

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015**GENERAL INFORMATION**

Introductory Organic Chemistry I and II (Chem 221 & 222) are a two-semester sequence required for all programmes in Chemistry, Biochemistry and Biology. *Chem 221 is a prerequisite for Chem 222.*

Course Description: Introduction to the use of IR and NMR spectroscopy for the identification of simple organic compounds. Benzene and aromatic compounds: aromaticity, electrophilic aromatic substitution, nucleophilic aromatic substitution, substituent effects. Chemistry of aldehydes and ketones: nucleophilic addition, oxidation, reduction, and condensation reactions, tautomerism. Chemistry of carboxylic acids and their derivatives. Chemistry of alcohols, ethers, and related compounds. Amines: basicity, reactions. Lectures and laboratory.

Instructor**Dr. Pat Forgione**

Office hours: Tues, 13:15-14:15 or by e-mail appointment in SP-275.11

Email: pat.forgione@concordia.ca, PLEASE PUT CHEM222 IN THE SUBJECT FOR ALL EMAILS!

Course Format

Lectures: 1.25 h / class, 26 classes; Wed/Fri 10:15-11:30 in CC-310

Labs: 4 h / week, starting Sept. 14th; section specified on your Portal;

Materials required

- 1) Chem 222 course lecture pack (available in bookstore)
- 3) *Lab text*: J. W. Lehman, *Operational Organic Chemistry*, 4th Ed., Prentice Hall Publishing
- 4) *Lab manual*: Concordia Dept. of Chem. & Biochem., *Organic Chemistry II*
- 5) any molecular model kit (e.g., Darling's Molecular Visions, or any other kit)
- 6) iClicker

Useful resources

- 1) M. Jones, Jr., S.A. Fleming, *Organic Chemistry*, 4th Edition, Norton Publishing (eBook also available)
- 2) Jones/Fleming 4th Ed. Study Guide & Solutions Manual, Norton Publishing
- 3) Course website (moodle site on your MyConcordia Portal): for lecture slides, handouts, problem sets
- 4) Other textbooks plus solutions manual (on reserve at Vanier library): for alternate explanations, problems
- 5) Interesting Read: Molecules that Changed the World, Nicolaou, K.C. Montagnon, T. Wiley-VCH, 2008 ISBN 978-3-527-30983-2

Molecular models

Using models helps considerably with many aspects of organic chemistry – many concepts require you to picture, rotate and draw 3D objects. Models **are** permitted in exams. You are strongly advised to buy a model kit, also available on reserve at Vanier Library.

Lectures and readings

Lectures will reinforce and clarify the textbook, with emphasis on important concepts. A combination of blackboard and powerpoint will be used – come to class prepared to take notes. The best approach to success in organic chemistry is to work at it every day, **cramming does not work for organic chemistry!** Keep up-to-date with the lecture material. Take detailed notes during class, and then work through them after class. Read the relevant sections of the textbook for clarification, elaboration, and illustrative examples, and use your molecular models to aid with 3-D visualization. Practice applying your knowledge by working through problems. Then do more problems. Be careful—to learn, you must work at a problem independently before you look to the solution for answer verification or to get a quick hint.

GRADING SCHEME, DEADLINES & ABSENCES: *To pass the course, you must earn $\geq 50\%$ on your combined Final Exam, Mid-Term Exam and In-Class Quiz scores (not including bonus marks) **AND** $\geq 50\%$ on the Lab Exam Final.* Grading scheme:

Homework:	5%	(initial review homework = 2%, best 6/8 = 3%, selected problems will be graded, due dates TBA)
Quizzes (in-class):	10%	(2 x 5% each, 10 multiple choice + 1 short answer, in-class, Oct. 2 nd and Nov. 18 th)
Mid-Term Exam:	20%	(during class time on Oct. 28 th , mostly short answer, some multiple choice)
Laboratory Marks:	25%	(lab reports 15%; lab exam 10% held during class time on Nov. 27 th)
Final Exam:	40%	(<i>covers entire course content</i> , scheduled by Exams Office)

If absent from an examination, you must produce a written excuse on letterhead paper, appropriately signed (e.g., by doctor or employer), **no later than one week** after the exam. If you know you will be absent in advance, contact me to arrange alternative arrangements. The Department determines the validity of the absence and necessary arrangements will be made. If **no valid reason** is produced, the student will receive a **zero** grade for the missed test.

