COWLEY COLLEGE
& Area Vocational Technical School

COURSE PROCEDURE FOR

ORGANIC CHEMISTRY II
CHM 4251 5 Credit Hours

Student Level:
This course is open to students on the college level in the sophomore year.

Catalog Description:
CHM4251 - ORGANIC CHEMISTRY II (N) (5 hrs)
A continuation of CHM5250 Organic Chemistry I. This course is an introduction to NMR, IR, and mass spectroscopy, synthetic organic chemistry, and compounds of biological interest. This course is for science and pre-professional students and includes laboratory experimentation.

Prerequisite:
CHM 4250 Organic Chemistry I and basic computer skills.

Controlling Purpose:
This is the second semester of a two-semester course in organic chemistry. This material will allow the student to become functional in the mechanistic rational for the behavior of organic reactants and important synthetic reaction mechanisms. The student will also be able to read and interpret IR, MNR, and mass spectrometer data.

Learner Outcomes:
Upon completion of the course, the student will have the conceptual tools to understand and apply the relationship between the structures of organic compounds and their properties.

Units Outcomes and Criterion Based Evaluation Key for Core Content:
The following defines the minimum core content not including the final examination period. Instructors may add other content as time allows.

Evaluation Key:

A = All major and minor goals have been achieved and the achievement level is considerably above the minimum required for doing more advanced work in the same field.

B = All major goals have been achieved, but the student has failed to achieve some of the less important goals. However, the student has progressed to the point where the goals of work at the next level can be easily achieved.

C = All major goals have been achieved, but many of the minor goals have not been achieved. In this grade range, the minimum level of proficiency represents a person who has achieved the major goals to the minimum amount of preparation necessary for taking more advanced work in the same field, but without any major handicap of inadequacy in his background.

D = A few of the major goals have been achieved, but the student's achievement is so limited that he is not well prepared to work at a more advanced level in the same field.

F = Failing, will be computed in GPA and hours attempted.

N = No instruction or training in this area.

UNIT I: CARBOXYLIC ACIDS AND THEIR DERIVATIVES

Outcomes: Upon completion of this unit, the student will understand the properties, nomenclature and reactivity of carboxylic acids and their derivatives.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						List the structure and reactive sites of carboxylic acids and their derivatives.
						Demonstrate the mechanism for the synthesis of carboxylic acids..
						Propose a synthetic reaction sequence for the acid chlorides, esters, and hydrolysis products of carboxylic acids.
						Describe the rational for the acidity of carboxylic acids.

UNIT II: SYNTHETIC TRANSFORMATIONS OF CARBOXYLATES

Outcomes: Upon completion of this unit, the student will have gained an understanding of synthetic transformations of carboxylates.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Describe the synthesis of a Grignard reagent.
						Illustrate a synthesis of a carboxylic derivative with an organometallic reagent.

UNIT III: ENOLS & ENOLATES

Outcomes: Upon completion of this unit, the student will have gained an understanding of Alkylation and Condensation of Enols and Enolates.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Relate the structure, nomenclature and reactivity of nucleophilic enols.
						Differentiate between thermodynamic and kinetic regioselectivity of enoltes.
						Describe the reactions of enols and enolates with carbonyls and carbanions.

UNIT IV: DIELS-ALDER & POLYENES

Outcomes: Upon completion of this unit, the student will have gained an understanding of Diels-Alder and Addition reactions of Polyenes.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Relate the structural details and nomenclature of polyenes.
						Illustrate the reaction pathways for Diels-Alder reactions.
						Describe the stereospecific, bicyclic, and unsymmetrical products of Diels Alder reactions.
						Demonstrate relationship between structure and wavelength in ultraviolet spectroscopy.

UNIT V: UNSATURATED CARBONYL & CARBANION

Outcomes: Upon completion of this unit, the student will have gained an understanding of the structure and reactivity of unsaturated carbonyl and carbanions species of Ylides.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Describe the reactions of electrophilic unsaturated carbonyls with nucleophiles.
						Diagram a Michael reaction and a Wittig reaction of a carbonyl compound.

UNIT VI: AROMATIC ELECTROPHILIC REACTIONS

Outcomes: Upon completion of this unit, the student will have gained an understanding of the structure and reactivity of aromatic compounds.

A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Demonstrate knowledge of aromaticity from structural and theoretical considerations.
						Relate nomenclature for aromatic compounds.
						Describe electrophilic reactions and sulfonation of aromatics.
						Distinguish between activators, deactivators and director substituents of benzene rings.
						Postulate a Friedel-Crafts Alkylation and Acylation synthesis.

