UNIVERSITY COLLEGE OF THE FRASER VALLEY

COURSE INFORMATION

DISCIPLINE/DEPARTMENT: Chemistry **IMPLEMENTATION DATE**: Fall 1976

Revised: ~~May 1997~~

Chemistry 212	Organic Chemistry II	4
SUBJECT/NUMBER OF COURSE CREDITS	**DESCRIPTIVE TITLE**	**UCFV**

CALENDAR DESCRIPTION: CHEM 212 continues the systematic examination of the reactions of the common functional groups that was begun in Chem 211. Aromatic compounds, aldehydes and ketones, carboxylic acids and their derivatives, carbohydrates, and amino acids are studied. In addition, selected topics of biological interest are also examined, including peptides and the Krebs Cycle. The importance of spectroscopic techniques in the analysis of organic compounds is emphasized. These techniques play a major role in the laboratory component of the course. The laboratory component of this course consists of eight four-hour sessions over the semester.

RATIONALE: With Chem 211, this course satisfies organic chemistry requirements for students pursuing careers in chemistry, biology, biochemistry, home economics, forestry, pre-medicine and pharmaceutical science.

COURSE PREREQUISITES: Chem 211

COURSE COREQUISITES: None

HOURS PER TERM FOR EACH STUDENT	**Lecture**	**46**	**hrs**	**Student Directed Learning**		**hrs**
	Laboratory	**32**	**hrs**			
	Seminar		**hrs**	**Other - specify:**		
	Field Experience		**hrs**	**Exams**	**6**	**hrs**
				TOTAL	**84**	**HRS**

MAXIMUM ENROLMENT: 24

Is transfer credit requested? : Yes 9 No

AUTHORIZATION SIGNATURES:

Course Designer(s): Peter W. Slade **Chairperson**: T. Cooper
Curriculum Committee

Department Head: A. Last **Dean**: K. Wayne Welsh

PAC: Approval in Principle _____ **PAC: Final Approval**: November 27, 1996
(Date) **(Date)**

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SYNONYMOUS COURSES:

(a) replaces N/A
(course #)

(b) cannot take N/A for further credit
(course #)

SUPPLIES/MATERIALS:

Laboratory supplies required.

TEXTBOOKS, REFERENCES, MATERIALS (List reading resources elsewhere)

TEXTS: Organic Chemistry, 4th edition, John McMurry (Brooks/Cole)
UCFV Laboratory Manual for Chemistry 211 and 212

REFERENCES: Organic Chemistry, 3rd edition, L.G. Wade Jr. (Prentice-Hall)
Organic Chemistry, 6th edition, Morrison and Boyd (Allyn and Bacon)
Organic Chemistry, 3rd edition, Fessenden & Fessenden (Brooks/Cole)
Organic Chemistry, 5th edition, T.W.G. Solomons (John Wiley & Sons)

OBJECTIVES:

Students enrolling in this course will be pursuing careers in chemistry or biology notably, but also other careers requiring a strong background in chemistry.

GENERAL: Students will understand the fundamental principles of organic chemistry.

SPECIFIC: It is intended that students will be able to:

1. Understand the basic principles underlying organic chemistry and apply them to new situations using a systematic and logical approach (e.g., in reaction syntheses).
2. Perform laboratory syntheses and analyses with care, precision, and confidence.
3. Relate the information obtained in laboratory experimentation to the theoretical presentations in class sessions.
4. Appreciate the connection between organic syntheses and biological systems, where applicable.

METHODS:

Presentation of the course will be by inter-related class (theory), seminar, and laboratory sessions. Class sessions will promote active student participation to ensure continual mutual feedback in order to reinforce the learning process. Films and audio-visual aids will be used where appropriate. Problem assignments will be continually given. Some selected problems will be collected and marked.

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STUDENT EVALUATION PROCEDURE:

This will be conducted under a flexible system guided by the following:

Laboratory (reports and techniques)	25%
Mid-term examinations (2)	40%
Class participation and instructor's assessment	5%
Final examination	30%

COURSE CONTENT: All references are to McMurry (McM)

Aromatic Compounds: McM ch. 15, ch. 16. Benzene and related compounds. Aromaticity, Huckel's rule, common aromatic heterocyclic compounds. Nomenclature of benzene derivatives. Electophilic substitution (nitration, alkylation halogenation, sulphonation), mechanism and effect of substituents on rate and position of substitution. Side chain derivatives.

