ANALYSIS OF FOOD PRODUCTS

FNH 4114/6114   FALL 2017

Instructor: Dr. Wes Schilling

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> Phone: 662-325-9456
> e-mail: schilling@foodscience.msstate.edu

Class Time: Monday and Wednesday 11:00 am- 11:50 am

Laboratory Time: Monday 2:00-4:50 pm;

Laboratory Coordinator: Yan Campbell, Sensory Laboratory 112, yl479@msstate.edu, phone (325-8366)

Teaching Assistants/:   Morgan Von Staden, Herzer 156, mev63@msstate.edu
Guest Lecturers

Office Hours: Available anytime; you should feel free to call prior to making a visit to make sure that we are in our offices and available. Questions may also be submitted by e-mail.

Textbook: Food Analysis, fifth edition.
http://www.barnesandnoble.com/s/Food-
Analysis?keyword=Food+Analysis&store=textbook, also available at amazon.com
A bound laboratory notebook with numbered pages and duplicate pages for carbon copies is required.
Calculator (regression, statistics) is needed for all laboratories and exams.
Several handouts will be provided.

Software: Students will be required to use spreadsheets for data handling and graphical presentations. Microsoft Excel is preferred but students may use any spreadsheet that has regression analysis subroutines and graphical output.

Attendance: Attendance is mandatory for all laboratory sessions. Excused absences will only be granted by the instructor prior to the start of the laboratory session. Unexcused absences will result in a "zero" grade for all assignments associated with that lab.

Objective: This course is designed to acquaint students with the basic laboratory and problem solving skills used in modern food analysis by a combination of interactive **LECTURES** and hands on laboratory experience.

Honor Code: I support the Honor Code at Mississippi State University and expect all students to work independently and abide by all its policies.

Lab. Protocol: Be on time to lab.
Do not wear open toe shoes to lab.
A lab coat is recommended, but not required.
Read the lab in advance and include all calculations, tables, and flow diagrams in your lab notebook as required prior to starting lab.

LABORATORY SCHEDULE (Subject to Change)

DATE   **TOPIC** (Currently)

AUGUST   21   Intro lab and Data Analysis

            28   Lab 2. Moisture, Water Activity and Proximate Analysis.

SEPTEMBER   4   Holiday (No lab).

            11   Lab 3. pH Determination / Buffers.

            18   Lab 4. Spectroscopy: Visible Spectra.

            25   Lab 5. Spectroscopy: Extinction Coefficient & Standard Curve.

OCTOBER   2   Fall Break Week (No lab scheduled)

            9   Lab 6.   Colorimetric Protein Assays.

            16   Lab 7. Enzyme as Reagents.

            23   Lab 8. Texture Analysis (Instron).

            30   Lab 9.   Sensory Evaluation.

NOVEMBER   6   Lab 10. Gas Chromatography.

            13   Lab 11. Sensory Evaluation part 2

            20   Lab 12. Industrial Applications

LABORATORY REPORTS

Written laboratory reports are required for this course. All laboratory reports are due at the beginning of your next laboratory session. Any laboratory report submitted by 11 am on the Wednesday prior to the next lab will be considered early and receive a 10% bonus. **Reports not turned in at start of lab will be considered late, and late lab reports will not be accepted.** Exceptions to the above policies will only be granted when arrangements have been made <u>prior</u> to the original Monday deadline. Normally, exceptions will be granted only in those situations accepted for missed exams, below.

Do not share returned, graded lab reports or computer discs with files containing your laboratory report with fellow students. If a fellow student copies your report, the Honor Court will also charge you with a violation.

GRADES

All missed examinations will be given a grade of "zero" with the following exceptions: (a) where arrangements have been made <u>prior</u> to the examination; (b) illness (doctor's excuse required); © serious family problems or illness (documentation required). Your final grade will be based upon the following scale:

Lecture Examination #1	15%
Lecture Examination #2	15%
Final Examination	20%
Laboratory Reports (8)	30%
Homework Assignments	10 %
Attendance	5 %
Participation	5 %
	_____
TOTAL =	100%

NOTE: <u>THE FINAL EXAMINATION WILL BE COMPREHENSIVE.</u>

TENTATIVE LECTURE SCHEDULE

DATE		TOPIC
August	16	Welcome and Introduction to Food Analysis
	21, 23, 28	Evaluation of Analytical Data (Standard curve Information)
		Evaluation of Analytical Data/Sampling and Sample Preparation, Solving Problems, Units Review
	30, Sept 6	Moisture Analysis/Proximate Analysis
September		
	8	pH and Titratable Acidity, Introduction to Flavor
	13	pH and Titratable Acidity, Introduction to Flavor; Lab 3 (Principles),
	15	lecture Spectroscopy UV-VIS Spectroscopy and Infrared Spectroscopy
	20	Test 1 Review, Lab 5 Spectroscopy lecture
	22	Test 1
	27	Atomic Absorption Spectroscopy, Mineral Analysis, Test Review!
October	2	Other Protein Analyses
	4	Lecture 6 lab, Lipid and Carbohydrate Analysis
	9	Enzyme Kinetics, Lab 7 Lecture
	11	Principles of Chromatography
	16	Gas Chromatography/ Flavor Analysis
	18	High Performance Liquid Chromatography, Lab 9 Lecture
	23	Texture Analysis, Lab 10 Lecture
	25	Test 2 review
	30	Test 2
November	1	Sensory Evaluation, Lab 10 Lecture
	6	Sensory Analysis, Color Analysis
	8	Color Analysis, Analysis of Dairy Products, (May make beef jerky, if we have time and interest)
	13	Analysis of Meat Products
	15	Industry Examples and Stories
	20	Industry Examples and Stories
November	27	Review for Final (Possibly take home)

