UNIVERSITY OF GUAM DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 310a

ORGANIC CHEMISTRY (3 CREDIT HOURS) FALL 2015

Instructor:	Dr. N. K. Suleman. Email: nsuleman@uguam.uog.edu
Office and Lab:	227 Science Building (Phone: 735-2834); Instrument Laboratory: Science 220
Office Hours:	M 9:50-10:50 AM & 12:30-2:00 PM; T 12:50-1:50 PM; W 9:50-10:50 AM & 12:30-2:00 PM. **Important Note**: During office hours, the instructor will be in either SC 227 or SC 220. Please check both locations if necessary.
Catalog Course Description:	CH 310a is the first semester of a full year lecture sequence covering the general principles of organic chemistry with emphasis on structure, stereochemistry, nomenclature, basic reactions and mechanisms, and the occurrence and uses of the main classes of compounds.
Prerequisite:	CH 103 & CH 103L
Rationale for Offering the Course:	CH 310a is designed primarily for science and engineering majors who require a rigorous introduction to organic chemistry. This course will also provide the necessary background for more advanced courses in chemistry such as CH 310b (Organic Chemistry II) and CH/BI 419 (Biochemistry).
Time & Location:	MW 11:00-12:20, Room Sc 221. CH 310a will meet for 160 minutes of lecture each week.
Required Text:	Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2013.
Optional Text:	Student Solutions Manual for Organic Chemistry, 8th ed., L. G. Wade, Jr. & J. W. Simek, Prentice Hall, Boston, 2012.
Required Molecular Models:	Molecular (HGS) Model Set for Organic Chemistry, The HGS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.
Contents of Course:	The specific topics to be covered are detailed on page 9 of this syllabus.
Learning Objectives:	Detailed learning objectives for each chapter are listed on pages 3-8 of this syllabus.
Format and Activities:	Classroom time will be spent primarily on the presentation and discussion of specific topics in organic chemistry by the instructor. This will frequently be followed by interactive problem solving sessions involving the entire class.

Moodle: **http://campus.uogdistance.com/:** It is essential that all the students in this class join the Moodle group by 8/21/2015. All assignments, lesson plans, handouts and copies of previous tests will be posted on Moodle. The instructor will also periodically send messages to the class through Moodle. The **enrollment key** for this class is: **CH 310a-01F2015**

Evaluation and Grading Criteria: An American Chemical Society (ACS) standardized final exam (200 points) will account for 33.3% of the course grade. 2 exams, 3 quizzes (announced and unannounced), as well as homework, will account for the remaining 66.6% of the course grade. Students caught cheating on an examination will fail the course. In the event an exam is missed, that exam will not be counted in the final course grade, providing an excuse can be validated in writing. The instructor will be the judge of the validity of the excuse. **No make-up exams will be provided. Unexcused missed exams will receive a grade of zero.**

GRADING SCALE:

2 Exams + 3 Quizzes + Homework total	**= 400 pts.**
Final Exam Score	**= 200**
Total Points Available	**= 600**

A = 90 % or greater of 600 pts. (540 - 600 pts.), B = 80% (480 - 539pts.), C = 70% (420 - 479 pts.), D = 60 % (360 - 419 pts.) & F < 60 % (000 - 359 pts.)

COURSE POLICIES:

Attendance: Periodic unannounced 10 minute quizzes may be given. Tardy students will have only the remaining time to complete the quiz. Quizzes missed without a valid reason will receive a "0". There will be no make-up quizzes. STUDENTS ARE ALSO ENCOURAGED TO SEE THE INSTRUCTOR REGULARLY DURING OFFICE HOURS.

Cell Phones & Beepers: **Warning!** Students are **required to turn off all such devices during all class and laboratory periods.** The instructor will uniformly apply a **penalty of 25 points** to each student for every infraction. These points will be deducted from the grand total.

EEO/ADA Concerns: If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact me privately to discuss your specific needs. You will need to provide me with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/2971/2243 (TTY) to coordinate your accommodation request.

Course Schedule: A tentative course schedule is provided on page 9 of this syllabus.

Drop Dates: Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.

Student Workload: Aside from the 160 minutes spent in class, it is expected that students will have to devote a minimum of an additional 320 minutes per week in order to make satisfactory progress in CH 310a.

Contact Information on Classmates: Students are encouraged to exchange contact information in order to facilitate and promote scholarly interaction outside the classroom.

Disruption of Class By Conversations Unrelated to Learning: The instructor seeks to generate a highly focused learning atmosphere for all students in the classroom and requests that individuals not engage in personal conversations or other activities that may detract from this goal. The instructor will provide one verbal warning to any disruptive student(s) after which a uniform **penalty of 25 points** will be applied to each student for every infraction. The instructor also reserves the right to dismiss any disruptive student from class. **Important Note**: The instructor wishes to clarify that all students are highly encouraged to address the class and/or the instructor with questions or comments relevant to the objectives of the course.

CHEMISTRY 310a SYLLABUS
(REVISED 8-15)

Text: Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2013.

Course Objectives:
Upon successful completion of this course, the student will demonstrate the ability to:

1. Identify the correct nomenclature of the International Union of Pure and Applied Chemistry and common names for the alkanes, cycloalkanes, alkenes, alkynes, alkyl halides, and alcohols.
2. Predict trends in physical and chemical properties of the alkanes, alkenes, alkynes, alkyl halides, aromatic compounds, alcohols, ethers, aldehydes and ketones including boiling point, reaction rates, optical activity, and acidity based on chemical principles.
3. Draw the interconverting forms of cyclohexane and its derivatives by performing "ring flips".
4. Identify the isomeric and stereochemical relationships between molecules (such as constitutional isomers, enantiomers, diastereomers, meso).
5. Analyze chemical reactions basic to the synthesis of alkanes, alkenes, alkynes, alkyl halides, and alcohols.
6. Analyze common chemical reactions of the alkanes, alkenes, alkynes, alkyl halides, and alcohols.
7. Predict the mode of nucleophilic substitution and elimination reaction pathways of alkyl halides and alcohols based on principles of structure.
8. Write detailed, step by step mechanisms for the common reactions of alkanes, alkenes, alkynes and alcohols.

Student Learning Objectives (SLOs) for Chapters 1-11:

Chapter 1. Introduction and Review

1. Write correct Lewis electron dot formulae for compounds.
2. Interconvert Lewis structures, dash line structures, condensed structures, and bent line structures.
3. Calculate the formal charge on a given atom in a Lewis structure.
4. Calculate the net charge on a polyatomic moiety.
5. Predict the geometry of molecules.
6. Identify bond types as ionic, covalent, and polar covalent on the basis of electronegativity differences.
7. Show the direction of the net dipole moment of simple molecules.
8. Interpret trends in electronegativity in the periodic chart.
9. Apply the rules of resonance for drawing alternate Lewis structures for molecules.
10. Assess the relative importance of different resonance contributors.
11. Point out the Lewis acid and the Lewis base in an organic reaction.
12. Demonstrate the use of "curved arrows" as a means of following electron movement in the course of organic reactions.
13. Predict trends in acidity and basicity in the periodic table.
14. Assess the relative strength of acids and bases from pKa values.
15. Predict the outcome of an acid-base reaction based on pKa values.
16. Predict the effects of proximate electron donating and electron withdrawing substituents on acidity and basicity.

Chapter 2. Structure and Properties of Organic Molecules

1. Construct sp, sp^2 and sp^3 hybrid orbitals from pure s and p orbitals of carbon.
2. Predict the bond angles and local geometry in sp, sp^2 and sp^3 hybridized carbon atoms.
3. Correlate covalent bond lengths and bond strengths to orbital hybridization.
4. Recognize the general effects of different bond strengths on chemical reactivity.
5. Differentiate various functional groups in organic molecules.
6. Classify alcohols, alkyl halides, and amines as primary, secondary, or tertiary.
7. Identify the intermolecular forces that exist between molecules.
8. Correlate the different intermolecular forces to trends in boiling points of pure organic compounds.
9. Correlate the different intermolecular forces to trends in the solubility of organic and inorganic compounds in water.

Chapter 3. Structure and Stereochemistry of Alkanes

1. Provide the correct I.U.P.A.C. and common name for alkanes, cycloalkanes and polycyclic alkanes.
2. Explain the boiling point vs. molecular weight and boiling point vs. molecular shape relationship for alkanes and cycloalkanes.
3. Identify the sources and principal uses of C_1-C_{16} alkanes.
4. Employ 3-dimensional models and various two dimensional projections of models of acyclic organic compounds in order to assess the relative stability of different conformations of these compounds.
5. Employ 3-dimensional models of substituted cyclohexanes in order to assess and illustrate the relative stability of different conformations of these compounds.

6. Use clear drawings to illustrate the relative stabilities of cis- and trans-disubstituted cyclohexanes.

Chapter 4. The Study of Chemical Reactions

1. Define the following terms: mechanism, kinetics, thermodynamics, enthalpy, entropy, Gibb's free energy, activation energy, transitions state, bond-dissociation energy, reactive intermediate, free radicals, carbocations, carbanions, carbenes.
2. Identify the products in the free radical halogenation reactions of alkanes and cycloalkanes based on the relative initial reagent concentrations.
3. Write a detailed mechanism for the free radical halogenation of an alkane or cycloalkane.
4. Correlate the value of an equilibrium constant with the free energy change for a given reaction.
5. Correlate the temperature dependence of rates to activation energies for a given reaction.
6. Construct a Reaction-Energy Diagram for a reaction given the relative energy values for the substrates, products, activation barrier and transition state.
7. Predict the relative stabilities of free radicals, carbanions and carbocations based on their 1^o, 2^o or 3^o structure.
8. Illustrate the principles of the Hammond Postulate via the construction of a Reaction-Energy Diagram for a highly exothermic or a highly endothermic reaction.
9. Compare the approximate relative 1^o/ 2^o product ratios for the free radical chlorination of propane to the 1^o/ 2^o product ratios for the free radical bromination of propane. Explain the results on the basis of the Reactivity/Selectivity principle.

Chapter 5. Stereochemistry

1. Manipulate 3-dimensional molecular models and their projection on a flat surface to analyze the spatial orientation of substituents of carbon.
2. Differentiate enantiomers, diastereoisomers, constitutional isomers, unrelated compounds and two molecules of the same substance on the basis of structure and observable physical properties.
3. Decipher the correct stereochemical descriptor (R/S) for a stereocenter according to the Cahn-Ingold-Prelog convention.
4. Illustrate what is meant by the term "optical activity".
5. Identify compounds inherently capable and incapable of optical activity.
6. Perform calculations on the relationship between the specific rotation of an optically active sample, its measured angle of rotation, concentration, and path length.
7. Perform calculations on the optical purity of a sample, its specific rotation, and the specific rotation of a pure authentic sample of the same material.
8. Convert 3-dimensional representations of molecules into Fischer Projections.
9. Illustrate methods useful in resolving a racemic mixture.

Chapter 6. Alkyl halides: Nucleophilic Substitution and Elimination Reactions

1. Differentiate between the nucleophile, the substrate, the leaving group, and the product of a chemical reaction.
2. Interpret potential energy diagrams and surfaces.
3. Describe the various factors that influence the rate of a chemical reaction.
4. Point out primary, secondary, and tertiary carbocations in organic structures.
5. Assess the thermodynamic stability of carbocations.
6. Differentiate between an S_N1 and an S_N2 reaction and the conditions that favor each.