Phenols: McM ch. 25 (25.4 - 25.9). Structure and nomenclature. Physical properties (H-bonding, acidity - contrast with alcohols and acids). Preparations and reactions (ring substitution, ether formation, effect of ring substitution on acidity).

Spectroscopy: McM ch. 12 (12.4 - 12.8) & ch. 13. Infra-red - bond stretching and bending, identification of major functional groups by stretching and bending modes (C-H, C=O, C=C, O-H, COOH, N-H, N-O). P.M.R. - basic concepts, shielding, chemical shift, spin-spin coupling, application to spectra. Determination of unknown structures by i.r. and p.m.r. spectroscopy. General application to lab work.

Carboxylic Acids and Derivatives: McM ch. 20, ch. 21 (omit 21.10), *28.1, *28.2. Review of nomenclature. Preparation (oxidation, Grignard reagents, hydrolysis of nitriles). Reactions (conversion to esters, amides, anhydrides, acid chlorides) and acidity. Nucleophilic acyl substitutions to acids and their derivatives using reaction mechanisms. Use of acids and derivatives in multi-step syntheses. *Fats, soaps, and detergents.

Aldehydes and Ketones: McM pp 705-715; ch. 19 (omit 19.15, 19.17); ch. 22 (22.3 - 22.5 & 22.7); ch. 23 (23.1 - 23.7 & [23.8 -23.9]). Review of nomenclature. Preparation (oxidation, reduction of acid chlorides, acylation). Reactions (oxidation; reduction; nucleophilic addition - Grignard, acetals/ketals, cyanohydrins; condensation - aldol, crossed aldol, [Claisen]), Cannizzaro reaction. Use of crossed aldol reactions in multi-step syntheses.

Amines: McM ch. 24, ch. 25. Nomenclature, preparation (reduction of nitro compounds, alkylation, reductive amination, reduction of nitriles, Gabriel method. Basicity and effect of ring substitution of electron donating and electron withdrawing groups on the basicity of aromatic amines. Reactions of amines with alkyl halides, benzene sulphonyl chloride, and nitrous acid. Use of diazonium compounds in multi-step syntheses and in coupling reactions. Sulphanilamide and sulpha drugs: synthesis and function.

Carbohydrates: McM ch. 26. Classification, particularly of the aldose series. Structures of monosaccharides (Fischer, Haworth, and chair forms, as applicable). Reactions of aldoses and ketoses
(particularly glucose and fructose) - oxidation, reduction, osazone formation, Kiliani-Fischer and Ruff reaction series, mutarotation. Di- and polysaccharides (sucrose, maltose, lactose, starch, cellulose), particularly their structures, linkages, and major properties.

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Amino Acids and Proteins: McM ch. 27. Structures and nomenclature of amino acids. Isoelectric point, cationic, anionic, and zwitterionic forms. Synthesis of amino acids by ammonolysis, amination, (Strecker synthesis), modified Gabriel and Gabriel/malonic ester methods. Protein structures and polypeptide syntheses.

Citric Acid Cycle/Krebs Cycle: McM ch. 30 and/or instructor handouts. Study of glycolysis and Krebs Cycle to demonstrate biochemical efficiency. Study of Krebs Cycle to illustrate previously discussed reactions: (a) aldol condensation, (b) dehydration, (c) hydration, (d) oxidation, and (e) decarboxylation.

LABORATORY EXPERIMENTS

To be selected from:

1. Biosynthesis of Ethanol (semester-long project)
2. Synthesis and Separation of Ortho- and Para-Nitrophenols (two week)
3. Infra-red Spectroscopy: Liquid and Solid Samples
4. Synthesis of a Carbonyl Compound: Synthesis of Sulcatol
5. Reactions of Carbonyls:
   a) Qualitative Characterization of Aldehydes and Ketones
   b) Identification by 2,4-dinitrophenyl hydrazone and Semicarbazone Derivatives
6. Carboxylic Acids and their Derivatives (amide and anilide)
7. Syntheses of Amines (tribromoaniline, p-bromoacetanilide, p-bromoaniline)
8. Reactions of Amines: Characterization by Derivative Formation and Identification

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COURSE CONTENT: (contd.)