Reg.No.:												

VIVEKANANDHA COLLEGE OF ENGINEERING FOR WOMEN
[AUTONOMOUS INSTITUTION AFFILIATED TO ANNA UNIVERSITY, CHENNAI]
Elayampalayam – 637 205, Tiruchengode, Namakkal Dt., Tamil Nadu.

Question Paper Code: 160002

B.E. / B.Tech. DEGREE END-SEMESTER EXAMINATIONS – NOV. / DEC. 2025
Third Semester
Artificial Intelligence & Data Science
U23AD301– ESSENTIALS OF PYTHON PROGRAMMING
(Regulation 2023)

Time: Three Hours | Maximum: 100 Marks

Answer ALL the questions

Knowledge Levels (KL)	K1 – Remembering	K3 – Applying	K5 - Evaluating
	K2 – Understanding	K4 – Analyzing	K6 - Creating

PART – A

(10 x 2 = 20 Marks)

Q.No.	Questions	Marks	KL	CO
1.	Write out the `simCalc.py` program and identify the parts of the program as follows: • Circle each identifier. • Underline each expression.	2	K2	CO1
2.	Write a program that computes Celsius temperatures and the Fahrenheit equivalents.	2	K2	CO1
3.	Assume that there are 66 members in a class for whom the lab evaluation is to be conducted. The course instructor has prepared three sets of question papers — Set 1, Set 2, and Set 3. The question paper Set 1 is to be given to students with register numbers (1, 4, 7, …), Set 2 to students with register numbers (2, 5, 8, …), and Set 3 to the remaining students. Given a list of register numbers, use list slicing to generate the list of students who belong to Set 1, Set 2, or Set 3.	2	K2	CO2
4.	In what way does a list differ from a tuple?	2	K2	CO2
5.	Write a Python code snippet that copies and transfers the contents of the source file (src.txt) to the destination file (dest.txt).	2	K2	CO3
6.	Write a Python code snippet that calculates the GCD of two positive numbers using recursion. Take two numbers — say, 60 and 48 — compute their GCD.	2	K2	CO3
7.	Does NumPy'snd arraystore data in a manner similar to a nested Python list? Explain.	2	K1	CO4
8.	Define Boolean indexing and fancy indexing pertaining to NumPy. Give appropriate examples.	2	K1	CO4

9.		Give a step-by-step procedure to import Seaborn in Python.	2	K1	CO5
10.		Consider the following confusion matrix: [[50, 10], [5, 35]] Devise a Python code to calculate accuracy, precision, recall, and F1-score using these values without using any built-in scikit-learn metrics.	2	K2	CO5

PART – B

(5 x 13 = 65 Marks)

Q.No.			Questions	Marks	KL	CO
11.	a)	i.	For a given string S[1:MAX], compute the length of its longest substring consisting of unique characters. Which is the suitable approach for the above problem statement? Write a python function with the below prototype. deflongSub(s: str, length: int) ->int:	7	K1	CO1
		ii.	Take a sample input, show step-by-step program execution, derive the output, and check whether observed output matches the expected result.	6		
			(OR)			
	b)	i.	Given a roman numeral, convert it to an integer. Input: s = "III" Output: 3 Input: s = "IX" Output: 9 Write a python function with the below prototype. defconRoman(s: str, length: int) ->int:	7	K1	CO1
		ii.	Take a sample input, show step-by-step program execution, derive the output, and check whether observed output matches the expected result.	6		
12.	a)		Describe what the keys(), values(), and items() methods do in a Python dictionary, and write a sample code to show how they work.	13	K2	CO2
			(OR)			
	b)		Paraphrase about the concept 'aliasing' pertaining to Python lists? Write a sample Python code to demonstrate how changing one list affects another when they are aliased.	13	K2	CO2
13.	a)	i.	Write a recursive functional call in Python to return all the possible permutations for a given array A[0:MAX] of distinct integers. Sample I/p: nums = [0,1] O/p: [[0,1],[1,0]] Ensure that the functional call follows the below prototype. def perm(A:str,length:int,idx:int)->str:	7	K2	CO3
		ii.	Show the step-by-step written program execution by constructing a recurrence tree for the recursive calls mentioned in the program.	6		
			(OR)			

	b)	Consider the following code snippet. defupdate(p, q): q = q + [4] p.append(5) x = [1, 2, 3] y = [10, 20] update(x, y) print(x, y)		K2	CO3
		i.	Predict the output and explain why x and y behave differently.	6		
		ii.	Which operation inside the function demonstrates aliasing and which demonstrates reassignment?	7		
14.	a)	i.	Given a square 2D NumPy array mat, compute the absolute difference between the sum of the main diagonal and the sum of the anti-diagonal. Input: mat=[[1,2,3],[4,5,6],[7,8,9]] Output: 0 # |1+5+9 - (3+5+7)| = |15-15| Ensure that the written (clean) code should work for all square matrices (N >= 2) as test cases.	7	K3	CO4
		ii.	Can it be optimized by reducing the time complexity below O(N) by setting a trade-off between space and time complexity? Justify with a demonstration.	6		
			(OR)			
	b)	i.	Given a 1D array arr, return an array where each element is the cumulative product up to that index. Input: arr = [1,2,3,4] Output: [1,2,6,24] Ensure that the written (clean) code should work for the range $(2,10^5]$ as test cases.	7	K3	CO4
		ii.	Can it be optimized by reducing the time complexity below $O(N^2)$ by setting a trade-off between space and time complexity? Justify with a demonstration.	6		
15.	a)	i.	Paraphrase about the cardinal features of Matplotlib that make it a powerful visualization library.	5	K2	CO5
		ii.	Elaborate the working philosophy of the following concepts: • Figure • Axes and • Subplots fit with respect to Matplotlib's architecture.	3		
		iii.	Outline a salient example to illustrate the structure of a basic plot.	5		
			(OR)			

b)	i.	Paraphrase about the core Python libraries used for data visualization and numerical analysis.	5	K2	CO5
	ii.	Explain about the specific roles of NumPy, Pandas, and Matplotlib in a typical data science workflow.	3		
	iii.	Outline an example that demonstrates their combined use in processing and visualizing a dataset.	5		

PART – C

(1 x 15 = 15 Marks)

Q.No.		Questions	Marks	KL	CO
16.	a)	A social media startup is building a message visualization tool that makes chat messages appear in creative patterns. One of the experimental features involves displaying text in a zigzag pattern before transmitting it to the receiver. For example, when the message "PAYPALISHIRING" is displayed using 3 rows, the pattern looks like this: P A H N A P L S I I G Y I R When the lines are read sequentially, the resulting string becomes "PAHNAPLSIIGYIR". Write a working Python program that takes a string 'St' and a specified number of rows 'R' as input, and then returns the zigzag-converted string as described above. Function prototype: `def zig(St:str,R:int)->str:` Show the step-by-step written program.	15	K1	CO1
		(OR)			
	b)	A telecom company is designing a smart dialing assistant for its mobile app. When users type a sequence of digits (like on a phone keypad), the app should suggest all possible word combinations that correspond to those numbers — similar to how older phones allowed typing words using numeric keypads. For example, the digit 2 maps to the letters a, b, c, and the digit 3 maps to d, e, f. If a user enters the digits "23", the assistant should display all possible letter combinations such as: `["ad", "ae", "af", "bd", "be", "bf", "cd", "ce", "cf"]` Write a Python working code that takes a string of digits (from 2–9) and returns all possible letter combinations based on the phone keypad mapping. The order of the combinations does not matter. Show the step-by-step written program execution by constructing a recurrence tree for the recursive calls mentioned in the program.	15	K1	CO1