7. Differentiate between an E-1 and an E-2 reaction and the conditions that favor each.
8. Explain why substitution or elimination is favored in a given reaction.
9. Identify the Rate Determining Step (RDS) in S_N1, S_N2, E-1 and E-2 reactions.
10. Explain the stereochemical consequences of substitution as they relate to the mechanism of that reaction.
11. Provide the major expected products of a reaction involving an alkyl halide or alcohol under specified conditions.

Chapters 7, 8, & 9 Alkenes & Alkynes: Structure, Properties, Synthesis and Reactions

1. Provide I.U.P.A.C. and common names for alkenes, cycloalkenes and alkynes.
2. Compute the index of hydrogen deficiency of an organic molecule.
3. Differentiate between alkanes, alkenes, cycloalkanes, cycloalkenes, alkynes and aromatic compounds based on the index of hydrogen deficiency of the molecules and simple chemical tests.
4. Assess the relative thermodynamic stability of alkenes.
5. Select a technique appropriate to measure relative thermodynamic stability of a series of alkenes.
6. Break down a target alkene or cycloalkene for synthesis from readily available starting material.
7. Identify the major expected alkene produced in typical synthetic reactions.
8. Select reagents appropriate for the conversion of different compounds into alkenes and alkynes.
9. Demonstrate the use of Markovnikov's rule for predicting addition reaction products.
10. Explain the basis for Markovnikov's rule.
11. Draw the complete mechanism for common addition reactions.
12. Reconstruct an alkene given its degradation products.
13. Interpret qualitative chemical tests for functional groups.
14. Select the major expected product of reactions of alkenes and alkynes.
15. Select reagents appropriate for the conversion of alkenes and alkynes into other compounds.
16. Devise a multi-step sequence of reactions to obtain a desired product from a given starting material.

Chapters 10 & 11 Alcohols: Structure, Synthesis and Reactions

1. Provide I.U.P.A.C. and common names for alcohols and phenols.
2. Predict trends in boiling points and water solubility of alcohols based on structure.
3. Explain the differing acidity constants for alcohols and phenols with the aid of resonance structures.
4. Outline the major methods for the preparation of alcohols.
5. Define the term ‘organometallic’ and explain the utility of these compounds in the preparation of alcohols.
6. Select the major expected product of reactions of alcohols.
7. Select reagents appropriate for the conversion of alcohols into other compounds.
8. Devise a multi-step sequence of reactions to obtain a desired alcohol product from a given starting material.

Key for Alignment Chart for Course, Program and Institutional Student Learning Objectives (SLOs)

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
PSLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science. **PSLO 2:** Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment. **PSLO 3:** Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. **PSLO 4:** Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems. **PSLO 5:** Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. **PSLO 6:** Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. **PSLO 7:** Demonstrate interaction skills and teamwork.	**ISLO 1**: Mastery of critical thinking and problem solving **ISLO 2**: Mastery of quantitative analysis **ISLO 3**: Effective oral and written communication **ISLO 4**: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context **ISLO 5**: Responsible use of knowledge, natural resources, and technology **ISLO 6**: An appreciation of the arts and sciences **ISLO 7**: An interest in personal development and lifelong learning	**MA 1:** Visual Inspection and Assessment by Instructor **MA 2:** Quizzes **MA 3:** Exams **MA 4:** Worksheets **MA 5:** Homework

Alignment of Student Learning Objectives (SLOs) with Program Learning Objectives (PSLOs) and Institutional Learning Objectives (ISLOs). (Revised August 2015).

Course SLOs (8): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Identify the correct nomenclature of the International Union of Pure and Applied Chemistry and common names for the alkanes, cycloalkanes, alkenes, alkynes, alkyl halides, and alcohols.	**PSLOs: 1 & 6**	**ISLOs: 1 & 6**	**MA: 1-5**
SLO 2. Predict trends in physical and chemical properties of the alkanes, alkenes, alkynes, alkyl halides, aromatic compounds, alcohols, ethers, aldehydes and ketones including boiling point, reaction rates, optical activity, and acidity based on chemical principles.	**PSLOs: 1, 2, 4, 5 & 6**	**ISLOs: 1, 2, 6, & 7**	**MA: 1-5**
SLO 3. Draw the interconverting forms of cyclohexane and its derivatives by performing "ring flips".	**PSLOs: 1, 2, 4, & 6**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 4. Identify the isomeric and stereochemical relationships between molecules (such as constitutional isomers, enantiomers, diastereomers, meso).	**PSLOs: 1, 2, 4, 5, 6, & 7**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 5. Analyze chemical reactions basic to the synthesis of alkanes, alkenes, alkynes, alkyl halides, and alcohols.	**PSLOs: 1-7**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 6. Analyze common chemical reactions of the alkanes, alkenes, alkynes, alkyl halides, and alcohols.	**PSLOs: 1-7**	**ISLOs: 1, 2, 3, 6, & 7**	**MA: 1-5**
SLO 7. Predict the mode of nucleophilic substitution and elimination reaction pathways of alkyl halides and alcohols based on principles of structure.	**PSLOs: 1, 2, 4, 5, 6, & 7**	**ISLOs: 1, 2 & 3**	**MA: 1-5**
SLO 8. Write detailed, step by step mechanisms for the common reactions of alkanes, alkenes, alkynes and alcohols.	**PSLOs: 1-7**	**ISLOs: 1, 2, 3, 6, & 7**	**MA: 1-5**

CH 310a TENTATIVE SCHEDULE

Fall 2015

WEEK	MONDAY	WEDNESDAY
(1) 8-17	No Class	Introduction & Review of Syllabus
(2) 8-24	Carbon Electronic Structure, Electronegativity, Bonding, Lewis Structures & Formal Charge	Functional Groups, Isomers & Resonance Theory
(3) 8-31	Acid-Base Chemistry	Structural Effects, pKa
(4) 9-07	**HOLIDAY**	Hybridization, Shapes of Molecules
(5) 9-14	Polarity of Molecules	Intermolecular Forces & Physical Properties
(6) 9-21	Alkane Nomenclature, Physical Properties	Conformations
(7) 09-28	Free Radical Halogenation	Free Radicals, Freons & Ozone
(8) 10-05	Reaction Pathways & TS Theory	Hammond Postulate
(9) 10-12	Stereoisomers, Chirality, R & S Nomenclature	Fischer Projections
(10) 10-19	Optical Activity, Meso Compounds	Nucleophilic Substitution
(11) 10-26	Substitution & Elimination	Leaving Groups, Solvent Effects
(12) 11-02	**HOLIDAY**	Review of Substitution & Elimination Rxns.
(13) 11-09	Alkene Structure, Nomenclature & Properties	**HOLIDAY**
(14) 11-16	Alkene Preparation & Stability	Reactions of Alkenes
(15) 11-23	Reactions of Alkenes	Review of Alkene Reactions
(16) 11-30	Alkynes	Alkyne Acidity, Reactions & Synthesis
(17) 12-07	Review of Alkenes & Alkynes	Alcohols: Physical & Chemical Properties

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Quizzes 1-3 are tentatively scheduled during weeks 4, 8 & 15 respectively. **Unit Exams 1 & 2** are tentatively scheduled during weeks 6 & 11 respectively. **American Chemical Society Standardized (1st Semester) Final Exam** will take place at **10:00-11:50 AM, Wednesday, December 16, 2015.**

UNIVERSITY OF GUAM DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 310a

ORGANIC CHEMISTRY (3 CREDIT HOURS) FALL 2015

Instructor:	Dr. Robert Gatewood... E-mail... rgatewood53@gmail.com
Office and Lab:	None
Office Hours:	None
Catalog Course Description:	CH 310a is the first semester of a full year lecture sequence covering the general principles of organic chemistry with emphasis on structure, stereochemistry, nomenclature, basic reactions and mechanisms, and the occurrence and uses of the main classes of compounds.
Prerequisite:	CH 103-103L
Rationale for Offering the Course:	CH 310a is designed primarily for science and engineering majors who require a rigorous introduction to organic chemistry. This course will also provide the necessary background for more advanced courses in chemistry such as CH 310b (Organic Chemistry II) and CH/BI 419 (Biochemistry).
Time & Location:	MW, 4:00-5:20Room Sc CH 310a will meet for 160 minutes of lecture each week.
Required Text:	Organic Chemistry, 8th ed., L. 0. Wade, Jr. Prentice Hall, Boston, 2012.
Optional Text:	Student Solutions Manual for Organic Chemistry, 8th ed., L. 0. Wade, Jr. & J. W. Simek, Prentice Hall, Boston, 2012.
Required Molecular Models:	Molecular (HOS) Model Set for Organic Chemistry, The HOS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.

Contents of Course: The specific topics to be covered are detailed on

Learning Objectives:	Detailed learning objectives for each chapter are listed on pages 7-8 of this syllabus.
Format and Activities:	Classroom time will be spent primarily on the presentation and discussion of specific topics in organic chemistry by the instructor. This will frequently be followed by interactive problem solving sessions involving the entire class.

Evaluation and Grading Criteria:	An American Chemical Society (ACS) standardized final exam (200 points) will account for 33.3% of the course grade. 5 exams announced as well as homework, will account for the remaining 66.6% of the course grade. Students caught cheating on an examination will fail the course. In the event an exam is missed, that exam will not be counted in the final course grade, providing an excuse can be validated in writing. The instructor will be the judge of the validity of the excuse. No make-up exams will be provided. Unexcused missed exams will receive a grade of zero.

GRADING SCALE:

5 exams+ Homework total	= 400 pts.
Final Exam Score	= 200
Total Points Available	= 600

A = 90 % or greater of 600 pts. (540 - 600 pts.), B = 80% (480 - 539pts.), C = 70% (420 - 479 pts.), D = 60 % (360 - 419 pts.) & F < 60 % (000 - 359 pts.)

COURSE POLICIES:

Attendance:	Periodic unannounced 10 minute quizzes may be given. Tardy students will have only the remaining time to complete the quiz. Quizzes missed without a valid reason will receive a "O". There will be no make-up quizzes. STUDENTS ARE ALSO ENCOURAGED TO SEE THE INSTRUCTOR REGULARLY BY APPOINTMENT.
Cell Phones & Beepers:	Warning! Students are required to turn off all such devices during all class and laboratory periods. The instructor will uniformly apply a penalty of 25 points to each student for every infraction. These points will be deducted from the grand total.
EEO/ADA Concerns:	If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact me privately to discuss your specific needs. You will need to provide me with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/297112243 (TTY) to coordinate your accommodation request.
Course Schedule:	A tentative course schedule is provided on pages 7-8 of this syllabus.

Drop Dates:	Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.
Student Workload:	Aside from the 160 minutes spent in class, it is expected that students will have to devote a minimum of an additional 320 minutes per week in order to make satisfactory progress in CH 310a.
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CHEMISTRY 310a SYLLABUS
(REVISED 8-15)

Text: Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2012.

