALYSIS WITH PYTHON

M Sc MATHEMATICS, M Sc MATHEMATICS (SF)

2019 Admission Onwards

8E656A65

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. What is the use of *expand()* in python? Explain with example.
2. Describe the errors in the following program
From sympy import Symbols
x= symbol(x)
pprint(x)
and rewrite the correct program
3. What will be the output of the following Python code? Explain the code.
from sympy import Limit, Symbol, sin, pi
x=Symbol('x')
l=Limit(sin(2*x), x, pi/4)
print(l.doit())
4. Write a program to find the derivative of the function $f(x, y) = 2xy + x^2y^2$ with respect to x .
5. Write a program to find the integral $\int 2 \sin x \, dx$.
6. What is the recurrence relation to calculate $P_n(x)$ in Newton's method?
7. Define roots of an equation.
8. Explain the method of bisection
9. What are the two steps used for solving simultaneous equations using Gauss elimination method?
10. Briefly explain the Simpson's rule.

(8×1=8 weightage)





Part B (Short Essay/Problems)

Answer any **six** questions.

Weight 2 each.

11. Write a Python program to expand the mathematical expression $(x + 1)(x + 4)$ and hence solve the obtained quadratic equation by displaying its roots in dictionary order.
12. (a) Why do we use the argument, `legend = True` in `plot()` function?
(b) Write a program to solve the inequality $x^2 + 4 < 0$ and print the solution.
13. (a) Write a program to find the critical points of the function $f(x) = x^2 - 2x + 1$.
(b) Write a program to evaluate $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$, if $f(x, y) = x^2y - \frac{y^3}{3}$.
14. Write a program that will allow the user to input any two single variable functions of x and print the area enclosed between the two.
15. Write short note on interpolation and curve fitting.
16. Use Newton- Raphson method to obtain successive approximations of $\sqrt{2}$ as the ratio of two integers.
17. Which procedure is known as forward substitution for 3x3 matrix?
18. What you mean by quadrature? 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 $\log(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \dots$. Using this series display the value of $\log 2$.
(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. (a) Write a program which will take a function as input and then print the result of differentiating with respect to the variable specified.
(b) Write a program to check the continuity of the function $f(x) = x^2$ at $x = 0$.
21. (a) Derive Lagrange's Interpolation formula.
(b) Find the Lagrange interpolating polynomial of degree 2 approximating the function $y = \ln(x)$ defined by the following table of values. Hence determine the value of $\ln(2.7)$.

x	2.0	2.5	3.0
y	0.69	0.91	1.09





22. (a) Write the algorithms of Doolittle's decomposition phase and solution phase.

(b) Decompose $\begin{bmatrix} 1 & -2 & 3 \\ 2 & -5 & 12 \\ 0 & 2 & -10 \end{bmatrix}$ into L and U.

(2×5=10 weightage)

