

# **MAE 4301/ME5390/AE5301: Wind/Wave/Ocean Current Energy Harvesting Systems I - Fundamentals**

(3-0-3)

Fall 2013

**Instructor(s):** Dr. D. Stefan Dancila

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**Faculty Profile:** <https://www.uta.edu/mentis/public/#profile/profile/view/id/3929>

**Office Hours:** By appointment

**Section Information:** MAE 4301-002/ ME 5390-006/ AE 5301-005 Wind/Wave/Ocean Current Energy Harvesting Systems I - Fundamentals

**Time and Place of Class Meetings:** Woolf Hall 311, Tuesdays and Thursdays 11:00-12:20

**Description of Course Content:** A broad senior/graduate first course in wind/wave/ocean current energy harvesting systems, focused on fundamentals, and serving as the basis for subsequent MAE specialized follow-on graduate course offerings focused on structures (conventional and composite), aero/hydro-mechanical response and control, and tailoring and smart material actuation, respectively, as well as for non-MAE, specialized graduate courses.

**Student Learning Outcomes:** Students will acquire a global view of societal energy needs, energy resources, and their geo-political distribution and potential, with an emphasis on wind, ocean current, and wave renewable energy. They will be able to quantify the renewable energy potential of a given source, and they will learn the principles and fundamental technical solutions used to harvest it. Students will develop and understanding and working knowledge of first order models of systems used to convert wind/wave/ocean current into electrical energy and to input it into the power grid. Students will also understand the major design drivers shaping the wind/wave/ocean current energy harvesting technical solutions. Innovative, advanced concept solutions will be presented, together with relevant socioeconomic and environmental considerations.

**Required Textbooks and Other Course Materials:** Course notes and materials. A student copy of Mathematica for your personal computer would be helpful. Mathematica is also available on the computers in the MAE Computer Lab.

**Midterm** – Tuesday, October 22, 2013, 11:00-12:20. Covers all class material to date, including homework and reading assignments.

**Homework** – Assigned weekly after Thursday class and due before the following Thursday class meeting. Covers all class material to date, including new reading assignments.

**Final Exam** – On the date scheduled by the University during the Final Exam Period. Covers all class material, including homework and reading assignments.

**NB.** Homework turned in late (after the class starts) will be considered late and penalized 20%.

**Attendance:** Students are expected to attend all class meetings and to arrive on time.

**Other Requirements:** None.

**Grading:** Each of the three components below will be graded on a scale from 0 to 100 points and the final numerical grade will be computed as a weighted average by using the weighting factors shown below.

Midterm	30%
Homework	20%
Final Exam	50%

The final letter grade will be determined by converting the numerical final grade according to the following ranges:

Final Numerical Grade	Letter Grade
85-100	A
75-84	B
65-74	C
50-64	D
0-49	F

**Expectations for Out-of-Class Study:** Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 9 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

**Make-up Exams:** A missed midterm and/or final exam can only be rescheduled, UTA regulations permitting, when missed due to major health problems and/or circumstances beyond the student's control, and in such cases at the earliest time possible and agreeable to the instructor thereafter.

**Grade Grievances:** Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current undergraduate / graduate catalog. For undergraduate courses, see [http://web.uta.edu/catalog/content/general/academic\\_regulations.aspx#19](http://web.uta.edu/catalog/content/general/academic_regulations.aspx#19); for graduate courses, see [http://grad.pci.uta.edu/about/catalog/current/general/regulations/#grade\\_grievances](http://grad.pci.uta.edu/about/catalog/current/general/regulations/#grade_grievances)

**Drop Policy:** Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through

the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid administered through the University may be required as the result of dropping classes or withdrawing. For more information, contact the Office of Financial Aid and Scholarships (<http://www.uta.edu/aao/fao/>).

**Americans with Disabilities Act:** The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at [www.uta.edu/disability](http://www.uta.edu/disability) or by calling the Office for Students with Disabilities at (817) 272-3364.

**Academic Integrity:** Students enrolled in this course are expected to adhere to the UT Arlington Honor Code:

*I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.*

*I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.*

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

**Student Support Services:** UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals, students may visit the reception desk at University College (Ransom Hall), call the Maverick Resource Hotline at 817-272-6107, send a message to [resources@uta.edu](mailto:resources@uta.edu), or view the information at [www.uta.edu/resources](http://www.uta.edu/resources).

**Electronic Communication:** UT Arlington has adopted MavMail as its official means to communicate with students about important deadlines and events, as well as to transact university-related business regarding financial aid, tuition, grades, graduation, etc. All students are assigned a MavMail account and are responsible for checking the inbox regularly. There is no additional charge to students for using this account, which remains active even after graduation. Information about activating and using MavMail is available at <http://www.uta.edu/oit/cs/email/mavmail.php>.

**Student Feedback Survey:** At the end of each term, students enrolled in classes categorized as “lecture,” “seminar,” or “laboratory” shall be directed to complete an online Student Feedback Survey (SFS). Instructions on how to access the SFS for this course will be sent directly to each student through MavMail approximately 10 days before the end of the term. Each student’s feedback enters the SFS database anonymously and is aggregated with that of other students enrolled in the course. UT Arlington’s effort to solicit, gather, tabulate, and publish student feedback is required by state law; students are strongly urged to participate. For more information, visit <http://www.uta.edu/sfs>.