Course Objectives:
Upon successful completion of this course, the student will demonstrate the ability to:

1. Identify the correct nomenclature of the International Union of Pure and Applied Chemistry and common names for the alkanes, cycloalkanes, alkenes, alkynes, alkyl halides, and alcohols.
2. Predict trends in physical and chemical properties of the alkanes, alkenes, alkynes, alkyl halides, aromatic compounds, alcohols, ethers, aldehydes and ketones including boiling point, reaction rates, optical activity, and acidity based on chemical principles.
3. Draw the interconverting forms of cyclohexane and its derivatives by performing "ring flips".
4. Identify the isomeric and stereochemical relationships between molecules (such as constitutional isomers, enantiomers, diastereomers, meso).
5. Analyze chemical reactions basic to the synthesis of alkanes, alkenes, alkynes, alkyl halides, and alcohols.
6. Analyze common chemical reactions of the alkanes, alkenes, alkynes, alkyl halides, and alcohols.
7. Predict the mode of nucleophilic substitution and elimination reaction pathways of alkyl halides and alcohols based on principles of structure.
8. Write detailed, step by step mechanisms for the common reactions of alkanes, alkenes, alkynes and alcohols.

Student Learning Objectives (SLOs) for Chapters 1-11:

Chapter 1 Introduction and Review

1. Write correct Lewis electron dot formulae for compounds.
2. Interconvert Lewis structures, dash line structures, condensed structures, and bent line structures.
3. Calculate the formal charge on a given atom in a Lewis structure.
4. Calculate the net charge on a polyatomic moiety.
5. Predict the geometry of molecules.
6. Identify bond types as ionic, covalent, and polar covalent on the basis of electronegativity differences.
7. Show the direction of the net dipole moment of simple molecules.
8. Interpret trends in electronegativity in the periodic chart.
9. Apply the rules of resonance for drawing alternate Lewis structures for molecules.
10. Assess the relative importance of different resonance contributors.
11. Point out the Lewis acid and the Lewis base in an organic reaction.
12. Demonstrate the use of "curved arrows" as a means of following electron movement in the course of organic reactions.
13. Predict trends in acidity and basicity in the periodic table.
14. Assess the relative strength of acids and bases from pKa values.
15. Predict the outcome of an acid-base reaction based on pKa values.
16. Predict the effects of proximate electron donating and electron withdrawing substituents on acidity and basicity.

Chapter 2 Structure and Properties of Organic Molecules

1. Construct sp, sp^2 and sp^3 hybrid orbitals from pure s and p orbitals of carbon.
2. Predict the bond angles and local geometry in sp, sp^2 and sp^3 hybridized carbon atoms.
3. Correlate covalent bond lengths and bond strengths to orbital hybridization.
4. Recognize the general effects of different bond strengths on chemical reactivity.
5. Differentiate various functional groups in organic molecules.
6. Classify alcohols, alkyl halides, and amines as primary, secondary, or tertiary.
7. Identify the intermolecular forces that exist between molecules.
8. Correlate the different intermolecular forces to trends in boiling points of pure organic compounds.
9. Correlate the different intermolecular forces to trends in the solubility of organic and inorganic compounds in water.

Chapter 3 Structure and Stereochemistry of Alkanes

1. Provide the correct I.U.P.A.C. and common name for alkanes, cycloalkanes and polycyclic alkanes.
2. Explain the boiling point vs. molecular weight and boiling point vs. molecular shape relationship for alkanes and cycloalkanes.
3. Identify the sources and principal uses of C1-C16 alkanes.

4. Employ 3-dimensional models and various two dimensional projections of models of acyclic organic compounds in order to assess the relative stability of different conformations of these compounds.
5. Employ 3-dimensional models of substituted cyclohexanes in order to assess and illustrate the relative stability of different conformations of these compounds.
6. Use clear drawings to illustrate the relative stabilities of cis- and trans-disubstituted cyclohexanes.

Chapter 4 The Study of Chemical Reactions

1. Define the following terms: mechanism, kinetics, thermodynamics, enthalpy, entropy, Gibb's free energy, activation energy, transitions state, bond-dissociation energy, reactive intermediate, free radicals, carbocations, carbanions, carbenes.
2. Identify the products in the free radical halogenation reactions of alkanes and cycloalkanes based on the relative initial reagent concentrations.
3. Write a detailed mechanism for the free radical halogenation of an alkane or cycloalkane.
4. Correlate the value of an equilibrium constant with the free energy change for a given reaction.
5. Correlate the temperature dependence of rates to activation energies for a given reaction.
6. Construct a Reaction-Energy Diagram for a reaction given the relative energy values for the substrates, products, activation barrier and transition state.
7. Predict the relative stabilities of free radicals, carbanions and carbocations based on their 1°, 2° or 3° structure.
8. Illustrate the principles of the Hammond Postulate via the construction of a Reaction-Energy Diagram for a highly exothermic reaction.
9. Compare the approximate relative 1°/2° product ratios for the free radical chlorination of propane to the 1°/2° product ratios for the free radical bromination of propane. Explain the results on the basis of the Reactivity/Selectivity principle.

Chapter 5 Stereochemistry

1. Manipulate 3-dimensional molecular models and their projection on a flat surface to analyze the spatial orientation of substituents of carbon.
2. Differentiate enantiomers, diastereoisomers, constitutional isomers, unrelated compounds and two molecules of the same substance on the basis of structure and observable physical properties.
3. Decipher the correct stereochemical descriptor (R/S) for a stereocenter according to the Cahn-Ingold-Prelog convention.
4. Illustrate what is meant by the term "optical activity".
5. Identify compounds inherently capable and incapable of optical activity.
6. Perform calculations on the relationship between the specific rotation of an optically active sample, its measured angle of rotation, concentration, and path length.
7. Perform calculations on the optical purity of a sample, its specific rotation, and the specific rotation of a pure authentic sample of the same material.
8. Convert 3-dimensional representations of molecules into Fischer Projections.
9. Illustrate methods useful in resolving a racemic mixture.

Chapter 6 Alkyl halides: Nucleophilic Substitution and Elimination Reactions

1. Differentiate between the nucleophile, the substrate, the leaving group, and the product of a chemical reaction.
2. Interpret potential energy diagrams and surfaces.
3. Describe the various factors that influence the rate of a chemical reaction.
4. Point out primary, secondary, and tertiary carbocations in organic structures.
5. Assess the thermodynamic stability of carbocations.
6. Differentiate between an SN1 and an SN2 reaction and the conditions that favor each.
7. Differentiate between an E-1 and an E-2 reaction and the conditions that favor each.
8. Explain why substitution or elimination is favored in a given reaction.
9. Identify the Rate Determining Step (RDS) in SN1, SN2, E-1 and E-2 reactions.
10. Explain the stereochemical consequences of substitution as they relate to the mechanism of that reaction.
11. Provide the major expected products of a reaction involving an alkyl halide or alcohol under specified conditions.

Chapters 7, 8, & 9 Alkenes & Alkynes: Structure, Properties, Synthesis and Reactions

1. Provide I.U.P.A.C. and common names for alkenes, cycloalkenes and alkynes.
2. Compute the index of hydrogen deficiency of an organic molecule.
3. Differentiate between alkanes, alkenes, cycloalkanes, cycloalkenes, alkynes and aromatic compounds based on the index of hydrogen deficiency of the molecules and simple chemical tests.
4. Assess the relative thermodynamic stability of alkenes.
5. Select a technique appropriate to measure relative thermodynamic stability of a series of alkenes.
6. Break down a target alkene or cycloalkene for synthesis from readily available staiting material.
7. Identify the major expected alkene produced in typical synthetic reactions.
8. Select reagents appropriate for the conversion of different compounds into alkenes and alkynes.
9. Demonstrate the use of Markovnikov's rule for predicting addition reaction products.
10. Explain the basis for Markovnikov's rule.
11. Draw the complete mechanism for common addition reactions.
12. Reconstruct an alkene given its degradation products.
13. Interpret qualitative chemical tests for functional groups.
14. Select the major expected product of reactions of alkenes and alkynes.
15. Select reagents appropriate for the conversion of alkenes and alkynes into other compounds.
16. Devise a multi-step sequence of reactions to obtain a desired product from a given starting material.

Chapters 10 & 11 Alcohols: Structure, Synthesis and Reactions

1. Provide I.U.P.A.C. and common names for alcohols and phenols.
2. Predict trends in boiling points and water solubility of alcohols based on structure.
3. Explain the differing acidity constants for alcohols and phenols with the aid of resonance structures.
4. Outline the major methods for the preparation of alcohols.

5. Define the term 'organometallic' and explain the utility of these compounds in the preparation of alcohols.
6. Select the major expected product of reactions of alcohols.
7. Select reagents appropriate for the conversion of alcohols into other compounds.
8. Devise a multi-step sequence of reactions to obtain a desired alcohol product from a given starting material.

CH310a TENTATIVE SCHEDULE

Fall 2015

WEEK	MONDAY	WEDNESDAY
(1) 8-17	No Class	Introduction to Organic Chemistry
(2) 8-24	Carbon Electronic Structure. Electronegativity. Bonding. Formal Charge	Functional Groups. Resonance Theory, Isomers
(3) 8-31	Acid – Base Chemistry	Structural effects, pKa
(4) 9-07	HOLIDAY	Hybridization. Shapes of molecules
(5) 9-14	Polarity of molecules	Intermolecular forces & Physical properties
(6) 9-21	Alkanes Nomenclature. Physical Properties	Conformations
(7) 9-28	Free Radical Halogenation	Free radicals, Freons & Ozone
(8) 10-05	Reaction Pathways& TS theory	Hammond postulate
(9) 10-12	Stereoisomers, Chirality, R&S Nomenclature	Fischer Projections
(10) 10-19	Optical activity, meso compounds	Nucleophilic substitution
(11)10-26	Substitution and Elimination	Leaving groups, solvent effects
(12)11-02	HOLIDAY	Review of substitution & elimination Rxns
(13)11-09	Alkene Structure. Nomenclature & properties	Holiday
(14)11-16	Alkene preparation & Stability	Reactions of Alkenes

(15) 11-23 Reactions of Alkenes	Review of Alkene Rxns
(16) 11-30 Alkynes	Alkyne Acidity, Reactions & Synthesis
(17) 11-07 Review of Alkenes & Alkynes	Alcohols: Physical & Chemical Properties

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EXAMS are tentatively scheduled for weeks 4,6,8,11,15

AMERICAN CHEMICAL SOCIETY STANDARDIZED (1st SEMESTER) FINAL EXAM
4:00-5:20 p.m. Wednesday, December 16, 2015

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
PSLO 1:Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science. PSLO 2: Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment. PSLO 3:Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. PSLO 4: Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems. PSLO S:Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. PSLO 6:Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. PSLO 7:Demonstrate interaction skills and teamwork.	ISLO 1:Mastery of critical thinking and problem solving ISLO 2: Mastery of quantitative analysis ISLO 3:Effective oral and written conununication ISLO 4: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context ISLO S: Responsible use of knowledge, natural resources, and technology ISLO 6: An appreciation of the arts and sciences ISLO 7: An interest in personal development and lifelong learning	MA 1:Visual Inspection and Assessment by Instructor *&.l:* Quizzes Ma1:Exams :Worksheets MA S:Homework

