



COURSE OUTLINE

1. **Course:** BCEM 471, Physical Biochemistry - Fall 2023

Coordinator(s)

Name	Email	Phone	Office	Hours
Dr Elmar Prenner	eprenner@ucalgary.ca	220-7632	BI 145	TBA

Section(s)

Lecture 01 : MWF 12:00 - 12:50 in MS 431

Instructor	Email	Phone	Office	Hours
Dr Elmar Prenner	eprenner@ucalgary.ca	220-7632	BI 145	TBA
Dr Megan Engel	megan.engel@ucalgary.ca		BI 411	13:00 - 14:00 on Fridays (September 22 -- October 20)

To account for any necessary transition to remote learning for the current semester, courses with in-person lectures, labs, or tutorials may be shifted to remote delivery for a certain period of time. In addition, adjustments may be made to the modality and format of assessments and deadlines, as well as to other course components and/or requirements, so that all coursework tasks are in line with the necessary and evolving health precautions for all involved (students and staff).

In Person Delivery Details:

Lectures will be delivered in person. Lecture notes and reading materials will be posted before class.

Course Site:

D2L: BCEM 471 L01-(Fall 2023)-Physical Biochemistry

Note: Students must use their U of C account for all course correspondence.

The class, delivered in person, is aimed at introducing students to fundamental physical chemistry concepts with applications to biological spectroscopy and thermodynamics. The tutorials are online and synchronous. The tutorial will be taught using online platform approved by the University of Calgary (Zoom). This time will also be used for group work on assignments.

ASSIGNMENTS: There will be a number of graded assignments (written assignments) during the course. They will be done either individually or in designated groups and submitted online with a timeline indicated in the course outline. All lecture-related materials (slides, notes and lecture-reading materials) will be posted online to D2L. TA assistance is provided for tutorials and assignments. All grading will be done via D2L. The course will be taught interactively with periods of short exercises where students are asked to apply the course material and Q&A periods both during lecture and tutorial periods.

IN-PERSON MIDTERM: There will be an in person-midterm during tutorial on October 25th, 2023. Midterm exam will be mostly problem solving and short answer questions. Time will be adjusted for SAS students if needed and accommodations for students will be done on a case-by-case basis.

IN-PERSON FINAL EXAM: The final written exam will be 2 hours in person. Exam will be comprised of mostly problem-solving questions and some short answer questions. Time will be adjusted for SAS students if needed and accommodations for students will be done on a case-by-case basis.

Equity Diversity & Inclusion:

The University of Calgary is committed to creating an equitable, diverse and inclusive campus, and condemns harm and discrimination of any form. We value all persons regardless of their race, gender, ethnicity, age, LGBTQIA2S+ identity and expression, disability, religion, spirituality, and socioeconomic status. The Faculty of Science strives to extend these values in every aspect of our courses, research, and teachings to better promote academic excellence and foster belonging for all.

The Biological Sciences Equity Committee acknowledges there are persistent barriers that prevent such accessibility and hinder our progress towards EDI. Our representatives (faculty, staff, postdocs, graduate and undergraduate students) are committed to addressing any concerns and work towards proactive solutions that enact necessary change within the department. To submit anonymous questions, comments or concerns regarding EDI related issues, please reach out to our Chair, Arshad Ayyaz (_arshad.ayyaz@ucalgary.ca), or a committee representative of your choice at <https://science.ucalgary.ca/biological-sciences/about/equity-diversity-and-inclusion>

Course Outcomes:

- Select appropriate quantum mechanical models (QM), formulate parameters from molecular chemical structures, and calculate the shape and energy of wavefunctions
- Use energy and intensity principles to extract & predict structural and functional information from UV/Vis and IR spectra and engage in the reverse process of predicting spectra from structure
- Evaluate the correlation between predictions and known spectra and formulate new applications of spectral methods to diverse biomolecules
- Select appropriate thermodynamic equations and models to calculate, analyze, and predict the properties and interactions of diverse biomolecules
- Develop conceptual understanding of key models used to describe energy flow in biological systems
- Evaluate the applicability of these theoretical results by comparing and contrasting the calculated/predicted results to experimental results and explain how they correspond (or not) to qualitative and quantitative values and trends
- Describe, based on the structures & thermodynamic properties of H₂O & biomolecules, how the properties of water influence the actions and interaction of biomolecules

2. Requisites:

See section [3.5.C](#) in the Faculty of Science section of the online Calendar.

