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

COURSE SYLLABUS

CH410: INSTRUMENTAL METHODS OF ANALYSIS

Instructor: Dr. Maika Vuki

Office: SC 228
Phone: 735 2781
E-mail: mvuki@guam.uog.edu; vukim@triton.uog.edu
Office Hours: MW 9-11; M, T, W

Scheduled Class Time Lectures: MW 12.30-13.50 Lab: T 4-7; Fri 2-5

Course Description
This course is designed for students who are majoring in chemistry. The course will cover the major areas of analytical instrumentation for chemical analysis. One of the critical factors in the identification and quantification chemical substances is the choice of analytical instrument. With the availability of a wide range of analytical instruments, the choice and the use these instruments require sound knowledge in the chemical principles and effective us of instrument. The course will give the students the principles and the field of applications to a number of advanced instrumentation available. At the end of this course, students should be able to distinguish between the main areas of instrumentation. Factors that causes the enhancement of signal or interferences should be understood and how to overcome them. The student must be confident in the basic operation to set up the instrument for a particular analysis.

Pre-requisite: CH310a-b, CH311, CH312, CH330/L, and MA161a-b. Co-requisite: CH410L

Course Student Learning Outcomes (SLO): Upon completion of the course, students will	**Matching Program Learning Outcomes (PLO)**	**Matching Insitutional Learning Outcomes (ILO)**	**Method of Assessment**
Classify the various types of analytical methods into major categories such as spectroscopic, separation, electrochemical, or classical wet methods	PLO5	ILO5	-Final Exam
Describe the basic principles of each type of instrumental method	PLO5	ILO5	-Midterm exams
Identify and describe the major components of instrumentation	PLO5	ILO5	-Midterm exam

			-Final exam
Describe the different types of interferences and possible mitigating factors for each instrument	PLO5	ILO5	-Midterm exam
Define the limitations of the individual type of instrumentation	PLO5	ILO5	-Midterm exams -Final exam
Operate and conduct chemical analysis on a range of instrumentation	PLO2 PLO5	ILO5	-Supplemental laboratory -Midterm exam
Conduct critical review of scientific literature, synthesize information and communicate clearly in writing and oral presentation	PLO3	ILO3	**-Research paper**
Develop an appreciation of the application of the different instrumentation	PLO6	ILO6	**-Final exam**
Solve analytical problems based on data form chemical analysis	PLO2 PLO4	ILO2	**- Assignments** **-Midterm exams**
Validate the data that are measured form the instruments studied	PLO2	ILO2	**-Assignemnts** **-Midterm exams**
Communicate clearly the principles, components, and application of instrumentations	PLO3	ILO3	**-Research paper**
Develop strong interactive skills in problem solving	PLO7	ILO7	**- Assignments**

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

*Principles of Instrumental Analysis, D.A. Skoog, F.J Holler, and S. R. Crouch, 6th Edition, 2007, Thompson
Principles of Instrumental Analysis, D.A. Skoog, F.J Holler, and T.A. Nieman, 5th, Thompson

Course Content
This course introduces students to a modern array of instrumental methods. The topics covered include: Measurement basics, Atomic spectroscopy (AAS, AES, ICP), Molecular Spectroscopy (UV-Vis, FTIR, NMR), Electroanalytical Chemistry (Voltammetry, Potentiometry, Polarography), Separation Methods (Gas Chromatography and High Pressure Liquid Chromatography). Under these topics, the different types of analytical instrumental methods will be covered.

Grading

Assignment:	5%
Quiz	5%
Research Paper:	10%
Three Mid-Term Exams:	50%
Final Exam:	35%

Course Grades

A: 90-100%
B: 80 – 89%

C: 70 – 79%
D: 50 – 69%
F: < 50%

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.

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COURSE SYLLABUS

INSTRUMENTAL METHODS OF ANALYSIS

Instructor: Dr. Maika Vuki

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Phone: 735 2781
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Office Hours: M,W 9-11; T, TH 9-10.

