Yukon University	**School of Science**
	CHEM 211 **Organic Chemistry II**
	Term: Winter 2024 **Number of Credits: 3**

Course Outline

INSTRUCTOR: Ernie Prokopchuk, PhD
E-MAIL: eprokopchuk@yukonu.ca
OFFICE: A2015
OFFICE HOURS: Thurs & Fri 1:30-3:30 pm
or by appointment or any time my door is open

CLASS: Tues & Thurs 10:30 -11:50 am
ROOM: A2202

LAB: Monday 1:00-3:50 pm
ROOM: A2803

COURSE DESCRIPTION

Building upon the concepts of functional group, syntheses design and reaction mechanisms introduced in the first term, students investigate the structure and reactions of aldehydes and ketones, carboxylic acids and their derivatives, dienes and conjugated systems, benzene and its derivatives, amines, and organometallic compounds. Students are introduced to the essential instrumental techniques of infrared spectroscopy, nuclear magnetic resonance spectroscopy, and mass spectrometry with an emphasis on interpretation and structure elucidation. The mandatory labs further develop the students' hands-on skills including some of the instrumental methods covered in class.

COURSE REQUIREMENTS

CHEM 210

Students are expected to come to this course with an understanding of concepts covered in CHEM 210. Reactions and mechanisms from CHEM 210 may be used in this course but they will not be reviewed during this course.

EQUIVALENCY OR TRANSFERABILITY

Receiving institutions determine course transferability. Find further information at:
https://www.yukonu.ca/current-students/transfer-credit

LEARNING OUTCOMES

After completing this course, students will be able to

- interpret spectroscopic data to determine the structure of simple organic molecules

- recognize common classes of organic molecules and be familiar with their physical and chemical properties

- accurately predict the outcomes of common reactions involving carbonyl compounds, carboxylic acid and its derivatives, aromatic compounds, amines, and organometallic compounds

- use electron arrows to describe reaction mechanisms for common reactions involving carbonyl compounds, carboxylic acid and its derivatives, aromatic compounds, amines, and organometallic compounds

- design multistep organic syntheses using reactions that students know

- carry out common organic laboratory procedures using standard organic laboratory equipment

COURSE FORMAT

Weekly breakdown of instructional hours

Three hours lecture, three hours lab. It is expected that this course will require 4 – 6 hours/week (on average) of homework, readings, and studying for the lecture component and 3 – 5 hours/week for readings, prelabs, and reports for the lab component. The actual time required will depend on the individual and some may need more or less time than these estimates.

Delivery format

Classes are delivered in-person (face-to-face).

Classes will be recorded with the intent to provide students with a way to revisit material covered in class. This may be helpful while studying or to review a topic covered in class. This also provides greater flexibility to students who are unable to make the occasional class due to work, or other commitments, but please note that these recordings are not intended to be a substitute for regular class attendance. If the technology fails, recordings may not be available for a given day. Videos will only be available via the course Moodle page and only to students registered in the course.

Material will regularly be posted on the course LMS, Moodle. This material will include links to lecture capture videos, assignments, course announcements, links to online content, including the textbook on and suggested practice problems on OpenStax, a pdf of everything written on the screen during class, and other useful or interesting material related to the course. Please be aware that all course announcements and any other notifications generated by Moodle are sent to your Yukon University email address. It is essential that you regularly check this email account or set it to automatically forward to your preferred email account.

Labs are a mandatory component of the course. Students are expected to attend all lab sessions, complete the experiments, and submit the required reports. If a lab period is missed, the report for that experiment cannot be submitted unless arrangements are made with the instructor. The lab grade will be determined based on lab quizzes, pre-lab exercises, lab performance, and the lab reports. Expectations for the labs are outlined in the lab manual.

EVALUATION

Assignments	10 %
Term Test 1 (60 minutes)	15 %
Term Test 2 (60 minutes)	15 %
Final Exam	30 %
Laboratory	30 %
Total	100%

Students must pass both the laboratory component (15/30) and the lecture component (35/70) in order to pass the course

Attendance

While attendance is not graded, it is strongly recommended. There is a strong correlation between regular attendance and academic performance.

Assignments

There will be at least 5 assignments due on an approximately bi-weekly basis. Assignments are worth 10% of the final grade based on the total mark obtained on all assignments. Assignments will involve a variety of questions or problems related to the course material. You will have at least one week to complete each assignment. Late assignments will not be accepted (receiving a mark of 0) once graded assignments have been returned to the class, which usually happens at the next class.

Tests and Examinations

There will be two 80-minute term tests (February 1, 2024 and March 7, 2024) held during scheduled class time. Each test is worth 15% of the final grade. The final examination (April 16, 2024, 9am-noon), worth 30% of the final grade, will cover material from the entire course, potentially including some content from the lab.

