

CURRICULUM GUIDE: OFFICIAL COURSE OUTLINE

Course Code	CHEM 202	Course Title	Organic Chemistry II			
Credit Value	4	Department	Mathematics and Science			
No. of weeks	14	Hrs. per week	<i>Lecture</i>	<i>Tutorial</i>	<i>Laboratory</i>	<i>Total</i>
			3	0	3	6
Course Description	Students will study the structure and reactions of aromatics, polycyclic aromatic and heteroaromatic compounds, and their enolates, and an introduction to the chemistry of fats, carbohydrates and proteins. The laboratory component is designed to complement the lecture material and give students experience with basic analytical techniques. Note: This course is a continuation of CHEM 201.					
Prerequisite(s)	ENGL 099, CHEM 201					
Initial Articulation Targets	<i>UBC</i>	<i>SFU</i>	<i>UVic</i>	<i>UNBC</i>	<i>TRU</i>	
	ALEX CHEM 201 (4) & ALEX CHEM 202 (4) = UBCV CHEM_V 213 (3) & UBCV CHEM_V 223 (3)	CHEM 283 (3), Q & CHEM 286 (1) - Q	CHEM 234 (1.5)	ALEX CHEM 201 (4) & ALEX CHEM 202 (4) = UNBC CHEM 201 (3) & UNBC CHEM 203 (3) & UNBC CHEM 250 (1) & UNBC CHEM 251 (1)	CHEM 2220 (3)	
For updated information on the transferability of this course, please consult the BC Transfer Guide, www.bctransferguide.ca						
Learning Outcomes	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> Recognize and name a variety of organic compounds using the IUPAC system of nomenclature. Use molecular orbital theory to understand the concept of aromaticity. Describe the conditions and products formed in the important organic reactions. Present the mechanisms of the important organic reactions using the correct conventions to represent the movement of electrons. Determine the identity of organic compounds based on spectroscopic evidence. Solve a variety of synthetic problems in which simple organic compounds are converted into more complex compounds. Explain the chemistry of fats, carbohydrates and proteins as further examples of the chemistry of the functional groups already studied. 					