Scheduled Class Time:

Lectures: M W 12.30-1.50
Lab ; T 4-6, F 1-5

Course Description

This course is designed for students who are majoring in chemistry. The course is the laboratory component of CH410 and should be done concurrently. The course will focus on the hands on operation of analytical instrumentation that complements the theory component from the lecture. The instruments studied includes, UV-Visible spectroscopy, Atomic Absorption Spectroscopy, Gas Chromatography, HPLC, FTIR, NMR, and Electroanalytical Methods.

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**
Operate and conduct chemical analysis on a range of instrumentation	PLO2 PLO5	ILO1 ILO2 ILO5	- Laboratory Reports
Develop an appreciation of the application of the different instrumentation	PLO6	ILO6	-Laboratory reports -Unknown project
Solve analytical problems based on data form chemical analysis	PLO4	ILO2	- Laboratory reports -Unknown project
Validate the data that are measured from the	PLO2	ILO2	- Laboratory reports

instruments studied			
Communicate clearly the principles, components, and application of instrumentations	PLO3	ILO3	-Project paper - Project final reports -Seminar
Develop strong interactive skills in problem solving	PLO7	ILO7	- Group work in Laboratory

Chemistry Program Learning Outcomes

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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

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Text book:
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Course Content

LABORATORY SCHEDULE (Tentative)
Spring 2016

Laboratory experiments handouts will be provided for the listed experiment**.**

Week	Day	Experiment	Comments
1			
2	1/29	Calibration of pH meter	
3	2/5	Project	
4	2/12	UV, Quantitative Analysis of aspirin	
5	2/19	Visible Absorption, Simultaneous determination of Chromium and Cobalt	
6	2/26	FTIR	
7	3/4	NMR	
8	3/11	GC	
9	3/18	voltammetry	
10	3/25	Potentiometry	
11	4/1	AAS Absorption	
12	4/8	AAS Emission	
13	4/15	Project	
14	4/22	Field visit	
15	4/29	Field visit	
16	5/6	Lab Exam	
17	5/13	No Lab	Final week
			Exam week

PROJECT
A project on the determination of an unknown compound will run parallel with the semester schedule. Each student will be given an unknown compound. Students are required to go through a series of test using the basic chemical test, such as determination of melting point, solubility, and flame test. This will be followed by using instrumentation, such as UV, IR, NMR, GC-MS etc., to further elucidate the identity of the compound.

ASSESSMENT

Laboratory Reports: 45%
Unknown: 20%
Instrumental skills: 10%
Lab Note book: 10%
Laboratory Exam: 15%

Course Grades

A: 90-100%
B: 80 – 89%
C: 70 – 79%
D: 50 – 69%
F: < 50%

Lab notebook
It is compulsory that a lab notebook be used for maintaining a log of every data that is obtained in the lab.

Pre-Lab
A necessary prerequisite for adequate performance in the laboratory is your preparation prior to the laboratory period. Students must be well acquainted with the instructions for the experiment to be carried out. You only have 4 hours to complete the experiments! Therefore, make sure you have read the procedures and the instrument operating instructions **before** coming to class. Also come to class with an outline of exactly how you intend to prepare your standard solutions and run your experiments.

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

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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 week from the completion of experiment.

Withdrawal from course
Students must follow the withdrawal procedure stipulated in the Undergraduate Catalogue. Withdrawal within the 8 weeks of class session requires the completion of withdrawal form from the Records Office. Withdrawal after 8 weeks of session will require the completion of a Petition to Withdraw from the Records Office. Students failing to withdraw will get an "UW" on their record, which is equivalent to an F grade.

Other information
A scientific calculator in required for laboratory work and data analysis.

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COURSE SYLLABUS

CH490-70 SPECIAL PROJECT IN CHEMISTRY

Instructor: Dr Tedros Bezabeh
Office: SC203, Science building
Contact number: 735-2784
Email: bezabeht@triton.uog.edu
Office hours: M, W, Th 2:00 – 4:00 pm

Credit Hours: 3 credits

Course description

This course will provide students with a scientific literature review and scientific publishing experience. Students will undertake a project on a specific topic related to biomedical application of chemistry under the close guidance of a selected faculty. The methods will involve conducting an extensive literature survey on a selected topic, summarizing the findings, drafting an outline of a review article, writing a full review article for a peer-reviewed journal. Students will also be required to write a full project report and make a presentation at a University seminar at the end of the course.

