ORIGINAL COURSE IMPLEMENTATION DATE: September 2016

REVISED COURSE IMPLEMENTATION DATE:

COURSE TO BE REVIEWED: (six years after UEC approval) December 2021

Course outline form version: 09/15/14

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: BIOC 401	**Number of Credits:** 3 Course credit policy (105)
Course Full Title: Enzymes, Coenzymes, and Inhibitors **Course Short Title (if title exceeds 30 characters):** Enzymology	
Faculty: Faculty of Science	**Department (or program if no department):** Chemistry

Calendar Description:

Topics include protein structure and function, theoretical principles of catalysis, strategies that enzymes use to catalyze reactions, and physical techniques used to study enzyme mechanisms. Chemical mechanisms for representative enzymes, coenzymes, enzyme inhibitors, and drugs are explored in detail.

Note: This course is offered as BIOC 401 and CHEM 401. Students may take only one of these for credit.
Note: Students with credit for CHEM 412C cannot take this course for further credit.

Prerequisites (or NONE):	CHEM 214.
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Equivalent Courses (cannot be taken for additional credit)

Former course code/number: **CHEM 412C**

Cross-listed with: **CHEM 401**

Equivalent course(s):

Note: Equivalent course(s) should be included in the calendar description by way of a note that students with credit for the equivalent course(s) cannot take this course for further credit.

Transfer Credit

Transfer credit already exists: ☐ Yes ☒ No

Transfer credit requested (OReg to submit to BCCAT):
☐ Yes ☒ No (if yes, fill in transfer credit form)

Resubmit revised outline for articulation: ☐ Yes ☒ No

To find out how this course transfers, see **bctransferguide.ca**.

Total Hours: 45

Typical structure of instructional hours:

Lecture hours	33
Seminars/tutorials/workshops	12
Laboratory hours	
Field experience hours	
Experiential (practicum, internship, etc.)	
Online learning activities	
Other contact hours:	
Total	**45**

Special Topics

Will the course be offered with different topics?
☐ Yes ☒ No

If yes, different lettered courses may be taken for credit:
No ☐ Yes, repeat(s) ☐ Yes, no limit

Note: The specific topic will be recorded when offered.

Maximum enrolment (for information only): 24

Expected frequency of course offerings (every semester, annually, every other year, etc.): annually

Department / Program Head or Director: David Fenske	**Date approved:**	Sept 16, 2015
Faculty Council approval	**Date approved:**	November 6, 2015
Campus-Wide Consultation (CWC)	**Date of posting:**	December 11, 2015
Dean/Associate VP: Lucy Lee	**Date approved:**	November 6, 2015
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	December 18, 2015

Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Characterize enzymatic catalysis within the framework of chemical kinetics and thermodynamics.
2. Explain the general mechanistic strategies that enzymes use to catalyze chemical reactions.
3. Explain the mechanistic basis for the function of several major classes of enzymes, coenzymes, inhibitors, and drugs.
4. Explain how laboratory experiments are used to elucidate enzyme mechanisms.
5. Propose enzyme or inhibitior mechanisms that are consistent with experimental data.
6. Propose biosynthetic pathways for the assembly of common natural product classes (terpenes and polyketides) that are consistent with structural features and experimental data.
7. Critically analyze recent enzymological research literature.
8. Deliver an oral presentation in a manner suitable to a scholarly audience based on analysis of recent enzymological research literature.

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods (guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion)

Lectures, oral presentations.

Grading system: Letter Grades: ☒ Credit/No Credit: ☐ Labs to be scheduled independent of lecture hours: Yes ☐ No ☒

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Text(s) and Resource Materials (if more space is required, download Supplemental Texts and Resource Materials form)

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Bugg, T.D.H.	Introduction to Enzyme and Coenzyme Chemistry	☒	Blackwell	2012
2.	Silverman, R.B.	The Organic Chemistry of Enzyme-Catalyzed Reactions	☒	Academic Press	2002
3.			☐		
4.			☐		
5.			☐		

Required Additional Supplies and Materials (software, hardware, tools, specialized clothing, etc.)

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	15%	Midterm exams: (2)	30%	Practicum:	%
Quizzes/tests:	%	Lab work:	%	Field experience:	%	Shop work:	%
Project/Presentation:	15%	Other:	%	Other:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

Module 1: Introductory topics: protein structure/folding, non-covalent interactions, enzyme classification and nomenclature
Module 2: General catalytic strategies used by enzymes: non-enzymatic and enzymatic examples of catalysis via acid/base, covalent metal cation-mediated, proximity and orientation, and electrostatic mechanisms.
Module 3: Experimental methods in enzymology: physical methods used to study enzyme mechanisms, stereochemical methods in enzymology, types of enzyme inhibitors, enzyme and inhibition kinetics, transition state theory
Module 4: Enzyme catalyzed group transfer and hydrolysis reactions: phosphate transfer, acyl transfer, glycosyl transfer, methyl transfer involving SAM and tetrahydrofolate, case studies of HIV protease and influenza sialidase enzymes and inhibitors.
Module 5: Enzymatic chemistry involving pyridoxal: non-enzymatic model reactions, racemases, decarboxylases, amino transferases, side chain-modifying enzymes, inhibitors.
Module 6: Enzymatic chemistry involving thiamine: benzoin condesation, decarboxylases, pyruvate dehydrogenase, transketolases, inhibitors
Module 7: Enzymatic redox chemistry involving nicotinamide and flavins: alcohol dehydrogenases, acyl-CoA dehydrogenase, amine-oxidases, flavin oxidases, mono-oxygenases, transient oxidations in selected isomerization and elimination reactions, inhibitors.
Module 8: Enzymatic carbon-carbon bond formation: carboxylation reactions involving biotin and vitamin K, Rubisco, fattyacid/polyketide biosynthesis, aldolases, mevalonate pathway/terpenes.
Module 9: Student presentations on examples of enzyme mechanism and/or inhibition taken from the recent research literature.