Course SLOs (6): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Give the correct I.U.P.A.C. or common names for representative alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.	PSLOs: 1 & 6	ISLOs: 1 & 6	MA: 1-S
SLO 2. Based on chemical principles, predict trends in physical and chemical properties including boiling point, reaction rate, optical activity, acidity & basicity for the following compounds: alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	PSLOs: 1,2, 4, S & 6	ISLOs:1, 2, 6, & 7	MA: 1-S
SLO 3. Analyze chemical reactions basic to the synthesis of alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxy lie acids and their derivatives, amines and their derivatives, carbohydrates and amino acids	PSLOs: 1,2, 4, & 6	ISLOs:1, 6, & 7	MA: 1-S
SLO 4. Analyze the mechanistic pathways of the common chemical reactions of alcohols, ethers, polyenes, aromatics, phenols, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	PSLOs: 1,2, 4, S, 6, & 7	ISLOs: 1, 6, & 7	MA:1-s
SLO 5. Combine the knowledge of reactions from all the chapters studied to synthesize compounds whose preparation requires more than one step.	PSLOs: 1-7	ISLOs: 1, 6, & 7	MA: 1-S
SLO 6. Deduce the structure of a compound from qualitative tests and spectral data.	PSLOs: 1-7	ISLOs: 1,2,3,6 1 & 7	Md: 1-5

UNIVERSITY OF GUAM DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 310b

ORGANIC CHEMISTRY (3 CREDIT HOURS) SPRING 2016

Instructor:	Dr. N. K. Suleman. Email: nsuleman@uguam.uog.edu
Office and Lab:	227 Science Building (Phone: 735-2834); Instrument Laboratory: Science 220
Office Hours:	M 9:50-10:50 AM and 12:30-2:00 PM; T 12:50-1:50 PM; W 9:50-10:50 AM and 12:30-2:00 PM in Science 227/220. Students are encouraged to see the instructor regularly during these office hours. **Important Note**: During office hours, the instructor will be in either Sc 227 or Sc 220. Please check both locations if necessary.
Catalog Course Description:	CH 310b is the second semester of a full year lecture sequence covering the general principles of organic chemistry with emphasis on structure, stereochemistry, nomenclature, basic reactions and mechanisms, and the occurrence and uses of the main classes of compounds.
Prerequisite:	CH 310a and CH 103-103L
Rationale for Offering the Course:	CH 310b is designed primarily for science and engineering majors who require a rigorous introduction to organic chemistry. This course will also provide the necessary background for more advanced courses such as CH/BI 419 (Biochemistry).
Time & Location:	MW 11:00-12:20, Room Sc 221. CH 310b will meet for 160 minutes of lecture each week.
Required Text:	Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2012.
Optional Text:	Student Solutions Manual for Organic Chemistry, 8th ed., L. G. Wade, Jr. & J. W. Simek, Prentice Hall, Boston, 2012.
Required Molecular Models:	Molecular (HGS) Model Set for Organic Chemistry, The HGS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.
Contents of Course:	The specific topics to be covered are detailed on the last page of this syllabus.
Learning Objectives:	Learning objectives for the course are listed on page 3 of this syllabus.
Format and Activities:	Classroom time will be spent primarily on the presentation and discussion of specific topics in organic chemistry by the instructor. This will frequently be followed by interactive problem solving sessions involving the entire class.

Moodle: **http://campus.uogdistance.com/.** It is essential that all the students in this class join the Moodle group by 1/21/2016. All assignments, lesson plans, handouts and copies of previous tests will be posted on Moodle. The instructor will also periodically send messages to the class through Moodle. The **enrollment key** for this class is: **CH 310b-01S2016**

Evaluation and Grading Criteria: An American Chemical Society (ACS) standardized comprehensive final exam (200 points) will account for 33.3% of the course grade. 4 exams, and possibly announced and unannounced quizzes, as well as homework, will account for the remaining 66.6% of the course grade. Students arriving late for an exam will have only the remaining time to complete the exam. Students caught cheating on an examination will fail the course. In the event an exam is missed, that exam will not be counted in the final course grade, providing an excuse can be validated in writing. The instructor will be the judge of the validity of the excuse. **No make-up exams will be provided. Unexcused missed exams will receive a grade of zero.**

GRADING SCALE:

4 Exams + Quizzes + Homework total	**= 400 pts.**
Final Exam Score	**= 200**
Total Points Available	**= 600**

A = 90 % or greater of 600 pts. (540 - 600 pts.), B = 80% (480 - 539pts.), C = 70% (420 - 479 pts.), D = 60 % (360 - 419 pts.) & F < 60 % (000 - 359 pts.)

COURSE POLICIES:

Attendance: Periodic unannounced 10 minute quizzes may be given. Tardy students will have only the remaining time to complete the quiz. Quizzes missed without a valid reason will receive a "0". There will be no make-up quizzes.

Cell Phones & Beepers: **Warning!** The checking of email/telephone messages or texting is not permitted during any class period. The instructor recommends that students **turn off all such devices during all class periods.** The instructor will uniformly apply a **penalty of 25 points** to each student for every infraction (including a telephone beeping or ringing). These points will be deducted from the grand total.

EEO/ADA Concerns: If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact the instructor privately to discuss your specific needs. You will need to provide the instructor with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/2971/2243 (TTY) to coordinate your request.

Course Schedule: A tentative course schedule is provided on the last page of this syllabus.

Drop Dates: Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.

Student Workload: Aside from the 160 minutes spent in class, it is expected that students will have to devote a minimum of an additional 320 minutes per week in order to make satisfactory progress in CH 310b.

Contact Among Classmates: Students are encouraged to exchange contact information in order to facilitate and promote scholarly interaction outside the classroom.

Disruption of Class by Conversations/ Activities Unrelated to Learning: The instructor seeks to generate a highly focused learning atmosphere for all students in the classroom and requests that individuals not engage in personal conversations or other activities that may detract from this goal. The instructor will provide one verbal warning to any disruptive student(s) after which a uniform **penalty of 25 points** will be applied to each student for every infraction. At the instructor's discretion, the disruptive students may also be dismissed from class. **Important Note**: The instructor wishes to clarify that all students are highly encouraged to address the class and/or the instructor with questions or comments relevant to the objectives of the course.

CHEMISTRY 310b SYLLABUS

Text: Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2012.

Course Objectives: At the conclusion of this course, the student should be able to:

1. Give the correct I.U.P.A.C. or common names for alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.

2. Based on chemical principles, predict trends in physical and chemical properties including boiling point, reaction rate, optical activity, acidity & basicity for the following compounds: alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.

3. Analyze chemical reactions basic to the synthesis of alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.

4. Analyze the mechanistic pathways of the common chemical reactions of alcohols, ethers, polyenes, aromatics, phenols, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.

5. Combine the knowledge of reactions from all the chapters studied to synthesize compounds whose preparation requires more than one step.

6. Deduce the structure of a compound from qualitative tests and spectral data.

Key for Alignment Chart for Course, Program and Institutional Student Learning Objectives (SLOs)

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
PSLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science. **PSLO 2:** Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment. **PSLO 3:** Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. **PSLO 4:** Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems. **PSLO 5:** Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. **PSLO 6:** Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. **PSLO 7:** Demonstrate interaction skills and teamwork.	**ISLO 1**: Mastery of critical thinking and problem solving **ISLO 2**: Mastery of quantitative analysis **ISLO 3**: Effective oral and written communication **ISLO 4**: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context **ISLO 5**: Responsible use of knowledge, natural resources, and technology **ISLO 6**: An appreciation of the arts and sciences **ISLO 7**: An interest in personal development and lifelong learning	**MA 1:** Visual Inspection and Assessment by Instructor **MA 2:** Quizzes **MA 3:** Exams **MA 4:** Worksheets **MA 5:** Homework

Alignment of Student Learning Objectives (SLOs) with Program Learning Objectives (PLOs) and Institutional Learning Objectives (ILOs). Revised January 2016

Course SLOs (6): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Give the correct I.U.P.A.C. or common names for representative alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.	**PSLOs: 1 & 6**	**ISLOs: 1 & 6**	**MA: 1-5**
SLO 2. Based on chemical principles, predict trends in physical and chemical properties including boiling point, reaction rate, optical activity, acidity & basicity for the following compounds: alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	**PSLOs: 1, 2, 4, 5 & 6**	**ISLOs: 1, 2, 6, & 7**	**MA: 1-5**
SLO 3. Analyze chemical reactions basic to the synthesis of alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.	**PSLOs: 1, 2, 4, & 6**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 4. Analyze the mechanistic pathways of the common chemical reactions of alcohols, ethers, polyenes, aromatics, phenols, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	**PSLOs: 1, 2, 4, 5, 6, & 7**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 5. Combine the knowledge of reactions from all the chapters studied to synthesize compounds whose preparation requires more than one step.	**PSLOs: 1-7**	**ISLOs: 1, 6, & 7**	**MA: 1-5**
SLO 6. Deduce the structure of a compound from qualitative tests and spectral data.	**PSLOs: 1-7**	**ISLOs: 1, 2, 3, 6, & 7**	**MA: 1-5**

CH 310b TENTATIVE SCHEDULE

Spring 2016

WEEK	MONDAY	WEDNESDAY
(1) 1-18	No Class	Intro. to CH 310b and CH. 10: Alcohols
(2) 1-25	Alcohols: Structure and Synthesis	Synthesis of Alcohols
(3) 2-01	CH. 11: Reactions of Alcohols	Reactions of Alcohols
(4) 2-08	Reactions of Alcohols; Thiols	CH. 14: Ethers, Epoxides, and Sulfides
(5) 2-15	Ethers, Epoxides, and Sulfides	CH. 18: Aldehydes & Ketones
(6) 2-22	Aldehydes & Ketones	Aldehydes & Ketones
(7) 2-29	Aldehydes & Ketones	CHs. 20 & 21: Carboxylic Acids
(8) 3-07	**Holiday** (Guam History Day)	Carboxylic Acids
(9) 3-14	Carboxylic Acid Derivatives	Carboxylic Acid Derivatives
(10) 3-21	**Spring Break**	
(11) 3-28	CH. 15: Conjugated Systems	Conjugated Systems
(12) 4-04	CH. 16: Aromatic Compounds	Aromatic Compounds
(13) 4-11	Reactions of Aromatic Compounds	Reactions of Aromatic Compounds
(14) 4-18	Reactions of Aromatic Compounds	CH. 19: Amines
(15) 4-25	Amines	CH. 23: Carbohydrates
(16) 5-02	Carbohydrates	Carbohydrates
(17) 5-09	CH. 24: Amino Acids & Proteins	Amino Acids & Proteins

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Exams 1-4 are tentatively scheduled to take place during weeks 4, 7, 12, & 15 respectively.
The confirmed time and location of each exam will be announced in class at least 1 week in advance.