Pre-requisite: CH330, CH330L, CH310a-b, CH311, CH312 or consent of instructor

Rationale

The proposed Research Methods course will cover topics including proposal writing, literature review, understanding statistical analysis of data, report writing, and presentation of scientific reports.

Course Student Learning Outcomes (SLO): Upon completion of the course, students will	**Matching Program Learning Outcomes (PLO)**	**Matching Institutionl Learning Outcomes (ILO)**	**Method of Assessment**
utilize the tools available through the University of Guam to access primary scientific literature	PLO4 PLO6 PLO1	ILO3	Literature review

read appropriate scientific papers and extract the critical information	PLO4 PLO6 PLO1	ILO5	Literature review
prepare a project proposal based on recent scientific literature	PLO4 PLO3 PLO6	ILO3	Review article
critically evaluate and interpret published data	PLO2	ILO1	Final report
familiarize themselves with the correct terminology in the area of study	PLO1	ILO1	-Literature review
successfully communicate scientific information through scientific reports and oral presentations	PLO3 PLO4	ILO3	Presentation
extend the knowledge and understanding of variety of chemical concepts in different contexts	PLO6	ILO6	-Literature review -Final report -Presentation
demonstrate skill of independent learning and making decisions based on data	PLO7	ILO7	Writing a scientific article for a peer reviewed journal

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ILO6: An appreciation of the arts and sciences
ILO7: An interest in personal development and lifelong learning

Text book: There is no prescribed text for this course. Students will be using the relevant published articles for specific references.

Teaching Method/ Course Content

It is recommended that students consult directly with their selected faculty and seek course approval a semester prior to taking the course. Teaching method will involve one to one discussion on a weekly basis. This will include project title, literature review, project proposal, and report writing. Throughout the semester, the student and faculty will hold weekly meetings to discuss project deadlines and progress report. This course will require a significant amount of independent student work in the library and on the internet. Students enrolled in this course are expected to devote at least 6 hours per week in independent study, writing or experimentation.

The proposed schedule for the course will have:

Weeks 1-3:

- Identifying an area of research relating chemistry to medicine/biology
- Proposing a suitable title for the review article
- Identifying sources/databases
- Performing searches with the appropriate keywords
- Reading abstracts and ordering relevant articles

Weeks 4-7:

- Reading selected relevant full articles:
- Summarizing/extracting the necessary information from each article

Week 8

- Identifying a journal for the submission of the article

- Drafting an outline with all the relevant sections of a review article (based on the selected journal's guidelines)

Weeks 9-12
- Writing the review article including all citations

Week 13
- Revising the article (based on advisor's input)
- Submitting the article to a selected journal

Weeks 14-15
- Prepare PowerPoint slides for presentation
- Practice presentation
- Make a formal presentation in the College's Seminar series

Grading

Grade for this course will be obtained from the major required tasks

Literature review 30%
Scientific writing (review article) 50%
Presentation 20%

Assessment

This course integrates several core skills that are listed under the Program Learning Outcomes. Among others, this course will require the mastery of the following skills PLO's:

1. Demonstrate the knowledge in advanced instrumentation, applications, interpretation, and experimental design to address scientific queries in chemistry, industry, the environment, health, and related fields. (PLO Goal #5)

   Assessment: (Summative Assessment) Experimental design report, meeting report, problem solving approach, also final report.

2. Demonstrate a sense of exploration and research approach that enables students to pursue lifelong learning in chemistry. (PLO Goal #6)
   Assessment: (Summative Assessment) Literature survey report, experimental design, experimentation, final report.

3. Demonstrate the ability to clearly articulate, formulate, and communicate scientific information using computer, written and oral communication skills. (PLO Goal #6)

Assessment: (Summative Assessment) Final presentation and written report. CH491 seminar rubric will be adapted and applied.

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

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