**Biochemistry of Renewable Energy (CHEM 396) Syllabus – Fall 2024**

**Professor:** Dr. Colin Gates, cgates4@luc.edu

**Lecture:** Monday and Wednesday 6:00-7:15 PM, Flanner Hall Rm. 105

**Office hours:** Flanner Hall 022, time determined by poll during first week of class

**Prerequisites:** Biochemistry I (CHEM 370) or equivalent.
*Recommended background: General biology, general physics, introduction to environmental science, basic inorganic chemistry, Biochemistry II, biophysical chemistry, plant biochemistry, proteomics, genetics- this is a very interdisciplinary course and we'll cover the necessary background, so don't worry if you don't have all of these.*

**Description:** Biochemistry of Renewable Energy, CHEM 396 is an upper-level class addressing fundamental topics and chemical underpinnings in the use of biological, biologically derived, and bioinspired forms of renewable energy. The course will cover both established biofuel production and biological energy use mitigation practices and developing approaches, requiring students to familiarize themselves with current research literature. As renewable energy is a broad field which overlaps various other subjects, the course will touch briefly on a range of topics which are not strictly included in biochemistry, such as engineering, inorganic chemistry, and environmental science. Students are expected to finish this class with an introductory understanding of the renewable energy landscape and the biochemical pathways involved in sourcing energy from life.

**Textbooks:** *Biofuels : Alternative Feedstocks and Conversion Processes* by Ashok Pandey, Christian Larroche, Steven C. Ricke, Claude-Gilles Dussap, Edgard Gnansounou, and Claude-Gilles Dussap. *Bioenergy : Biomass to Biofuels* by Anju Dahiya. We are using these two books because they are both available online for free through the Loyola library system and there is a physical copy of the latter in the Cudahy Library. You may also buy/rent from the bookstore if you like but this is not required at all. These textbooks mostly focus on topics 4-9 below and for the others we will be primarily using supplemental materials provided on Sakai.

**Useful References:** A general biochemistry textbook. Plant biochemistry, biophysical chemistry, and inorganic chemistry texts may also be useful but the relevant materials will be on Sakai.

**Topics Covered** (in chronological order; subject to change):

1. Background: Energy and the Environment
2. Background: Conventional Fuels
3. Background: Non-Biological Renewables
4. Principles of fermentation
5. Bioethanol production
6. Biodiesel production
7. Biodiesel, bioethanol, and other fuels/products from algae and cyanobacteria
8. Biohydrogen production
9. Biobutanol and green liquid hydrocarbon production
10. Photosynthesis and bioenergetic transduction
11. Bioelectrical generation
12. Agricultural improvement strategies
13. Energy consumption mitigation strategies
14. Biomimetics for renewable energy
15. Future directions and pitfalls/student presentations

In the second half of the course content will transition to presentations of subjects of interest by students, which will essentially comprise literature reviews of one or more recent papers as determined by student and instructor by October 14th and presented at the end of the course (dates to be determined based on enrollment).

**Contact:** Always make sure any e-mail contact to Dr. Gates has a subject line beginning with CHEM 396. E-mail sent without this header may wind up in a junk folder. E-mail will be answered within 24 hours either via direct reply or via verbal response in class or office hours. If there is no response in this time frame, please check to make sure you used the correct format and resend your message. Office hours will be held in Flanner Hall 022 from 9:30 to 11 AM on Fridays unless changed in-class, at which time this syllabus will be updated. Office hours will be held in-person and remote concurrently via Zoom; please see Resources in the course Sakai site for Zoom links.

**Accommodations:** All lectures will be recorded via Zoom and posted after class. If we switch to remote, lectures will be pre-recorded and posted on Sakai. Use of the Sakai Forum is encouraged for assistance from your fellow students in addition to the Discussion sessions. Students seeking accommodations for disabilities must send me an official letter from the Student Accessibility Center SAC in the first week of classes (by the end of the day on September 3rd – failure to do so will result in the SAC not receiving exam materials). The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Student Accessibility Center (SAC), Sullivan Center, (773) 508-3700, contact SAC@luc.edu. Further information is available at http://www.luc.edu/sac/. All students with the documented time extension will start any exams 30 minutes before the scheduled time of the exam. Please follow details sent in a general announcement before each exam. Make-ups are not required to be available for any component of this course, though exam grading will be adjusted as per the Grading section if a student misses an exam for a valid medical reason and supplies documentation within one week (168 hours) of the missed exam.

