UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 100

Course Title: Introduction to Inorganic Chemistry Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: ✓ general education requirement
✓ part of Nursing and Agriculture major program
_____ elective

1. **Catalog Description:** This is a one-semester course for students preparing for technical training in natural sciences or laboratory work. The course covers the elementary principles of inorganic chemistry emphasizing nomenclature, stoichiometry, and solution chemistry. It includes three hours of lecture weekly. The lab, CH 100L, MUST be taken concurrently. Prerequisite: Completion of MA085 level II. Corequisite: CH 100L

2. **Course Content:**

   Measurements and calculations, matter and energy, elements, atoms, and ions, and chemical nomenclature. Reactions in aqueous solutions, chemical composition, chemical quantities, modern atomic theory, chemical bonding, gases solutions, acid and bases.

3. **Rationale for the Course:**

   This course is primarily designed for the health science (nursing) and agriculture majors

4. **Skills and Background Required or Expected:**

   Preparatory (high school chemistry); basic math skills such as solving algebraic problems.

5. **Teaching Methodologies and Anticipated Class Size:**

   Lectures, problem-solving sessions, laboratory experiments
   Lecture class size = 25
   Anticipated class size: 25

6. **Learning Objectives for Students:**

   1. Define basic chemical concepts and apply in Inorganic Chemistry.
   2. Apply mathematical and chemical concepts to solve simple quantitative and qualitative problems in chemistry.
   3. Explain the fundamental structure of matter and how it relates to properties.
   4. Identify and name simple chemical compounds
   5. Write and balance simple chemical compounds.
   6. Communicate chemical concepts clearly in written and oral.
   7. Relate chemistry to everyday experience.
   8. Interact to enhance learning chemistry.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. **Methods of Evaluation:**

3 Mid-terms (3 x 12) = 36%
Pop Quizzes = 9%
Comprehensive Final = 30%
Lab Reports & 2 Lab Exams = 25%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Introductory Chemistry: A Foundation, latest edition, Author: Zumdahl/DeCoste, Publisher: Houghton Mifflin Co.

Study Guide: Introductory Chemistry:, latest edition, Author: James F. Hall, Publisher: Houghton Mifflin Co.

Complete Solutions Guide, latest edition, Author: James F. Hall, Publisher: Houghton Mifflin Co.

10. Subsequent Courses:

CH 101

11. Additional Course Descriptors, if any: None

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 100L

Course Title: Introduction to Inorganic Chemistry Lab Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: ✓ General Education Requirement
✓ Part of Nursing and Agriculture major program
_____ Elective (for biology and physical science majors)

1. **Catalog Description:** This is a one-semester course for students preparing for technical training in natural sciences or laboratory work. The course covers the practical aspects of elementary principles of inorganic chemistry emphasizing measurements, stoichiometry and solution chemistry. It includes three hours of laboratory per week. The CH 100L MUST be taken concurrently with CH100 lecture. Prerequisite: Completion of MA 085 Level II. Co-requisite: CH 100.

2. **Course Content:**

   Measurements and calculations, matter and energy, elements, atoms, and ions, and chemical nomenclature; Reactions in aqueous solutions, chemical composition, chemical quantities, modern atomic theory, chemical bonding, gases solutions, acid and bases.

3. **Rationale for the Course:**

   This course is primarily designed for the health science (nursing) and agriculture majors. Students will be introduced to basic chemical measurements where basic laboratory skills will be developed.

4. **Skills and Background Required or Expected:**

   Preparatory level chemistry (high school chemistry) and basic math skills such as solving algebraic problems.

5. **Teaching Methodologies and Anticipated Class Size:**

   Lectures, problem-solving sessions, laboratory experiments, laboratory report writing
   Lecture class size: 25
   Anticipated class size: 25

6. **Learning Objectives for Students:**

   1. Use chemical safety knowledge and skills in laboratory to conduct experiments.
   2. Conduct experiment using a procedure, collect, analyze, and interpret data.
   3. Communicate laboratory results clearly, in written and oral presentations.
   4. Relate experimental observation to chemical concepts.
   5. Apply accuracy and precision in measurements and calculations.
   6. Interact and collaborate with peers in learning chemistry.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. Methods of Evaluation:

Lab final	=	30%
Lab practical	=	30%
Lab Reports	=	40%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Foundation of Chemistry in the Laboratory (paperback), Morris Hein/Judith N. Peisen/Leo R.Best/ Robert L. Miner: John Wiley & Sons, Inc., Latest edition.

10. Subsequent Courses:

CH 101

11. Additional Course Descriptors, if any: None

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 101

Course Title: Introduction to Organic Chemistry Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Spring

Course counts as: ✓ General Education Requirement
✓ Part of Nursing & Agriculture major program
_____ Elective

1. **Catalog Description:** This organic chemistry course is tailored for students preparing for technical training in natural sciences and for those seeking a practical approach to the chemical analysis and organic synthesis. It includes three hours of lecture weekly. The lab, CH 101L, MUST be taken concurrently. Prerequisite: CH 100-100L, or consent of instructor. Co-requisite: CH 101L

   CH 101L is the laboratory portion of CH 101 and MUST be taken concurrently. The course consists of one-three hour laboratory period per week.

2. **Course Content:** Saturated, unsaturated and aromatic hydrocarbons, alcohols, phenols, thiols, ethers and sulfides, aldehydes and ketones, carboxylic acids, carbohydrate, lipids, amines, amino acids and proteins, nucleic acids, metabolic processes.

3. **Rationale for the Course:** This is a one-semester course tailored for nursing and agriculture majors. The course also qualifies as a general education course. It covers basic concepts of carbon chemistry and their associated properties. Topics are studied under various heading such as alkanes, alkenes, alkynes and functional groups under alcohols, carboxylic acids, amines, etc. The importance of these compounds in food, medicine, and other industries, will be discussed. It is a course that will enable students to appreciate the role chemistry play in our daily lives.

4. **Skills and Background Required or Expected:** Introduction to Inorganic Chemistry (CH 100) is a prerequisite; Basic Algebra skills expected.

5. **Teaching Methodologies and Anticipated Class Size:**
   Lectures, problem-solving and laboratory experiments.
   Lecture class size = 40
   Lab class size = 25

6. **Learning Objectives for Students:**
   1. Identify functional groups and write name and structure of simple organic compounds.
   2. Solve simple reactions of organic compounds.
   3. Relate chemical and physical properties to the structure and composition of compound.
   4. Identify the structure of biochemical molecules and explain their function.
   5. Relate the relevance of organic chemistry to everyday life.
   6. Describe basic chemical changes in the metabolic process.
   7. Communicate chemical concepts clearly.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. Methods of Evaluation:

Mid-Term Exams (3 x20)	=	60%
Pop Quizzes	=	10%
Comprehensive Final Exam	=	30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Chemistry: An introduction to general, organic, and biological chemistry, latest edition, Author: Timberlake, K.C., Pearson, 2008

10. Subsequent Courses: None; however students interested in learning more about organic chemistry can attempt CH 310a-b, CH 311 and CH 312 courses.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 101L

Course Title: Introduction to Organic Chemistry Lab Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Spring

Course counts as: ✓ General Education Requirement
✓ Part of Nursing & Agriculture major program
_____ Elective

1. **Catalog Description:** This organic chemistry course is tailored for students preparing for technical training in natural sciences and for those seeking a practical approach to the chemical analysis and organic synthesis. It consists of a three hour laboratory per week. CH 101L MUST be taken concurrently with CH101 lecture. Prerequisite: CH 100-100L, or consent of instructor. Co-requisite: CH 101L

2. **Course Content:** Carbon type of bonding and isomerism, saturated, unsaturated and aromatic hydrocarbons, alcohols, phenols, thiols, ethers and epoxides and sulfides, aldehydes and ketones, carboxylic acids, amines, amino acids and proteins, carbohydrates, nuclei acids.