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015

STRATEGIC LEARNING (see also http://learning.concordia.ca/SL_basics.shtml)

Research shows that students who attend Strategic Learning groups earn higher grades and withdraw less often than students who do not participate. Strategic Learning (SL) leaders are undergraduate students who have recently taken the selected course and done well in it. Their role is to facilitate collaborative learning among students who attend the groups. They are trained so that they can help students develop effective learning and study strategies appropriate to course material. Their role is NOT to lecture and teach course content but rather to help students interact with course material using effective learning strategies. The SL sessions integrate how to learn with what to learn. Students have the opportunity to become actively involved in the course material as the SL leaders use the text and lecture notes as vehicles for improving students' study skills and learning strategies and thus their understanding of course content. Sessions of one hour each are scheduled outside class time, usually at different times each week. Attendance is voluntary; groups are open to all students in the class throughout the semester. Early in the term, the SL leader assigned to our course will introduce himself / herself to the class and announce the times and locations of the SL sessions. **I strongly encourage you to take advantage of this free programme!**

MANDATORY QUIZ AND SEMINAR

As part of this course, you are *required* to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (note: passing grade for the quiz is 100%). The aim of this seminar is to clarify the academic conduct code in terms of what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. You are only exempt from repeating the seminar and the quiz if you have done both in Fall 2010 or more recently,* otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that late-comers will not be admitted):

Date	Time	Place
Monday, Sept. 21	16:45-17:45	CC-310
Tuesday, Sept. 22	16:45-17:45	CC-310
Tuesday, Sept. 22	20:45-21:45	HC-155
Wednesday, Sept. 23	16:45-17:45	CC-310
Wednesday, Sept. 23	20:45-21:45	SP-S110
Thursday, Sept. 24	16:45-17:45	CC-310
Friday, Sept. 25	16:45-17:45	CC-310

As space for each of the seminars is limited by the room size, please sign up to your preferred time. Sign up sheets are available outside SP 201.01 (Departmental office).

If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.6) for details on removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the CHEM 101 Moodle site (for guest login, go to: <http://moodle.concordia.ca/moodle>, Arts and Science, Chemistry and Biochemistry, Specialized Chemistry Sites, CHEM 101, look under FAQ).

PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY:

The academic code of conduct can be found in section 17.10 of the academic calendar (<http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html>). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change without notice.

FINAL LETTER GRADES: The letter grades for the course will be based on the following scale:

A+ = 87 – 100%	A = 83 – 86%	A- = 80 – 82%
B+ = 77 – 79%	B = 73 – 76%	B- = 70 -72%
C+ = 67 – 69%	C = 63 – 66%	C- = 60 -62%
D+ = 57 – 59%	D = 53 – 56%	D- = 50 - 52%
F = < 50%		

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015

LABORATORY INFORMATION

The laboratory coordinator is Marika Dochia, SP201.10, Tel. (514) 848-2424 ext. 5976, marica_dochia@hotmail.com. **All questions on matters related to the lab component of the course should be addressed to her.** All students must attend the section for which they are registered. Changes will be considered only in exceptional circumstances (e.g., course conflict). If you miss a lab, you must provide a medical note, or you will receive a grade of zero. **Only one absence is allowed.** Laboratory performance is graded on the quality of the experimental work and the report, as well as the Lab Exam.

The Chem 222 laboratories are located in SP-112. Starting the week of Sept. 14th, you will have a lab EVERY week except for the mid-winter break week; please refer to the attached schedule of experiments. Each laboratory section will have one or two demonstrators (TAs); be sure to write down your TAs' contact information in case you need to reach them.

