

**ME 5390-005 / MAE 4301-005: Energy Technologies and Research Trends**  
Spring 2016

**Instructor(s):** Sunand Santhanagopalan

**Office Number:** Engineering Lab Building (ELB) 254

**Office Telephone Number:** 817-272-3711

**Email Address:** ssanthan@uta.edu

**Office Hours:** 3:30 - 4:30 PM Thursday

**Section Information:** ME 5390-005 / MAE 4301-002

**Time and Place of Class Meetings:** Tuesdays and Thursdays, 2:00- 3:20 PM, Science Hall 332

**Description of Course Content:** This course is offered to graduate and senior undergraduate students with engineering and science background to lead them into the exciting world of research and development for energy conversion and storage. New energy technology is expected to be the growth point of our economy and job market, as well as a most powerful means to confront the global energy/environmental crisis. This area has experienced tremendous growth since the past several decades. It is now well positioned to be a focus of research and higher education.

**Student Learning Outcomes:** This class will provide students fundamental knowledge on the working principle of energy conversion and storage, the micro and nanofabrication technology to support such systems, the unique scientific phenomena to significantly enhance their performance and the tools/methodology for doing research in this area. The students will develop understanding on various devices and systems for energy conversion and storage, such as fuel cells, batteries, supercapacitors, solar cells, solar water splitting and energy harvesters, in term of their working mechanisms, characterization, fabrication and new technologies to improve them, particularly from micro and nano scale. The students will also practice and improve their skills to conduct research in this area through identifying a research idea, investigating it through literature research and discussion, presenting it the class and writing a project report.

**Required Textbooks and Other Course Materials:** No textbook is required. Lecture notes and assigned readings will be available at "My Blackboard" the day before the lecture or earlier. Please download and print lecture notes for your own review and individual study.

**Descriptions of major assignments and examinations:** Two sets of homework, a midterm, a final, a project presentation and a project final report.

**Homework:** 2/3 sets of homework. Homework should be submitted at the beginning of the class on the due date.

**Project:** Each student will work on a small project to explore new ideas on energy technologies.

**Exams:** Two exams (one midterm and one final exam) will be given. The exact dates and time will be announced later.

**Attendance:** Attendance is important as the class will progress on discussion and points will be reserved for active participation.

**Grading:** Homework: 20%; Midterm: 20%; Final: 20%; Project: 35%; Class participation: 5%.

Students are expected to keep track of their performance throughout the semester and seek guidance from available sources (including the instructor) if their performance drops below satisfactory levels.

**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://wwwb.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.

**Title IX:** The University of Texas at Arlington is committed to upholding U.S. Federal Law "Title IX" such that no member of the UT Arlington community shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity. For more information, visit [www.uta.edu/titleIX](http://www.uta.edu/titleIX).

**Academic Integrity:** Students enrolled all UT Arlington courses 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.

**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:** Straight out the door, turn right or left and exit building by stairs. DO NOT USE ELEVATORS!

**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).

**The English Writing Center (411LIBR):** Hours are 9 am to 8 pm Mondays-Thursdays, 9 am to 3 pm Fridays and Noon to 5 pm Saturdays and Sundays. Walk In *Quick Hits* sessions during all open hours Mon-Thurs. Register and make appointments online at <http://uta.mywconline.com>. Classroom Visits, Workshops, and advanced services for graduate students and faculty are also available. Please see [www.uta.edu/owl](http://www.uta.edu/owl) for detailed information.

**Tentative Lecture Schedule** (The final schedule may be adjusted)

Week	Topics covered	Notes
W1: 01/19	Introduction; Micro- and nano-science: scaling law.	
W2: 01/26	Introduction to microfabrication and nanofabrication	
W3: 02/02	Energy storage and conversion systems overview: Fuel cells, Batteries, Supercapacitors	
W4: 02/09	Energy storage and conversion systems: Energy harvesting , Fuel production	
W5: 02/16	Material considerations Electrochemistry: reactions and electrochemical potentials	
W6: 02/23	Electrochemical deposition and etching	
W7: 03/01	Midterm exam, Nanomaterial for lithium batteries	Initiation of projects
W8: 03/08	Electrochemistry : Voltammetry Electrochemistry : Other electrochemical methods	
	Spring Break: 03/14 – 03/19	
W9: 03/22	Research methodology and tools	Project Proposal
W10: 03/29	3D energy devices	Project Proposal
W11: 04/05	3D energy devices (cont)	Lab tour
W12: 04/12	Microfluidics and nanofluidics for energy applications	
W13: 04/19	Project final presentations	
W14: 04/26	Project final presentations	
W15: 05/03	Project final presentations	
05/10	Final week: Final Exam	Project Report due

**Emergency Phone Numbers:** In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911.