3. **Rationale for the Course:** This course leaves the practical skills to be gained in basic reactive and tests for organic compounds. The basic practical skills in ? isolating products and purification will be introduced.

4. **Skills and Background Required or Expected:** Introduction to Inorganic Chemistry (CH 100 & CH 100L) is a prerequisite; Basic Algebra skills expected.

5. **Teaching Methodologies and Anticipated Class Size:**
   Lectures, problem-solving and laboratory experiments. Laboratory report writing
   Lecture class size = 40
   Lab class size = 25

6. **Learning Objectives for Students:**
   1. Apply chemical safety and knowledge in laboratory to carry out experiments.
   2. Conduct experiment, collect, analyze, and interpret data.
   3. Relate experimental observations to chemical concept.
   4. Write laboratory reports clearly following the scientific reporting method.
   5. Communicate data using standard software.
   6. Present seminar using communication tools.
   7. Collaborate with peers to conduct experiment and learn chemistry

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. **Methods of Evaluation:**
   Laboratory final exam = 30%

Lab Reports	=	40%
Laboratory practical exam	=	30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Chemistry Laboratory Manual, An Introduction to General, Organic, and Biological Chemistry, latest edition, Author: K.C. Timberlake

10. Subsequent Courses: None; however students interested in learning more about organic chemistry can attempt CH 310a-b, CH 311 and CH 312 courses.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 102

Course Title: General Chemistry I Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: ✓ General Education Requirement
✓ Part of Biology, Chemistry major program
_____ Elective

1. **Catalog Description:** This course is designed for science majors and minors and emphasizes an in-depth study of modern chemical principles, theories, and laws pertaining to atomic structure, nature of the chemical bond, and stoichiometric considerations of all aspects of inorganic chemistry. It includes three hours of lecture weekly. The lab, CH 102L, MUST be taken concurrently. Prerequisite: Demonstrated proficiency at the MA 161 level or concurrent enrollment in 161a. Corequisite: CH 102L

2. **Course Content:** Principal topics include measurements, atomic theory, atomic properties, the mole concept, chemical stoichiometry, molarity, precipitation, acid base and redox reactions, gases, thermochemistry, atomic and molecular structure/periodic relationships, liquids and solids/intermolecular forces.

3. **Rationale for the Course:** This is a foundational course leading to further studies in science. It introduces the student to the scientific method and critical thinking as the means for problem solving.

   Atomic theory, the mole concept and chemical stoichiometry are perhaps the most fundamental ideas in chemistry. CH 102 aims to provide a sound introduction to these concepts and will illustrate the utility of these concepts in problem-solving situations in chemistry. The problem-solving approach will help the student gain a deeper understanding of these topics and will provide a firm foundation for further university-level chemistry.

4. **Skills and Background Required or Expected:** Students should know basic algebra and preferably should have taken preparatory chemistry at the high school level. MA 161a is a prerequisite for this course.

5. **Teaching Methodologies and Anticipated Class Size:** This course will require students' active participation in class, In addition to formal lectures, there will be problem-solving and question and answer sessions. Small group problem-solving will be encouraged to enhance a larger amount of class participation. In light of this, class size should be capped at not more than twenty-five (25) students, although an optimal size would be twenty (20) or less.

6. **Learning Objectives for Students:**

   1. Should be able to describe a scientific method and list the essential components of scientific method.
   2. Should be able to use mathematical skills to solve quantitative and qualitative problems in chemistry.
   3. Should be able to explain modern atomic structure and relate to chemical properties and composition of matter.
   4. Should be able to describe the bonding theories and its application to molecular and ionic compounds, and elements.
   5. Name and describe the formula of compounds using the chemical nomenclature.
   6. Should describe the laws governing the behavior of gases and the kinetic model for gases and use these laws for quantitative problem solving.
   7. Should be able to describe and quantify the energy in chemical and physical changes.
   8. Student should be able to communicate clearly through written, oral presentations.

9. Students should be able to develop good interaction skills and use this to enhance problem solving, critical thinking, communication, and personal development.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. Methods of Evaluation: There will be three in-class examinations and a comprehensive final examination, on which students will be expected to solve problems involving chemical stoichiometry, thermochemistry, atomic structure and mole-concept. Problem-solving skills expected of the students in exams include analyzing chemical information, and applying mathematical concepts and equations to arrive at a solution. Percentages assigned these assessments will be as follows:

In-class examinations (3 x 20) = 60%
Quizzes = 10%
Final comprehensive exam = 30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Author: Petrucci/Harwood/Herring, latest edition

Publisher: Prentice Hall

10. Subsequent Courses: CH 102 is designed to precede CH 103. It will also benefit students who will go on to take any further chemistry course.

11. Additional Course Descriptors, if any: None

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 102 L

Course Title: General Chemistry Lab I Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: ✓ General Education Requirement
✓ Part of Biology, Chemistry major program
_____ Elective

1. **Catalog Description:** CH 102L is the laboratory portion of CH 102 and MUST be taken concurrently with CH 102. The course consists of one three-hour laboratory period per week. Corequisite: CH 102

2. **Course Content:** This course provides the students "hands-on" experience with basic techniques of laboratory work and the practical experience necessary to better understand the content presented in CH 102. Topics include measurements, stoichiometry, solution reactions, thermochemistry, gases, chemical bonding.

3. **Rationale for the Course:** This is a foundational laboratory course leading to further exposure to "hands-on" learning experiences. It introduces the student to the fundamentals of observation and to the scientific method. Students will also develop writing skills.

4. **Skills and Background Required or Expected:** Students should know basic algebra and preferably should have taken preparatory chemistry at the high school level. MA 161a is a prerequisite and CH 102 is a co-requisite for this course.

5. **Teaching Methodologies and Anticipated Class Size:** This course will require students' active participation in learning laboratory skills by performing experiments in chemistry. Class size is limited to not more than twenty-four (24) students, although an optimal size would be twenty (20) or less. Close supervision of the student's work and safety considerations preclude a larger class size.

6. **Learning Objectives for Students:**
   1. Use safety knowledge and skills to conduct experiments.
   2. Conduct experiment from a given procedure, collect, analyze, and interpret data.
   3. Apply precision and accuracy in measurements and calculations.
   4. Relate the experimental observations to chemical concepts.
   5. Solve quantitative and qualitative problems in chemistry.
   6. Write clear laboratory reports using standard scientific reporting method.
   7. Use standard computer technology to present and analyze data.
   8. Collaborate with peers in learning chemistry.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. **Methods of Evaluation:** Lab write-ups involve responding to a list of pre-lab and post-lab questions to enhance an understanding of laboratory experiments. Practical lab experiments will test their experimental techniques and skills in

volumetric methods. A written laboratory final exam will test them on cumulative knowledge gained in this course.

These assessment activities will be weighted as follows:

Lab write-ups	40%
Lab practical exam	30%
Lab written exam	30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides: Experiments in General Chemistry (A laboratory program to accompany Petrucci & Harwood) by Gerald Weiss, Thomas Greco and Lyman, Rickard, latest edition.