Prerequisite(s):

Biochemistry 341 or 393; and Chemistry 353 or 355; and 3 units from Mathematics 249, 251, 265, 275, 281, or Applied Mathematics 217; and 3 units from Mathematics 253, 267, 277, 283, 211, 213, or Applied Mathematics 219; and Physics 211 or 221, and 223.

3. Grading:

The University policy on grading and related matters is described in [F.1](#) and [F.2](#) of the online University Calendar.

In determining the overall grade in the course the following weights will be used:

Course Component	Weight	Due Date (duration for exams)	Modality for exams	Location for exams
Assignments (5 assignment) ¹	30%	Ongoing		
Midterm	36%	Oct 25 2023 at 04:00 pm (110 Minutes)	in-person	During tutorial in MS 431 on Oct 25
Registrar Scheduled Final Exam	34%	Will be available when the final exam schedule is released by the Registrar	in person	Will be available when the final exam schedule is released by the Registrar

¹ Tentative due dates Sep 22/ Oct 6/ Oct 18/ Nov 10/ Nov 29

Each piece of work (reports, assignments, quizzes, midterm exam(s) or final examination) submitted by the student will be assigned a grade. The student's grade for each component listed above will be combined with the indicated weights to produce an overall percentage for the course, which will be used to determine the course letter grade.

The conversion between a percentage grade and letter grade is as follows.

	A+	A	A-	B+	B	B-	C+	C	C-	D+	D
Minimum % Required	95 %	90 %	85 %	80%	75%	70 %	65 %	60%	55%	50 %	45 %

This course will have a Registrar Scheduled Final exam that will be delivered in-person and on campus. [The Final Examination Schedule](#) will be published by the Registrar's Office approximately one month after the start of the term. The final exam for this course will be designed to be completed within 2 hours.

The University of Calgary offers a [flexible grade option](#), Credit Granted (CG) to support student's breadth of learning and student wellness. Faculty units may have additional requirements or restrictions for the use of the CG grade at the faculty, degree or program level. To see the full list of Faculty of Science courses where CG is not eligible, please visit the following website: <https://science.ucalgary.ca/current-students/undergraduate/program-advising/flexible-grading-option-cg-grade>

4. **Missed Components Of Term Work:**

In the event that a student legitimately fails to submit any online or in-person assessment on time (e.g. due to illness, domestic affliction, etc...), please contact the course coordinator, or the course instructor if this course does not have a coordinator to arrange for a re-adjustment of a submission date, or possible exemption and reweighing of components. Absences not reported within 48 hours will not be accommodated. Students may be asked to provide supporting documentation ([Section M.1](#)) for an excused absence, See [FAQ](#).

If an excused absence is approved, options for how the missed assessment is dealt with is at the discretion of the coordinator or course instructor. Some options such as an exemption and pro-rating among the components of the course may not be a viable option based on the design of this course.

5. **Scheduled Out-of-Class Activities:**

There are no scheduled out of class activities for this course.

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6. **Course Materials:**

Lectures, Lecture-reading, Assignments and Recommended Readings will be posted on D2L.

In order to successfully engage in their learning experiences at the University of Calgary, students taking online, remote and blended courses are required to have reliable access to the following technology:

- A computer with a supported operating system, as well as the latest security, and malware updates;
- A current and updated web browser;
- Webcam/Camera (built-in or external);
- Microphone and speaker (built-in or external), or headset with microphone;
- Current antivirus and/or firewall software enabled;
- Stable internet connection.

