



# Mechanical Engineering Dept. Department

## Syllabus

### ME 434: Wind Engineering (3-0-3)

#### Course Catalog Description:

Basic meteorological aspects, meteorological measurements, fundamentals of wind speed, wind power resource assessment, Introduction to wind speed analysis, power generation, wind power economics, and mitigation of green house gases tools, wind turbine technology and selection, Introduction to wind-diesel hybrid power system design and optimization.

#### Course Pre-requisites:

- ME 311: Fluid Mechanics

#### Course Objectives:

1. To describe the basics of meteorology and wind.
2. Properly select the wind speed, direction, other meteorological sensors, data acquisition system, towers, for design calculation.
3. To utilize wind data analysis tool for wind speed data analysis.
4. To select a potential site for wind farm development based on annual, monthly, diurnal knowledge of wind speed, wind turbulence, wind shear, wind frequency, Weibull distribution, maximum energy carrying wind speed, and most probable wind speed analysis.
5. To design and optimize the wind-diesel hybrid power systems with or without battery backup for isolated grids and small remotely located installations.
6. To understand and interpret the boundary layer, turbulence, fluttering, buffeting, and related concepts in wind power and structural integrity related aspects.

#### Course Learning Outcomes:

- CLO1. Understand the concept of energy in the wind.
- CLO2. Understand engineering problems related with Wind Energy
- CLO3. Solve engineering problems related with Wind energy.
- CLO4. Think as an engineer for solving problems that may arise in the areas of Wind Energy.

#### Learning Resources:

- Johnson, G.L., Wind energy systems, electronic edition. 2006.
- Thomas Ackermann, Wind power in power systems, 2nd Ed., John Wiley 2012.
- Ali Keyhani, Design of smart power grid renewable energy systems, 3rd Ed., John Wiley. 2019.

## Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Mid term exam	8	15.0%
Class work	End of semester	10.0%
Project	End of semester	30.0%
Final exam	End of semester	20.0%
Homework	Various	10.0%
Quizzes	Various	15.0%

## Lecture Weekly Schedule:

Week#	Topics
1	Basic meteorology, how winds are created and type of winds.
2	Basic meteorology, how winds are created and type of winds. (Continue)
3	Global wind power scenario and meteorological measurements
4	Local wind power related initiatives, synoptic meteorological stations, wind masts, Introduction to Lidars.
5	Local wind power related initiatives, synoptic meteorological stations, wind masts, Introduction to Lidars. (Continue)
6	Local wind power related initiatives, synoptic meteorological stations, wind masts, Introduction to Lidars. (Continue)
7	Wind power resources assessment.
8	Wind power resources assessment. (Continue)
9	Wind power resources assessment. (Continue)
10	Wind power resources assessment. (Continue)
11	Introduction to Wind Turbines.
12	Wind power calculation, wind turbine selection, potential site identification and selection.
13	Wind power calculation, wind turbine selection, potential site identification and selection. (Continue)
14	Hybrid power systems introduction, design and optimization.
15	Hybrid power systems introduction, design and optimization. (Continue)