Materials required for labs:

- 1) J. W. Lehman, *Operational Organic Chemistry*, 4th Ed., Prentice Hall Publishing; (at University Bookstore)
- 2) *Organic Chemistry II, Laboratory Manual*, Dept. of Chemistry & Biochemistry;
- 3) a lab coat and safety glasses (**mandatory**, to be worn at all times in the lab).

Students who are repeating the course, and have passed the lab component within the past two (2) years, may request a lab exemption. Applications for the exemption (forms available in SP201.01) must be submitted by 11 September (i.e. prior to the start of the laboratory); late applications will not be accepted. Signed and completed forms are to be returned to Hilary Scuffell, (SP 275.01). Students **MUST** register for the appropriate lab exemption lab/tutorial section (section 56); students registered in any other lab/tutorial sections will be required to complete the lab portion of the course (No exceptions). Students who withdraw from the course must also check out from the lab. Only students officially registered in the course may attend the lab and receive a grade for lab work.

CHEM 222 LABORATORY SCHEDULE, WINTER 2015

Date:	Experiment No.	Title:
Mon. Sept. 14 - Fri. Sept. 18	Check In / Safety Instructions & Exp. 4	Synthesis of Salicylic Acid from Wintergreen Oil
Mon. Sept. 21 - Fri. Sept. 25	Exp. 11 (Wk # 1)	Identification of Unknown Ketones
Mon. Sept. 28 - Fri. Oct. 2	Exp. 11 (Wk # 2)	Identification of Unknown Ketones (NMR demonstration)
Mon. Oct. 5 - Fri. Oct. 9	Exp. 7	A Green Synthesis of Camphor
Mon. Oct. 12 - Fri. Oct. 16	Thanksgiving - No Labs	
Mon. Oct. 19 - Fri. Oct. 23	(Hand – Out, see Moodle)	Haloform Oxidation of 4'-Methoxyacetophenone (IR / solid demonstration)
Mon. Oct. 26 - Fri. Oct. 30	Exp. 20	Reaction of Iodoethane with Sodium Saccharin, an Ambient Nucleophile (NMR)
Mon. Nov. 2 - Fri. Nov. 6	Exp. 30	Synthesis of Triphenylmethanol and the Trityl Carbocation
Mon. Nov. 9 - Fri. Nov. 13	Exp. 30	Synthesis of Triphenylmethanol and the Trityl Carbocation
Mon. Nov. 16 - Fri. Nov. 20	Exp. 29	Borohydride Reduction of Vanillin to Vanillyl Alcohol
Mon. Nov. 23 - Fri. Nov. 27	Exp. 9	Isolation and Isomerization of Lycopene from Tomato Paste (UV) & Check Out

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015

Dr. Pat Forgione

Readings & problems from: CHEM 222 Course Pack (available in the bookstore and on reserve in library).

- You are **NOT** responsible for every section of each chapter; consult the readings list & lecture notes from class.
- Use this schedule (*subject to change*) as a guideline to keep on track with your reading & to plan your study goals.

Lecture	Topics	Suggested Reading	Suggested problems
1	Introduction, Syllabus, Review	Review Org I Material	S _N 1/2, E1/E2, resonance structures etc. (see below for additional material)
2	Mass Spectrometry: Fragmentation, isotopes (UV/Vis for lab)	3-21 40-48	12.41, 12.47, 12.53
3	IR: fingerprint and characteristic bands	21-40	12.43cdijk, 12.45, 12.49, 12.54a, 12.57-58ac, 12.61, 12.63, 12.65-66, 12.69a
4	NMR: spin state, equivalent proton, resonance	61-68	13.43
4	NMR: chemical shift, integration and splitting	69-88, 92-96, 99-102,	13.45, 13.46, 13.48a-g, 13.50-51, 13.54, 13.57, 13.62, 13.66, 13.69
5	NMR: complex splitting. ¹³ C NMR Index of hydrogen deficiency.	102-107	13.55, 13.59
6	Structure determination: problem solving		13.56, 13.61, 13.71bcd-72
7	Conjugated diene: conjugation and UV-Vis spectroscopy	40-46, 131-136, 148-154	14.21, 14.39, 14.40, 14.43-44,
8	Conjugated diene: kinetic vs thermodynamic control.	136-140	14.22abcd, 14.23-24,
9	Conjugated diene: kinetic vs thermodynamic control Alcohols: acidity and basicity.	165-167, 168-170, 174-176	14.25, 14.51 11.25-26abcde
10	Alcohols: addition, substitution.	172-174, 177-184	11.27-30a, 11.32
11	Alcohols: oxidation, elimination, protection and spectroscopy.	97-99, 189, 213-224, 238	11.34-35, 12.13abde, 12.15a, 12.16-17abc
12	Ether and epoxide: synthesis and reaction	167-170, 186-188, 190-196, 198-199	11.26fghij, 11.38-40defij, 11.41ab, 11.42-43, 11.47-48
13	Benzene: nomenclature and aromaticity	249-266	15.18-22, 15.29, 15.33-34, 15.37

