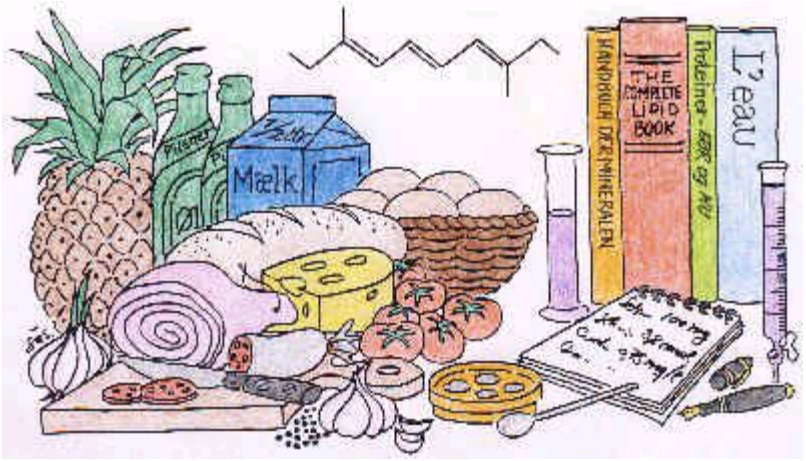
SCIENCE & TECHNOLOGY 103

PHYSICAL & CHEMICAL METHODS OF FOOD ANALYSIS

2015



A. E. Mitchell PhD

Lecture/Discussion: Monday, Wednesday, Friday 11:00 -12:00 PM
Lab Sections: Tuesday, Thursday 9-12:00 PM or 2-5:00 PM - 1220 RMI South

Instructor: Alyson Mitchell, PhD
2214 South RMI Building (for scheduling appointments only)
530-304-6618; aemitchell@ucdavis.edu

TAs: TBA

Please Note:

Lab coats and safety glasses are required for this lab.
Please purchase them in time for the first lab meeting.

Open shoes **may not** be worn in the lab. You will be sent home if you are wearing inappropriate shoes or attire. There are no make up labs.

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GENREAL CONTENT

LABORATORIES

COURSE OBJECTIVES:

This course covers the basic science relating to the chemical and physical analysis of foods. This course will introduce principles relating to the separation and quantification of various constituents within foods. My goal is to stimulate your interest in the chemical analysis of foods and provide you with a general understanding of instrumental methods relating to food analysis. Because food analysis relies on accurate measurement, it is important for you to develop good laboratory skills and control of quantitative techniques. Wherever possible the procedures used in this laboratory are those adopted by professionals to ensure results of the greatest reliability. In order to be successful it is important that you have an understanding of the theoretical background of the analytical procedures. Without this it, is not possible to apply methods to new samples with any confidence. You are encouraged to develop your knowledge of food analysis by reading both the laboratory manual and required text (Food Analysis: Third Edition, S. Suzanne Nielsen).

Course Goals:

- Food Science and Technology 103 is designed to acquaint students with the theory and application of physical and chemical methods for determining the chemical composition of foods. Modern separation and instrumental analysis techniques are stressed.

Entry Level:

- Mastery of material in general chemistry (CHE 2A, B and C) and organic chemistry (CHE 8A and B) and food chemistry (FST 100A and FST101A) are required.

Course Structure:

Contact Hours

- The course is given as three 1-hour lectures and one 3-hour weekly laboratory
- Office hours are held twice weekly by TAs for a total of 2-hours /week
- Additional time is always available through scheduled appointments with the instructor (contact the instructor through email to schedule an appointment)

Course Format

- The lectures are used to present the theory of various analytical techniques used in modern food analysis
- Laboratory exercises are selected to compliment lecture material and require written laboratory reports
- The pre-lab discussions are used to help student understand how theory relates to the instrumentation used in the laboratory exercises

Topical Outline:

- Food Analysis & Sampling
- Statistics & Data Handling
- Protein Determination / Titratable Acidity / Brix
- Sample Prep I: Polarity, and Solubility
- Sample Prep II: Partitioning, Extraction and Fractionation
- Sample Prep III: Extraction and Fractionation
- Spectroscopy I: Principles
- Spectroscopy II: UV-vis, Fluorescence
- Principles of Chromatography
- Principles of Gas Chromatography (GC)
- Principles of High Performance Liquid Chromatography (HPLC)
- Qualitative & Quantitative Analysis
- Proximate Analysis
- Analysis of Lipids
- Analysis of Carbohydrates
- Analysis of Pigments & Antioxidants
- Color Analysis
- Vitamin Analysis
- Principles of Atomic Absorption Spectroscopy
- Principles of Atomic Emission Spectroscopy
- Principles of Mass Spectrometry

Potential Course Overlap:

This course builds on BIS 102 and FST100A (Food Chemistry). It also builds on the laboratory experience gained in FST101A. FST 103 is different from ANS 137 (2 units) in that it provides more theory of instrumentation and hands on experience with contemporary equipment. FST 103 is more chemical than biochemical focused.

