

BIOL 4560 / 6560: Quantum Biology (Spring, 2024)

Instructor Information

Instructor name: Dr. Jonghoon Kang

Instructor contact: Bailey Science Center 2217, 229-333-7140, jkang@valdosta.edu

Instructor office hours:

9 AM – 11 AM, 3 PM – 4 PM on Monday / 9 AM – 11 AM on Wednesday or by appointment

Course Information

BIOL 4560 / 6560 Quantum Biology. 3 Hour.

BIOL 4560: Prerequisites: A grade of "C" or better in MATH 2261, BIOL 1107, BIOL 1107L, BIOL 1108, 1108L, BIOL 3200, CHEM 1211, CHEM 1211L, CHEM 1212, CHEM 1212L, and either PHYS 1111K or PHYS 2211K or consent of the instructor.

BIOL 6560: Prerequisite: Admission into the graduate program or permission of the instructor.

Time and Location

Monday, Wednesday, Friday 8:00 – 8:50 am, #2202

Course Description

- A study of the role of quantum mechanics in biological and biochemical phenomena. Basic concepts in quantum aspects of nature will be reviewed and their implications in biology will be examined.
- Required texts: [Physical Chemistry for the Biosciences](#), by Raymond Chang from University Science Books (ISBN-13: 978-1891389337)

- Pens or Pencils, Calculator, and **Paper-based regular notebooks**

- ***Specific Description of Course***

The course focuses on how **quantum mechanics** plays a role in biological and biochemical phenomena. Basic concepts in quantum aspects of nature will be reviewed and their implications in biology will be examined. Traditionally biologists don't need to learn quantum mechanics because most biological phenomena can be explained without knowing the quantum nature of the system. However, with recent development of experimental techniques and theoretical advancement, it is now clear that ***the quantum aspect of nature plays a critical role in some biological phenomena including consciousness***. This course is ***ambitious and exciting*** in that we are going to ***explore the interface between biology and the quantum world to learn how the weirdest aspect of nature manifests itself in biology***. I will teach ***biology, mathematics, physics, and chemistry*** relevant to this course. The use of mathematics will be minimized to the level of pre-calculus and basic calculus as this course is mainly targeted for biology students.

Specific Outcomes

- Comprehend basic (quantum) physics.
- Acquire basic mathematical skills used in quantum mechanics.

- Recognize the necessity of quantum physics in explaining some biological phenomena.
- Describe those biological phenomena with quantum mechanics.
- Demonstrate literature analysis capability in quantum biology.
- Demonstrate competency for the basic quantum physics and chemistry in standard tests such as MFT, GRE, MCAT, DAT, PCAT, and OAT.
- Be ready to conduct research with me, if you want.

Assignments

General description of the assignments: Students are required to read the lecture materials to be covered before and after class.

Policies for missed assignments, make-up assignments, late assignments, and/or extra credit: If you miss any assignment due to medical or family-related emergency you can have make-up assignments as long as you prove the valid reason of your absence (doctor's notes). If you miss class more than three times for any reason, you won't pass this course. So, make sure that you attend all lectures.

Assessment Policy

Total Score for Undergraduate = 400 (Four in Class Exams) + 400 (Final) = 800

Total Score for Graduates = 400 (Four in Class Exam) + 400 (Final) + 100 (Term Paper) = 900

| Total score (%) | Grade |
|-----------------|-------|
| >= 90% | A |
| >= 80% | B |
| >= 60% | C |
| >= 40% | D |
| < 40% | F |

Accommodations Statement

Students with disabilities who are experiencing barriers in this course may contact the Access Office for assistance in determining and implementing reasonable accommodation.

<https://www.valdosta.edu/student/disability/>

Non-Discrimination and Title IX Statement

<https://www.valdosta.edu/administration/student-affairs/title-ix/>

Academic Integrity: You know that cheating is a bad thing to do. Students caught cheating will receive a grade of F for the test in question and will be reported to the Dean of Students. You are expected to follow VSU's Academic Integrity Code.

From VSU's Academic Integrity Code (the full code is available at

<https://www.valdosta.edu/academics/academic-affairs/academic-honesty-policies-and-procedures.php>

“Academic integrity is the responsibility of all VSU faculty and students. Faculty members should promote academic integrity by including clear instruction on the components of academic integrity and clearly defining the penalties for cheating and plagiarism in their course syllabi. Students are responsible for knowing and abiding by the Academic Integrity Policy as set forth in the Student Code of Conduct and the faculty members’ syllabi. All students are expected to do their own work and to uphold a high standard of academic ethics.”

Classroom demeanor or conduct: Every student should make the lecture a comfortable and enjoyable learning experience. Late entry to the classroom or leaving early are not desirable behaviors. Common sense should be practiced and expected.

Additional Information

Strategies used to support learning: Students are encouraged to take advantage of my office hours. Studying as a group (study group) should be a good idea. However, you must complete all assignments by yourself. If cheating is found in your work, all students involved will get zero points in those assignments.

I will teach you and you will learn a fascinating science, quantum biology. Therefore, your intellectual enhancement from taking this course will depend on both of us.

TENTATIVE LAB SCHEDULE AND TOPICS

| Date | Topic |
|-------------|---|
| 1/8 | Introduction about Instructor; Syllabus |
| 1/10 – 2/2 | Chapter 11 Quantum Mechanics and Atomic Structure (10 lectures) |
| 2/5 | Open Notebook EXAM 1 (100 pts) |
| 2/7 – 2/16 | Chapter 12 The Chemical Bond (5 lectures) |
| 2/19 – 2/28 | Chapter 13 Intermolecular Forces (5 lectures) |
| 3/1 | Open Notebook EXAM 2 (100 pts) |
| 3/4 – 4/5 | Chapter 14 Spectroscopy (12 lectures) |
| 4/8 | Open Notebook EXAM 3 (100 pts) |
| 4/10 – 4/17 | Chapter 15 Photochemistry and Photobiology (4 lectures) |
| 4/19 – 4/26 | Chapter 16 Macromolecules (4 lectures) |
| 4/29 | Open Notebook EXAM 4 (100 pts) |
| 5/1 | Cumulative Final Exam (400 pts) 8:00 am – 10 :00 am |

IMPORTANT DATES FOR SPRING SEMESTER-2024

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|-------------|--|
| January 8 | First Class Day for spring 2024 |
| January 11 | Registration for spring 2024 ends (11:59pm) |
| January 15 | Dr. Martin Luther King, Jr Holiday (University Closed) |
| Feb 29 | Official Midterm for spring 2024 |
| March 7 | Withdrawal Deadline for full-term VSU courses |
| March 11-15 | Spring Break (university open/no classes meet) |
| April 1 | Registration Begins for fall 2024 (by classification) |
| April 29 | Last class day for spring 2024 |
| May 3 | Graduate School Commencement Ceremony |
| May 4 | Undergraduate Commencement Ceremony |
| May 6 | Students View Final Grades in Banner after 5pm |