AMERICAN CHEMICAL SOCIETY STANDARDIZED FINAL EXAM
WEDNESDAY, MAY 18th 2016 at 10:00-11:50 AM in Room Science 221

UNIVERSITY OF GUAM DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 310b

ORGANIC CHEMISTRY (3 CREDIT HOURS) SPRING 2016

Instructor:	Dr. Robert Gatewood… E-mail…rgatewood53@gmail.com
Office and Lab:	**None**
Office **Hours:**	None
Catalog Course: Description:	CH 310b is the second semester of a full year lecture sequence covering the general principles of organic chemistry with emphasis on structure, stereochemistry, nomenclature, basic reactions and mechanisms, and the occurrence and uses of the main classes of compounds.
Prerequisite:	CH 310a and CH 103-103L
Rationale for Offering the Course:	CH 310b is designed primarily for science and engineering majors who require a rigorous introduction to organic chemistry. This course will also provide the necessary background for more advanced courses such as CH/BI 419 (Biochemistry).
Time & Location:	MW, 4:00-5:20, Room Sc 221. CH 310b will meet for 160 minutes of lecture each week.
Required Text:	Organic Chemistry, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2012.
Optional Text:	Student Solutions Manual for Organic Chemistry, 8th ed., L. G. Wade, Jr. & J. W. Simek, Prentice Hall, Boston, 2012.
Required Molecular Models:	Molecular (HGS) Model Set for Organic Chemistry, The HGS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.
Contents of Course:	The specific topics to be covered are detailed on the last page of this syllabus.
Learning Objectives:	Learning objectives for the course are listed on page 3 of this syllabus.
Format and Activities:	Classroom time will be spent primarily on the presentation and discussion of specific topics in organic chemistry by the instructor. This will frequently be followed by interactive problem solving sessions involving the entire class.
Moodle:	**http://campus.uogdistance.com/:** It is essential that all the students in this class join the Moodle group by 1/21/2016. All assignments, lesson plans, handouts and copies of previous tests will be posted on Moodle. The instructor will also periodically send messages to the class through Moodle. The **enrollment key** for this class is: **CH 310b-02S2016**

Evaluation and Grading Criteria: An American Chemical Society (ACS) standardized comprehensive final exam (200 points) will account for 33.3% of the course grade. 4 exams, and possibly announced and unannounced quizzes, as well as homework, will account for the remaining 66.6% of the course grade. Students arriving late for an exam will have only the remaining time to complete the exam. Students caught cheating on an examination will fail the course. In the event an exam is missed, that exam will not be counted in the final course grade, providing an excuse can be validated in writing. The instructor will be the judge of the validity of the excuse. **No make-up exams will be provided. Unexcused missed exams will receive a grade of zero.**

GRADING SCALE:

4 Exams + Quizzes + Homework total	**= 400 pts.**
Final Exam Score	**= 200**
Total Points Available	**= 600**

A = 90 % or greater of 600 pts. (540 - 600 pts.), B = 80% (480 - 539pts.), C = 70% (420 - 479 pts.), D = 60 % (360 - 419 pts.) & F < 60 % (000 - 359 pts.)

COURSE POLICIES:

Attendance: Periodic unannounced 10 minute quizzes may be given. Tardy students will have only the remaining time to complete the quiz. Quizzes missed without a valid reason will receive a "0". There will be no make-up quizzes.

Cell Phones & Beepers: **Warning!** The checking of email/telephone messages or texting is not permitted during any class period. The instructor recommends that students **turn off all such devices during all class periods.** The instructor will uniformly apply a **penalty of 25 points** to each student for every infraction (including a telephone beeping or ringing). These points will be deducted from the grand total.

EEO/ADA Concerns: If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact the instructor privately to discuss your specific needs. You will need to provide the instructor with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/2971/2243 (TTY) to coordinate your request.

Course Schedule: A tentative course schedule is provided on the last page of this syllabus.

Drop Dates: Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.

Student Workload:	Aside from the 160 minutes spent in class, it is expected that students will have to devote a minimum of an additional 320 minutes per week in order to make satisfactory progress in CH 310b.
Contact Information on Classmates:	Students are encouraged to exchange contact information in order to facilitate and promote scholarly interaction outside the classroom.
Disruption of Class by Conversations/ Activities Unrelated to Learning:	The instructor seeks to generate a highly focused learning atmosphere for all students in the classroom and requests that individuals not engage in personal conversations or other activities that may detract from this goal. The instructor will provide one verbal warning to any disruptive student(s) after which a uniform **penalty of 25 points** will be applied to each student for every infraction. **Important Note**: The instructor wishes to clarify that all students are highly encouraged to address the class and/or the instructor with questions or comments relevant to the objectives of the course.

CHEMISTRY 310b SYLLABUS
(REVISED 1-16)

Text: **Organic Chemistry**, 8th ed., L. G. Wade, Jr. Prentice Hall, Boston, 2012.

Course Objectives: At the conclusion of this course, the student should be able to:

1. Give the correct I.U.P.A.C. or common names for alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.

2. Based on chemical principles, predict trends in physical and chemical properties including boiling point, reaction rate, optical activity, acidity & basicity for the following compounds: alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.

3. Analyze chemical reactions basic to the synthesis of alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.

4. Analyze the mechanistic pathways of the common chemical reactions of alcohols, ethers, polyenes, aromatics, phenols, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.

5. Combine the knowledge of reactions from all the chapters studied to synthesize compounds whose preparation requires more than one step.

6. Deduce the structure of a compound from qualitative tests and spectral data.

Key for Alignment Chart for Course, Program and Institutional Student Learning Objectives (SLOs)

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
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Alignment of Student Learning Objectives (SLOs) with Program Learning Objectives (PLOs) and Institutional Learning Objectives (ILOs). Revised January 2016

Course SLOs (6): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Give the correct I.U.P.A.C. or common names for representative alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.	PSLOs: 1 & 6	ISLOs: 1 & 6	MA: 1-5
SLO 2. Based on chemical principles, predict trends in physical and chemical properties including boiling point, reaction rate, optical activity, acidity & basicity for the following compounds: alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	PSLOs: 1, 2, 4, 5 & 6	ISLOs: 1, 2, 6, & 7	MA: 1-5
SLO 3. Analyze chemical reactions basic to the synthesis of alcohols, ethers, polyenes, aromatics, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates and amino acids.	PSLOs: 1, 2, 4, & 6	ISLOs: 1, 6, & 7	MA: 1-5
SLO 4. Analyze the mechanistic pathways of the common chemical reactions of alcohols, ethers, polyenes, aromatics, phenols, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.	PSLOs: 1, 2, 4, 5, 6, & 7	ISLOs: 1, 6, & 7	MA: 1-5
SLO 5. Combine the knowledge of reactions from all the chapters studied to synthesize compounds whose preparation requires more than one step.	PSLOs: 1-7	ISLOs: 1, 6, & 7	MA: 1-5
SLO 6. Deduce the structure of a compound from qualitative tests and spectral data.	PSLOs: 1-7	ISLOs: 1, 2, 3, 6, & 7	MA: 1-5

CH 310b TENTATIVE SCHEDULE

Spring 2016

WEEK	MONDAY	WEDNESDAY
(1) 1-18	No Class	Intro. to CH 310b and CH. 10: Alcohols
(2) 1-25	Alcohols: Structure and Synthesis	Synthesis of Alcohols
(3) 2-01	CH. 11: Reactions of Alcohols	Reactions of Alcohols
(4) 2-08	Reactions of Alcohols; Thiols	CH. 14: Ethers, Epoxides, and Sulfides
(5) 2-15	Ethers, Epoxides, and Sulfides	CH. 18: Aldehydes & Ketones
(6) 2-22	Aldehydes & Ketones	Aldehydes & Ketones
(7) 2-29	Aldehydes & Ketones	CHs. 20 & 21: Carboxylic Acids
(8) 3-07	**Holiday** (Guam History Day)	Carboxylic Acids
(9) 3-14	Carboxylic Acid Derivatives	Carboxylic Acid Derivatives
(10) 3-21	**Spring Break**	
(11) 3-28	CH. 15: Conjugated Systems	Conjugated Systems
(12) 4-04	CH. 16: Aromatic Compounds	Aromatic Compounds
(13) 4-11	Reactions of Aromatic Compounds	Reactions of Aromatic Compounds
(14) 4-18	Reactions of Aromatic Compounds	CH. 19: Amines
(15) 4-25	Amines	CH. 23: Carbohydrates
(16) 5-02	Carbohydrates	Carbohydrates
(17) 5-09	CH. 24: Amino Acids & Proteins	Amino Acids & Proteins

Exams 1-4 are tentatively scheduled to take place during weeks 4, 7, 12, & 15 respectively.
The confirmed time and location of each exam will be announced in class at least 1 week in advance.

AMERICAN CHEMICAL SOCIETY STANDARDIZED FINAL EXAM
WEDNESDAY, MAY 18th 2016 at 10:00-11:50 AM in Room Science 221

UNIVERSITY OF GUAM

DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 311 FALL 2015

BASIC LABORATORY TECHNIQUES IN ORGANIC CHEMISTRY (2 CREDIT HOURS)

Instructor:	Dr. N. K. Suleman. Email: nsuleman@uguam.uog.edu
Office & Lab:	227 Science Building (Phone: 735-2834); Instrument Laboratory: Science 220
Office Hours:	M 9:50-10:50 AM & 12:30-2:00 PM; T 12:50-1:50 PM; W 9:50-10:50 AM & 12:30-2:00 PM. **Important Note**: During office hours, the instructor will be in either SC 227 or SC 220. Please check both locations if necessary.
Catalog Course Description:	This course consists of laboratory work in organic chemistry with emphasis on the development of manipulative skills in such techniques as distillations, reduced pressure fractionations, chromatography, crystallizations, and constructions of apparatus utilized in the preparations, purifications, identification, and study of simple organic compounds.
Corequisite:	CH 310a (or concurrent)
Rationale for Offering the Course:	CH 311 is designed primarily for science and engineering majors who require a rigorous introduction to laboratory techniques in organic chemistry. This course will also provide students with an introduction to spectroscopic techniques which will lay the foundation for the subsequent laboratory course: CH 312 Organic Chemistry Laboratory Techniques II.
Time and Location:	Section 1: TTH 2:00-4:50 PM, Section 2: T 2:00-4:50 PM, TH 5:00-7:50 PM. On Tuesdays, class will be held in Room AV1 in the main library. On Thursdays class/lab will be held in rooms SC 221 & SC 230. CH 311 will meet for 340 minutes of laboratory and discussions each week.
Required Lab Manual:	Experimental Organic Chemistry. A Miniscale & Microscale Approach, 5th ed., J. C. Gilbert & S. F Martin. Thompson Brooks/Cole, USA, 2011.
Required Molecular Models:	Molecular (HGS) Model Set for Organic Chemistry, The HGS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.
Contents of Course:	The specific topics to be covered are detailed on the last page of this syllabus.
Format and Activities:	A prelab discussion will be held in the classroom prior to each laboratory exercise. Following the completion of the laboratory, a postlab discussion will ensue. Further details regarding the format can be found on page 4 of this syllabus.
Evaluation And Grading Criteria	A detailed account of all laboratory activities will be maintained in a laboratory notebook by each student. In addition, worksheets relevant to each laboratory exercise will be submitted at pre-announced times and graded. Guidelines for writing the lab notebook are outlined in the reference laboratory text and will also be further discussed in class. Guidelines for the completion of the worksheets will be discussed in class. Late

worksheets and will suffer a penalty, as detailed on page 4 of this syllabus. A written final laboratory exam and between one and two quizzes will account for the balance of the lab grade.