References:

1. Food Analysis: Third Edition, S. Suzanne Nielsen, REQUIRED (2003).
2. Official Methods of Analysis. Association of Official Analytical Chemists, 15th ed. (1990).
3. Food Analysis: Theory and Practice. Pomeranz and Meloan, 3rd. ed., (1994).
4. Food Chemistry, Fourth Edition; Srinivasan Damodaran, Kirk L. Parkin and Owen R. Fennema (Editors). (2007).

Learning Outcome and Assessment Statement:

The successful student:

A. General learning outcomes:

Upon successful completion of this course, the student will be able to:

- apply a scientific approach to data analysis and problem solving
- organize and communicate scientific data and ideas in a written format
- apply critical thinking skills to data assessment and presentation
- select appropriate solutions when faced with practical problems
- work cooperatively and effectively with others

B. Specific learning outcomes:

Upon successful completion of this course, the student will

- Describe and discriminate how reactive groups of food components play an important role in chemical reactions
- Describe and use contemporary analytical methods for quantitatively evaluating the composition of major food components
- Describe and distinguish the chemical and physical properties of major food components and relate this information to the isolation and chemical analysis of food components
- Select and apply appropriate basic statistical methods to sampling/testing and the assessment of experimental data
- Explain the major chemical reactions that occur during food processing and storage and relate these reactions to food quality, safety and shelf-life
- Explain the techniques of UV-Vis spectroscopy, high performance liquid chromatography (HPLC), gas chromatography (GC), atomic adsorption spectroscopy (AAS), atomic emission spectroscopy (AES) and mass spectrometry (MS) and discuss and understand their applications in food analysis
- Discuss food additives, adulterants, vitamins and toxins and describe the analytical methods used for quantitatively evaluating these compounds in foods
- Write reports summarizing and evaluating experimental data related to the chemical analysis of foods

General Information:

The laboratory will be carried out in a series of 3-hour sessions. To optimise use of the available equipment some of the labs are timetabled in groups; for easy reference individual timetables will be provided.

In order to make the experience an enjoyable one for everybody, we ask you to:

(a) Read each experiment completely **BEFORE** you come to the laboratory. Prepare a flow-diagram in your notebook of the actions you expect to take in the laboratory so you can get the best results in the least amount of time.

(b) Carry out the assigned pre-laboratory exercises. This must be turned in **at the beginning** of every lab **for full credit** on lab reports. Try to establish an understanding of the theoretical basis of the experiment.

(c) Ask questions of the teaching staff during the laboratory sessions. Do not be "afraid" to ask questions. Asking questions is a **sensible and legitimate** part of the learning process.

Grading (Assessment):

Evaluation Methods:

- All assignments and laboratory reports are expected to be typed and of professional quality.
- No late work will be accepted without prior approval from the instructor.
- No make-up exams will be given unless if there is advanced permission and justifiable reason for missing the exam.
- **There are no make-up laboratories**

- This course teaches advanced material and requires students to integrate their knowledge.
- Assessment includes pre-laboratory homework assignments, exams to test knowledge, laboratory reports that require more advanced skills (using analytical equipment, applying correct procedures and statistical tests and interpreting experimental data), and performance in lab.

Exams:

Midterms (2)	40%
Final	25%
Lab reports	25%
Homework	10%

Composite Score: Grading is based on a standard percentage scale.

90-100%	Letter grade A	(A+, 97-100%; A, 94 to< 97%; A-, 90 to < 94%)
80-89%	Letter grade B	(B+, 87- 90%; B, 84 to < 87%; B-, 80 to < 84%)
70-79%	Letter grade C	(C+, 77- 80%; C, 74 to < 77%; C-, 70 to < 74%)
60-69%	Letter grade D	(D+, 67- 70%; D, 64 to < 67%; D-, 60 to< 64%)
< 60%	Letter Grade F	

Request for Re-grading: Requests for re-grading any quiz or exam must be **submitted in writing to Dr. Mitchell** (forms available on smartsite) **within 1 week** after the exams have been returned. The instructor reserves the right to re- grade the entire exam upon submission.

Academic honesty: The University policy for academic honesty will be followed. Please be aware of the definition of academic dishonesty and its consequences. No student will receive a credit if a dishonest act on his/her part is evident relative to the work assigned. Simply put, I have a **no tolerance** policy towards cheating.

Attendance: Every student is expected to attend and participate in class. The student is responsible for obtaining notes and materials for any class he/she misses.

Class Cancellation: Class will only be cancel due to an emergency situation. If this should occur students will be notified as soon as possible through the class email list.

Students with Disability: If you need an accommodation due to a disability, please make arrangements to discuss this with me during the first two weeks of the quarter.

Academic Probation: If you are on academic probation please let me know right away so that I can help you develop a strategy for success in this course.

