**AE/ME 47XX   Wind Engineering (3-0-3)**

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 Course Objectives: This introductory course will allow students to learn about wind energy and its potential, modeling and design horizontal axis wind turbines, and analysis of the economic benefits of wind turbine systems.

Grade is based on three term mini projects, one final project report, and an oral presentation.

1. Overview of Wind Engineering (6 hours) Lecture Modules: [1.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_1.1.ppt), [1.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_1.2.ppt), [1.3](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_1.3.ppt)
   * Benefits of wind energy
   * Assessment of Wind Resources
   * Assessment of means of energy production, consumption, and cost
   * Green credit
   * Wind turbine terminology and definitions
2. Actuator disk model of horizontal axis wind turbines (3 hours) Lecture Module [2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_2.ppt)
3. Review of airfoil aerodynamics (9 hours) Lecture Modules: [3.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_3.1.ppt), [3.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_3.2.ppt), [3.3](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_3.3.ppt), [3.4](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_3.4.ppt), [3.5](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_3.5.ppt)
   * Lift, drag, and pitching moment
   * Panel method for airfoil analysis
   * Modeling laminar and turbulent boundary layers, and transition
   * Airfoil design for wind energy applications
4. Blade element theory (9 hours) Lecture Modules [4.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_4.1.ppt) and [4.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_4.2.ppt)
   * Inflow models based on combined blade element theory
   * Incorporation of swirl losses in inflow
   * Root and tip loses, and stall delay models
   * Wind turbine modeling tools  [WT\_PERF](http://wind.nrel.gov/designcodes/simulators/wtperf/), [Yaw\_Dyn](http://wind.nrel.gov/designcodes/simulators/yawdyn/) and [PropID](http://www.ae.illinois.edu/m-selig/propid/)
5. Horizontal axis wind turbine design using blade element theory (6 hours) Lecture Modules [5.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_5.1.ppt) and [5.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_5.2.ppt)

         Conversion of mechanical energy into electricity (3 hours)

         Basic AC Power Generators

         Hybrid Power Systems

         Hybrid System Modeling and Simulation    [Homer](http://www.ae.gatech.edu/%7Elsankar/AE4803/homergettingstarted210.pdf)

1. Economic analysis of wind turbine systems (3 hours) Lecture Modules [6.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_6.1.ppt) and [6.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_6.2.ppt)
2. Impact of wind turbines on the environment (3 hours) Lecture Modules [7.1](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_7.1.ppt), [7.2](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_7.2.ppt) , [7.3](http://www.ae.gatech.edu/%7Elsankar/AE4803/Module_7.3.ppt)
3. Presentations by students (3 hours)