**Exams:** There will be two exams: a midterm and a final. Exams are closed-book; students may not consult their notes, the Internet, course materials, other students, or any resource other than their own existing knowledge and logistical questions to the proctor. Students may use a non-graphing calculator, scratch paper, pen/pencil, and eraser during exams. All students must follow LUC Academic Integrity policies (discussed below) and agree to the honor pledge below. Violations will result in a grade of zero being assessed for the exam and be reported for potential further penalty. Exam dates and times are as follow:

- Midterm: Wednesday, October 21st at 6:00 PM (during lecture) – 75 minutes
- Final exam: Monday, December 9th at 7:00 PM – 2 hours; please see the official exam calendar for further explanation of finals schedule: http://luc.edu/academics/schedules/index.shtml

Students will receive explanations of exam format via Sakai or lecture at least one week prior to the exam. Students are expected to come adequately prepared for exams; additional resources will most likely not be available. Retakes or substitutions are at the instructor's discretion and the instructor reserves the right to require any and all graded components be done exactly as specified.

**Grading:** The value of course components to the final grade is as follows:

| | |
|---|---|
| Class participation | 15% |
| Course Project Presentation | 20% |
| Quizzes | 25% |
| Midterm Exam | 20% |
| Final Exam | 20% |
| Total | 100% |

It is the student's responsibility to keep track of all announcements, policies, and changes to the class. The instructor reserves the right to change or adjust to this syllabus as necessary, including, but not limited to, the grading policy and course schedule. The instructor will alert students via Sakai of any changes. Students are responsible for reading all directions carefully and asking the instructor if anything is not clear. Students have the option to fill out an Incomplete Grade Form in the event of major extenuating circumstances causing disruption of the final exam, at the instructor's discretion, as documented here: https://www.luc.edu/regrec/faculty.shtml

**Breakdown of letter grades:**

| A | A- | B+ | B | B- | C+ | C | C- | D | F |
|---|---|---|---|---|---|---|---|---|---|
| 100-93 | 92-90 | 89-87 | 86-83 | 82-80 | 79-77 | 76-73 | 72-70 | 69-60 | <60 |

The instructor reserves the right to apply an upward curve to the final grades if needed but is under no obligation to do so.

**Relevant Dates:**

- August 26th: Classes begin; first meeting of class
- September 3rd: Late registration ends
- September 8th: Last day to withdraw without a "W"
- September 9th: Last day to switch between credit/audit and to opt into pass/no pass grading
- October 7th: Mid-Semester break; no class
- November 1st: Last day to withdraw with a "W"; a "WF" is assigned after this date
- November 27th: Thanksgiving break; no class
- December 4th: Last day of classes
- December 9th: Final Exam

More information available here: http://www.luc.edu/academics/schedules

## University and Department Policies

### Syllabus Statement On Recording

In this class software will be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded. These recordings will be made available only to students enrolled in the class, to assist those who cannot attend the live session or to serve as a resource for those who would like to review content that was presented. All recordings will become unavailable to students in the class when the Sakai course is unpublished (i.e. shortly after the course ends, per the Sakai administrative schedule). Remote students who prefer to participate via audio only will be allowed to disable their video camera so only audio will be captured. Please discuss this option with your instructor.

The use of all video recordings will be in keeping with the University Privacy Statement shown below:

### Privacy Statement

Assuring privacy among faculty and students engaged in online and face-to-face instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring in online or face-to-face classes may be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered. Students will be informed of such recordings by a statement in the syllabus for the course in which they will be recorded. Instructors who wish to make subsequent use of recordings that include student activity may do so only with informed written consent of the students involved or if all student activity is removed from the recording. Recordings including student activity that have been initiated by the instructor may be retained by the instructor only for individual use.

### Masking Statement

This course will follow the mask advisory policies, and COVID-19 policies more broadly, of the Department of Chemistry and Biochemistry superseding all other directives. Any student who is noticeably ill is obligated to wear a mask in class if attending in-person and is encouraged to attend remotely if this is an option.