10. Subsequent Courses: CH 102L is designed to precede CH 103L. It will also benefit students who will go on to take any further chemistry course.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 103

Course Title: General Chemistry II Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Spring

Course counts as: ✓ General Education Requirement
✓ Part of Biology and Chemistry major programs
_____ Elective

1. **Catalog Description:** This course is a continuation of CH 102-102L with further study of reactions and stoichiometric problems. The periodic table is studied with emphasis on physical and chemical properties. Thermochemistry, Kinetics, Chemical Equilibrium, electrochemistry, are introduced with respect to data gathering and simple deduction. It includes three hours of lecture weekly. The lab, CH 103L, MUST be taken concurrently. Prerequisites: CH 102-102L, and MA 161a or MA 161b or MA 165 or higher level or placement at this level. (CH 100-100L may be substituted for CH 102-102L by program consent). Corequisite: CH 103L

2. **Course Content:** The following topics will be covered in CH 103; compositions and physical properties of solutions, chemical kinetics, principles of chemical equilibrium, solution equilibria (acids and bases/solubility and precipitation/complex ion formation), thermodynamics, spontaneous change and equilibrium, and electrochemistry, periodicity.

3. **Rational for the Course:** CH 103 is a continuation of core General Chemistry, a foundational course for the natural science majors and minors**.**

4. **Skills and Background Required or Expected:** CH 102 skills and MA 161a skills.

5. **Teaching Methodologies and Anticipated Class Size:** Lectures, problem-solving and discussion sessions, lab experiments. Lecture class size = 40 students and Lab size = 25 students.

6. **Learning Objectives for Students:**

1.Describe the chemical concepts in solution processes, equilibrium, reaction rates, acidity and basicity, entropy, electrochemistry.
2. Use the chemical concepts to solve quantitative and qualitative problems in chemistry.
3. Explain the general properties of elements in periodic table; identify periodic trends in periodic table and use this as predictive tool for chemical and physical properties for both elements and compounds.
4. Process and communicate the chemical concepts clearly.
5. Relate the chemical principles to industrial and environmental applications.
6. Communicate chemical concepts clearly both in written and oral presentations.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-term exams	60%
Quizzes	10%
Final Exam	30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Text: R. H. Petrucci (chapters 11-21), General Chemistry, latest Edition, McMilan.

Lab Manual: A.S. Weiss, R.K. Wismer & T.G. Greco, Experiments in General Chemistry, recent edition

Recommended Texts: a) The Student Guide and b) The Solutions Manual

10. Subsequent Courses:

CH 310a-b
CH 330

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 103L

Course Title: General Chemistry II Lab Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Spring

Course counts as: X General Education Requirement
X Part of Chemistry & Biology major programs
_____ Elective

1. **Catalog Description:** This is a laboratory course that complements CH 103. It covers experimental techniques in the following topics: Kinetics, chemical equilibrium, Thermochemistry, electrochemistry, and analytical chemistry. It has a three-hour of laboratory weekly. The lab, CH 103L, MUST be taken concurrently with CH 103 Lecture.

2. **Course Content:** The following topics will be covered in CH 103; compositions and physical properties of solutions, chemical kinetics, principles of chemical equilibrium, solution equilibria (acids and bases/solubility and precipitation/complex ion formation), thermodynamics, spontaneous change and equilibrium, and electrochemistry, periodicity.

3. **Rationale for the Course:** CH 103 is a continuation of core General Chemistry, a foundational course for the natural science majors and minors.

4. **Skills and Background Required or Expected:** CH 102 skills and MA 161a skills.

5. **Teaching Methodologies and Anticipated Class Size:**

Lectures, problem-solving and discussion sessions, lab experiments.
Lecture class size = 50 students
Lab size = 25 students.

6. **Learning Objectives for Students:**

1. Use safety knowledge and skills to conduct experiments.
2. Conduct experiment from a given procedure, collect, analyze and interpret data.
3. Apply precision and accuracy in measurements and calculations.
4. Relate the experimental observations to chemical concepts.
5. Solve quantitative and qualitative problems in chemistry.
6. Write clear laboratory reports using standard scientific reporting method.
7. Use standard computer technology to present and analyze data.
8. Collaborate with peers in learning chemistry.
9. Present seminar using computer technology

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. **Methods of Evaluation:**

Laboratory reports	=	45%
Laboratory practical exam	=	30%
Lab Exams final	=	25%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Text: R. H. Petrucci (chapters 11-21), General Chemistry, latest. Edition, McMilan.

Lab Manual: A.S. Weiss, R.K. Wismer & T.G. Greco, Experiments in General Chemistry.

Recommended Texts: a) The Student Guide and b) The Solutions Manual

10. Subsequent Courses: CH 310a-b & CH 330

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 310a-b

Course Title: Organic Chemistry Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Fall (a)/Spring (b)

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major program
_____ Elective

1. Catalog Description: This is 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 main classes of compounds. This course is designed for chemistry and biology majors. Prerequisite: CH 103-103L.

2. Course Content:

a - Fall Semester:

1. An Introduction to Structure and Bonding in Organic Compounds.
2. Covalent Bonding and Chemical Reactivity.
3. Reactions of Organic Compounds as Acids and Bases.
4. Reaction Pathways; Alkanes and Cycloalkanes.
5. Stereochemistry.
6. Nucleophilic Substitution and Elimination Reactions.
7. Alkenes.
8. Alkynes.
9. Infrared.
10. Nuclear Magnetic Resonance Spectroscopy.
11. Alcohols, Diols and Ethers

b - Spring Semester:

1. Aldehyde and Ketones. Reactions at Electrophilic Carbon Atoms.
2. Carboxylic Acids and Their Derivatives I. Nucleophilic Substitution Reactions at the Carbonyl Group.
3. Carborylic Acids and Their Derivatives II. Synthetic Transformations and Compounds of Biological Interest.
4. Enols and Enolate Anions and Nucleophiles I. Halogenation, Alkylation and Condensation Reactions.
5. Enols and Enolate Anions as Nucleophiles II. Conjugate Addition Reactions; Ylids.
6. The Chemistry of Aromatic Compounds I. Electrophilic Aromatic Substitution.
7. Free Radicals.
8. Mass Spectroscopy.
9. The Chemistry of Amines.
10. The Chemistry of Aromatic Components I. Synthetics Transformation.
11. Carbohydrates (Selected Sections).
12. Amino Acids, Peptides and Proteins (Selected Sections).

18. Research methods

3. Rationale for the Course:

Organic Chemistry is a required course for chemistry and biology majors. It is intended to provide basic knowledge of and proficiency in the use of nomenclature, bonding, structural theory, synthesis, reaction mechanism and identification of organic compounds. It provides basic knowledge for students to continue education for advanced degrees in chemistry, biology and in the health related science.

4. Skills and Background Required or Expected: This course assumes some background in general chemistry. Completion of CH103/CH103L is required.

5. Teaching Methodologies and Anticipated Class Size:

A three one-hour lectures or two 80 minutes lectures per week. Material included in the text will be supplemented with the study guide and lecture discussion. Anticipated class size is 15-20 students.

6. Learning Objectives for Students:

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

1. Write the correct I.U.P.A.C. or common names for alkanes, polyenes, alcohols, ethers, 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: polyenes, alcohols, ethers, aldehydes and ketones, carboxylic acids and their derivatives, amines and their derivatives, carbohydrates, amino acids and polymers.
3. Analyze chemical reactions related to the synthesis of polyenes, alcohols, ethers, 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 polyenes, alcohols, ethers, 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.
7. Communicate chemical concepts through written and oral presentation.
8. Interact with peers and contribute effectively to team work and learning
9. Conduct literature research and critically read summarize scientific papers.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs.

7. Methods of Evaluation:

Course assessment will be based upon four mid-term exams (including a final exam), weekly quizzes, research project, and seminar.

