



UNIVERSITY OF CALGARY

DEPARTMENT OF BIOLOGICAL SCIENCES COURSE OUTLINE

1. **Course:** BIOCHEMISTRY 471 – PHYSICAL BIOCHEMISTRY

Lecture Section(s): L01 MWF 12:00-12:50 SA 124A FALL 2017

TUTORIAL: T01 T 15:30-17:20 ST 128

COURSE COORDINATOR: Dr. S. Noskov

LECTURER(S): Dr. E. Prenner BI 145A 220-7632 eprenner@ucalgary.ca
 Dr. S. Noskov BI 447 210-7971 snoskov@ucalgary.ca

Course website or Desire 2 Learn (D2L) course name: F2017 BCEM471L01

Biological Sciences Department BI 186 403-220-3140 biosci@ucalgary.ca

2. **Prerequisites:** Biochemistry 341 or 393; Chemistry 353 or 355; one of Mathematics 249, 251, 265, 275, 281 or AMAT 217 and one of Mathematics 253, 267, 277, 283, 211, 213 or AMAT 219; and Physics 211 or 221 and 223.

3. **Grading:** The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Assignments (7 x 2% each)	14%	
Midterm I (Tues. Oct. 17)	26%	(During Tutorial)
Midterm II (Tues. Nov. 7)	26%	(During Tutorial)
Final Exam	34%	

There will be a final exam scheduled by the Registrar's office

Each piece of work (assignment, midterm tests or final examination) submitted by the student will be assigned a percentage score. The student's average percentage score for the various components 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.

Final Grade Scale :

A+ : 95 or higher
A : 90 and under 95
A- : 85 and under 90
B+ : 80 and under 85
B : 75 and under 80
B- : 70 and under 75
C+ : 65 and under 70
C : 60 and under 65
C- : 55 and under 60
D+ : 53 and under 55
D : 50 and under 53
F : <50

4. **Missed Components of Term Work:** The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in Section 3.6. It is the student's responsibility to familiarize himself/herself with these regulations. See also Section E.6 of the University Calendar

5. **Course Materials:** Assignments and Recommended Readings will be posted on D2L

6. **Examination Policy:** The use of camera devices, MP3 Players and headphones, wireless earbuds or wireless access devices such as smart phones, smart watches, iOS and/or Android, etc., during the examination will not be allowed. All exams are closed book. Students should also read the Calendar, Section G, on Examinations.

7. **Writing across the curriculum statement:** 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.

8. **ETHICS IN THE BIOLOGICAL SCIENCES**

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.

9. **OTHER IMPORTANT INFORMATION FOR STUDENTS:**

(a) **Academic Misconduct:** (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under Section K. Student Misconduct to inform yourself of definitions, processes and penalties

(b) **Assembly Points:** In case of emergency during class time, be sure to FAMILIARIZE YOURSELF with the information on assembly points.

(c) **Student Accommodations:** Students needing an Accommodation because of a Disability or medical condition should contact Student Accessibility Services in accordance with the Procedure for Accommodations for Students with Disabilities available at http://www.ucalgary.ca/policies/files/policies/procedure-for-accommodations-for-students-with-disabilities_0.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, preferably in writing, to the Associate Head of Biological Sciences, Dr. H. Addy by email addy@ucalgary.ca or phone 403 220-3140.

(d) **Safewalk:** Campus Security will escort individuals day or night (<http://www.ucalgary.ca/security/safewalk/>). Call 220-5333 for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) **Freedom of Information and Privacy:** This course is conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPPA). As one consequence, 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 also <http://www.ucalgary.ca/secretariat/privacy>.

(f) **Student Union Information:** VP Academic Phone: 403 220-3911 Email: suvpaca@ucalgary.ca
SU Faculty Rep. Phone: 403 220-3913 Email: science1@su.ucalgary.ca, science2@su.ucalgary.ca and science3@su.ucalgary.ca;
Student Ombuds Office: 403 220-6420 Email: ombuds@ucalgary.ca; <http://ucalgary.ca/provost/students/ombuds>

(g) **Internet and Electronic Device Information:** You can assume that in all classes that you attend, your cell phone should be turned off unless instructed otherwise. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

(h) At the University of Calgary, feedback provided by students through the Universal Student Ratings of Instruction (USRI) survey provides valuable information to help with evaluating instruction, enhancing learning and teaching, and selecting courses (www.ucalgary.ca/usri). Your responses make a difference - please participate in USRI Surveys.

COURSE LEARNING OUTCOMES

Students enrolling in this course should be able to demonstrate achievement of the learning outcomes for the advanced-level course in Biochemistry curriculum. The passing grade in the course corresponds to the following minimal goals: In each of the following units students will be able to:

QM/Spectroscopy Unit

1. Select appropriate quantum mechanical models (QM), formulate parameters from molecular chemical structures, and calculate the shape and energy of wave functions.
2. 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.
3. Evaluate the correlation between predictions and known spectra and formulate new applications of spectral methods to diverse biomolecules.