**Final Review Week:** A period of five class days prior to the first day of final examinations in the long sessions shall be designated as Final Review Week. The purpose of this week is to allow students sufficient time to prepare for final examinations. During this week, there shall be no scheduled activities such as required field trips or performances; and no instructor shall assign any themes, research problems or exercises of similar scope that have a completion date during or following this week *unless specified in the class syllabus*. During Final Review Week, an instructor shall not give any examinations constituting 10% or more of the final grade, except makeup tests and laboratory examinations. In addition, no instructor shall give any portion of the final examination during Final Review Week. During this week, classes are held as scheduled. In addition, instructors are not required to limit content to topics that have been previously covered; they may introduce new concepts as appropriate.

**Emergency Exit Procedures:** Should we experience an emergency event that requires us to vacate the building, students should exit the room and move toward the nearest exit, which is located to the right end of the hallway as you exit the classroom (stairwell leading down to a building exit). When exiting the building during an emergency, one should never take an elevator but should use the stairwells. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist handicapped individuals.

#### **Emergency Procedures for Disabled Personnel:**

- If the disabled person cannot safely evacuate the building, one person should stay with the disabled individual while another person reports his/her location to the University Police.
- Hearing impaired and visually impaired persons need only one person each to notify them of a fire alarm or guide them to safe escape routes during an evacuation.
- After evacuating employees and students have cleared all stairways, disabled persons should be assisted to the stairwell landings to await emergency personnel. All doors to the stairwells must be kept closed during this time.

NOTE: Environmental Health & Safety would like to offer the following reminders to those who are disabled or have special needs:

- Take control without depending on others to take the first step.
- Don't be afraid to let others know you need assistance.
- Don't hesitate to communicate what your special needs are in order to make the evacuation easier and safer for you and for your assistants.
- Communicate with those who can help as soon as you are able by dialing 3003 to campus Police.
- Plan ahead. Be prepared. Know what you are going to do before an emergency arises. Make a plan and then test it. Determine what your alternatives are.
- When you enter an unfamiliar building, look it over and locate the most available telephones, note horizontal exits and ramps, note exit signs and enclosed stairwells (determine if landings are large enough), note rooms that would make good areas of refuge, and note the location of fire alarm pull stations.
- Never take an elevator in a building on fire.
- Don't delay your evacuation or communication to evacuate. Speaking with someone over the telephone will help to keep you calm.

See UT Arlington Procedure 7-6: Emergency/Fire Evacuation Procedures  
(<https://www.uta.edu/policy/procedure/7-6>).]

**Librarian to Contact:** Sylvia George-Williams and/or Melissa Gonzales

<b>Library Home Page</b>	<a href="http://www.uta.edu/library">http://www.uta.edu/library</a>
<b>Subject Guides</b>	<a href="http://libguides.uta.edu">http://libguides.uta.edu</a>
<b>Subject Librarians</b>	<a href="http://www.uta.edu/library/help/subject-librarians.php">http://www.uta.edu/library/help/subject-librarians.php</a>
<b>Database List</b>	<a href="http://www.uta.edu/library/databases/index.php">http://www.uta.edu/library/databases/index.php</a>
<b>Course Reserves</b>	<a href="http://pulse.uta.edu/vwebv/enterCourseReserve.do">http://pulse.uta.edu/vwebv/enterCourseReserve.do</a>
<b>Library Catalog</b>	<a href="http://discover.uta.edu/">http://discover.uta.edu/</a>
<b>E-Journals</b>	<a href="http://liblink.uta.edu/UTAlink/az">http://liblink.uta.edu/UTAlink/az</a>
<b>Library Tutorials</b>	<a href="http://www.uta.edu/library/help/tutorials.php">http://www.uta.edu/library/help/tutorials.php</a>
<b>Connecting from Off- Campus</b>	<a href="http://libguides.uta.edu/offcampus">http://libguides.uta.edu/offcampus</a>
<b>Ask A Librarian</b>	<a href="http://ask.uta.edu">http://ask.uta.edu</a>

## Course Topics:

1. **Energy resource characterization and modeling:** Fundamental aspects of wind/wave/ocean current forcing; Geographic/topographic and temporal resource distribution; Energy content characterization and modeling; Reliable data sources; Site selection.
2. **Fundamentals of fluid flow energy harvesting:** Principles and fundamental concepts; First order modeling (conceptual and preliminary design level appropriate); Energy harvesting capacity and harvesting efficiency limits; Betz theorem.
3. **Fundamentals of energy conversion:** Fundamentals of electrical power generation; Power conversion efficiency; Optimal configurations.
4. **Proven technologies:** Overview of state of the art technological solutions; Configurations; Capacities and efficiency; Limitations and scientific/technical/technological roadblocks.
5. **Design drivers:** 20-year averaged cost of energy; reliability; maintenance costs.
6. **Advanced concept technologies:** Overview of new concepts and anticipated trends; Opportunities for breakthrough, paradigm-shifting developments. Potentially disruptive technologies.
7. **Socioeconomic and environmental considerations:** Community acceptance; Impact on the environment – noise, wildlife impact, etc.

## Course Schedule:

**Midterm** – Tuesday, October 22, 2013, 11:00- 12:20

**Homework** – assigned weekly after Thursday class and due before the following Thursday class meeting.

**Final Exam** – on the date scheduled by the University during the Final Exam Period.

*As the instructor for this course, I reserve the right to adjust this schedule in any way that serves the educational needs of the students enrolled in this course. – Dr. D. Stefan Dancila*