Moodle : **http://campus.uogdistance.com/:** It is essential that all the students in this class join the Moodle group. All assignments, lesson plans, handouts and copies of previous tests will be posted on Moodle. The instructor will also periodically send messages to the class through Moodle. The **enrollment key** for this class is: **CH 311F2015**

Grading: The grade from CH 311 will be apportioned in the following way:

Laboratory Reports	**= 30%**
Quiz(s)	**= 25%**
Final Lab Exam Score	**= 30%**
Lab Notebook	**= 15%**

GRADING SCALE:

A ≥ 90 %, B 80-89%, C 70-79%, D 60-69%, F < 60%

Course Schedule: A tentative course schedule is provided on the last page of this syllabus.

Drop dates: Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.

Student Workload: Aside from the 340 minutes spent in the laboratory and classroom, it is expected that students will have to devote a minimum of an additional 180 minutes per week in order to make satisfactory progress in CH 311.

Contact Information on Classmates: Students are encouraged to exchange contact information in order to facilitate and promote scholarly interactions outside the classroom.

COURSE POLICIES

EEO/ADA Concerns If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact me privately to discuss your specific needs. You will need to provide me with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/2971/2243 (TTY) to coordinate your accommodation request.

SAFETY WARNING: Students are advised that the instructor will **dismiss** and issue a **failing grade** to any student who violates the safety rules of the chemistry laboratory. **Strict adherence to safety in the laboratory is a requirement for passing this course.**

RULES FOR THE ORGANIC CHEMISTRY LAB

1. Attendance: Lab begins promptly at 2:00 (or 5:00) PM. For reasons of safety, students are required to attend the entire pre-lab in order to carry out each experiment. **Students may NOT go directly to the lab without permission of the instructor.** Laboratory forums (post-labs) will be scheduled following completion of major experiments to clarify results and implications of the completed laboratory work. Attendance is likewise **required** for these sessions.

2. Make - ups: There will be no make - up labs. Those who miss a lab will receive a score of zero for that lab in the absence of a bona fide reason for such absence.

3. Quizzes: There will be one or two announced quizzes during the semester. These will be given at the beginning of the lab period. Topics for quizzes include, but are not limited to, the experiment to be performed on that day, work carried out on a previous experiment, and laboratory safety considerations. There will be no make-up quizzes. **Those arriving late will have only the remaining allotted time to complete the quiz. Those arriving after the quizzes have been collected will receive a 0 for that quiz.**

4. Dry - Labing: Writing a report without actually carrying out an experiment (dry-labing) is a very serious offense. Dry-labing will earn a zero.

5. Cell Phones & Beepers: Warning! Students are required to turn off all such devices during **all** class and laboratory periods. The instructor will uniformly apply a **penalty of 25 points** to each student for every infraction. These points will be deducted from the grand total.

6. Disruption of Class By Conversations and Activities Unrelated to Learning: The instructor seeks to generate a highly focused learning atmosphere for all students in the classroom and requests that individuals not engage in personal conversations or other activities that may detract from this goal. The instructor will provide one verbal warning to any disruptive student(s) after which a uniform **penalty of 25 points** will be applied to each student for every infraction. The instructor also reserves the right to dismiss any disruptive student from class. **Important Note**: The instructor wishes to clarify that all students are highly encouraged to address the class and/or the instructor with questions or comments relevant to the objectives of the course.

7. Safety: Students are warned to keep their **eyes covered** with ***approved* eye goggles** at **all times** while in the laboratory. The instructor has the right to severely penalize any offenders (up to 100 % of the semester's lab grade) and to dismiss the student from the lab if warnings are not heeded. No contact lenses are permitted in the lab.

GUIDELINES FOR THE PREPARATION & SUBMISSION OF LAB WORKSHEETS

Upon completion of each experiment, a worksheet prepared by the instructor will be issued to the class. The worksheets are designed to provide the student with a thorough review of the entire experiment. In addition, the worksheets will inform the instructor of the outcome of the experiment for each group.

CAUTION: The following situations will result in a worksheet being severely penalized:

1. Unprofessional Appearance : It must be clear that the writer takes some pride in the worksheet. The absence of a fastener to hold the report together, torn out spiral notebook paper, smudged, soiled, crumpled or creased reports will be subject to a penalty of up to 100% of the worksheet grade.

2. Plagiarism : Use your own words to convey the information. Give proper credit to authors whose ideas are used in your worksheet. A report containing plagiarism will earn a grade of zero.

3. Tardiness : Each worksheet (or assignment) has a due date and time. Absence from lab on the due date is **NOT** an excuse. Each assignment must be **handed in directly to the instructor**. Assignments may **NOT** be turned in at the main office or at the instructor's office in his absence. **The penalty for late assignments is *10 PERCENT/MINUTE*. REPORTS TURNED IN AT OR AFTER 2:10 or 5:10 PM EARN A ZERO.**

Student Learning Objectives (SLOs):

Upon successful completion of this course, the student will demonstrate the ability to:

1. Apply principles of chemical safety in the storage and laboratory manipulation of organic reagents.
2. Isolate and purify organic compounds using recrystallization, distillation & extraction.
3. Carry out synthetic reactions using ground-glassware kits.
4. Perform synthetic reactions in which some of the reactants are sensitive to moisture or oxygen.
5. Characterize and identify compounds by measuring physical properties such as melting point, boiling point, and functional group-specific chemical tests.
6. Design the experimental set-up as well as work-up and purification procedure for a given reaction.
7. Identify the principal functional groups in organic molecules by detailed analysis of Infrared Spectra.
8. Relate the results of laboratory work to concepts of organic chemistry and report the findings and conclusions in accordance with a specified format.

Key for Alignment Chart for Course, Program and Institutional Student Learning Objectives (SLOs)

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
PSLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science. **PSLO 2**: Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment. **PSLO 3**: Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. **PSLO 4**: Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems. **PSLO 5**: Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. **PSLO 6**: Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. **PSLO 7**: Demonstrate interaction skills and teamwork.	**ISLO 1**: Mastery of critical thinking and problem solving **ISLO 2**: Mastery of quantitative analysis **ISLO 3**: Effective oral and written communication **ISLO 4**: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context **ISLO 5**: Responsible use of knowledge, natural resources, and technology **ISLO 6**: An appreciation of the arts and sciences **ISLO 7**: An interest in personal development and lifelong learning	**MA 1**: Visual Inspection and Assessment by Instructor **MA 2**: Quizzes **MA 3**: Exams **MA 4**: Worksheets **MA 5**: Homework

Alignment of Student Learning Objectives (SLOs) with Program Learning Objectives (PSLOs) and Institutional Learning Objectives (ISLOs). (Revised August 2015).

Course SLOs (8): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Apply principles of chemical safety in the storage and laboratory manipulation of organic reagents.	PSLOs: 1-7	ISLOs: 1, 3 & 5	MA: 1-5
SLO 2. Isolate and purify organic compounds using recrystallization, distillation & extraction.	PSLOs: 1, 2, 4, 5 & 6	ISLOs: 1, 2, 3, & 5	MA: 1-5
SLO 3. Carry out synthetic reactions using ground-glassware kits.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-5
SLO 4. Perform synthetic reactions in which some of the reactants are sensitive to moisture or oxygen.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-5
SLO 5. Characterize and identify compounds by measuring physical properties such as melting point, boiling point, and functional group-specific chemical tests.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-5
SLO 6. Design the experimental set-up as well as work-up and purification procedure for a given reaction.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-5
SLO 7. Identify the principal functional groups in organic molecules by detailed analysis of Infrared Spectra	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-5
SLO 8. Relate the results of laboratory work to concepts of organic chemistry and report the findings and conclusions in accordance with a specified format.	PSLOs: 1-7	ISLOs: 1, 2, 3, 6, & 7	MA: 1-5

CH 311 TENTATIVE LABORATORY SCHEDULE

FALL 2015

(Week #)	DATE	ACTIVITIES	REFERENCE
(W 1)	08/20	No Class	
(W 2)	08/25	Introduction to CH 311, Review of Syllabus & Safety Rules	Class Discussion
(W 2)	08/27	Laboratory Orientation & Check-in	Handouts
(W 3)	09/01	Melting Point (MP) Determination Prelab, Notebook Preparation	pp38-41; 113-117 Lab. Txt.
(W 3)	09/03	Melting Point Determination Lab	pp38-41; 113-117 Lab. Txt.
(W 4)	09/08	**1. CH 310a Quiz I**. 2. MP Determination Postlab & Report	Handouts
(W 4)	09/10	Functional Groups & Isomers Using Molecular Models	Handout
(W 5)	09/15	Prelab: Recrystallization & Notebook Preparation	pp93-104 Lab. Txt.
(W 5)	09/17	Recrystallization Lab	pp93-104 Lab. Txt.
(W 6)	09/22	**CH 310a Exam I**	
(W 6)	09/24	Recrystallization Postlab & Report	Class Discussion/Handouts
(W 7)	09/29	Prelab: Simple & Fractional Distillation	pp127-142 Lab. Txt.
(W 7)	10/01	Simple Distillation Lab	pp127-142 Lab. Txt.
(W 8)	10/06	1. **CH 310a Quiz II**. 2. Simple Distillation Postlab	pp127-142 Lab. Txt.
(W 8)	10/08	Fractional Distillation Lab	pp127-142 Lab. Txt.
(W 9)	10/13	1. Gas Chromatography (GC): Theory & Applications	pp196-206 Lab. Txt.
(W 9)	10/15	GC Analysis of Distillation Fractions, Postlab & Report	Class Discussion
(W 10)	10/20	1. **Lab Quiz** 2. Introduction to Spectrometric Methods	Handout
(W 10)	10/22	Infrared Spectroscopy: Theory & Applications	
(W 11)	10/27	1. **CH 310a Exam II**	Class Discussion
(W 11)	10/29	Use of Separatory Funnel & Review of $S_N1,2$ & E1,2 Rxns.	Class Discussion
(W 12)	11/03	Prelab: Preparation of tert-Butyl Chloride via an S_N1Rxn.	Handout
(W 12)	11/05	Lab: S_N1Preparation of tert-Butyl Chloride	Handout
(W 13)	11/10	Postlab for S_N1 Lab: Infrared Analysis, Yield & Report	Class Discussion
(W 13)	11/12	Infrared Spectroscopy Review and Problem Solving	Class Discussion
(W 14)	11/17	Prelab: Dehydration of Cyclohexanol	Handout
(W 14)	11/19	Lab: Dehydration of Cyclohexanol	Handout
(W 15)	11/24	1. **CH 310a Quiz III** 2. Postlab & Report for Dehydration Lab	Class Discussion
(W 15)	11/26	**Holiday**	
(W 16)	12/01	**Lab Final Exam**	
(W 16)	12/03	Review for CH 310a	Class Discussion
(W 17)	12/08	**Holiday**	
(W 17)	12/10	1. Cleanup of Lab & Checkout. 2. **Course Evaluations** and **Assessment**	

UNIVERSITY OF GUAM

DIVISION OF NATURAL SCIENCES

COURSE OUTLINE & SYLLABUS FOR CH 312 SPRING 2016

LABORATORY TECHNIQUES IN ORGANIC CHEMISTRY (2 CREDIT HOURS)

