

Syllabus: Chem 596, Advanced Special Topics in Chemistry: Energy and Fuels/Green Chemistry

Instructor: Dr. Jing Gu

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Class Schedule: Tues. & Thurs. 9:30-10:45 am, LH 442

Office Hours and Location: By appointment on Tues. or Thurs., EIS 210 or Zoom

Textbooks and instruction materials: (Optional, Please do not buy)

- 1, Energy: Production, conversion, storage, conservation, and coupling (ISBN 978-4471-2372-9) 2018, Wiley
- 2, Renewable Energy: Power for a sustainable future (ISBN 978-0199545339) 2017, Wiley
- 3, Carbon Dioxide Utilisation: Closing the Carbon Cycle (ISBN: 9780444627469) 2014, Elsevier
- 4, ACS Journal access: Energy & Fuels
- 5, Electronic handouts: Frontier Publications in the Filed
- 6, Green Chemistry: Principles and Case Studies, Felicia A. Etzkorn

Prerequisite

Preferably Chem 520A, Chem427, and Chem520B

Course Description: This course is intended for Chemistry, Materials Science, Physics, and Geology majors, and is designed to prepare students for further research in Materials Science, Chemistry, Chemical Engineering, Nanotechnology, Renewable Energy or, more generally, employment in energy resources and fuel generation. The class will be divided into two parts: the first part of the course content will include advanced concepts in chemical/physical properties and structures of solar energy, biofuels, general renewable energy sources and the current energy situation. The second part of this course content will include Green Chemistry principles and

case studies that will related to sustainable future for chemistry development. The course will rely both on the books and literatures. Not all material in the text book will be covered and not all material covered will be found in the textbooks. Additional reading from primary literatures and presenting will be an integral part of this course. This course cannot be exhaustive in its coverage of all but it is hoped that it will serve as a rational foundation of self-development in further studies.

Major topics will include:

- History and Current Advanced Topics in Energy and Fuels (length: 1 week)
- Calculate the Energy Efficiency and Thermodynamics of certain renewable energy systems (1 week)
- Solar Energy:

3a) Solar cells: Principles, Major Semiconductors and Outlooks (1 week);

3b) Solar fuels: Catalysis, Nanotechnology, and Functional Materials (1 week)

3c) Photocatalysis and Electrocatalysis (1 week)

3d) Solar thermal (0.5 week)

- Renewable Biofuels (1-2 weeks)
- Other Renewable & Sustainable Energy topics: CO₂ capture and conversion (1 week)
- Energy storage: Li-ion battery (1 week)
- Principles of Green Chemistry (1 week)
- Green Chemistry applications in Energy Efficiency (1 week)
- Green Chemistry applications in Renewable Feedstocks (1 week)
- Frontier renewable energy research discussion and perspective (length: 1 week)

Expected Outcomes:

Upon completion of Chemistry 596, students should be able to:

- Apply knowledge obtained in this class on critical thinking from chemistry perspective in the field of the overall energy and fuel research and potential green chemistry applications in energy efficiency and renewable feedstocks
- Define Energy concepts, knowledge, barriers, and histories
- Analyze the direction of future possible renewable energy challenges and opportunities

- Utilize knowledge gained from this class to perform logical thinking and utilize concepts and theories to predict the properties of a device, such as a solar energy device.
- Apply the green chemistry principles and case studies to judge the current chemical process.
- Demonstrate the skill sets necessary to continue on to further energy and fuel-related research with a green chemistry perspective.

Examinations and Points:

Attendance and class performance: 10 points

Note: "Attendance" will be evaluated via a signing-up sheet for attendance in each class (60% points).

"Class performance" is specified based on "in-class" discussion in which each and everyone should be involved, particularly in the "presentation section". Students will be evaluated based on "in-class" questions and discussion (40% points).

Presentations: 20 points

Note: presentation based on "Energy and Fuels or Green Chemistry" topic 15-30 minutes for each student. The grading is based on the clarity of the topic, background introduction, understanding of the presentation topic, future perspective of the topic, questions and answers based on the selected presentation topic, and student's future or current research interest that is related to the selected presentation topic.

In-class quiz: 20 points

Note: Two quizzes will be given in the class.

Homework: 20 points

Note: Two sets of homework will be assigned in week 2 and 10.

Final Exam: 30 points

Note: A paper-based final exam will be given at the end of the semester.

Total points: 100 points (100%)

Grading: A: 90-100%, A-: 85-89%, B+: 75-85% B:70-75% B-:65-70% C: 55-65%, D: 45-55%, F<45%

Grading for undergraduate students:

Attendance and class performance: 10 points

Note: "Attendance" will be evaluated via a signing-up sheet for attendance in each class (6 points).

"Class performance" is specified based on "in-class" discussion in which each and everyone should be involved, particularly in the "presentation section". Students will be evaluated based on "in-class" questions and discussion (4 points).

Presentations: 20 points

Note: presentation based on "Energy and Fuels" topic 10-20 minutes for each undergraduate student.

The grading is based on the clarity of the topic, background introduction, understanding of the presentation topic, and questions and answers based on the presentation topic exclusively.

In-class quiz: 20 points

Note: Two quizzes will be given in the class.

Homework: 30 points

Note: Three sets of homework will be assigned in week 2, 6 and 10.

Final Exam: 20 points

Note: A paper-based final exam will be given at the end of the semester. Final Exam is an open exam.

The grading letter difference is also listed below.

Total points: 100 points (100%)

Grading: A: 90-100%, A-: 80-89%, B+: 75-80%, B:70-75%, B-:65-70% , C: 55-65%, D: 45-55%, F<45%

University Policies:

Accommodations: If you are a student with a disability and need accommodations for this class, please contact the Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and I cannot provide accommodations based on disability until I have received an accommodation letter from the Student Ability Success Center.

Student Privacy and Intellectual Property: The Family Educational Rights and Privacy Act (FERPA) mandates the protection of student information, including contact information, grades, and graded assignments. SDSU e-mail will be used to communicate with you. Students will be notified at the time of an assignment if copies of student work will be retained beyond the end of the semester or used as examples for future students or the wider public. Students maintain intellectual property rights to work products they create as part of this course unless they are formally notified otherwise.

Religious observances: According to the University Policy File, students should notify the instructors of affected courses of planned absences for religious observances by the end of the second week of classes.

Academic Honesty: The University adheres to a strict policy prohibiting cheating and plagiarism. Examples of academic dishonesty include but are not limited to: ● copying, in part or in whole, from another's test or other examination; ● obtaining copies of a test, an examination, or other course material without the permission of the instructor; ● collaborating with another or others in work to be presented without the permission of the instructor; ● falsifying records, laboratory work, or other course data; ● submitting work previously presented in another course, if contrary to the rules of the course; ● altering or interfering with grading procedures; ● assisting another student in any of the above; ● using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work); ● copying and pasting work from an online or offline source directly and calling it your own; ● using information you find from an online or offline source without giving the author credit; ● replacing words or phrases from another source and inserting your own words or phrases.

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities. Academic dishonesty will result in disciplinary review by the University and may lead to probation, suspension, or expulsion. Instructors may also, at their discretion, penalize student grades on any assignment or assessment discovered to have been produced in an academically dishonest manner.