Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, MAY/JUNE 2025

ELECTRONICS AND COMMUNICATION ENGINEERING

III Semester

EC23S01 & NUMERICAL AND SIGNAL PROCESSING PRACTICE THROUGH PYTHON

(Regulation 2023)

Time: 1.5 hrs. Max. Marks: 50

PART- A (3 Marks x 10 =30 Marks)

(Answer all Questions)

Q. No.	Questions	Marks
1	Write a function **square** that takes a number as input and returns its square.	3
2	Implement a Python function to time-shift and time-scale a discrete-time signal. Use the function to shift a sinusoidal signal x[n]=sin((2π5n) by 2 units to the right and scale the time axis by a factor of 0.5. Plot the original and transformed signals.	3
3	Write a program that takes three numbers as input and uses conditional statements to determine and print the largest of the three numbers.	3
4	Write a Python program using NumPy to solve the system of linear equations 2x+3y=8 and 3x+2y=7 by matrix inversion.	3

5	What will the following Matplotlib code do?
	`plt.plot([1, 2], [3, 4], label="Line A")`
	`plt.legend()`
	`plt.show()`
		3

6	What will len(open("file.txt", "r").read().splitlines()) do when executed?	3

7	Given the matrix A, What does the matrix P represent in the following code?
	`import numpy as np`
	`from scipy.linalg import lu`
	`A = np.array([[3, 1, 2], [6, 3, 4], [3, 1, 5]])`
	`P, L, U = lu(A)`
		3

8	What will the following recursive function output?
	`def recursive_sum(nums):`
	`  if len(nums) == 0:`
	`  return 0`
	`  return nums[0] + recursive_sum(nums[1:])`
	
	`numbers = [1, 2, 3, 4]`
	`print(recursive_sum(numbers))`
		3

9	What does the following code output?
	`keys = ['a', 'b', 'c']`
	`values = [1, 2, 3]`
	`my_dict = {k: v*2 for k, v in zip(keys, values)}`
	`print(my_dict)`
	`squared_values = [v**2 for v in my_dict.values()]`
	`print(squared_values)`
		3

10	What will the following code output? name = "Alice" age = 25 info = f"My name is {name} and I am {age} years old." print(info.replace("Alice", "Bob").split(" "))	3

PART- B (5 Marks x 4 = 20 Marks)

(Answer any 4 Questions)

Q. No.	Questions	Marks
I.	Write a program in python to implement matrix multiplication for two 3x3 matrices using nested loops.	5
II.	Write a program to find the eigenvalues of a matrix and verify that the product of the eigenvalues equals the determinant of the matrix.	5
III.	Generate a continuous-time sinusoidal signal $x(t)=\sin(2\pi 5t)$ and sample it at different rates: 10 Hz, 20 Hz, and 50 Hz over 1 second. Plot the continuous and sampled signals. What happens when the sampling rate is below, at, and above the Nyquist rate?	5
IV.	Write a Python program to perform and visualize the convolution of two discrete-time signals. Use a rectangular pulse x1[n] and an exponential decay signal $x2[n]=e-0.5nu[n]$. Plot the two signals and their convolution.	5
V.	Write a Python program to compute the impulse response of a discrete-time linear time-invariant (LTI) system. Simulate a system with the difference equation $y[n]=0.5y[n-1]+x[n]$, where x[n] is an impulse signal. Plot the impulse response and discuss the system's stability and causality.	5
VI.	Write a Python program to compute the Discrete Fourier Transform (DFT) of a sinusoidal signal $x(t)=\sin(2\pi 10t)$. Use numpy.fft to perform the Fourier Transform and plot both the time-domain signal and the magnitude spectrum. Discuss how the frequency content is reflected in the spectrum.	5