

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 86
(For candidates admitted from the academic year 2023 – 2024 and thereafter)

M.Sc. DEGREE EXAMINATION, APRIL 2026
BRANCH I - MATHEMATICS
SECOND SEMESTER

COURSE : ELECTIVE
PAPER : MATHEMATICAL PYTHON
SUBJECT CODE : 23MT/PE/MP15
TIME : 3 HOURS **MAX. MARKS: 100**

THEORY:

Q. No.	SECTION A ($10 \times 1 = 10$) Answer ALL questions	CO	KL
1.	Python is a _____ programming language. a) Compiled b) Interpreted c) Machine d) Assembly	1	1
2.	_____ keyword is used to define a function in Python. a) func b) define c) def d) function	1	1
3.	_____ loop is used when the number of iterations is known. a) while b) do-while c) for d) repeat	1	1
4.	_____ is used to open a file in Python. a) open() b) file() c) read() d) write()	1	1
5.	JSON stands for_____. a) Java Script Object Notation b) Java Source Open Network c) Joint Standard Object Name d) None	1	1
6.	NumPy is mainly used for_____. a) Web design b) Numerical computing c) File storage d) Networking	1	1

7.	Matplotlib is used for_____. a) Plotting graphs b) File compression c) Machine learning d) Data storage	1	1
8.	Curve fitting is used in_____. a) Regression analysis b) File handling c) Networking d) Debugging	1	1
9.	Gradient descent is a _____. a) Sorting technique b) Optimization technique c) Encryption method d) Loop structure	1	1
10.	The try block is used for_____. a) Looping b) Error handling c) File creation d) Sorting	1	1
Q. No.	SECTION B (10 × 1 = 10) Answer ALL questions	CO	KL
11.	What is the purpose of indentation in Python? a) Decoration b) Code block definition c) Variable declaration d) Error generation	2	2
12.	Which data type is immutable? a) List b) Dictionary c) Tuple d) Set	2	2
13.	Why are modules used in Python? a) To reduce code readability b) To reuse code c) To increase errors d) To delete files	2	2
14.	Exception handling prevents_____. a) Program execution b) Syntax highlighting c) Program crash d) File saving	2	2

15.	NumPy arrays are preferred over lists because they_____. a) Use more memory b) Are slower c) Perform faster numerical operations d) Cannot store numbers	2	2
16.	SymPy helps in solving equations_____. a) Numerically only b) Symbolically c) Graphically only d) Manually	2	2
17.	A scatter plot is mainly used to show_____. a) Text data b) Relationship between two variables c) File structure d) Loop iterations	2	2
18.	Gradient descent minimizes a function by_____. a) Increasing slope b) Moving opposite to gradient c) Random guessing d) Looping infinitely	2	2
19.	Solving differential equations in Python commonly uses_____. a) NumPy only b) SciPy library c) JSON module d) OS module	2	2
20.	In graph theory, the degree of a node represents_____. a) Weight b) Number of connected edges c) Graph size d) Matrix order	2	2



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PRACTICAL:

Q. No.	SECTION C ($2 \times 20 = 40$) Answer ANY TWO questions	CO	KL
21.	Develop a Python program to store student details (Roll No, Name, Marks in 3 subjects) using dictionary and tuples. Use functions to compute total, average and grade. Display topper details and the students scoring above class average.	3	3
22.	a) Create a custom python module for finding the area and perimeter of various shapes (Square, Rectangle, Triangle, Circle) by defining functions within a single python file. Import the file into python script, accept user choices for shape selection and print the results. b) Create a list of floating-point numbers between 10 and 20 and calculate its mean, median, mode, and standard deviation.	3	3
23.	Use NumPy to: a) Create a 4×4 matrix A with random integer values between -5 and 5; compute its eigenvalues and eigenvectors. b) Solve the following system of linear equations: $4x + 2y - z = 1;$ $x + 5y + 3z = 2;$ $2x + y + 6z = -1$ c) Find the roots of the polynomial $x^3 + 3x^2 + 2x + 1$ d) Create an array of five elements with evenly spaced values between 1 and 2, calculate its average, variance and standard deviation.	3	3

Q. No.	SECTION D ($2 \times 10 = 20$) Answer ANY TWO questions	CO	KL
24.	Create a program to generate the first n Fibonacci numbers using a loop and find the sum of all its values.	4	4
25.	Design a program to read multiple lines from a file, split the lines into list of words and print only those words whose length is less than 4 and begins with the character 'a', 'i' or 'c'.	4	4
26.	Use suitable data to draw a scatter plot and a bar diagram, display them as two subplots, one on top of each other, give individual subplot titles, title for the entire figure and label the axis.	4	4
27.	Write a python code which uses the Batch Gradient Descent (BGD) to minimize the cost function $f(x) = x^3 + 4x$ and plot the same.	4	4
Q. No.	SECTION E ($2 \times 10 = 20$) Answer ANY TWO questions	CO	KL
28.	Write a suitable python program using JSON package to illustrate serialization and deserialization.	5	5
29.	Use suitable package to (a) Create the expression: $(\sin x + \cos x)^3 - 3 \log x + \frac{1}{2}$. (b) Expand the expression $\sin(x + y)$ and find its limit as $x \rightarrow \infty$. (c) Evaluate the expression $\int_0^1 (e^x - x^2) dx$. (d) Evaluate the expression $\sum_{i=0}^{10} x^i$ and $\prod_{i=1}^{10} \frac{1}{i}$.	5	5
30.	Use suitable package to draw a connected bipartite graph and obtain the shortest path between any two points.	5	5
31.	Implement a python program to solve the linear homogenous differential equation $\frac{dy}{dt} + y = 0$.	5	5