

**AE/ME 4701 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)
  - 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)
3. Review of airfoil aerodynamics (9 hours)
  - 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)
  - Inflow models based on combined blade element theory
  - Incorporation of swirl losses in inflow
  - Root and tip losses, and stall delay models
  - Assessment of publicly available wind turbine modeling tools
5. Horizontal axis wind turbine design using blade element theory (6 hours)
6. Conversion of mechanical energy into electricity (3 hours)
  - Basic AC Power Generators
  - Hybrid Power Systems
  - Hybrid System Modeling and Simulation
7. Economic analysis of wind turbine systems (3 hours)
8. Impact of wind turbines on the environment (3 hours)
9. Presentations by students (3 hours)