For more information please refer to the UofC [ELearning](#) online website.

7. **Examination Policy:**

The midterm and final exams are closed book examinations. You may not access your lecture notes or any other resources during exams. Each student is allowed to have one 4" x 6" card with equations and notes for midterm and final examination.

Students should also read the Calendar, [Section G](#), on Examinations.

8. **Approved Mandatory And Optional Course Supplemental Fees:**

There are no mandatory or optional course supplemental fees for this course.

9. **Writing Across The Curriculum Statement:**

For all components of the course, in any written work, the quality of the student's writing (language, spelling, grammar, presentation etc.) can be a factor in the evaluation of the work. See also Section [E.2](#) of the University Calendar.

In this course, the quality of the student's writing in assignments and examinations will be a factor in the evaluation of those reports. See also Section E.2 of the University Calendar.

10. Human & Living Organism Studies Statements:

Students will not participate as subjects or researchers in human studies.

See also [Section E.5](#) of the University Calendar.

STUDIES IN THE BIOLOGICAL SCIENCES INVOLVE THE USE OF LIVING AND DEAD ORGANISMS. Students taking laboratory and field-based courses in these disciplines can expect involvement with and experimentation on such materials. Students perform dissections on dead or preserved organisms in some courses. In particular courses, students experiment on living organisms, their tissues, cells, or molecules. Sometimes field work requires students to collect a variety of living materials by many methods, including humane trapping.

All work on humans and other animals conforms to the Helsinki Declaration and to the regulations of the Canadian Council on Animal Care. The Department strives for the highest ethical standards consistent with stewardship of the environment for organisms whose use is not governed by statutory authority. Individuals contemplating taking courses or majoring in one of the fields of study offered by the Department of Biological Sciences should ensure that they have fully considered these issues before enrolling. Students are advised to discuss any concern they might have with the Undergraduate Program Director of the Department.

Students are expected to be familiar with [Section SC.4.1](#) of the University Calendar.

11. Reappraisal Of Grades:

A student wishing a reappraisal, should first attempt to review the graded work with the Course coordinator/instructor or department offering the course. Students with sufficient academic grounds may request a reappraisal. Non-academic grounds are not relevant for grade reappraisals. Students should be aware that the grade being reappraised may be raised, lowered or remain the same. See [Section I.3](#) of the University Calendar.

- a. **Term Work:** The student should present their rationale as effectively and as fully as possible to the Course coordinator/instructor within **ten business days** of either being notified about the mark, or of the item's return to the class. If the student is not satisfied with the outcome, the student shall submit the Reappraisal of Graded Term work [form](#) to the department in which the course is offered within 2 business days of receiving the decision from the instructor. The Department will arrange for a reappraisal of the work within the next ten business days. The reappraisal will only be considered if the student provides a detailed rationale that outlines where and for what reason an error is suspected. See sections [I.1](#) and [I.2](#) of the University Calendar
- b. **Final Exam:** The student shall submit the request to Enrolment Services. See [Section I.3](#) of the University Calendar.

12. Other Important Information For Students:

- a. **Mental Health** The University of Calgary recognizes the pivotal role that student mental health plays in physical health, social connectedness and academic success, and aspires to create a caring and supportive campus community where individuals can freely talk about mental health and receive supports when needed. We encourage you to explore the mental health resources available throughout the university community, such as counselling, self-help resources, peer support or skills-building available through the SU Wellness Centre (Room 370, MacEwan Student Centre, [Mental Health Services Website](#)) and the Campus Mental Health Strategy website ([Mental Health](#)).
- b. **SU Wellness Services:** For more information, see their [website](#) or call [403-210-9355](#).
- c. **Sexual Violence:** The Sexual Violence Support Advocate, Carla Bertsch, can provide confidential support and information regarding sexual violence to all members of the university community. Carla can be reached by email (syva@ucalgary.ca) or phone at [403-220-2208](#). The complete University of Calgary policy on sexual violence can be viewed [here](#).
- d. **Student Ombuds Office:** A safe place for all students of the University of Calgary to discuss student related issues, interpersonal conflict, academic and non-academic concerns, and many other problems.
- e. **Student Union Information:** [SU contact](#), Email your SU Science Reps: science1@su.ucalgary.ca, science2@su.ucalgary.ca, science3@su.ucalgary.ca,
- f. **Academic Accommodation Policy:**

