



PRESIDENCY UNIVERSITY

BENGALURU

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End - Term Examinations – MAY/ JUNE 2025

Date: 02-06-2025

Time: 01:00 pm – 04:00 pm

School: SOE	Program: B. Tech-ECE/VLSI Design and Technology	
Course Code: ECE3019	Course Name: Python Programming for Electronics Applications DEII	
Semester: IV	Max Marks: 100	Weightage: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	24	24	26	26	-

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

10Q x 2M=20M

1.	Explain the role of histogram equalization in enhancing image contrast in digital image processing.	2 Marks	L2	CO3
2.	Why are grayscale images commonly used in image analysis instead of RGB images?	2 Marks	L2	CO4
3.	How does NumPy contribute to efficient numerical operations in scientific computing with Python?	2 Marks	L2	CO1
4.	Explain the significance of using PySpice for simulating electronic circuits in Python-based environments.	2 Marks	L2	CO1
5.	Define sampling in digital signal processing. How is the sampling frequency determined and why is it important?	2 Marks	L2	CO2
6.	Develop a Python script to create and display a continuous sine wave signal, representing a real-time analog waveform.	2 Marks	L2	CO3
7.	Write a Python program to compute the total resistance of three resistors connected in series.	2 Marks	L2	CO2
8.	Differentiate between filtering in the spatial domain and frequency domain in image processing.	2 Marks	L2	CO4
9.	Provide a short explanation of how a low-pass filter can be used for image smoothing.	2 Marks	L2	CO4
10.	What makes the Fast Fourier Transform (FFT) a preferred technique in many signal processing tasks?	2 Marks	L2	CO3

Part B

Answer the Questions.

Total Marks 80M

11.	a.	While developing a testing framework for an embedded signal processing unit, an engineer decides to use Python to simulate a sine wave. She intends to utilize libraries including NumPy, SciPy, and Matplotlib for signal generation and visualization. Explain the application of these libraries in electronics and provide a Python code snippet to generate and display the sine wave.	10 Marks	L3	C01
Or					
12.	a.	Emma is analyzing antenna-received radio signals in her communications project, but the presence of random noise complicates the process of extracting useful data. To evaluate the success of filtering strategies, she intends to visualize both the noisy and filtered versions of the signal. Demonstrate how Matplotlib can be used for this purpose and write a Python script that generates a noisy sine wave, applies an appropriate time-domain filter (among mean, median), and displays both signals on a plot.	10 Marks	L3	C01
13.	a.	With Python becoming a popular choice for electronics applications—ranging from automation to signal analysis—how does it stand up against more established languages like C and Java? Explain the key advantages and limitations of using Python in this context, and provide a detailed scenario in which Python is a more suitable option than C or Java.	10 Marks	L3	C01
Or					
14.	a.	While working on EEG signal noise reduction, Dr. Samuel is considering the use of either convolution or correlation techniques in Python. Discuss the mathematical distinction between the <code>scipy.signal.convolve</code> and <code>scipy.signal.correlate</code> functions. Recommend the appropriate function for signal filtering and explain your reasoning.	10 Marks	L3	C01
15.	a.	Considering that adding resistors in parallel always results in a lower total resistance, while series connections increase it, how can an engineer determine the appropriate configuration to achieve a specific resistance value? Write a Python script that automatically calculates the equivalent resistance of a set of resistors connected in parallel.	10 Marks	L3	C02
Or					
16.	a.	Resistors in electronic circuits are selected with consideration for both electrical performance and thermal safety due to power dissipation. Create a Python script that models a basic resistive circuit using Ohm's law, and outputs the voltage, current, and power corresponding to different resistor values.	10 Marks	L3	C02

17.	a.	Verifying the truth tables of logic gates is fundamental in digital circuit design to confirm the integrity of logical functions. Write a Python program that performs a comprehensive verification of the truth tables for various gates (AND, OR, NOT, NAND, NOR, XOR, XNOR). Explain how this verification process can be automated and how you can ensure the correctness of your Python implementation by comparing the output with the theoretical truth tables.	10 Marks	L3	C02
Or					
18.	a.	PySpice offers a Python interface for SPICE simulators, making it a valuable tool for circuit design and analysis. How can PySpice be applied to simulate and analyze practical circuits, such as power distribution systems or noise in analog devices? Reflect on the difficulties in modeling real-world non-ideal components and how PySpice can aid in improving the performance and durability of circuit designs by addressing these challenges.	10 Marks	L3	C02
19.	a.	A signal processing engineer is designing a digital system for processing analog signals and must ensure accurate reconstruction of the original signal post-sampling. Write a brief note on Sampling Theorem and its relevance in digital signal processing. What factors should be considered when choosing the correct sampling frequency? Write a Python code that generates a sinusoidal signal, samples it with the correct sampling rate, and visualizes both the original and sampled signals.	20 Marks	L3	C03
Or					
20.	a.	Alex is working on a signal processing project where he needs to analyze how a signal is affected by a system characterized by an impulse response. To do this, he decides to use convolution as a mathematical tool. Help Alex by explaining the concept of convolution in signal processing in brief and writing a Python program to compute and visualize the convolution of two signals. (Assume suitable signals for convolution computation.)	20 Marks	L3	C03
21.	a.	In image processing, visual quality plays a key role in analysis and interpretation. How does histogram equalization transform the distribution of pixel intensities to enhance contrast in an RGB image? Explain the visual differences that can be observed post-equalization by writing a Python program to plot the histogram, apply histogram equalization, and display both the original and the equalized images side by side.	20 Marks	L3	C04
Or					
22.	a.	Reducing a color image to grayscale is a common preprocessing step in image analysis. However, the method chosen for this conversion can influence the detail and contrast of the image.	20 Marks	L3	C04

		Describe three standard methods for converting an RGB image to grayscale and implement them in Python. Compare the outputs to understand how each method affects the grayscale representation.			
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