Petition for Re-grade FST 103:

Name: _____ ID# _____

Section: _____ Quarter/Year _____

I would like to have _____ re-graded for the following reason:

_____ 1. My test score has been incorrectly totaled

_____ 2. I feel my answer was not scored correctly as compared to the posted key for the exam.

Please re-grade the following question (s):

Include a **short** explanation (use back of page if necessary):

In submitting this quiz/midterm for a re-grade, I affirm that I have not altered it in any way.

Signed: _____

Dated: _____

*** Requests for re-grades must be submitted within one week after the exams are returned. Also note that Academic Senate regulations prohibit reassessment of final exams or any other coursework once final grade has been determined.**

LECTURE SCHEDULE 2015

Lecture: Monday, Wednesday, Friday 12:000 -1:00 PM
Lab Sections: Tuesday, Thursday 9-12:00 PM or 2-5:00 PM - 1220 RMI South

Date	Lecture Tile	Chapter	Lecturer
Jan 6	Course Introduction	1, 2 and 4	Mitchell
Jan 7	Sampling and Data Handling	3 and 5	Mitchell
Jan 9	Evaluation of Analytical Data	4	Mitchell
Jan 12	Protein Determination & Standard Curves	9	Mitchell
Jan 14	Sample Prep I: Polarity, and Solubility		Mitchell
Jan 16	Sample Prep II: Partitioning		Mitchell
Jan 19	MLK Holiday		
Jan 21	Sample Prep III: Distillation		Mitchell
Jan 23	Spectroscopy I: Principles	22	Mitchell
Jan 26	Spectroscopy II: Uv-vis, Fluorescence	23	Mitchell
Jan 28	Analysis of Color	32	Mitchell
Jan 30	**Midterm #1**		Mitchell
Feb 2	Principles of Chromatography I	27	Mitchell **Last day to drop
Feb 4	Principles of Chromatography II	27	Mitchell
Feb 6	Principles of Chromatography III	27	Mitchell
Feb 9	Gas Chromatography I	29	Mitchell
Feb 11	Gas Chromatography II	29	Mitchell
Feb 13	HPLC I	28	Mitchell
Feb 16	Presidents Day Holiday		Mitchell
Feb 18	HPLC II	28	Mitchell
Feb 20	Pigments & Phytochemical Analysis		
Feb 23	**Midterm #2**		
Feb 25	Proximate Analysis	6, 7, 25	Mitchell
Feb 27	Carbohydrate & Fiber Analysis	10	Mitchell
Mar 2	Analysis of Vitamins	11	Mitchell
Mar 4	Analysis of Fats and Lipids	8, 14	Mitchell
Mar 6	Analysis of Pesticide, Mycotoxin & Drug Residues	19	Mitchell
Mar 9	Food Additives and Dyes	19	Mitchell
Mar 11	Mass Spectrometry I	26	Mitchell
Mar 13	Mass Spectrometry II	26	Mitchell
Mar 16	Review Session		Mitchell
Mar _17-21	**Final Exam**		**Mitchell**

LABORATORY SCHEDULE 2015

Date	**Laboratory Topic**	**Lab Topic**	**#**
Jan 6	Safety & Sampling	Tuesday AM / PM	1
Jan 8	Safety & Sampling	Thursday AM / PM	1
Jan 13	Protein Determination	Tuesday AM / PM	2
Jan 15	Protein Determination	Thursday AM / PM	2
Jan 20	Uv-vis in Food Analysis	Tuesday AM / PM	3
Jan 22	Uv-vis in Food Analysis	Thursday AM / PM	3
Jan 27	Color Analysis	Tuesday AM / PM	4
Jan 29	Color Analysis	Thursday AM / PM	4
Feb 3	Antioxidants in Tea	Tuesday AM / PM	5
Feb 5	Antioxidants in Tea	Thursday AM / PM	5
Feb 10	GPC	Tuesday AM / PM	6
Feb 12	GPC	Thursday AM / PM	6
Feb 17	HPLC-I / GC - I	Tuesday AM / PM	7/8
Feb 19	HPLC-I / GC - I	Thursday AM / PM	7/8
Feb 24	GC-I / HPLC-I	Tuesday AM / PM	7/8
Feb 26	GC-I / HPLC-I	Thursday AM / PM	7/8
Mar 3	HPLC-II / GC -II	Tuesday AM / PM	9/10
Mar 5	HPLC-II /GC -II	Thursday AM / PM	9/10
Mar 10	GC-II /HPLC -II	Tuesday AM / PM	9/10
Mar 12	GC-II /HPLC -II	Thursday AM / PM	9/10

1. Read all instructions carefully BEFORE coming to the laboratory
2. Complete all PRE-LAB exercise questions BEFORE coming to lab
3. Use only ink in you laboratory journal, no pencil, or white out. Line-out is okay
4. Keep all records in this journal.