Content	<p>Core topics – all of the following will be covered:</p> <p>Aromatic Compounds (Arenes)</p> <ul style="list-style-type: none">• Aromaticity, resonance energy and Hückel's rule ($4n+2$)• Electrophilic aromatic substitution reactions, inductive and resonance effects• Electron-donating and electron-withdrawing groups• Oxidation of alkyl benzenes, phenols (preparation and reactions)• Diazonium salts, nucleophilic aromatic substitution reactions and benzyne• Aryl halides in the environment, dioxins, DDT and PCBs <p>Aldehydes and Ketones</p> <ul style="list-style-type: none">• Oxidation and reduction reactions of carbonyl compounds• Reactions with Grignard reagents and other nucleophiles• Synthesis of hydrates, hemiacetals, acetals, hemiketals and ketals• Synthesis of cyanohydrins, carbinolamines, imines and enamines <p>Carbohydrates</p> <ul style="list-style-type: none">• Aldoses and ketoses, D/L/R/S convention for glucose and other monosaccharides• Pyranose and furanose forms, Fischer Projection and Haworth Projection formulas• Mutarotation, glycosides, oxidation and reduction reactions of saccharides• Disaccharides and polysaccharides <p>Carboxylic Acids and Derivatives</p> <ul style="list-style-type: none">• Trends in the pKa values of acids, resonance and inductive effects• Polyfunctional acids (diprotic acids, -keto acids, , and other unsaturated acids)• Synthesis and reactions of esters, lactones, anhydrides, acid halides, amides, lactams and Nitriles <p>Enolates and Carbanions</p> <ul style="list-style-type: none">• Acidity of α-hydrogens, acid and base-catalyzed enolization/tautomerism• Mechanism of α-halogenation, Aldol and Claisen condensations• Enamine (Stork) alkylation and acylation• Reformatsky and Cannizzaro reactions• Michael addition, Mannich reaction and Robinson annulations• Malonic and acetoacetic ester syntheses <p>AMINES</p> <ul style="list-style-type: none">• Basicity and nucleophilicity of amines• Syntheses and reactions (Gabriel, Hofmann, Schmidt and Curtius reactions)• Hofmann elimination and Hinsberg test <p>Amino Acids and Lipids</p> <ul style="list-style-type: none">• Acid/base properties of amino acids, synthesis and reactions• Peptides and proteins
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	<ul style="list-style-type: none">Fats, oils, waxes, terpenes and steroids <p>Additional topics may also be covered, at the discretion of the instructor.</p> <p>Labs (8 from the following list):</p> <ul style="list-style-type: none">Electrophilic aromatic reaction: Nitration of benzoic acidElectrophilic aromatic reaction: Bromination of acetanilideThe metal hydride reduction of a ketoneCanizzaro reaction: Identification of an unknownA Solventless aldol reaction: Green chemistry in actionSynthesis of an azo dyeSynthesis of o-Eugenol from Guaiacol: Preparation and Claisen rearrangement of guaiacol allyl ether productConversion of Vanillin to Zingerone by catalytic hydrogenation of the Vanillin-Acetone condensation productThe Grignard reaction: Synthesis of phenyl-substituted alcoholsPreparation of the cyclopentadiene-maleic anhydride adduct by the Diels-Alder reactionDesign your experiment – An ester synthesis								
Methods of Instruction	Lectures, group discussions, problem solving, hands-on labs, quizzes, assignments, labs, simulations								
Required Textbook(s)	<p>The following textbook(s) is/are required, or approved equivalent(s).</p> <p>Klein, David R. Organic Chemistry. 4th Edition, Wiley, 2020.</p> <p>LibreTexts Chemistry. https://chem.libretexts.org/</p> <p>Liu, Xin. Organic Chemistry I. KPU, 2021.</p> <p>McMurry, John E. Organic Chemistry. 9th Edition, Cengage Learning, 2016.</p> <p>Soderberg, Timothy. Organic Chemistry with a Biological Emphasis Volume I and II. Open Textbook Library. 2022.</p>								
Required Equipment and Technology	<p>Students are required to have a computer with internet access.</p> <p>The following resources are provided by the College:</p> <ul style="list-style-type: none">Office 365Student email								
Homework Hours	At minimum, students can expect one hour of homework for every hour of instructional time.								
Evaluation	<table border="1"><thead><tr><th>Component</th><th>% Value</th></tr></thead><tbody><tr><td>Quizzes and assignments</td><td>10-15%</td></tr><tr><td>Laboratory experiments and activities</td><td>15-20%</td></tr><tr><td><ul style="list-style-type: none">Weight divided over 8 labsMidterm exam (2)</td><td>30-40%</td></tr></tbody></table>	Component	% Value	Quizzes and assignments	10-15%	Laboratory experiments and activities	15-20%	<ul style="list-style-type: none">Weight divided over 8 labs Midterm exam (2)	30-40%
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	Comprehensive final exam	30-35%	
Completion Requirements	The minimum grade to pass this course is D (50%). Unless otherwise stated, a minimum grade of C- (55%) is required for this course to fulfil a prerequisite.		
Course Designer(s)	Patrick Duffy, Ph.D. Department of Chemistry, Kwantlen Polytechnic University	Consultant(s), <i>if applicable</i>	
Dean's Approval	Barbara Moon, Ph.D., Dean of Arts and Sciences, Alexander College	Dean's Approval Date	June 10, 2015
Curriculum Committee Approval Date	June 10, 2015	First Term Offered	Fall 2016
Last Review Date	September 1, 2024	Next Review Date	September 1, 2029
Revision History	January 24, 2020 - Full review and updates by Jason Mirzaei, Ph.D. and Miriam Grob, Ph.D. faculty, Chemistry discipline, Alexander College, and Patrick Duffy, Ph.D. Department of Chemistry, Kwantlen Polytechnic University. September 1, 2024 - Lab assignments and assessments detailed by Kelly Cheung.		