It is the student's responsibility to request academic accommodations according to the University policies and procedures listed below. The student accommodation policy can be found at: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Student-Accommodation-Policy.pdf>

Students needing an accommodation because of a disability or medical condition should communicate this

need to Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities: <https://www.ucalgary.ca/legal-services/sites/default/files/teams/1/Policies-Accommodation-for-Students-with-Disabilities-Procedure.pdf>.

Students needing an accommodation in relation to their coursework or to fulfil requirements for a graduate degree, based on a Protected Ground other than Disability, should communicate this need, by filling out the [Request for Academic Accommodation Form](#) and sending it to Lisa Gieg by email imgieg@ucalgary.ca preferably 10 business days before the due date of an assessment or scheduled absence.

- g. **Misconduct:** Academic integrity is the foundation of the development and acquisition of knowledge and is based on values of honesty, trust, responsibility, and respect. We expect members of our community to act with integrity. Research integrity, ethics, and principles of conduct are key to academic integrity. Members of our campus community are required to abide by our institutional [Code of Conduct](#) and promote academic integrity in upholding the University of Calgary's reputation of excellence. Some examples of academic misconduct include but are not limited to: posting course material to online platforms or file sharing without the course instructor's consent; submitting or presenting work as if it were the student's own work; submitting or presenting work in one course which has also been submitted in another course without the instructor's permission; borrowing experimental values from others without the instructor's approval; falsification/fabrication of experimental values in a report. Please read the following to inform yourself more on academic integrity:

[Student Handbook on Academic Integrity](#)
[Student Academic Misconduct Policy](#) and [Procedure](#)
[Faculty of Science Academic Misconduct Process](#)
[Research Integrity Policy](#)

Additional information is available on the [Student Success Centre Academic Integrity page](#)

- h. **Copyright of Course Materials:** All course materials (including those posted on the course D2L site, a course website, or used in any teaching activity such as (but not limited to) examinations, quizzes, assignments, laboratory manuals, lecture slides or lecture materials and other course notes) are protected by law. These materials are for the sole use of students registered in this course and must not be redistributed. Sharing these materials with anyone else would be a breach of the terms and conditions governing student access to D2L, as well as a violation of the copyright in these materials, and may be pursued as a case of student academic or [non-academic misconduct](#), in addition to any other remedies available at law.
- i. **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIP). Students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page. For more information, see [Legal Services](#) website.
- j. **Surveys:** At the University of Calgary, feedback through the Universal Student Ratings of Instruction ([USRI](#)) survey and the Faculty of Science Teaching Feedback form provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses. Your responses make a difference - please participate in these surveys.

BCEM 471 F23 - Physical Biochemistry - Tentative Schedule

Week	Month	Day	Instructor	Lectures	Tutorial , Exams, and Assignments
1	Sept	6	EJP/ME	Introduction to the Course	
1	Sept	6	EJP (KSA)	→ Tutorial	Tutorial #1 Problem solving
1	Sept	8	EJP (KSA)	QM for biochemists (1 lecture)	
2	Sept	11	EJP (KSA)	FEM models of conjugated systems	
2	Sept	13	EJP (KSA)	QM models of aromatic systems	
2	Sept	13	EJP (SD)	→ Tutorial	Tutorial #2 Practice Prob. QM
2	Sept	15	EJP (KSA)	Harmonic oscillator & vibrating molecules	Begin Assignment #1 QM
3	Sept	18	Guest speaker	QM	
3	Sept	20	ME	Solids, Liquids, and Gase	