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Seyhan Ege, Organic Chemistry. D.C. Heath and Company, latest Edition.

Seyhan, Ege, Roberta KIemman and Marjorie L.C. Carter, Studv Guide for Organic Chemistry. D.C. Heath and Company, latest Edition.

10. Subsequent Courses:

This course will prepare student for undergraduate courses in biochemistry, cellular physiology and for graduate courses in chemistry, biology and in medical science.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 311

Course Title: Basic Laboratory Techniques in Organic Chemistry Credit Hours: 2

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major program
_____ Elective

1. Catalog Description: Laboratory work in organic chemistry with emphasis on the development of manipulative skills in such techniques as distillations, reduced pressure fractionations, chromatography, and crystallizations, and constructions of apparatus utilized in the preparations, purification, identification and study of simple organic compounds. The course consists of a six hours laboratory. Co-requisite: CH 310a.

2. Course Content:

1. Introduction
2. Laboratory Safety and Waste Disposal.
3. Crystallization. Macroscale and Microscale Crystallization and Impure Acetanilide (containing sand, charcoal, and a few traces of aniline - brief handout).
4. Melting Points and Boiling Points. Melting points of Pure Acetanilide, and Phthalic Acid. Determination of Unknown with Mixed Melting Point.
5. Distillation. Macroscale and Microscale Simple Distillation. Microscale Fractional Distillation. Instant Microscale Distillation.
6. Steam Distillation. Macroscale - Steam Distillation of 0-nitrophenol from p-n itrophenol.
7. Extraction. Extraction of Caffeine from Tea. Distribution Coefficient of Benzoic Acid (Microscale).
8. Sublimation of Caffeine.
9. Thin-Layer Chromatography. Separation of Food Color (green, yellow, red, blue) using paper chromatography. (Handout)
10. Column Chromatography. Microscale. Separation of two dyes: methyl orange and methyl blue. (Handout)
11. The S_N2 Reaction. Macroscale - Synthesis of 1-Bromobutane.

3. Rationale for the Course:

The basic laboratory technique course is a required course for chemistry and biology majors. It covers basic experimental techniques for studying organic reactions. Laboratory safety and basic chemical reactions will be covered. Students should gain deeper appreciation of concepts that are discussed in the lecture. The skills acquired will prepare students for advanced courses in chemistry and biology.

4.Skills and Background Required or Expected:

This course requires a background in general chemistry and a concurrent enrollment in CH 310a Organic Chemistry.

5. Teaching Methodologies and Anticipated Class Size:

Two three-hour laboratory. material included in the text will be supplemental with the lecture discussion with emphasis on theory and lab techniques.

Anticipated class size: 15-20 students.

6. Learning Objectives for Students:

1. Apply principles of chemical safety in storage and chemical preparation or testing.
2. Identify and assemble apparatus for chemical experiment.
3. Use the laboratory procedure and conduct experiment to obtain the desired product.
4. Write clear and systematic laboratory report.
5. Participate effectively with peers in solving laboratory based problems.
6. Relate the chemical concept to experimental data.
7. Interpret spectral data.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Quizzes and one final exam (30%), laboratory experiments and reports (60%) and personal evaluation including neatness, attendance, attitude, etc. (10%).

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Kenneth L. Williamson, Macroscale and Microscale Organic Experiments. Latest edition, D.C. Heath and Company.
Handouts for additional experiments.

10. Subsequent Courses: CH 330, CH 410, CH 450

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 312

Course Title: Laboratory Techniques in Organic Chemistry Credit Hours: 2

Date of Final Approval: _____ Semester Offered: Spring

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major program
_____ Elective

1. Catalog Description:

This course is a continuation of CH 311 with emphasis on continued development of manipulative skills as required by preparation, purification, identification and study of more complex organic compounds. It consists of six hours of laboratory work per week. Prerequisite: CH 311and concurrent with CH 310b

2. Course Content:

1. Oxidation; Cyclohexanone from Cyclohexanol (Macroscale); Adipic Acid from Cyclohexanone.
2. Esterification; Methyl Benzoate by Fischer Esterification (Macroscale).
3. Aldehydes and Ketones; Semicarbazones (Microscale).
4. Grignard Synthesis of Triphenylmethanol and Benzoic Acid
5. Nitration of Methyl Benzoate (Microscale, double quantities).
6. Sulfanilamide from Nitrobenzene; Sulfanilamide (Macroscale).
7. Photochemistry. The Synthesis of Benzopinacol.
8. Infrared (Discussion and demonstration).
9. Nuclear Magnetic Resonance Spectroscopy
10. Ultraviolet Spectroscopy
11. Handout: Identification of an unknown organic compound by the use of IR and NMR spectra.
12. IDGAME: An Organic Compound Identification Game. Two unknown organic compounds.
13. SQUALOR: Simulated Qualitative Organic Analysis. Two unknown organic compounds.
14. Qualitative Organic Analysis (One unknown organic compound).
15. Searching the Chemical Literature (Handout assignments).
16. Seminar

3. Rationale for the Course:

This course is a continuation of CH 311 and required course for chemistry and biology majors. It deals with chemical synthesis and reactions of major organic compounds. Students will apply skills gained from CH311 and develop further quantitative and qualitative skills in interpretation of multiple spectral data.

4. Skills and Background Required or Expected:

This course requires a background of CH 311, or equivalent and concurrently taking CH 310b.

5. Teaching Methodologies and Anticipated Class Size:

Two three-hour laboratory per week. Material included in the text will be supplemental with lecture discussion with emphasis on spectral analysis and identification of organic compounds. Anticipated class size: 12-18 students.

6. Learning Objectives for Students:

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 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.
9. Interact with peers to solve problems.
10. Communicate experimental data clearly through written and oral format.
11. Conduct literature research and critically evaluate scientific data.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Quizzes and one final exam (30%), laboratory experiments and reports (50%), and personal evaluation, seminar (10%); neatness, attendance, attitude, etc. (10%).

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Kenneth L. Williamson, Macroscale and Microscale Organic Experiments. Latest edition, D.C. Heath and Company.

10. Subsequent Courses:

Students are well prepared to take BIICH 419 Biochemistry and BI 416 Cellular Physiology. This second one-semester course provides additional knowledge and experience in lab techniques for students preparing for studies in graduate school.

11. Additional Course Descriptors, if any:

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 330

Course Title: Quantitative Analysis Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Fall Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major program
✓ Elective

1. Catalog Description:

This course is a study of select quantitative schemes as utilized in volumetric and gravimetric analyses with emphasis upon acquiring an understanding of the basic theoretical principles involved. Some modern methods of analysis must be discussed. Laboratory emphasis is on the use of modern techniques for chemical analysis. The statistical methods for analyzing data will also be covered. It includes three hours of lecture weekly. The lab, CH 330L, MUST be taken concurrently with CH330 lecture. Prerequisites: CH 103-103L. Co-requisite: CH 330L

2. Course Content:

The evaluation of analytical data, the solubility of precipitates, Gravimetric analysis, Titrimetric methods, theory of neutralization titrations and titration curves, precipitation reactions, complex formation titrations, electrochemistry, theory and practice of redox titration and an introduction to spectroscopic methods of analysis.

3. Rationale for the Course:

Quantitative analytical data are crucial to research activity in chemistry, biochemistry, biology, geology and other sciences. Hence training in quantitative analysis is an integral component of a chemist's and biologist's education.

4. Skills and Background Required or Expected:

CH 102 and CH 103; Elementary algebra and statistics skills will be essential. Desirable math skills: Differential Calculus.

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving skills and focused laboratory exercises on quantitative chemical analysis. Anticipated class size = 6 to 8 students.

