

**United States Naval Academy  
Mechanical Engineering Department**

**Catalog Description:** EM447 Wind and Current Energy

**Credit:** 3 (3-0-3)

**Designation:** Elective, engineering major

This course will cover wind and water turbine technology including design of turbine blades, analysis of flow regimes and energy conversion. The economics and policies involved in implementing these renewable energy systems will also be studied.

**Prerequisites:** Thermodynamics (EM317 or EM319) and Fluid Mechanics/Aerodynamics (EM316, EM324 or EA301)

**Corequisites:** None

**Textbooks:** Wind Energy Explained, 2<sup>nd</sup> ed. Manwell, McGowan and Rogers, Wiley, 2009.

**Course Director:** Prof. K.A. Flack

**Course Content:**

<b>No.</b>	<b>Topic or Subtopic</b>	<b>hrs.</b>
1	Introduction to Wind Energy, current and predicted usage	3
2	Wind Resource Characteristics	4
3	Blade Aerodynamics and design	11
4	Power Conversion and Grid Integration	3
5	Dynamics, Fatigue and Vibration	3
6	Turbine Blade Materials	1
7	Control Strategies	1
6	Land Based and Off-Shore Wind Farms	3
7	Wind Turbine Economics	3
8	Introduction to Tidal Turbines	2
9	Tidal Turbine Design	6

**Assessment Methods:**

		<b>YES</b>	<b>NO</b>
A	Quizzes		X
B	Homework	X	
C	Exams		X
D	Laboratory Reports		X
E	Oral Presentations	X	
F	Design Reports/Notebooks	X	
G	Prototypes/Demonstrations		X
H	Projects	X	
I	Other		X

**Course Outcomes** <sup>1</sup> :

1. Students will demonstrate an understanding of the basics of airfoil design for wind turbines. (B,C,F)
2. Students will demonstrate an understanding of wind resource characteristics. (B,C,F)
3. Students will demonstrate an understanding of wind turbine power conversion. (B)
4. Students will demonstrate an understanding of the basics of land based and off shore wind farms. (B,H)
5. Students will demonstrate an understanding of the economics of wind energy. (B,H)
6. Students will demonstrate an understanding of the policy of wind energy. (B,H)
7. Students will demonstrate an understanding of the design characteristics of tidal turbines. (B,F)
8. Students will demonstrate the ability to report the results of laboratory experiments, comparing experimental results to analytical results. (F,H)
9. Students will demonstrate the ability to present orally a topic of current interest related to wind or tidal energy. (E)

<sup>1</sup> Letters in parenthesis refer to the assessment methods listed in the previous section.

	<b>Course Outcomes</b>									
<b>Program Outcomes</b>	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(a)	X	X	X	X			X	X	X	
(b)	X	X			X		X	X	X	
(c)					X	X				
(d)										
(e)	X	X	X	X	X		X	X		
(f)						X				
(g)						X				
(h)						X			X	
(i)					X	X			X	
(j)						X			X	
(k)	X							X		

**Date of Latest Revision:** 27 OCT 2017, Prof. K.A. Flack