### Academic Integrity

All students are expected to be fully responsible for their own work. All submitted work must be only your own work. Plagiarism, exam “cheat sheets”, and other academic dishonesties will not be tolerated- students caught cheating in any way on any assignment will receive a grade of zero on that assignment and a report to the Chemistry Department Chair and the School of Arts and Sciences Dean with potential further consequences to follow within the class and/or the student’s academic transcript. Please see the Academic Integrity section of the Undergraduate Studies Catalog for more information: https://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml

The following are explicitly considered academic dishonesty:

- Plagiarism – using the words or ideas of others without proper source acknowledgement.
    - Generative artificial intelligence is a form of plagiarism for the purposes of this class, as it uses the words of others without acknowledgement, and detectable use will be treated accordingly.
- Self-plagiarism – use of one's own work for multiple submissions for credit without approval.
- Purchasing or otherwise acquiring someone else's work to submit as your own.
- Fabrication of data, observations, interviews, surveys, or other information, or undocumented/improperly documented alteration of data.
- Collusion – working with other students on any exam or assignment without instructor approval.
- Use of work submitted by another student in a previous semester.
- Cheating – use of unauthorized study aids or materials during an exam, communication or distribution of unapproved exam materials, use of a proxy to take an exam on a student's behalf, falsifying medical or otherwise relevant documentation, looking up answers on the Internet during an exam, or asking another student for answers during an exam.
- Academic misconduct – includes allowing others to use your work improperly.

**Honor Pledge: By registering in this class and remaining registered, you agree that you will abide by all terms of this syllabus, bring any concerns to the instructor as appropriate, and specifically follow all policies listed in the preceding Academic Integrity section in full.**

**Registration**

Students may not attend classes for which they are not officially registered. Registration must be completed in LOCUS by the end of the day on Tuesday, September 3rd. Unregistered students will be asked to leave the class in keeping with LUC policies. Students may opt into Pass/No-Pass or Audit status until the end of the day on Monday, September 9th. Requests for Pass/No-Pass status are handled through the student's Academic Advisor, NOT the instructor.

**University-Authorized Absences**

Students may be allowed to miss class without penalty in order to participate in University-sponsored events if the absence schedule is conveyed in full to the instructor by the appropriate academic advisor (not the student) by Loyola e-mail within the first week of classes, i.e. by the end of the day on August 30th. After this time no further approval will be granted for any reason. Athletes, please see https://www.luc.edu/athleteadvising/attendance.shtml for specific information.

**Religious Accommodations**

Any student anticipating a religious situation or holiday which would affect absence or performance must inform the instructor by Loyola e-mail by the end of the business day on the second Friday of classes (by the end of the day on September 6th) to be eligible for any accommodations.

**All exams are in person.** This policy may be revised in response to change in University policy or development of the needs of the course. Unless such a change is made, however, all students are expected to be physically present for all exams and no students will be permitted to have remote exams.

**Course Repeat Rule**

Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). The Department

advises that it is preferable to complete a course with a grade of C or C-, and to demonstrate growth in future coursework, than to withdraw from a course.
After the second attempt, the student must secure approval for a third attempt. Students must come to the Chemistry Department, fill out a permission to register form or print it from the Department of Chemistry & Biochemistry website: https://www.luc.edu/chemistry/forms/ and personally meet and obtain a signature from either the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. A copy of this form is then taken to your Academic Advisor in Sullivan to secure final permission for the attempt.

**Tutoring Center**

Tutoring for this class may be available. Please see http://www.luc.edu/tutoring/Small_Group_Info.shtml for more information on availability.

**Harassment (Bias Reporting)**

*It is unacceptable and a violation of university policy to harass, discriminate against or abuse any person because of their race, color, national origin, gender, sexual orientation, disability, religion, age or any other characteristic protected by applicable law. Such behavior threatens to destroy the environment of tolerance and mutual respect that must prevail for this university to fulfill its educational and health care mission. For this reason, every incident of harassment, discrimination or abuse undermines the aspirations and attacks the ideals of our community. The university qualifies these incidents as incidents of bias. To uphold our mission of being Chicago's Jesuit Catholic University-- a diverse community seeking God in all things and working to expand knowledge in the service of humanity through learning, justice and faith, any incident(s) of bias must be reported and appropriately addressed. Therefore, the Bias Response (BR) Team was created to assist members of the Loyola University Chicago community in bringing incidents of bias to the attention of the university. If you believe you are subject to such bias, you should notify the Bias Response Team at this link: http://webapps.luc.edu/biasreporting*

**Online COVID-19 Class Policies Statement:**

In case of transition to online classes at any point, this course and its policies were designed to facilitate its use as a HyFlex or fully online educational experience. Modifications are noted in this document where relevant.