14	Diels Alder reaction	141-146	14.26-35, 14.48
15	Electrophilic aromatic substitution: mechanism and activation	281-288, 295-300	McMurry 16.29-30, 16.37-38, 16.51
16	EAS: directing effect	300-306	McMurry 16.28, 16.32-33, 16.40, 16.43, 16.49-50, 16.52, 16.53-54
17/18	Friedel-Craft reactions and reaction on substituents	290-295, 311-319	McMurry 16.31a-g, 16.34-36abc, 16.45-47, 16.48, 16.55a, 16.68-69
18/19	Carbonyl: introduction. Aldehyde and Ketone: nucleophilic addition	211-213, 335-343, 346-348	Brown 16.15-16a-h
19	Aldehyde and Ketone: reduction, hydration, Grignard reagent	225-238, 343-345, 351, 374-377	Brown 16.19-22
20	Aldehyde and Ketone: acetal, imine and enamine formation,	351-358, 361-364, 377-379	Brown 16.31, 16.36, 16.43
21	Aldehyde and Ketone:, Wittig reactions. Carboxylic acids: nomenclature, acidity	348-350, 397-406	Brown 16.24-25, 16.54a-c,e-j, 16.55a-c,e-j, 16.56-57, 16.60-61, 17.7a-d, 17.8-9, 17.17, 17.25-28
22	Carboxylic acids: formation and hydration	406-407, 409-417	Brown 17.18ad, 17.19bcd, 17.20a-e,g, 17.21-23, 17.32-33, 17.35
23	Carboxylic acid derivatives: Reaction, Hydrolysis, nucleophilic acyl substitution	431-466	18.13-14a,b-f, i, 18.17-21, 18.24abc, 18.25-30, 18.32-33, 18.35, 18.41, 18.45, 18.47-48
24	Enols and enolates: tautomerization, bromination and alkylation	365-372	Brown 16.50
25	Enols and enolates: Aldol and Claisen condensation. Amine: Basicity and alkylation	483-485, 493-495, 533-542, 546-552, 555-565, 570-571	20.19abcqst, 20.20abei, 20.22a-e, 20.23a, 20.24a, 20.25abc, f-m, 20.26, 20.30a-d, g 20.31a-j, m

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015

Dr. Pat Forgione

Readings & problems from: Jones/Fleming, *Organic Chemistry*, 4th Ed., Norton Publishing.

- Although the CHEM 222 Course Pack (see above) is the official course material for the class, the equivalent from Jones/Fleming is provided below that was used in previous years for this course. You are **NOT** responsible for this material but it may help provide alternative explanations if you require.
- Read the Introduction of the textbook, pages xxxiii-xxxix, this gives suggestions on how to use the textbook and some excellent advice on how to study organic chemistry.

