HW#3 ME 4210 Due Date: Friday, October 2, 2015

1. Derive the strain transformation matrix, $[T]_\varepsilon$,from the equation given below:

$$\begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_{12} \end{bmatrix} = [T] \begin{bmatrix} \varepsilon_x \\ \varepsilon_y \\ \varepsilon_{xy} \end{bmatrix}$$

2. Derive $\eta_{y,xy}$ and $\eta_{xy,x}$ as a function of engineering constants in principal material coordinates.

3. Write a MATLAB function to import the lamina properties given below from an Excel spreadsheet and plot the elastic constants as a function of lamina orientation, θ.

$E_1 = 135$ GPa , $E_2 = 10$ GPa $G_{12} = 5$ GPa $v_{12} = 0.3$

a. Plot E_x as a function of θ (normalize the y axis with E_1)
b. Plot G_{xy} as a function of θ (normalize the y axis with G_{12})
c. Plot E_y as a function of θ (normalize the y axis with E_2)
d. Plot v_{xy} as a function of θ (normalize the y axis with v_{12})
e. Plot $\eta_{y,xy}$ as a function of θ

4. Write a short paragraph for each plot stating your interpretation of the plot.