Department of Electrical and Computer Engineering
The University of Alabama in Huntsville
Spring 2023

CPE 381: Fundamentals of Signals and Systems for Computer Engineers

Due: Monday February 6 at 9:35 am
Please upload notes and published Matlab script as PDF files to Canvas

Student name:

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1 10	2 15	3 20	4 10	4 15	5 30	Total

Homework #1

1. (10 points) Write the formula and plot the roots of

   $z^7 + 1 = 0$

2. (15 points) Represent the following complex numbers in alternative form (polar ←→ {Re,Im} z=x +*j*y)
   a) $1 + j$
   b) $1 - j$
   c) $5\, e^{j210^\circ}$
   d) $5\, e^{-j210^\circ}$
   e) $z\, z^*$

3. (20 points) Use Euler's identity to find trigonometric identities in terms of sin(α), sin(β), cos(α), and cos(β):
   a) sin(α + β)
   b) cos(α + β)

   Demonstrate all the steps in formula evaluation.

4. (10 points) Write a script in Matlab to plot function

$$y(t) = Ae^{-t}\sin(2\pi ft)\,, t \geq 0, \qquad y(t) = 0\ for\ t < 0$$

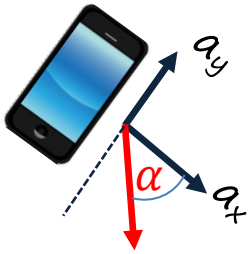
for *f* = 2Hz, *A*= 2, sampling frequency (F_s) of 20 Hz, and $-4 \leq t \leq 4$.

Plot the signal using blue line and envelope (positive and negative) of the signal using dotted red line.

5. (15 points) Write a script in Matlab and plot the function $y(2-\tau)$ where $y(t)$ is function from problem #4. Use Matlab arrays to manipulate samples from function in problem #4.

6. (30 points)

Accelerometer with analog output, sensitivity ±2g, and power supply of +3V is used in smartphone to determine orientation of the smartphone according to the figure below.



What are the values of X and Y components [in Volts] for the following positions

a)
X =
Y =

b)
X =
Y =

c)
X =
Y =

d)
X =
Y =

What is the angle of the smartphone if:

e) X = 1.875 V, Y = 0.8505 V → α =

f) X = 2.1495 V, Y = 1.875V → α =

Please draw a phone as a part of the solution to avoid confusion.