Week	Topics	Readings	Suggested Problems
1	Introduction (<i>Review Chem 221</i>)	(<i>Ch. 1-5, 7-10</i>)	
1	Spectroscopy (Section 1 Chem 222 Course Pack)	15.1 - 15.6, 15.8, (see "Specific Advice", p. 751)	6.4, 6.7-6.9, 6.11, 6.17, 6.29, 6.30, 10.8-10.9, 10.12, 10.16-10.17, 10.21-10.22, 10.31- 10.32, 10.33 (a-f), 10.34, 10.39 (a-i), 10.46- 10.47, 10.50, 10.52
2			
3	Reactions of alcohols, ethers, epoxides & related reactions (Section 2 Chem 222 Course Pack)	6.1 - 6.5, 6.7, 10.1, 10.3 -10.5	12.15, 12.17-12.19, 12.21-12.22, 12.24, 12.28-12.30, 12.38, 12.40, 12.42-12.46, 12.48-12.49, 12.52-12.53, 12.60-12.62
4	Dienes and the Allyl System (Section 2 Chem 222 Course Pack)	12.1, 12-5 – 12-7, 12-9 – 12.12	13.7, 13.8, 13.14, 13.17, 13.20, 13.23, 13.26, 13.27, 13.31-13.34, 13.36-13.37, 13.43, 13.44-13.47, 13.51, 13.54
5	Conjugation and Aromaticity (Section 3 Chem 222 Course Pack)	13.1 – 13.12	14.1, 14.4-14.6, 14.8, 14.11-14.14, 14.16, 14.18, 14.19, 14.21-14.22, 14.27, 14.28, 14.30-14.32, 14.34-14.37, 14.45-14.46, 14.49, 14.51, 14.54-14.55, 14.57, 14.59- 14.60, 14.63
6	Substitution Reactions of Aromatics (Section 3 Chem 222 Course Pack)	14.1 – 14.	15.2-15.4, 15.7, 15.10, 15.12-15.14, 15.16, 15.18, 15.21-15.22, 15.23, 15.26, 15.32, 15.33-15.35, 15.37, 15.39-15.43, 15.50- 15.56, 15.58, 15.64, 15.73, 15.80-15.83
8	Carbonyl Chemistry I (Section 4 Chem 222 Course Pack)	16.1-16.15	16.32 (a-d), 16.37 (a-f), 16.38(a,d), 16.39 (a- k), 16.40 (a-c), 16.42 (a-e), 16.44, 16.46, 16.48 (a-d), 16.49d, 16.52, 16.58-16.60, 16.64
9	Carboxylic Acids (Section 4 Chem 222 Course Pack)	17.1-17.7	17.25e, 17.28 (c,f), 17.30(a-g), 17.31(d-h), 17.34, 17.35, 17.39, 17.42, 17.43a, 17.45, 17.48, 17.49, 17.51
10	Derivatives of Carboxylic Acids (Section 4 Chem 222 Course Pack)	18.1 – 18.11	18.33b, 18.35, 18.37, 18.38c, 18.40, 18.42, 18.43, 18.50(a-d), 18.55
11/12	Carbonyl Chemistry II (Section 4 Chem 222 Course Pack)	19.1-19.9, 19.11- 19.12	19.47, 19.49 (a-e), 19.50, 19.53(a-b), 19.54a, 19.58, 19.61, 19.62, 19.65-19.66, 19.68a, 19.70, 19.73, 19.75a, 19.79, 19.84
13	Amine Chemistry / Review (Section 5 Chem 222 Course Pack)		
	Final Exam (40 %)		Scheduled by the Examinations Office

CHEM 222 - INTRODUCTORY ORGANIC CHEMISTRY II - Fall 2015

Dr. Pat Forgione

What you are expected to know before you take this class:

CHEM 221 Introductory Organic Chemistry I (3 credits)

Basic aspects of orbitals and their role in covalent bonding; delocalization of electrons. Alkanes: structure, nomenclature, isomerism, reactions. Introductory stereochemistry: enantiomers, diastereomers, conformers, Fischer and Newman projections, specification of chirality, E/Z isomerism. Conformations of cyclic compounds. Alkylhalides: SN1; SN2; E1; E2 reaction mechanisms. Free-radical reactions, organometallic compounds. Chemistry of alkenes, alkynes, and dienes

Detailed Course Topics:

Atoms & Molecules; Orbitals & Bonding (Jones - Chapter 1)

- Atoms, atomic orbitals and molecular orbitals, covalent bonds and Lewis structures, **resonance and arrow pushing (very important to review)**, bond strength and reactivity.