6. Learning Objectives for Students:

1. Define the chemical equilibrium and its application to quantitative analysis.
2. Use statistical concepts to solve for accuracy and precision in measurements and calculations.
3. Identify the instrumentation and methodology that is applied for chemical analysis.

4. Analyses and interpret data.
5. Solve multiple equilibrium equations.
6. Demonstrate both independent and collaborative learning skills.
7. Conduct basic research through literature search and experimentation.
8. Communicate chemical concepts clearly through written and oral presentations.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-Term Exams (3 x 20)	60%
Comprehensive Final Exam	30%
Seminar project	10%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Douglas Skoog, and J.J. Leary, Principles of Instrumental Analysis, latest edition, Saunders.

10. Subsequent Courses:

This is a terminal undergraduate course in instrumental methods.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 330L

Course Title: Quantitative Analysis Lab Credit Hours: 2

Date of Final Approval: _____ Semester Offered: Fall Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major program
✓ Elective

1. Catalog Description:

This course is a study of select quantitative schemes as utilized in volumetric and gravimetric analyses with emphasis upon acquiring an understanding of the basic theoretical principles involved. Laboratory emphasis is on the use of modern techniques will be utilized. The laboratory consists of a 6 hour laboratory per week. The lab, CH 330L, MUST be taken concurrently with the CH330 lecture. Prerequisites: CH 103-103L. Co-requisite: CH 330L

2. Course Content:

The evaluation of analytical data, the solubility of precipitates, Gravimetric analysis, Titrimetric methods, theory of neutralization titrations and titration curves, precipitation reactions, complex formation titrations, electrochemistry, theory and practice of redox titration and an introduction to spectroscopic methods of analysis.

3. Rationale for the Course:

Quantitative analytical data are crucial to research activity in chemistry, biochemistry, biology, geology and other sciences. Hence training in quantitative analysis is an integral component of a chemist's and biologist's education.

4. Skills and Background Required or Expected:

CH 102 and CH 103; Elementary algebra and statistics skills will be essential. Desirable math skills: Differential Calculus.

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving skills and focused laboratory exercises on quantitative chemical analysis. Anticipated class size = 6 to 8 students.

6. Learning Objectives for Students:

1. Apply chemical safety knowledge and skills in laboratory.
2. Conduct experiment, analyze data, interpret data.
3. Relate the experimental observation to chemical concepts.
4. Communicate laboratory results clearly in both written and oral presentations.
5. Conduct both independent research and demonstrate adequate collaborative skills.
6. Demonstrate adequate skills in validation of quantitative data using experimental method and statistics.
7. Use computer technology to analyze and present data.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Laboratory reports	40%
Laboratory Exam	20%
Project	20%
Seminar	20%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Douglas Skoog, and J.J. Leary, Principles of Instrumental Analysis, latest edition, Saunders.

10. Subsequent Courses:

This is a terminal undergraduate course in instrumental methods.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 392

Course Title: Laboratory Teaching and Assisting Credit Hours: 1-3

Date of Final Approval: _____ Semester Offered: Fall/Spring

Course counts as: _____ general education requirement
_____ part of _____ major program
_____ elective

1. Catalog Description:

This course provides for practical educational experience in undergraduate course laboratories. It may be taken more than once for credit. Prerequisite: Completion of course in which laboratory is offered, or of an equivalent course and consent of instructor.

2. Course Content:

3. Rationale for the Course:

4. Skills and Background Required or Expected:

5. Teaching Methodologies and Anticipated Class Size:

Anticipated class size:

6. Learning Objectives for Students:

1. Apply chemical safety knowledge and skill in the laboratory.
2. Explain the safety procedures clearly to students.
3. Evaluate preliminary data for improvement.
4. Conduct experiment, collect, analyze, and interpret data.
5. Set-up, calibrate, and operate standard laboratory instrument.
6. Prepare and analyze standards and samples with adequate reproducibility and accuracy.
7. Perform quality assurance for validating experimental measurements.
8. Communicate clearly procedures and chemical concepts.
9. Relate chemical concept to experimental data.
10. Adequate interaction skills with students, positive approachable.
11. Supervise a laboratory class.
12. Demonstrate leadership skills.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

10. Subsequent Courses:

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 410

Course Title: Instrument Methods of Analysis Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Spring Even Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
✓ Elective

1. Catalog Description:

This course is a study of different instrument methods of analysis as available. Both chemical and instrumental principles will be dealt with under the major analytical methods such as Spectrochemical methods, separation methods, electrochemical methods. Emphasis is on practical utilization of instrumentation in the field of analytical chemistry. It includes three hours of lecture weekly. The lab, CH 410L, MUST be taken concurrently. Prerequisites: CH 310a-b, 311, 312, 330, and MA 161a-b or consent of program. Co-requisite: CH 410L

2. Course Content:

Elementary electronics, microprocessors in chemical instrumentation, optical spectroscopic instrumentation, molecular fluorescence phosphorescence spectroscopy, atomic absorption, emission spectroscopy. Infrared and Raman spectroscopy, NMR, x-ray spectroscopy and electroanalytical chemistry, gas and liquid chromatography.

3. Rationale for the Course:

A vast array of powerful and analytical techniques, for solving analytical chemistry problems exist. Analytical techniques of interest to chemists, biologists and environmental scientists will be presented and an appreciation for modern instrument methods of analysis will be provided.

4. Skills and Background Required or Expected:

CH 310 a-b, CH 311-2, CH 330, MA 161 a-b

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving and laboratory exercises Class size = 6 to 8

6. Learning Objectives for Students:

1. Define the chemical concepts used for instrumentation.
2. Describe the process of acquiring data in analytical instrument and the limitations of response based on signal to noise ratio, interference.
3. Describe types of interference and how they are minimized.
4. Use procedure to set up and calibrate and instrument and collect data.
5. Interpret data and relate it to both quantitative and qualitative information.

6. Conduct research using literature and laboratory experimentation.
7. Communicate chemical knowledge very clearly both in written and oral using computer software.
8. Critically evaluate scientific information.
9.Explain the basic principles for data collection in major in XXXXXXX.
10. Identify the specific application for each instrumentation and then its limitations.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-Term Exam	-	40%
Final Exam	-	30%
Project		15%
Seminar		15%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Fundamentals of Analytical Chemistry, Douglas Skoog, and Donald West, latest edition, Saunders Publishing.
Recommended Text: Solutions Manual to accompany the text, Saunders Publishing Company.

10. Subsequent Courses:

CH 410 & CH 450a-b

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 410L

Course Title: Instrument Methods of Analysis Lab Credit Hours: 2

Date of Final Approval: _____ Semester Offered: Spring Even Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
✓ Elective

1. Catalog Description:

This course deals with the practical aspect of instrumental methods of analysis. Emphasis is on practical utilization of instrumentation in the field of analytical chemistry. It consists of a six hour laboratory per week. The lab, CH 410L, MUST be taken concurrently with CH410 lecture. Prerequisites: CH 310a-b, 311, 312, 330, and MA 161a-b or consent of program. Co-requisite: CH 410L

2. Course Content:

Elementary electronics, microprocessors in chemical instrumentation, optical spectroscopic instrumentation, molecular fluorescence phosphorescence spectroscopy, atomic absorption, emission spectroscopy. Infrared and Raman spectroscopy, NMR, x-ray spectroscopy and electroanalytical chemistry.

3. Rationale for the Course:

A vast array of powerful and analytical techniques, for solving analytical chemistry problems exist. Analytical techniques of interest to chemists, biologists and environmental scientists will be presented and an appreciation for modern instrument methods f analysis will be provided.