Applied Thermo Unit

1. Select appropriate thermodynamic equations and models to calculate, analyze, and predict the properties and interactions of diverse biomolecules.
2. Develop conceptual understanding of key models used to describe energy flow in biological systems
3. 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.
4. Describe, based on the structures & thermodynamic properties of H₂O & biomolecules, how the properties of water influence the actions and interaction of biomolecules.

BCEM 471 – Physical Biochemistry – Tentative Schedule

Week	Month	Day	Instructor	Lectures	Tutorial , Exams, and Assignments
1	Sept	11	SN-EJP	Introduction to the Course	
1	Sept	12	SN	→	Tutorial #1 Problem Solving/Calculus
1	Sept	13	SN	QM for biochemists	
1	Sept	15	SN	FEM models of conjugated systems	
2	Sept	18	SN	QM models of aromatic systems	Begin Assignment #1
2	Sept	19	SN	→	Tutorial #2; Practice Prob.
2	Sept	20	SN	Harmonic oscillator & vibrating molecules	
2	Sept	22	SN	Atomic & molecular wavefunctions	
3	Sept	25	SN	The Huckel model applied to UV-Vis Spectra	
3	Sept	26	SN	→	Tutorial #3 Problem solving Submit assignment1
3	Sept	27	EJP – 1	Intro to Spectroscopy	
3	Sept	29	EJP – 2	Principles of Spectroscopy	Begin Assignment #2
4	Oct	2	EJP	IR Spectroscopy	
4	Oct	3	EJP	→	Tutorial #4 Problem solving, Practice problems
4	Oct	4	EJP	Applications of IR Spectroscopy	
4	Oct	6	EJP	Principles of Fluorescence	Submit Assign #2 & Begin Assign #3
5	Oct	9	EJP	☺☺ Thanksgiving – No Lecture ☺☺	
5	Oct	10	EJP	☺☺ Thanksgiving – No Tutorial ☺☺	
5	Oct	11	EJP	Intro to Fluorescence	
5	Oct	13	EJP	Fluorescence Spectroscopy	Submit Assign #3
6	Oct	16	SN/EJP	Synopsis and Review	
6	Oct	17	SN /EJP	☼☼ Midterm Exam ☼☼	Midterm Exam-1 during Tutorial #5
6	Oct	18	EJP	Applications of Fluorescence	Begin Assign #4
6	Oct	20	EJP	Dynamic Light Scattering	
7	Oct	23	SN	Solids, Liquids, and Gases	
7	Oct	24	EJP	→	Tutorial #6 – Practice Problems
7	Oct	25	SN	1 st Law of Thermo	
7	Oct	27	SN	2 nd Law of Thermo	Submit Assign #4
8	Oct	30	SN	Calorimetry and Its Applications (ITC & DSC)	
8	Oct	31	SN	→	Tutorial #7– Practice Problems
8	Nov	1	SN	Free Energy & spontaneity	
8	Nov	3	SN	3 rd Law of Thermo	
9	Nov	6	SN/EJP	Synopsis and Review	
9	Nov	7	SN /EJP	☼☼ Midterm Exam ☼☼	Midterm Exam-2 during Tutorial #8
9	Nov	8	SN	Ideal gases & solutions (Henry's & Raoult's Laws)	
9/10	Nov	10/13		No Lecture	
10	Nov	14		→	
10	Nov	15	SN	Standard States of solids, liquids, and gases	Begin Assign #5
10	Nov	17	SN	Dependence of Free Energy on Temp. & Conc.	Tutorial #9 – Practice Prob.
11	Nov	20	SN	Electrolyte Solutions & Debye-Huckel Theory	
11	Nov	21		→	Tutorial #10 – Practice Prob; Begin Assign #6
11	Nov	22	SN	Thermo applied to Multiple Equilibrium & Buffers	Submit Assign #5
11	Nov	24	SN	Water and Hydrogen Bonding	
12	Nov	27	SN	The Hydrophobic Effect	
12	Nov	28	SN	→	Tutorial #11
12	Nov	29	SN	Thermodynamics applied to Proteins	Submit Assign #6, Begin Assign #7
12	Dec	1	SN	Thermo applied to Lipids & Detergents	
13	Dec	4	SN	Thermodynamics applied to Nucleic Acids	
13	Dec	5	SN	→	Tutorial #12 – Practice Problems
13	Dec	6	SN	Synopsis and Review	Submit Assign #7

Three Hour Final Exam to be scheduled by the Registrar.