# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

#### ECE 6382

#### Engineering Analysis I

**Exam 2**

#### Dec. 12, 2022

1. This exam is open-book and open-notes. Calculators are allowed. Computers are allowed as long as they are not used to communicate in any way with anyone other than the instructor. Cell phones or any other devices that have communication functionality are not allowed.
2. Show all of your work. No credit will be given if the work required to obtain the solutions is not clearly shown.
3. Please perform all your work on the exam in the space allowed if possible, though you can attach extra pages if necessary.
4. Please write neatly. You will not be given credit for work that is not **easily** legible.
5. Circle your final answers.

**Problem 1 (25 pts.)**

Consider the following three functions:



a) Find the Wronskian for these three functions. Simply as much as you can.

b) Are these functions linearly dependent or independent? Explain clearly your reasoning using the Wronskian.

c) Can any of the three functions be expressed as a combination of the other two? If so, please show how to do it. (Do this for any of them for which your answer is yes.)

**Helpful identity**: 

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**Problem 2 (25 pts.)**

Find the leading term of the asymptotic series for the following integral, as Ω gets large:

.

where .

The original path is along the imaginary axis from  to .

As part of your solution, show what the SDP and SAP paths look like.

**Note:** A helpful identity might be 

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**Problem 3 (25 pts.)**

a) Find the first three nonzero terms of the asymptotic series for the following integral as Ω gets large:

.

b) Assume that we keep only the first term of the asymptotic series. Give a formula that asymptotically predicts what the error is in using this leading term to estimate the integral, as Ω gets large.

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**Problem 4 (25 pts.)**

A parallel 1 Amp current source is on a semi-infinite transmission line as shown below. The line is open-circuited at *z* = 0, and extends to infinity in the positive *z* direction.



a) Find the solution for the voltage  at any point on the line. This is the same as finding the Green’s function . (The subscript “*v*” denotes that we are solving for voltage.)

b) Find the solution for the current  at any point on the line.

c) Now assume that the line is excited by a distributed surface current source (units of [A/m]) of width *w* that is centered at *z* = *z*0 and is given as:



Find the voltage  on the line for .

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