Instructor:	Dr. N. K. Suleman. Email: nsuleman@uguam.uog.edu
Office:	227 Science Building (Phone: 735-2834); Instrument Laboratory: Science 220
Office Hours:	M 9:50-10:50 AM and 12:30-2:00 PM; T 12:50-1:50 PM; W 9:50-10:50 AM and 12:30-2:00 PM in Science 227/220. **Important Note**: During office hours, the instructor will be in either Sc 227 or Sc 220. Please check both locations if necessary.
Catalog Course Description:	This course is a continuation of CH 311with emphasis on the continued development of manipulative skills as required by preparation, purification, identification and study of more complex organic compounds.
Prerequisite:	CH 311; corequisite 310b
Rationale for Offering the Course:	CH 312 is designed primarily for science and engineering majors who require a rigorous training in laboratory techniques in organic chemistry. This course will emphasize the use of spectroscopic techniques for organic structure determination which will be helpful in subsequent courses such as CH/BI 419 (Biochemistry).
Time and Location:	Section 1: T 2:00-3:50 PM in room Sc 101 and TH 12:30-4:20 in room Sc 230. Section 2: T 2:00-3:50 PM in room Sc 101 and TH 4:30-8:20 PM in Room Sc 230. CH 312 will meet for 340 minutes of laboratory and discussions each week.
Reference Lab Manual:	Experimental Organic Chemistry. A Miniscale & Microscale Approach, 5th ed., J. C. Gilbert & S. F Martin. Thompson Brooks/Cole, USA, 2011.
Required Molecular Models:	Molecular (HGS) Model Set for Organic Chemistry, The HGS Hinomoto Plastics Co., Ltd. Tokyo, Japan. Other commercial model sets will be acceptable.
Contents of Course:	The specific topics to be covered are detailed on the last page of this syllabus.
Format and Activities:	A prelab discussion will be held in the classroom prior to each laboratory exercise. Following the completion of the laboratory, a postlab discussion will ensue. Further details regarding the format can be found on pp 3-4 of this syllabus.
Moodle:	**http://campus.uogdistance.com/**. It is essential that all the students in this class join the Moodle group by 1/25/2016. All assignments, lesson plans, handouts and copies of previous tests will be posted on Moodle. The instructor will also periodically send messages to the class through Moodle. The **enrollment key** for this class is: **CH 312S2016**

Evaluation And Grading Criteria

A detailed account of all laboratory activities will be maintained in a laboratory notebook by each student. These notebooks will be collected for grading throughout the semester. In addition, worksheets relevant to each laboratory exercise will be submitted at pre-announced times and graded. Guidelines for writing the lab notebook are outlined in the reference laboratory text and will also be further discussed in class. Guidelines for the completion of the worksheets will be discussed in class. Late assignments will suffer a penalty, as detailed on page 4 of this syllabus. A written final laboratory exam and two quizzes will account for the balance of the lab grade.

Grading:

The grade from CH 312 will be apportioned in the following way:

Laboratory Reports*	**= 25%**
Quizzes	**= 30%**
Final Lab Exam Score	**= 30%**
Lab Notebook	**= 15%**

* A score -0- on 3 or more lab reports will automatically result in a course grade of **< F >.**

GRADING SCALE: A ≥ 90 %, B 80-89%, C 70-79%, D 60-69%, F < 60%

Course Schedule:

A tentative course schedule is provided on the last page of this syllabus.

Drop dates:

Please refer to the 2015-2016 Undergraduate Catalog for detailed information on drop dates.

Student Workload:

Aside from the 340 minutes spent in the laboratory and classroom, it is expected that students will have to devote a minimum of an additional 180 minutes per week in order to make satisfactory progress in CH 312.

Contact Information on Classmates:

Students are encouraged to exchange contact information in order to facilitate and promote scholarly interactions outside the classroom.

COURSE POLICIES

EEO/ADA Concerns

If you are a student with a disability who will require an accommodation(s) to participate in this course, please contact me privately to discuss your specific needs. You will need to provide me with documentation concerning your need for accommodation(s) from the EEO/ADA Office. If you have not registered with the EEO/ADA Office, you should do so immediately at 735-2244/2971/2243 (TTY) to coordinate your accommodation request.

RULES FOR THE ORGANIC CHEMISTRY LAB

1. Attendance: Lab begins promptly at 12:30 (or 4:30) PM on Thursdays. For reasons of safety, students are required to attend the entire pre-lab on the preceding Tuesday in order to carry out each experiment. **Students arriving late on the day of the experiment may NOT go directly to the lab without permission of the instructor.** Laboratory forums (post-labs) will be scheduled following completion of major experiments to clarify results and implications of the completed laboratory work. Attendance is likewise **required** for these sessions.

2. Make - ups: There will be no make - up labs. Those who miss a lab will receive a score of zero for that lab in the absence of a bona fide reason for such absence.

3. Quizzes: There will be two announced quizzes during the semester. These will be given at the beginning of the lab period. Topics for quizzes include, but are not limited to, the experiment to be performed on that day, work carried out on a previous experiment, and laboratory safety considerations. There will be no make-up quizzes. **Those arriving late will have only the remaining allotted time to complete the quiz. Those arriving after the quizzes have been collected will receive a 0 for that quiz.**

4. Dry - Labing: Writing a report without actually carrying out an experiment (dry-labing) is a very serious offense. Dry-labing will earn a zero.

5. Cell Phones & Beepers: Warning! The checking of email/telephone messages or texting is **not permitted** during any class or lab period. Students are required to turn off all such devices during all class and laboratory periods. The instructor will uniformly **apply a penalty of 25 points** to each student for every infraction(including a telephone beeping or ringing). These points will be deducted from the grand total.

6. Disruption of Class By Conversations and Activities Unrelated to Learning: The instructor seeks to generate a highly focused learning atmosphere for all students in the classroom and requests that individuals not engage in personal conversations or other activities that may detract from this goal. The instructor will provide one verbal warning to any disruptive student(s) after which a uniform **penalty of 25 points** will be applied to each student for every infraction. The instructor also reserves the right to dismiss any disruptive student from class. **Important Note**: The instructor wishes to clarify that all students are highly encouraged to address the class and/or the instructor with questions or comments relevant to the objectives of the course.

7. Safety Warning: Students are reminded that **strict adherence to safety in the laboratory is a requirement for passing this course.** The instructor may **dismiss** and issue a **failing grade** to any student who violates the safety rules of the chemistry laboratory. All individuals are required to keep their **eyes covered** with ***approved* eye goggles** at **all times** while in the laboratory. No contact lenses are permitted in the lab.

GUIDELINES FOR THE PREPARATION & SUBMISSION OF LAB WORKSHEETS

Upon completion of each experiment, a worksheet prepared by the instructor will be issued to the class. The worksheets are designed to provide the student with a thorough review of the entire experiment. In addition, the worksheets will inform the instructor of the outcome of the experiment for each group.

CAUTION: The following situations will result in a worksheet being severely penalized:

1. Unprofessional Appearance: It must be clear that the writer takes some pride in the worksheet. The absence of a fastener to hold the report together, torn out spiral notebook paper, smudged, soiled, crumpled or creased reports will be subject to a penalty of up to 100% of the worksheet grade.

2. Plagiarism: Students are encouraged to work cooperatively. However each student must use their own words to express their ideas in the individual worksheets. Worksheets from different students having very similar content or wording will collectively earn a grade of zero. Give proper credit to authors whose ideas are used in your worksheet.

3. Incomplete Worksheets: A good faith attempt must be made to answer all the questions on the worksheet. In the absence of such evidence, the instructor may impose a penalty of 20% of the total worksheet grade for **each** question left unanswered.

4. Tardiness : Each worksheet (or assignment) has a due date and time. Absence from lab on the due date is **NOT** an excuse. Each assignment must be **handed in directly to the instructor**. Assignments may **NOT** be turned in at the main office or at the instructor's office in his absence. **The penalty for late assignments is *10 PERCENT/MINUTE*. REPORTS TURNED IN 10 MINUTES AFTER THE DUE TIME EARN A ZERO.**

Student Learning Objectives for this Laboratory Course (SLOs):

At the conclusion of this course, the student should be able to perform the following tasks:

1. Apply principles of chemical safety in the storage and laboratory manipulation of organic reagents.

2. Isolate and purify organic compounds using recrystallization, distillation, extraction and chromatography.

3. Carry out synthetic reactions using ground-glassware kits.

4. Conduct synthetic reactions in which some of the reactants are sensitive to moisture or oxygen using specialized techniques and glassware.

5. Characterize and identify compounds by measuring physical properties such as melting point, boiling point, Rf values, and functional group-specific chemical tests.

6. Identify and delineate the exact constitutional and stereochemical makeup of molecules by detailed analysis of Infrared, Ultraviolet, ^{1}H & ^{13}C Nuclear Magnetic Resonance and Mass Spectra.

7. Design the experimental set-up as well as the work-up and purification procedure for a given reaction.

8. Relate the results of laboratory work to concepts of organic chemistry and report the findings and conclusions in accordance with a specified format.

Key for Alignment Chart for Course, Program and Institutional Student Learning Objectives (SLOs)

Chemistry Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs, (ISLOs) (7)	Methods of Assessment (MA) (5)
PSLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science. **PSLO 2:** Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment. **PSLO 3:** Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. **PSLO 4:** Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems. **PSLO 5:** Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. **PSLO 6:** Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. **PSLO 7:** Demonstrate interaction skills and teamwork.	**ISLO 1**: Mastery of critical thinking and problem solving **ISLO 2**: Mastery of quantitative analysis **ISLO 3**: Effective oral and written communication **ISLO 4**: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context **ISLO 5**: Responsible use of knowledge, natural resources, and technology **ISLO 6**: An appreciation of the arts and sciences **ISLO 7**: An interest in personal development and lifelong learning	**MA 1:** Visual Inspection and Assessment by Instructor **MA 2:** Quizzes **MA 3:** Exams **MA 4:** Worksheets **MA 5:** Homework

Alignment of Student Learning Objectives (SLOs) with Program Learning Objectives (PLOs) and Institutional Learning Objectives (ILOs). Revised January 2016

Course SLOs (6): Upon completion of the course, students will	Program SLOs (PSLOs) (7)	UOG (Institutional) SLOs (ISLOs) (7)	Methods of Assessment (MA)
SLO 1. Apply principles of chemical safety in the storage and laboratory manipulation of organic reagents.	PSLOs: 1 - 7	ISLOs: 1, 3, 5, 6 & 7	MA: 1-4
SLO 2. Isolate and purify organic compounds using recrystallization, distillation, extraction and chromatography.	PSLOs: 1 - 7	ISLOs: 1, 2, 3, 5 &6	MA: 1-4
SLO 3. Carry out synthetic reactions using ground-glassware kits.	PSLOs: 1 - 7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-4
SLO 4. Conduct synthetic reactions in which some of the reactants are sensitive to moisture or oxygen using specialized techniques and glassware.	PSLOs: 1 - 7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-4
SLO 5. Characterize and identify compounds by measuring physical properties such as melting point, boiling point, Rf values, and functional group-specific chemical tests.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-4
SLO 6. Identify and delineate the exact constitutional and stereochemical makeup of molecules by detailed analysis of Infrared, Ultraviolet, ^{1}H & ^{13}C Nuclear Magnetic Resonance and Mass Spectra.	PSLOs: 1-7	ISLOs: 1, 2, 3, 5, 6 & 7	MA: 1-4
SLO 7. Design the experimental set-up as well as the work-up and purification procedure for a given reaction.	PSLOs: 1 - 7	ISLOs: 1 - 7	MA: 1-4
SLO 8. Relate the results of laboratory work to concepts of organic chemistry and report the findings and conclusions in accordance with a specified format.	PSLOs: 1, 2, 3, 4, 6 & 7	ISLOs: 1 - 7	MA: 1-4