Laboratory component

The laboratory component of the course is worth 30% of the final grade. This will be based on lab performance (10%), pre-lab questions (10%), lab quizzes (5%), and lab reports (75%). The specific evaluation criteria for the lab are detailed in the lab manual.

COURSE WITHDRAWAL INFORMATION

The final day to withdraw without academic penalty is March 7, 2024.

TEXTBOOKS & LEARNING MATERIALS

As a step to making education more affordable, we will be using John McMurry's Organic Chemistry, available for free on OpenStax. This includes the textbook, practice problems, and solution manual. Other supporting information may be provided from LibreText. Some copies of traditional textbooks will be placed on reserve in the library. You will need access to a computer or other suitable device, as internet access is required for this course.

The Laboratory Manual for Chemistry 211 will be provided. You will need to provide your own notebook for use as a Lab Notebook. This must be a separate notebook, not the one you are using for course notes. More information will be provided in the first lab session.

Students will need to provide their own safety glasses. These MUST be clear (not tinted) and ANSI Z87.1 (or later) or CAS 94.1 (or later) certified; this information will be on the packaging. These are the same kind of safety glasses required in the Trades and can be purchased wherever such safety equipment is sold.

Lab coats are mandatory, and students can purchase these online ahead of time, or from the campus bookstore. Cotton lab coats are best, but most expensive. Blends are acceptable but 100% polyester must be avoided as these are quite flammable.

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures for further details about academic standing and student rights and responsibilities.

Note that artificial intelligence tools such as Chat GPT can be useful in the same way as a web search or Wikipedia. They can be a starting point but cannot be used to do the work for you. Simply copying the output from something like Chat GPT and submitting it as your own work will be considered plagiarism the same as if you copied directly from a book, webpage, or classmate. Furthermore, appropriate referencing is expected in submitted work. You would not reference Chat GPT as it is not an actual source of information, much as you would not reference the results of a web search. References should be to the published scientific literature, or, when appropriate, to the popular scientific media.

ACCESSIBILITY AND ACADEMIC ACCOMMODATION

Yukon University is committed to providing a positive, supportive, and barrier-free academic environment for all its students. Students experiencing barriers to full participation due to a visible or hidden disability (including hearing, vision, mobility, learning disability, mental health, chronic or temporary medical condition), should contact Accessibility Services for resources or to arrange academic accommodations: access@yukonu.ca.

TOPIC OUTLINE

Week	Unit	Topic
1, 2	10	Nuclear Magnetic Resonance Spectroscopy - how NMR works – the theory - interpretation of HNMR spectra - shielding and deshielding of protons - chemical shifts - spin-spin coupling and splitting patterns - HNMR spectra and rate processes - interpretation of CNMR
2	11	Mass Spectrometry - how MS works – the theory - the mass spectrum - determination of molecular formulas and weights - fragmentation
3	12	Conjugated unsaturated systems - allylic substitution - allyl radicals - allyl cations - 1,3-butadiene - UV-vis spectroscopy - 1,4-addition - Diels-Alder reaction
4	13	Aromatic compounds - benzene - nomenclature - stability - Huckel's Rule - heterocyclic aromatic compounds - spectroscopy

4, 5	14	Reactions - electrophilic substitution reactions - halogenation - nitration - sulfonation - Friedel-Crafts alkylation and acylation - Clemmensen and Wolff-Kishner reductions - substituent effects - alkenylbenzenes - nucleophilic substitutions
6, 7	15	Aldehydes and Ketones - nomenclature - properties - synthesis - nucleophilic addition to the carbonyl group - addition of alcohols - addition of amines - addition of HCN - addition of Ylides - oxidation - analysis and spectroscopy
8, 9	16	carboxylic acids and their derivatives - nomenclature and properties - preparation - acyl substitution - acyl chlorides - carboxylic acid anhydrides - esters - amides - decarboxylation of carboxylic acids

		- tests for acyl
10, 11	17, 18	Enols and enolates - acidity of carbonyl compounds - keto and enol tautomers - reactions involving enols and enolates - synthesis of methyl ketones - synthesis of substituted acetic acids - synthesis of enamines - the Claisen condensation - acylation of ketone enolates - aldol reactions - addition to α,β-unsaturated aldehydes and ketones - the Mannich reaction
12	19	Amines - nomenclature - structure and properties - basicity - preparation - reactions - with nitrous acid - replacement reactions of arenediazonium salts - coupling reactions with arenediazonium salts - reactions with sulfonyl chlorides - synthesis of sulfa drugs - analysis - eliminations involving ammonium compounds
13	20	Phenols and aryl ethers - structure and physical properties - synthesis - reactions

		- phenols as acids - other O-H group reactions - cleavage of alkyl aryl ethers - Claisen rearrangement - Quinones

**Specific dates of topic coverage may be subject to change. Some topics may not be covered depending on time constraints.*