Department of Electrical and Computer Engineering
The University of Alabama in Huntsville
Spring 2020

CPE 381: Fundamentals of Signals and Systems for Computer Engineers

Due: Wednesday, January 22 at 9:35 am
Please bring hardcopy to the class and upload softcopy to Canvas

**Student name:**

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| 1<br>30 | 2<br>10 | 3<br>20 | 4<br>10 | 5<br>30 | Total |
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# Homework #1

1. (10 points) Find and plot the roots of

$$z^7 + 1 = 0$$

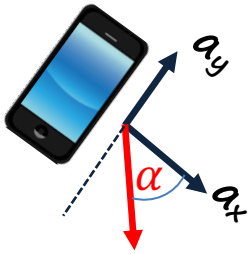
2. (30 points) Represent the following complex numbers in alternative form (polar ←→ {Re,Im} z=x +*j*y )
   a) $1 + j$
   b) $1 - j$
   c) $5\, e^{j210^\circ}$
   d) $5\, e^{-j210^\circ}$
   e) $z\, z^*$
   f) if $w = e^z$ and $z=1+j$ find log(w)

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)

4. (10 points) Write a script in Matlab to plot cosine signal with frequency 2Hz and amplitude 4 damped with time constant of 1 second ($e^{-t}$) for two seconds and sampling frequency of 20 Hz.
Plot the signal using *plot* and *stem* functions in Matlab.

5. (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.