UNIT VII: RADICAL REACTIONS OF ALKANES Outcomes: Upon completion of this unit, the student will have gained an understanding of free radical reactions of alkanes.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Describe halogenation of alkane radicals and detail a mechanistic pathway.
						Illustrate Anti-Markovnikov additions with bromides.
						Describe the oxidation and auto-oxidation of free radicals and phenols in biochemical species.

UNIT VIII: AMINES Outcomes: Upon completion of this unit, the student will have gained an understanding of the chemistry of Amines.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Describe the structural basicity of amines.
						Illustrate the structure, nomenclature, and reactivity of amine species.
						Describe the synthesis of an amine.
						Discuss the nitrosation, reduction, and re-arrangements of amines.
						Describe the Hofmann elimination of quaternary amines.

UNIT VIIII: AROMATIC SYSTEMS Outcomes: Upon completion of this unit, the student will have gained an understanding of the synthetic transformations of aromatic systems by nucleophilic substitution, oxidation, and the Sandmeyer reaction.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Discuss the mechanism and transformation of aryl compounds by the Sandmeyer reaction.
						Describe the mechanism and rational for nucleophilic aromatic substitution.
						Describe the synthesis of azo dyes and indicators.
						Discuss the spectroscopic analysis of aromatic species by ultra-violet spectra.

UNIT X: HETEROCYCLIC COMPOUNDS & REACTIVITY Outcomes: Upon completion of this unit, the student will have gained an understanding of Heterocyclic compounds and reactivity.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Express knowledge of nomenclature and structure of heterocycles by identification of species by IUPAC name.
						Discuss the mechanism for the reactions of heterocycles as acids and bases.
						Describe the synthesis of heterocycles with nucleophilic carbonyl compounds.
						Discuss the mechanism of importance for biologically active heterocycles.

UNIT XI: CARBOHYDRATES Outcomes: Upon completion of this unit, the student will have gained an understanding of the chemistry and structure of carbohydrates.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Illustrate the structure and nomenclature of carbohydrates by drawing and naming.
						Discuss the stereochemical configuration and biological importance of stereochemical carbohydrates.
						Differentiate relative and absolute configurations of carbohydrates and chiralty with Fischer projections.
						Discuss the reactions of monosaccharides as carbonyl compounds.
						Discuss the synthetic transformation of monosaccharides and the characteristics of polysaccharides, and other naturally occurring sugars.

UNIT XII: ELECTROCYCLIC, CYCLOADDITION, & CARBENE CONCERTED REACTIONS Outcomes: Upon completion of this unit, the student will have gained an understanding of electrocyclic, cycloaddition, and carbene concerted reactions.						
A	B	C	D	F	N	Specific Competencies Demonstrate the ability to:
						Discuss the evolution of the concerted reaction theory.
						Describe photochemical dimerization and the MP picture of the Diels-Alder reaction.
						Illustrate electrocyclic reactions of cyclobutenes and cyclohexatrienes.
						Discuss the mechanism of the Cope re-arrangement.
						Discuss the Claisen re-arrangement.

Projects Required:
None

Textbook:
Contact the Bookstore for current textbook information.

References:
MSDS Catalogue, CRC Handbook of Chemistry and Physics, the Merck Index

Materials/Equip:
Organic lab glassware, Gas Chromatograph, PC computers, Fume Hood, Organic molecular model kits, Mel-temps.

Attendance Policy:
Students should adhere to the attendance policy outlined by the instructor in the course syllabus.

Grading Policy:
The grading policy will be outlined by the instructor in the course syllabus.

Maximum class size:
Based on classroom occupancy

Course Timeframe:
The U.S. Department of Education, Higher Learning Commission and the Kansas Board of Regents define credit hour and have specific regulations that the college must follow when developing, teaching and assessing the educational aspects of the college. A credit hour is an amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally-established equivalency that reasonably approximates not less than one hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work for approximately fifteen weeks for one semester hour of credit or an equivalent amount of work over a different amount of time. The number of semester hours of credit allowed for each distance education or blended hybrid courses shall be assigned by the college based on the amount of time needed to achieve the same course outcomes in a purely face-to-face format.

Refer to the following policies:

402.00 Academic Code of Conduct
263.00 Student Appeal of Course Grades
403.00 Student Code of Conduct

Disability Services Program:
Cowley College, in recognition of state and federal laws, will accommodate a student with a documented disability. If a student has a disability which may impact work in this class which requires accommodations, contact the Disability Services Coordinator.