3	Sept	20	EJP(SD)	→ Tutorial	Tutorial #3: Work on Assignment 1
3	Sept	22	Guest speaker QM		Submit Assignment 1
4	Sept	25	ME	1 st Law of Thermo	
4	Sept	27	ME	2 nd Law of Thermo	
4	Sept	27	ME	→ Tutorial	Tutorial #4: Practice Problems Thermo
4	Sept	29	ME	Calorimetry and Its Applications (ITC & DSC)	Begin Assignment #2 Thermo 1
5	Oct	2	ME	Free Energy & spontaneity	
5	Oct	4	ME	3 rd Law of Thermo	
5	Oct	4	ME	→ Tutorial	Tutorial #5: Practice problems and work on and Assignment 2
5	Oct	6	ME	Ideal gases & solutions (Henry's & Raoult's Laws)	Submit Assignment 2
6	Oct	9		JJ Thanksgiving - No Lecture JJ	
6	Oct	11	ME	Standard States of solids, liquids, and gases	Assignment 2 marked Begin Assignment #3 Thermo 2
6	Oct	11	ME	→ Tutorial	Tutorial #6: - Lecture: Dependence of Free Energy on Temp. & Conc.
6	Oct	13	ME	Electrolyte Solutions & Debye- Huckel Theory	
7	Oct	16	ME	Practice problems Thermo 2	
7	Oct	18	ME	Thermo applied to Multiple Equilibrium & Buffers	
7	Oct	18	ME	→ Tutorial	Tutorial #7: - Work on and submit assignment #3
7	Oct	20	ME	Introduction to non-equilibrium Thermodynamics	
8	Oct	23	ME/EJP(KSA)	review	Assignment 3 marked before class
8	Oct	25		No class	
8	Oct	25		* * Midterm Exam * *	Tutorial #8: Midterm
8	Oct	27	EJP	Water and Hydrogen Bonding	
9	Oct	30	EJP (SD)	The Hydrophobic Effect	
9	Nov	1	EJP (SD)	Thermodynamics applied to Proteins	
9	Nov	1	EJP	→ Tutorial	Tutorial #9: Practice Problems Thermo 3
9	Nov	3	EJP	Lipids/DNA	Start assignment # 4 Thermo Thermo/UV
10	Nov	6	EJP	Intro to Spectroscopy	
10	Nov	8	EJP	Principles of Spectroscopy	
10	Nov	8	EJP	→ Tutorial	Tutorial #10: Practice problems UV/IR
10	Nov	10	EJP	IR Spectroscopy	Submit assignment #4
11	Nov	13		No Lecture	
11	Nov	15		No Lecture	
11	Nov	15		No Tutorial	

11	Nov	17		No Lecture	Assignment 4 marked
12	Nov	20	EJP	Application of Absorbance/Tutorial IR	
12	Nov	22	EJP	Intro to Fluorescence	Start assignment 5 IR/Flu
12	Nov	22	EJP	→ Tutorial	Tutorial #11: Lecture : Fluorescence Spectroscopy
12	Nov	24	EJP	Practice problems Flu	
13	Nov	27	EJP	Applications of Fluorescence	
13	Nov	29	EJP	Raman Spectroscopy/Tutorial Flu	
13	Nov	29	EJP	→ Tutorial	Tutorial #12: work on and submit assignment 5
13	Dec	1	EJP	Dynamic Light Scattering	
14	Dec	4	EJP	Demo	
14	Dec	6	EJP	Review	
14	Dec	6	EJP	Tutorial -	Tutorial #13: Assignment 5 marked

Two Hour Final Exam to be scheduled by the Registrar.

Electronically Approved - Sep 01 2023 10:52

Department Approval