MEMS 5705 - Wind Energy Systems
Homework 2
Due 2/6/17

Problems 2.7 and 2.10.

2.7 Analysis of time series data for a given site has yielded an average velocity of 6 m/s. It is determined that a Rayleigh wind speed distribution gives a good fit to the wind data.

a) Based on a Rayleigh wind speed distribution, estimate the number of hours that the wind speed will be between 9.5 and 10.5 m/s during the year.

b) Using a Rayleigh wind speed distribution, estimate the number of hours per year that the wind speed is equal to or above 16 m/s.

2.10 A wind turbine with a rotor diameter of 55 m is rated at 1 MW at a hub height wind speed of 14 m/s. It has a cut-in speed of 4 m/s and a cut-out speed of 25 m/s. Assume that this machine is located at a site where the mean wind speed is 10 m/s and that a Rayleigh wind speed distribution can be used. Calculate the following:

a) The number of hours per year that the wind is below the cut-in speed.

b) The number of hours per year that the machine will be shut down due to wind speeds above the cut-out velocity.

c) The energy production (kWh/year) when the wind turbine is running at rated power.