

Syllabus of ENEG 4320
Energy Storage Technology

Fall, 2023

Monday: 1:30 – 2:50 pm

Friday: 9:00 – 10:20 am

Room: 1409

Instructor: Professor Minhua Shao, Tel.: 3469-2269, Room: CYT2006, email: kemshao@ust.hk

Scope

The scope of this course is to introduce different types of energy conversion and storage technologies mainly involving electrochemistry. The course is designed for senior undergraduate students with science and engineering backgrounds. We will study basic electrochemical engineering concepts and reaction mechanisms of different energy technologies. Critical materials/components design and selection will be also discussed. Their applications will be explored. After the course, the students should have a general understanding of each technology and its limitations.

Methodology

Lecture notes and final project. For the first part, lecture-based learning will be conducted. Home work (literature review) will be assigned after lectures. All the lecture notes will be posted on the Canvas at least one day before the lecture. The students are responsible for downloading them from the website.

There will be a Mid-term exam, but NO Final exam. The Mid-term exam date will be announced later. The Mid-term exam will be **open** books and notes. However, computers, cell phones or tablets are not allowed during the exam. The mid-term exam will be conducted physically in the classroom.

For the final project, each student will select a topic related to the electrochemical energy conversion and storage and give a 15 min presentation in the last two classes of the semester. Again, it is expected that the presentation will be delivered physically in the classroom.

There will be an additional project report (about 3000-4000 words including references) after conducting a literature review. The report will be due at **5 pm, December 4**. Plagiarism is prohibited in this class. The report will be automatically rated F once plagiarism is detected.

Skills Trained

Problem solving, Critical thinking, Presentation, and Literature review

Outline of the course (Subject to change)

Introduction to energy conversion and storage (Week 1)

Electrochemical engineering fundamentals (Week 2-4)

Fuel cells (Week 5-6)

Electrolyzers (Week 7)

Lithium-ion batteries (Week 8-9)

Batteries beyond lithium-ion (Li-S, metal-air, etc.) (Week 10)

Photovoltaic cells (Week 11)

CO₂ reduction and Supercapacitors (Week 12)

Presentations (Week 13)

Grading Methodology

UG

Attendance: 10%
Mid-term exam: 50%;
Final presentation: 30%;
Home work: 10%;
Office hours: 0 or -5 points.

PG

Attendance: 10%
Mid-term exam: 40%;
Final report: 25%
Final presentation: 15%;
Home work: 10%;
Office hours: 0 or -5 points.

Assignments:

Biweekly reading assignments and home work.

The office hours are mandatory. At least one office hour appearance is required before the last day of the class (November 30, 2023). Otherwise, **5 points** will be deducted from the final score.

Other Information:

Office hours: Room CYT2006, Monday 3-4 pm

TA: TBD

Textbook

No text book is required.

References

Allen J. Bard, et al., *Electrochemical Dictionary*, Springer, 2012.

Cynthia G. Zoski, *Handbook of electrochemistry*, Elsevier, 2007.

Jiujun Zhang, et al., *Electrochemical Technologies for Energy Storage and Conversion*, Wiley, 2011.

Allen J. Bard, Larry R. Falkner, *Electrochemical Methods*, 2nd edition, John Wiley & Sons, 2001.