Photon Science
CHEM 4470/6470 (3.0 credits)
Course Syllabus – Spring 2020

Instructor: Samer Gozem
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Office Hours: Mondays, 4:00 – 5:30 pm.

Lecture time and place: MW 5:30 – 6:45 pm, Aderhold Learning Center 406.

Course Prerequisites: Math 2212 or Math 2202
Phys 2212K or Phys 1112K
Chem 2400
… all with a grade of C or higher.

Textbook: "*Principles of Molecular Photochemistry: An Introduction"* by N.J. Turro, V. Ramamurthy, and J.C. Scaiano, 1st Edition, ISBN 978-1891389573.

Supplemental reading:
For a more in-depth discussion of fluorescence spectroscopy: "*Principles of fluorescence spectroscopy*" by Joseph R Lakowicz, 3rd Edition, Springer US, 2006, ISBN 978-1-4899-7880-6.

For a solid theoretical insight into photochemistry, *"Electronic Aspects of Organic Photochemistry"* by Joseph Michl and Vlasta Bonačić-Koutecký is an excellent reference.

For practical details regarding organic photochemistry (including instrumentation, experimental techniques, and numerical data), the "*CRC Handbook of Organic Photochemistry*" is a good resource.

E-Text: Redshelf offers a 180 day online/downloadable version of the Turro textbook.

Course Description: Photon Sciences is a 3-credit semester course that discusses events occurring in molecular systems following the absorption of light. The first few lectures will introduce some essential background concepts. Next, we will discuss how light absorption is accompanied by changes in the molecular electronic and nuclear structures (**photophysics**). We will then discuss how such photophysical processes can sometimes lead to molecular transformations (**photochemistry**). Finally, we will explain photochemistry that occurs in biological systems such as proteins and DNA (**photobiology**).

Course Objectives: Understand the various processes that can occur upon exciting a molecule with light.

Grading:

Contribution	% (4470)	% (6470)
Participation	5	5
Assignments	30	15
Midterm	25	25
Final	25	25
Project	15	30

Assignments & Exams: There will be three assignments throughout the semester worth a total of 30% for Chem 4470 students and worth 15% for Chem 6470. Some of those may be take-home assignments, and some will be in-class assignments. There will also be one midterm exam and one final exam. Exams are worth 25% each.

Project: Students will be assigned projects requiring them to apply what they learned from the photophysics and photochemistry sections of the class to discuss a problem related to biology. Students have the opportunity to discuss their projects with the instructor beforehand and suggest something relevant to their academic/research interests, otherwise students will be assigned a random project. All students will write a short report for their project. In addition, Chem 6470 students will also present/discuss what they learned in class.

Project reports need to be concise, clearly written, and referenced. The reports are worth 15% of the course grade and should be **at most** 1000 words (figure captions and references do not count towards word count). Reports will be assessed based on the student's ability to discuss the photophysics or photochemistry of a biological system using concepts learned in this class and referencing appropriate chemical literature.

Chem 6470 students will also be asked to present their project towards the end of the semester to share what they learned. The entire project (written + presentation) is worth 30% of the grade for Chem 6470.

Some questions that students may address during the report. Those are just examples of questions to consider as you search literature on your topic. You are by no means restricted to those questions:

- If an absorption or fluorescence spectrum is known for your system, include it in the report and comment about it.
- Is the character of the lowest excited state known? (i.e., is it pi-pi*, n-pi*, or something else?)
- What happens to this system as soon as it absorbs light? Are the photophysical or photochemical properties known?
- Have quantum yields been reported for such processes? Does this system undergo only one process or are there competing processes?
- If there is a photochemical reaction, is the mechanism known? Does it go through a ground state intermediate, excited state intermediate, or funnel?
- Have there been any discussions in literature about interesting solvent effects? Protein mutation effects? Can they be explained using concepts discussed in this course?

Last day to withdraw: March 3rd, 2020.
The University requires faculty, on a date set by the Provost after the mid-point of the course,

1. to give a WF to all those students who are on their rolls but no longer taking the class, and
2. to report the last day the student attended or turned in an assignment.

Student Integrity Policy: All assignments, exams and tests taken must represent the student's individual, unaided efforts. Receiving unauthorized outside information or offering unauthorized information to another student during an examination is cheating. Any suspected offenses may be referred to the Department of Chemistry and the College of Arts and Sciences for appropriate action. Students should be particularly familiar with how to avoid plagiarism in academic writing. Written work submitted in this class that are fully or partially plagiarized will receive a maximum grade of 50% or will be given an automatic 0%, at the discretion of the instructors. More information about plagiarism and how to avoid it can be found here (see section links on the left-hand side):
http://research.library.gsu.edu/c.php?g=666018&p=4683714

GSU students have free access to Grammarly, which provides grammar, spelling, and citation monitoring (i.e. automatically checks for plagiarism). I strongly recommend using it!
https://technology.gsu.edu/technology-services/it-services/training-and-learning-resources/grammarly/

COVID-19 update: For the purpose of social distancing, classes have been cancelled from March 14th – March 29th, and will resume online starting March 30th until the end of the semester. All remaining Photon Sciences lectures will be hosted live on Webex at the usual class time (MW 5:30-6:45 pm). A link will be emailed to all students prior to each lecture that they can use to join. This will provide all students the opportunity to attend the lecture live and interact/ask questions. The online lectures will also be recorded and be made available to students.

Graduate student presentations will take place, as planned, during lectures from April 13th to April 22nd. At the end of the lecture prior to each student's presentation date, students will be asked to test their mic and screen sharing function to make sure they can present during the following class session as planned.

Below is an updated schedule for the remaining lectures this semester. Assignment 3 and the Final exam will be posted to iCollege.

Date	Topic
3/30	1D and 2D potential energy surfaces for understanding photochemistry
4/1	Mechanism of photochemical bond-breaking reactions
4/6	Photochemical rearrangements
4/8	Factors determining the quantum yields of photochemical reactions
4/13-4/22	Graduate student photobiology presentations
4/27	Overview and general considerations for photobiology

Important dates and deadlines:

4/8	Assignment 3 due (will be posted on iCollege 4/1)
4/22	Due date for Chem 4470 and 6470 final reports
5/4	Online Final Exam (via iCollege)