4. Skills and Background Required or Expected:

CH 310 a-b, CH 311-2, CH 330, MA 161 a-b

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving and laboratory exercises
Class size = 6 to 8

6. Learning Objectives for Students:

1. Apply chemical safety knowledge and skills in the laboratory.
2. Conduct experiment, collect, analyze and interpret data.
3. Set up, calibrate and operate analytical instrument.
4. Prepare and analyze standards and samples with adequate reproducibility and accuracy.
5. Conduct research using literature and laboratory experimentation.
6. Communicate chemical knowledge very clearly both in written and oral using computer software.
7. Critically evaluate scientific information.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-Term Exam	-	50%
Final Exam	-	30%
Project and seminar		20%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Fundamentals of Analytical Chemistry, Douglas Skoog, and Donald West, latest edition, Saunders Publishing.
Recommended Text: Solutions Manual to accompany the text, Saunders Publishing Company.

10. Subsequent Courses:

CH 410 & CH 450a-b

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH/BI 419

Course Title: Biochemistry Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Spring Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry and Biology major programs
_____ Elective

1. Catalog Description:

This course covers the principles of protein chemistry and enzyme nomenclature, catalysis, kinetics, and control. It includes three hours of lecture weekly. The lab, CH/BI 419L, MUST be taken concurrently. Prerequisite: CH 310a, CH 311, CH 310b and CH 312 or concurrent enrollment, BI 157-157L and BI158-158L or equivalent. Corequisite: CH/BI 419L

CH/BI 419L is the laboratory portion of CH/BI 419 and MUST be taken concurrently. The course consists of one three- hour laboratory per week. Corequisite: CH/BI 419

2. Course Content:

A. Lecture:

1. A Historical Review
2. Chemical Elements and Biogeochemical Cycles
3. Water as the Solvent of Life.
4. Some Basic Aspects of the Chemistry Life.
5. Cells: Biological Units of Molecular Organization.
6. Proteins I: Amino Acid Components and Structural Features.
7. Proteins II: Determination of Amino Acid Sequences.
8. Proteins Ill: Structure and Function.
9. Protein IV: Enzymes.
10. B-Vitamins and Coenzymes.
11. Carbohydrates.
12. Lipids and Membranes.
13. Nucleic Acids.
14. Energy and Life.
15. Anaerobic Synthesis of ATP (Glycolysis) and Pentose Phosphate Pathway.
16. Aerobic Synthesis of ATP I: Tricarboxylic Acid Cycle.
17. Aerobic Synthesis of ATP II: Electron Transport and Oxidative Phosphorylation.

B. Laboratory Experiments (Handouts)

1. General Laboratory Procedures. (Record Keeping, Graphs and Numerical Results, Errors, Accuracy and Precision, Concentrations and Dilutions, Laboratory Safety)
2. Preparation of a Buffer; Measurement of pH.
3. Titration of an Unknown Amino Acid; Formal Titration.
4. Absorption Spectrum of Riboflavin.
5. Spectrophometric Methods for the Determination of Proteins.
6. Enzyme Assays and Enzyme Units: Amylase.
7. Acid-Catalyzed Hydrolysis of Sucrose.
8. Presentations of special biochemical topics by students.

3. Rationale for the Course:

This is an introductory course in biochemistry. It is intended for students in any field of science or engineering who want a one-semester introduction to biochemistry but who do not intend to be a biochemistry majors. Attempts will be made to make biochemistry as clear and interesting as possible and to familiarize all science students with the major aspects of biochemistry. The students will gain practical experience in basic laboratory techniques and enzyme kinetics.

4. Skills and Background Required or Expected:

Prerequisites are CH 310a, CH 311, CH 310b and CH 312 or concurrent enrollment

5. Teaching Methodologies and Anticipated Class Size:

Three one-hour lectures and a three-hour laboratory per week. Material included in the text will be supplemented with assigned problems in enzyme kinetics, and in the preparation of buffer solutions.

Anticipated class size: 8-12 students.

6. Learning Objectives for Students:

At the end of the course, the student should be able to:

1. To learn the fundamental language of biochemistry, the major classes of biomolecules and the molecular logic of life.
2. To learn the structure and function of proteins and the latest methods and instrumentation used to analyze them.
3. To learn the importance of understanding the 3-D structure of proteins and the complex problem of protein folding and implications for neurodegenerative diseases.
4. To learn the structure and function of enzymes and the mechanism of enzyme catalysis and enzyme regulation in both health and disease.
5. To learn the approaches and instrumentation employed in the emerging field of Proteomics paralleling the Genomics revolution.
6. To learn the basic principles of bioenergetics.
7. To learn the fundamentals and of metabolism and its regulation.
8. To learn the cellular generation of the chemical energy required for sustaining life.
9. To learn the fundamentals of the complex balance of the physical, chemical, and biological context in which each biomolecule, reaction, or pathway operates and the relationship between structure and function.
10. To learn applications of biochemistry to problems in medicine, dentistry, agriculture, forensics, anthropology, environmental sciences, and other fields.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Weekly quizzes and/or problem set (20%), four exams including a final exam (55%) and laboratory reports (25%).

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Required text: Frank B. Armstrong. Biochemistry, Oxford University Press, latest edition. Recommended Laboratory Reference Book: Biochemical Techniques for Biochemistry Laboratory. J.F. Robyt and B.J. white. BrookslCole Publishing Company, latest edition. Handouts for selected lab experiments.

10. Subsequent Courses:

This course will prepare students for undergraduate courses in biochemistry, cellular physiology, and other science courses in medical science.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH/BI 419L

Course Title: Biochemistry/Biochemistry Laboratory Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Spring Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry, Biology major program
_____ Elective

1. Catalog Description:

This course covers the principles of protein chemistry and enzyme nomenclature, catalysis, kinetics, and control. It includes three hours of lecture weekly. The lab, CH/BI 419L, MUST be taken concurrently. Prerequisite: CH 310a, CH 311, CH 310b and CH 312 or concurrent enrollment, BI 157-157L and BI 158-158L or equivalent. Co-requisite: CH/BI 419L

CHI/BI 419L is the laboratory portion of CH/BI 419 and MUST be taken concurrently. The course consists of one three- hour laboratory per week. Co-requisite: CH/BI 419.

2. Course Content:

A. Lecture:

1. A Historical Review
2. Chemical Elements and Biogeochemical Cycles
3. water as the Solvent of Life.
4. Some Basic Aspects of the Chemistry Life.
5. Cells: Biological Units of Molecular Organization.
6. Proteins I: Amino Acid Components and Structural Features.
7. Proteins II: Determination of Amino Acid Sequences.
8. Proteins Ill: Structure and Function.
9. Protein IV: Enzymes.
10. B-Vitamins and Coenzymes.
11. Carbohydrates.
12. Lipids and Membranes.
13. Nucleic Acids.
14. Energy and Life.
15. Anaerobic Synthesis of ATP (Glycolysis) and Pentose Phosphate Pathway.
16. Aerobic Synthesis of ATP I: Tricarboxylic Acid Cycle.
17. Aerobic Synthesis of ATP II: Electron Transport and Oxidative Phosphorylation.

B. Laboratory Experiments (Handouts)

1. General Laboratory Procedures. (Record Keeping, Graphs and Numerical Results, Errors, Accuracy and Precision, Concentrations and Dilutions, Laboratory Safety)
2. Preparation of a Buffer; Measurement of pH.
3. Titration of an Unknown Amino Acid; Formal Titration.
4. Absorption Spectrum of Riboflavin.
5. Spectrophotometric Methods for the Determination of Proteins.
6. Enzyme Assays and Enzyme Units: Amylase.
7. Acid-Catalyzed Hydrolysis of Sucrose.
8. Presentations of special biochemical topics by students.

