AEM 313 Problem Set #1

Due: 1st September 2017

Prepare solutions to the following 6 problems. Write on engineering or regular 8.5x11 paper and staple on the top left corner. Write out problem statement and assumptions. Provide calculations. Write a 1-2 sentence summary of what you learned. No more than one problem per page. Box your final answers.

1. Accurately plot an NACA 4414 airfoil with a chord of 7 inches. Show the mean chord line, the locations of maximum thickness and camber.
2. Compute the density of wet air in English units given 80% relative humidly and 80 degrees Fahrenheit. Include your Arden-Buck calculations or ASHRAE Psychrometric chart.
3. Compute the Reynolds Number and Dynamic Pressure of a flow at standard sea level (SSL) with a velocity of 100 ft/s and a length of 4 feet.
4. Draw to scale the planform of a linearly tapered wing with the following properties:
   - b = 5 in
   - $\Lambda_{c/4} = 30^\circ$
   - AR = 5
   - Taper ratio λ = 0.5
5. Determine the density at 15000 ft on a non-standard but dry day. The sea level pressure is 29.80 in-Hg ("inches of Mercury" in a manometer). The sea level temperature is 80° F with a lapse rate of:

$$\lambda = \begin{cases} -0.005 \frac{R}{ft} & h < 10000\ ft \\ 0 & h \geq 10000\ ft \end{cases}$$

6. A wind-tunnel model is connected to the following sting in a level attitude. The sting is initially pointed directly into the freestream velocity vector. The sting's roll mount is rotated right to φ=80˚. The sting's pitch mount is rotated up to θ=30˚. Then the sting's yaw mount is rotated left to ψ=-45˚ (note the minus). Determine α and β of the model with respect to the freestream.