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

#### ECE 6382

#### Engineering Analysis I

**Exam 2**

#### Dec. 15, 2014

1. This exam is open-book and open-notes. Any electronic devices (laptops, etc.) that have communication functionality must have the Internet access disabled.
2. Show all of your work. No credit will be given if the work required to obtain the solutions is not clearly shown (this includes showing all relevant paths in the complex plane that you use to solve a problem).
3. Perform all your work on the exam in the space allowed.
4. Write neatly. You will not be given credit for work that is not **easily** legible.
5. Circle your final answers.

Problem 1 (25 pts.)

Evaluate the following integral as Ω → ∞. The path *C* is shown below, which lies along the real axis from -∞ to ∞.

.

As part of your solution, clearly identify and sketch the path of steepest descent and the path of steepest ascent.



**Room for Work**

**Room for Work**

Problem 2 (25 pts.)

Asymptotically evaluate the following integral as *x* → ∞.

.

The first two terms of the asymptotic expansion are sufficient.

Hint: It might be helpful to recall that

.

**Room for Work**

**Room for Work**

Problem 3 (25 pts.)

Consider the Frobenius series solution about the point *x* = 0 of the following differential equation:

.

a) Classify the point *x* = 0 as an ordinary point, a regular singular point, or an irregular singular point.

b) Classify the differential equation as case 1, case 2, or case 3.

c) Find the Frobenius series solution for the solution that has the largest value of *α*. Find the first three terms of the series solution. Take *a*0 = 1.

**Room for Work**

**Room for Work**

Problem 4 (30 pts.)

Consider the differential equation

,

with the boundary conditions



a) Solve for the Green’s function G(*x*,*x*′) using “method 1” (the method of boundary matching).

b) Solve for the Green’s function G(*x*,*x*′) using “method 2” (the method of eigenfunction expansion).

Hint (for part (b)): It might be useful to recall that

.

**Room for Work**

**Room for Work**