3. Rationale for the Course:

This is an introductory course in biochemistry. It is intended for students in any field of science or engineering who want a one-semester introduction to biochemistry but who do not intend to be a biochemistry majors. Attempts will be made to make biochemistry as clear and interesting as possible and to familiarize all science students with the major aspects of biochemistry. The students will gain practical experience in basic laboratory techniques and enzyme kinetics.

4. Skills and Background Required or Expected:

Prerequisites are CH 310a, CH 311, CH 310b and CH 312 or concurrent enrollment

5. Teaching Methodologies and Anticipated Class Size:

Three one-hour lectures and a three-hour laboratory per week. Materials included in the text will be supplemented with assigned problems in enzyme kinetics, and in the preparation of buffer solutions.

Anticipated class size: 8-12 students.

6. Learning Objectives for Students:

At the end of the course, the student should be able to:

1.To learn the fundamentals of biochemistry laboratory science, including laboratory safety; scientific notation; significant figures in calculations; errors in experiments; accuracy *vs.* precision; international system of measurements; expressing concentrations of biochemical solutions; preparing dilutions; use of pipets and pipetman; analysis and interpretation of experimental data, and presentation of experimental data by preparing data tables, and graphs by hand and computer.
2. To perform titration experiments to learn the acid-base behavior of amino acids.
3. To conduct experiments in photometry and the use of both UV & visible spectrophotometer.
4. To perform, with the use of the Spectrophotometer, a series of experiments on enzyme kinetics and enzyme regulation & inhibition.
5. To perform experiments in *in vivo* biochemistry, integrating genetics with biochemistry in order to learn the biochemical basis and approaches that are undertaken to explain genetic processes.
6. To learn molecular biochemical approaches to purify and characterize proteins, essential to investigating cellular and organismal physiology.
7. To learn two high tech instrumentation (HPLC and GC-MS), useful for biochemical analysis.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Weekly quizzes and/or problem set (20%), four exams including a final exam (55%) and laboratory reports (25%).

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Required text: Frank B. Armstrong. Biochemistry, Oxford University Press.
Recommended Laboratory Reference Book: Biochemical Techniques for Biochemistry Laboratory. J.F. Robyt and B.J. white. Brooks Cole Publishing Company, latest edition. Handouts for selected lab experiments.

10. Subsequent Courses:

This course will prepare students for undergraduate courses in biochemistry, cellular physiology, and other science courses in medical science.

11. Additional Course Descriptors, if any:

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 420

Course Title: Nuclear Magnetic Resonance Spectroscopy Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Fall

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
✓ Elective

1. Catalog Description:

Principles and applications of NMR spectroscopy, utilizing examples from organic, inorganic, and biological chemistry will be covered. The course will involve three hours of classroom study per week.

Prerequisites: CH31O a-b, CH312, MA204 and consent of instructor.

2. Course Content:

Topics covered will include the theory of Nuclear Magnetic Resonance, instrumentation and techniques, chemical shifts, spin-spin and dipolar interactions, relaxation, analysis of complex spectra, structure elucidation, chemical exchange and dynamic NMR, two-dimensional NMR and selected contemporary developments in NMR Spectroscopy; may also include electron paramagnetic resonance spectroscopy.

3. Rationale for the Course:

NMR Spectroscopy is one of the most powerful research tools currently used in chemistry. This course aims to provides a comprehensive view of basic nuclear magnetic resonance principles and applications. This course will provide a strong foundation in NMR for students planning to pursue graduate studies in chemistry, biochemistry and medicine.

4. Skills and Background Required or Expected:

A sound knowledge of sophomore level (one-year) organic chemistry and integral calculus will be required.

5. Teaching Methodologies and Anticipated Class Size:

Lectures and discussion sessions, problem-solving sessions and computer methods of data analysis will be employed. The anticipated class size is about eight students.

6. Learning Objectives for Students:

1. Describe the principles of nuclear magnetic resonance.
2. Explain the significance of the shielding constants and proton chemical shifts.
3. Explain the origin and the effect of spin-spin coupling.
4. Analyze first order and second-order NMR spectra.
5. Outline the features of Fourier Transform NMR.
6. Explain the connection between line-broadening and rate processes – Dynamic NMR.
7. Analyze the Carbon-13 NMR spectra and recognize the trends in Carbon-13 chemical shifts.
8. Explain the two-dimensional NMR spectra and learn some multiple-pulse techniques.
9. Describe spin relaxation processes.
10. Explain high-resolution NMR spectra in the solid state and liquid crystal phase.
11. Understand NMR imaging in Medicine and biology.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-term exams, home-work evaluations and a comprehensive final exam will be utilized for evaluation.

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program Faculty, any one of more of the following may be selected: Pre/Post Test, Course embedded questions; Standardized exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Required Text: E.D. Becker, *High Resolution NMR*, Latest edition, Academic Press

Recommended Reference Text: J.K. Sanders and B. K. Hunter, *Modem NMR Spectroscopy*, latest edition, Oxford University Press (1993)

10. Subsequent Courses: None

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 430

Course Title: Inorganic Chemistry Credit Hours: 3

Date of Final Approval: _____ Semester Offered: Spring Even Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
✓ Elective

1. Catalog Description:

This course is a study of topics such as bonding models in inorganic chemistry, structure and reactivity of covalent bond, experimental determination of molecular structure, chemical forces, coordination chemistry from theoretical, structural and reaction mechanistic perspectives, chemical applications of group theory and molecular symmetry. It includes three hours of lecture per week. Prerequisites: CH 103-103L, MA 204 or consent of program.

2. Course Content:

Bonding models in inorganic chemistry, the solid state, the covalent bond (structure and reactivity), chemical forces, acid-base chemistry, chemistry in aqueous and nonaqueous solutions, theory, structures, reactions, kinetics and mechanisms of coordination compounds. Organometallic chemistry, Inorganic chemistry in biological systems.

3. Rationale for the Course:

This course is a required course for chemistry majors. It builds upon periodicity and chemistry of elements in the same group in the periodic table.

4. Skills and Background Required or Expected:

CH 103 and MA 204
Reasonable knowledge of Differential and Integral Calculus.

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving and discussion sessions Class size = 8

6. Learning Objectives for Students:

1. Explain the structure of the atom.
2. Apply Symmetry and Group Theory to inorganic molecules.
3. Explain bonding models in Inorganic Chemistry as applied to (a) Ionic compounds (b) the covalent molecules.
4. Describe Solid State
5. Explain Acid-Base chemistry and chemistry in Aqueous and non-aqueous Solvents.
6. Use the properties of coordination chemistry in the context of Structure, Bonding, Spectra and

magnetism, Kinetics and Mechanism.

7. Describe Organometallic chemistry, Inorganic chains, Rings, Cages and Clusters.
8. Describe the chemistry of Halogens and the Noble gases.
9. Apply Periodicity to predict properties of compounds

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-Term Exams (3 x 5%)	=	45%
Take-home Evaluations	=	20%
Comprehensive Final Exam	=	35%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program Faculty, any one of more of the following may be selected: Pre/Post Test, Course embedded questions; Standardized exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

J.E. Huheey, Inorganic Chemistry, Third Edition, Harper & Row, New York, latest edition.