Alkanes (Jones - Chapter 2)

- Hybrid orbitals, Newman projections, conformational analysis, naming and nomenclature, constitutional isomers, rings, physical properties.

Alkenes & Alkynes (Jones - Chapter 3)

- Structure and bonding of alkenes and alkynes, derivatives and isomers of alkenes and alkynes, nomenclature, physical properties, molecular formulas and degree of unsaturation, reactions, mechanism and regiochemistry of addition reactions, hydration reaction.

Stereochemistry (Jones - Chapter 4)

- Chirality, the R/S convention, properties of enantiomers, optical activity, diastereomers and molecules with more than one stereocenter, resolution, stereochemistry of rings, isomerism.

Rings (Jones - Chapter 5)

- Rings and strain, conformations of cyclohexane, monosubstituted and disubstituted rings, bicyclic compounds.

Alkyl Halides, Alcohols, Amines, Ethers (Jones - Chapter 6)

Alkyl halides – nomenclature and structure, alcohols, solvents, amines, ethers.

Nucleophilic Substitution/Elimination Reactions (Jones - Chapter 7) – very important chapter to succeed in Chem222!

- **Lewis Acids and Lewis Bases, substitution reactions, SN1 and SN2; mechanisms; factors affecting type and rate of substitution (structure, transition state stability, solvent, leaving group); nucleophilicity; stereochemistry of products; elimination Reactions, E1 and E2 mechanisms; regioselectivity; stereochemistry of elimination reactions.**

Equilibria (Jones Chapter 8)

Thermodynamics and kinetics, transition state and activation energy, reaction mechanism, reaction coordinate diagrams.

Addition to Alkenes and Alkynes (Jones - Chapter 9 & 10)

- hydrogen halides, bromination, electrophilic addition, carbocations, inductive effect, hydration, polymerization, hydroboration, hydrogenation, oxymercuration, epoxides, ozonolysis, hydration of alkynes, reduction of alkynes; keto/enol tautomerization.

Radicals (Jones - Chapter 11)

- Formation of radicals, addition of radicals; initiation, propagation, & termination; halogenation of alkanes; stability of alkyl radicals.

PARTIAL LIST OF CONCORDIA UNIVERSITY SERVICES...take advantage, they are there for your benefit!

1. Concordia Counselling and Development offers career services, psychological services, student learning services, etc.
<http://cdev.concordia.ca/>
2. The Concordia Library Citation and Style Guides: <http://library.concordia.ca/help/howto/citations.html>
3. Advocacy and Support Services: <http://supportservices.concordia.ca/>
4. Student Transition Centre: <http://stc.concordia.ca/>
5. New Student Program: <http://newstudent.concordia.ca/>
6. Access Centre for Students with Disabilities: <http://supportservices.concordia.ca/disabilities/>
7. Student Success Centre: <http://studentsuccess.concordia.ca/>
8. The Academic Integrity Website: <http://provost.concordia.ca/academicintegrity/>
9. Financial Aid & Awards: <http://web2.concordia.ca/financialaid/>
10. Health Services: <http://www-health.concordia.ca/>
11. etc. etc. etc.

SELECTED WORKSHOPS

First-year Experience Seminars are suitable for all students who are new to university-level study:

<http://cdev.concordia.ca/workshops-and-events/workshops/first-year/>

Counselling and Development Workshops cover a wide range of topics related to personal, academic and career development:

<http://cdev.concordia.ca/workshops-and-events/workshops/>

Student Experience Seminars are facilitated by the Student Success Mentors, who provide practical information and strategies from a student perspective:

<http://cdev.concordia.ca/workshops-and-events/workshops/student-experience/>

PLUS Leadership Workshop Series is designed to introduce students to the basic skills and knowledge needed to become effective leaders. A certificate is awarded to students who complete the entire series.

<http://cdev.concordia.ca/workshops-and-events/workshops/plus/>