CH 312 TENTATIVE LABORATORY SCHEDULE

SPRING 2016

WEEK	DATE	TITLE	REFERENCE
1	1/21	No Class or Lab	
2	1/26	Introduction to CH 312. Prelab: Dehydration of Cyclohexanol	Handouts
	1/28	Lab: Dehydration of Cyclohexanol	Handouts
3	2/02	Introduction to UV-Visible Spectroscopy	Lecture Text
	2/04	Complete Dehydration of Cyclohexanol Lab & Postlab	Handouts
4	2/09	**CH 310b Exam 1**	
	2/11	Prelab & Lab: Extraction of Caffeine from Tea	Handouts
5	2/16	Introduction to ^{1}H NMR Spectroscopy	Lecture Text
	2/18	Lab: UV analysis of Caffeine & Postlab	Handouts
6	2/23	Prelab: Grignard Synthesis of Benzoic Acid	Lecture Text
	2/25	Glassware & Reagent Preparation for Grignard Reaction	Handouts
7	3/01	**CH 310b Exam 2**	
	3/03	Long Lab: Grignard Synthesis of Benzoic Acid	Handouts
8	3/08	Charter Day	
	3/10	Lab: Grignard Synthesis of Benzoic Acid Continued	Handouts
9	3/15	**Lab Quiz I**	
	3/17	End Grignard Synthesis & Postlab	Class Discus.
10	3/22 & 3/24	**SPRING BREAK**	
11	3/29	Prelab: Synthesis of Methyl Benzoate	Handout
	3/31	Lab: Synthesis & Isolation of Methyl Benzoate	Handouts
12	4/05	**CH 310b Exam 3**	
	4/07	Lab: Vacuum Distillation of Methyl benzoate	Handouts
13	4/12	Postlab: Synthesis of Methyl Benzoate & Prelab: Nitration	Handout
	4/14	Lab: Nitration of Alkylbenzenes	Handout
14	4/19	**Lab Quiz II**	
	4/21	GC Analysis of Nitration products/postlab	Handout
15	4/26	**CH 310b Exam 4**	
	4/28	Polymers Lab: Synthesis and Properties of Nylon and Glyptal	Handout
16	5/03	^{13}C NMR Spectroscopy	
	5/05	Cleanup of Glassware & Laboratory Lockers; Checkout	
17	5/10	**CH 312 Final Exam**	
	5/12	Review for CH 310b Final Exam	Class Discus.

THE UNIVERSITY OF GUAM
COLLEGE OF NATURAL AND APPLIED SCIENCES
DIVISION OF NATURAL SCIENCES

COURSE SYLLABUS

CH 330-01 QUANTITATIVE ANALYSIS (3 CREDITS)

Instructor: Dr Maika Vuki
Office: SC228, Science building
Contact number: 735 2781
Email: mvuki@uguam.uog.edu; uguamchemistry@gmail.com
Office hours: TBA

Course description:

This course is the study of the principles and methods in quantitative analysis. It will cover the classical methods of quantitative analysis that deals with gravimetric and volumetric methods. The first section of the also course deals with statistical treatment of data. This will cover some basic statistical methods and specific expressions to deal with different sample size. This will be followed by the common analytical methods employing instrumentations covering electro-analytical chemistry, spectrometry, chromatography, and recent advanced techniques. The course has three hours of lecture per week.

CH330L is the laboratory portion of CH330 and MUST be taken concurrently. The laboratory component will provide experience in the analytical procedure and skills. The laboratories will cover topics that directly relate to the theory. The practical application of several analytical methods will be part of the laboratory exercise. The course consist of six hours of laboratory work per week.

Course Student Learning Outcomes (SLO): Upon completion of the course, students will	**Matching Program Learning Outcomes (PLO)**	**Matching Institutional Learning Outcomes (ILO)**	**Method of Assessment**

Provide a rigorous background in chemical principles that are particularly important to quantitative analytical chemistry	PLO1 PLO4	ILO1	- Topic exam -Project paper -Final exam
Develop an appreciation of the significance of accuracy and precision in analysis.	PLO6	ILO6	-Topic exams -Final exam
Be able to apply standard statistical analysis on a set of data	PLO2	ILO2	-Topic exam -Final exam -Project paper
Interpret a set of data using the statistical analysis	PLO2	ILO1	-Topic exam -Final exam
Solve basic equilibrium equations	PLO4	ILO2	-Topic exam
Be able to write a scientific report	PLO3	ILO3	-Project paper
Develop research and communication skills	PLO3	ILO3 ILO5	-Project paper
Develop above average laboratory skills to obtain high quality data	PLO2	ILO5	-Supplemental laboratory practice

Chemistry Program Learning Outcomes

PLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science
PLO 2: Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment
PLO 3: Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills
PLO 4: Demonstrate critical thinking, problem solving skills and the ability to use chemical knowledge and mathematical skills to identify, evaluate, analyze, synthesize, and integrate data and abstract ideas in solving problems
PLO 5: Demonstrate the knowledge and skills in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields

PLO 6: Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry
PLO 7: Demonstrate interaction skills and teamwork

Institutional Expected Student Learning Outcomes

Some of the expected fundamental knowledge, skills, and values that the University of Guam student will have demonstrated upon completion of any degree are:
ILO1: Mastery of critical thinking and problem solving
ILO2: Mastery of quantitative analysis
ILO3: Effective oral and written communication
ILO4: Understanding and appreciation of culturally diverse people, ideas and values in a democratic context
ILO5: Responsible use of knowledge, natural resources, and technology
ILO6: An appreciation of the arts and sciences
ILO7: An interest in personal development and lifelong learning

Text book

Quantitative Chemical Analysis, Harris, D.C., 8th edition, W.H. Freeman and Co.

Course Content

Week 1-2: Chapter 1-3 (Analytical Process, Chemical Measurement, Tools of the Trade, Experimental Error)
Week 3-4: Chapter 4-5 (Statistics, Quality Assurance and Calibration Methods)

Exam 1

Week 5-6: Chapter 6, 7
Week 7-8: Chapter 8, 9

Exam 2

Week 9-10: Chapter 10, 11
Week 11-12: Chapter 13-16

Exam 3

Week 13-14: Chapter 18-20
Week 15-16: Chapter 22-24

Exam 4

Topic exams will be taken after covering major sections as indicated. Should there be four exams taken, the best three will be counted towards your final grade. If only three exams are taken, then all of these will be counted towards your final grade.

Method of Evaluation:

Topic exam (3 x18.3) 50%

Project paper: 10%

Assignment and Quiz: 10%

Final Exam: 30%

Course Policy

Lectures and laboratory are compulsory. Missed lectures will have points deducted form full attendance whereas missing laboratory will get a zero point. If you are going to be absent, the instructor must be notified in advance and evidence must be produced. Make up laboratory may be scheduled.
This schedule is tentative and may be changed by the instructor; changes will be announced in class or by email.
Email queries will be accepted and assignment may be submitted through email but must be with prior approval of the instructor.
Use of scientific calculator is required for the course but no preprogrammed data or equation in permitted in exam or laboratory classes.

Academic Dishonesty: All submitted assignments and laboratory report must be the individual student work. The university's policy on academic misconduct, including cheating and plagiarism will be enforced.

Special needs: Student with Disabilities

If you are a student with a disability who will require special arrangement, please contact the instructor to discuss your requirements. Documentary evidence will be required and you are also required to register with the EEO/ADA Office. Contact number is 735 – 2244/2971/2243.
The course has a rigorous laboratory component designed on using instrumentation. Students who miss more than three laboratory will be excluded from sitting the final exam. This will also apply to late submission of laboratory report. All lab reports must be submitted one day from the completion of experiment.

Tobacco-free/Smoke-free/beetle nut-free Campus

UOG is a tobacco free and beetle nut free campus. Thank you for not using tobacco products and beetle nut on campus, and for helping make UOG a healthy learning and living environment.

CH330L-01 QUANTITATIVE ANALYSIS LABORATORY (2 CREDITS)

THE UNIVERSITY OF GUAM
COLLEGE OF NATURAL AND APPLIED SCIENCES
DIVISION OF NATURAL SCIENCES

COURSE SYLLABUS

CH 330L-01 QUANTITATIVE ANALYSIS LABORATORY (2 CREDITS)

Instructor: Dr Maika Vuki
Office: SC228, Science building
Contact number: 735 2784
Email: mvuki@uguam.uog.edu
Office hours: TBA

Course Description

CH330L is the laboratory component of the lecture course. The two courses must be taken concurrently. The laboratory exercises deals with the practical applications of chemical analysis. The different analytical methods will be covered starting from the classical volumetric and gravimetric techniques then followed by spectrometric and separation techniques. Students will be introduced to the steps involved in chemical analysis in quantitative determination.

Course Student Learning Outcomes (SLO): Upon completion of the course, students will	**Matching Program Learning Outcomes (PLO)**	**Matching Institutional Learning Outcomes (ILO)**	**Method of Assessment**
Learn and master the basic skills needed to perform quantitative analytical measurements	PLO2	ILO5	-Laboratory reports
Understand and apply a variety of chemical reactions for the quantitative analysis of unknowns	PLO1 PLO2	ILO1	-Laboratory project
Introduce students to formal laboratory writing and data presentation	PLO3	ILO3	-Laboratory reports - Laboratory notebook

			- Seminar
Learn how to calculate the concentration of an analyte in an unknown sample	PLO2	ILO2	-Laboratory reports
Learn how to handle the statistical treatment of experimental data obtained via volumetric and instrumental methods of analysis	PLO2 PLO4	ILO2 ILO5	-Laboratory reports
Understand the difference between accuracy and precision of the results obtained	PLO1	ILO1	-Laboratory reports
Investigate instrumental methods	PLO4	ILO5	- Laboratory reports

Chemistry Program Learning Outcomes

PLO 1: Demonstrate the knowledge of fundamental concepts of chemistry and its relevance to the scientific method and other fields in science

PLO 2: Demonstrate the skills to make observations, experimentation, collect and collate data, analyze and interpret data in a safe chemical environment

PLO 3: Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills

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ILO7: An interest in personal development and lifelong learning

Course Content

CH330 Experiment schedule (Tentative)

Week

1. Introduction
2. Gravimetric: Determination of the water of crystallization
3. Volumetric: Determination of available chlorine in bleach
4. Determination of Copper by iodometric titration
5. Complexometric titration: Determination of the water hardness
6. Determination of Fe by spectrometric method
7. Alkalinity of Soda ash
8. pH titration
9. Electrochemical determination
10. Determination of Cu and Zn by Flame Atomic absorption spectroscopy
11. Gas Chromatographic determination of ethanol in Beverages
12. Laboratory Project
13. Laboratory Project
14. Laboratory Project
15. No Lab
16. Seminar
17. Review

Laboratory grading

Laboratory reports: 50%
Laboratory note book: 10%
Laboratory project: 30%
Seminar: 10%

Academic Dishonesty: All submitted assignments and laboratory report must be the individual student work. The university's policy on academic misconduct, including cheating and plagiarism will be enforced.

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