## AME 578 Modern Alternative Energy Conversion Devices

Prerequisites: Graduate students or AME seniors in good standing

Recommended preparation: B.S. in AE, ME, or Physics

Fall Semester, 2016, MW 12:30 to 1:50

Classroom: OHE100B

Instructor: John Hall

Office: VHE M22
Office hours: Monday and Wednesday by appointment, 11:00-12:00 AM and 2:00-3:30 PM

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## The course.

The following text books are highly recommended. I will suggest supplementary reading from time to time from the texts.

Batteries for Sustainability 2013 Selected Entries from the Encyclopedia of Sustainability Science and Technology, Ralph J. Brodd (ed.), Springer Science + Business Media, New York (2013) ISBN 978-1-4614-5790-9. Amazon Kindle price $52.46 (rent) $155.56 (buy)

Fuel Cell Fundamentals, Ryan O'Hayre , Suk-Won Cha, Whitney Colella, Fritz B. Prinz, Wiley; 2 edition (January 9, 2009), ISBN-10: 0470258438, ISBN-13: 978-0470258439, Amazon price $23.92 (rental), 111.19 (sale)

AME 578 is focused on the physics, design and performance for energy conversion devices including batteries, fuel cells, and photovoltaics. Environmental implications of the use of various energy sources and energy/power conversion technologies will be included.

The students are expected to acquire a broad technical view of various alternative energy conversion devices, their principles, designs and operations. Emphasis will be placed on quantitative calculations of efficiency, thermal behavior, life, charge and mass transport.

## Grading

Homework will be regularly assigned but not collected. Assigned problems will be reviewed in general at the next class. It is the student’s responsibility complete and understand the assignments

The course has both a midterm (focus batteries) and a final (focus (solar cells and fuel cells). The final is not cumulative and the two tests are equally one third of the course grade.

The final third of the grade will result from a technical report on a topic related to some aspect of a specific alternative energy conversion device will be required. Students will work in groups of two or three to prepare a written report. The ideal report will show quantitative calculations for the topical energy conversion device. Original calculational or experimental work is strongly encouraged. Final written reports are due 12/1/14 to be followed by TBD minute presentations from each group.

## AME 578 Schedule

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| Date | Week | Topic |
| 8/22/16 | 1 | Course Introduction, Battery Energy Storage |
| Conventional Aqueous Batteries - 1 |
| 8/29/16 | 2 | Conventional Aqueous Batteries - 2 |
| Nickel Hydrogen Batteries |
| 9/5/16 | 3 | Labor Day |
| Flow Batteries |
| 9/12/16 | 4 | Lithium Ion Organic Electrolytes the SEI and Negstive and Positive Active Materials |
| Lithium Ion Cell Design and Manufacturing |
| 9/19/16 | 5 | Lithium Ion Battery Design, Operation and Charge Control Electronics |
| Lithium Ion Life 1 |
| 9/26/16 | 6 | Lithium Ion Life 2 |
| Lithium Ion Safety |
| 10/3/16 | 7 | Special Topics - Sodium and Gas Depolarized Batteries |
| Midterm (10/5/16) |
| 10/10/16 | 8 | Photovoltaic Energy Conversion  |
| Silicon Cells and Modules |
| 10/17/16 | 9 | Alternative Single Junction Materials (Cd/TE, CIGS, etc) |
| Organic Technologies |
| 10/24/16 | 10 | Advanced Single Junction Technologies |
| Multijunction Cell Technology  |
| 10/31/16 | 11 | Solar and Wind Farms |
| An Introduction to Fuel Cells |
| 11/7/16 | 12 | The PEM Fuel Cell |
| Alkaline Fuel Cells |
| 11/14/16 | 13 | The Phosphoric Acid, Molten Carbonate, and Solid Oxide Fuel Cells |
| The Hydrogen Econcomy |
| 11/21/16 | 14 | Fuel Cell Environmental Impact |
| Thanksgiving (11/23/16) |
| 11/28/16 | 15 | Research Reports |
| Research Reports |
| 12/5/16 | 16 | Final (TBD) |
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