10. Subsequent Courses:

This is a terminal undergraduate course in Advanced Inorganic Chemistry.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 450a-b

Course Title: Physical Chemistry Credit Hours: 4/4

Date of Final Approval: _____ Semester Offered: a-Fall Even Years; b-Spring Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
_____ Elective

1. Catalog Description:

This is a full-year lecture sequence covering the application of physical principles to chemistry with theoretical, mathematical treatment. Laws of thermodynamics, thermochemical equilibria, ionic equilibria, phase equilibria, chemical kinetics, quantum theory, molecular structure, statistical mechanics, electrochemistry, surface chemistry and photochemistry are studied. It includes four hours lecture weekly. Prerequisites: MA 203, MA 204 or consent of program.

2. Course Content:

Thermodynamics, chemical kinetics, quantum mechanics and spectroscopy, statistical mechanics, electrochemistry.

3. Rationale for the Course:

It is an integral component in the training of chemistry majors.

4. Skills and Background Required or Expected:

MA 203 and MA 204
Reasonable knowledge of Differential and Integral Calculus.

5. Teaching Methodologies and Anticipated Class Size:

Lectures, problem solving and discussion sessions
Class size = 6

6. Learning Objectives for Students:

1. Explain advanced chemical concepts in thermodynamics, kinetics, equilibrium, quantum, ? of electrocleus by solving chemistry.
2. Organize a vast array of interconnected chemical concepts and communicate them effectively.
3. Analyze chemical information and to formulate solutions to chemical problems.

4. Identify, analyze and interpret chemical data. Develop an ability to adequately apply the chemical concepts, facts and models of chemistry to other disciplines in sciences and engineering.
5. Apply mathematical concepts, equations, and quantitative information to the solution of chemical problems.
6. Accomplish long-term retention of chemical facts and concepts.
7. Use the chemical literature and computer resources to gather research information.
8. Use computer programs to generate and analyze data.
9. Communicate chemical information clearly.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Mid-Term Exams (3 x 15%)	=	45%
Homework Evaluations	=	20%
Final Comprehensive Exam	=	35%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program faculty, any one or more of the following may be selected: Pre/Post Test; Course-embedded questions; Standardized Exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Required Text: P. W. Atkins, Physical Chemistry, latest edition. P.W. Atkins, Solutions Manual for Physical Chemistry, latest edition, Freeman, New York, latest.

10. Subsequent Courses:

CH 450 a-b together with CH 451 lab are senior level undergraduate (terminal) courses. These courses will be good foundational courses for graduate studies in chemistry/biochemistry/physics.

11. Additional Course Descriptors, if any:

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 451

Course Title: Physical Chemistry Laboratory Credit Hours: 2

Date of Final Approval: _____ Semester Offered: Spring Odd Years

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
_____ Elective

1. Catalog Description:

This course covers the mathematical tools normally utilized in experimental physical chemistry and experimental contact with thermodynamics, chemical equilibrium, chemical kinetics and phase equilibrium. It consists of six hours of laboratory weekly. Prerequisite: Consent of program.

2. Course Content:

Laboratory experiments in the determination of standard enthalpy and entropy changes, standard electrode potentials, solubility product; rotation-vibration spectra of simple molecules, determination of order of reaction by spectrophotometry, reaction kinetics and molecular dynamics simulations, photochemistry and quantum yield, NMR spectral analysis by computer methods and temperature-dependent NMR spectra for the study of intramolecular rate processes.

3. Rationale for the Course:

To teach an array of practical skills, relevant to modern experimental physical chemistry which are essential to the training of chemists.

4. Skills and Background Required or Expected:

CH 450-a, concurrent registration in CH 450-b, and MA 204

5. Teaching Methodologies and Anticipated Class Size:

Laboratory exercises, pre-lab lectures, computer methods of data analysis. Class size = 8.

7. Learning Objectives for Students:

1. Apply chemical safety knowledge and skill in the laboratory.
2. Conduct experiment, collect, analyze and interpret data.
3. Critically evaluate the experimental results and relate to chemical concepts.
4. Communicate laboratory results clearly and accurately.
5. Use computer to analyze data.

6. Design experimental approach for physical measurements.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Lab Reports & Results	=50%
Mid-Term Exam	=20%
FINAL EXAM	=30%

8. Methods for Student Learning Outcomes Assessment:

Depending on Instructor and Program Faculty, any one of more of the following may be selected: Pre/Post Test, Course embedded questions; Standardized exams; Portfolio Evaluation; Direct Observation; and Capstone Course Evaluation.

9. Required and Recommended Texts or Study Guides:

Arthur M. Halpern, Experimental Physical Chemistry, latest edition, Prentice Hall.

10. Subsequent Courses:

This is a terminal course in experimental physical chemistry for undergraduate chemistry majors. Students pursuing graduate work in chemistry will find this course to be the foundation for furthering their intellectual growth.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.

UNIVERSITY OF GUAM
COURSE OUTLINE

College: College of Natural and Applied Sciences Course Number: CH 491

Course Title: Chemistry Seminar Credit Hours: 1

Date of Final Approval: _____ Semester Offered: Fall/Spring

Course counts as: _____ General Education Requirement
✓ Part of Chemistry major program
_____ Elective

1. Catalog Description:

This is a course designed to familiarize the student with research or reviews and surveys of chemical literature. It may be taken more than once for credit with consent of program. Prerequisite: Upper division status and consent of program.

2. Course Content:

Students will be taught the various techniques employed to search the chemical literature. Students will be given orientation to the UOG's chemistry acquisitions and journal collections. Students will be instructed on the techniques for making effective oral presentations.

3. Rationale for the Course:

To teach an important skill in the art of oral presentation that is vital to the functions of chemistry professional. This course will also help develop effective communication skill.

4. Skills and Background Required or Expected:

Upper division status in chemistry and the ability to communicate concepts and techniques of chemistry as required.

5. Teaching Methodologies and Anticipated Class Size:

Techniques for making effective oral presentations will be discussed. A tour of the UOG library and chemistry journals will be given to the seminar students. Techniques for locating primary journal articles will be taught. The class size will be about six students.

8. Learning Objectives for Students:

1. Use the scientific publication databases to acquire *primary* journal article, e.g. Chemical Abstracts Indexes, Pub med and EBSCO.
2. To write a concise summary (with pertinent references) on specific topic in the chemical sciences.
3. Identify relevant audio, visual aids using standard computer software to accompany a presentation.
4. To deliver a clear and well organized presentation.
5. To deliver a presentation within the allotted time.

6. To review and summarize background and historical coverage to meet the needs of the audience.
7. Critically evaluate the topic, propose improvements, future work.
8. To adequately address questions from the audience in a non-defensive manner.
9. To correctly estimate the time required for each activity in the preparation of a chemistry seminar.

Note: With Program Faculty Consultation, an instructor may add additional SLOs to the above Program Faculty approved SLOs

7. Methods of Evaluation:

Effectiveness of final oral presentation	=	70%
Submission of progress reports and a final report	=	30%

8. Methods for Student Learning Outcomes Assessment:

Use of Seminar Rubrics, Pre and post presentation, portfolio

9. Required and Recommended Texts or Study Guides:

Although no single textbook is required students will be introduced to various monographs such as the American chemical Society's STYLE GUIDE, Second Edition (Ed: Janet Dodd, Washington, D. C., 1997). This manual has a useful and informative chapter on making effective oral chemistry presentations.

10. Subsequent Courses:

This is a terminal course in chemistry for undergraduate chemistry majors and minors.

11. Additional Course Descriptors, if any:

The Calendar of Assignments, Assessment Project, a Statement Concerning the "Americans with Disabilities Act" (ADA) Accommodations for Students, Attendance and Grading Policies are to be included in the course syllabus.