Data Analysis (Things that you must be able to do)

1) determine the mean (by hand and using excel)
2) determine the standard deviation (by hand and using excel)
3) Know why you run replicates
4) Have an appreciation for the importance of sampling correctly and choosing the correct technique
5) determine the relative standard deviation (by hand and using excel)
6) determine the standard error of the mean (by hand and using excel)
7) determine confidence intervals for both the normal and t-distributions (by hand and using excel)
8) Understand your sources of error
9) Know the definitions of specificity, and sensitivity
   a. What determines sensitivity in the standard curve?
10) Figures of Merit for the Standard Curve
   a. Limit of Detection (Determine using Excel)
   b. Linear Range (Determine using Excel)
   c. Sensitivity (Determine using Excel)
   d. R-square (Determine using Excel)
11) Determine the equation of line for a standard curve
12) Determine values for unknown samples using a standard curve
13) Graph standard curves using Excel
14) Use appropriate figure captions on your standard curve graphs
15) Know how to appropriately report data with significant digits
16) Know when to reject data (Q stat)

x_i = observation i
i= 1, 2,….n
n=total number of observations
y = response (absorbance, peak area)
m=sensitivity
x= concentration
b= y-intercept

Standard curve information

Learning Outcomes and Objectives for Food Analysis

There are three parts to Food Analysis: sample preparation, instrumental analysis, and data analysis

Food Analysis Lecture:

1) You should be familiar with the names of the instruments and methods that are used to determine the composition and chemical properties of foods
2) You should able to understand the general chemistry behind how the instruments work, but you should by no means be an expert
3) You should have an understanding and appreciation of the importance of sample preparation in food analysis for methods commonly used in food analysis
   a. Homogenization
   b. Storage
   c. Preparation of samples for UV-VIS spectroscopy, Infrared spectroscopy, atomic absorbtion spectroscopy pH, moisture analysis, chromatography (gas, liquid, paper, thin layer)
4) Understand how the applications mentioned in 3c are utilized in the food industry
5) Be able to take data that you receive from an analysis and know what to do with it
   a. Is it right
   b. Did you take enough samples
   c. Determine the appropriate mean (concentration)
   d. Determine the appropriate standard deviation (concentration)
   e. Determine the appropriate relative standard deviation (concentration)
   f. Run regression on standard curves
   g. Determine unknowns
   h. Perform calculations (chemistry)
6) Improve your ability to solve problems as well as improve your ability to understand what the problem is?
7) **You should know exactly what infrared spectroscopy is used for in the food industry (you should also never forget this)**
8) **You should be able to locate the correct method when asked to make a determination about a food product**

At the end of this course, you should be able to do the following in the laboratory:
1) Record the correct information in a laboratory notebook in an appropriate manner (including visual observations, etc.)
2) Perform dilution tables
3) Read and understand laboratory methods prior to attending laboratory classes
4) Improve your ability to work on a laboratory benchtop
5) Understand the objectives of your laboratories
6) Understand how to handle (what to do with) data in your laboratories
7) Understand the basic statistics necessary in Food Analysis. To be able to calculate these statistics if you have access to the data and the formulas. To be able to locate the correct formulas
8) Understand the importance of sample preparation
9) Understand the purpose of using different equipment and the basic theory behind how they work. Also understand how to tell if data is accurate and what to do with the numbers that the equipment provides to you.

Class rules
1) You should not talk among yourself during lecture time unless you are working in groups. (1st offense, you will be asked to stop, 2nd offense, you will be asked to leave)
2) You should show up to the laboratory class on time.
3) You should not miss class, especially labs without an appropriate excuse that is cleared with the instructor prior to class.
4) You should not use your cell phone during lecture time. You can use your cell phone in lab to time experiments and when you are at a desk during waiting time in labs. However cell phones, should not be used on lab benches and when someone is teaching in front of the chalkboard during lab time.

APPLIED FOOD CHEMISTRY

FNH 4241/6241   SPRING 2018

INSTRUCTORS:

Dr. Wes Schilling
Office: Herzer Building, Room 106
Phone: 325-9456
Email: Schilling@fsnhp.msstate.edu

OFFICE HOURS:

Based on appointment, you should feel free to call or email prior to visiting to make sure that I am in my office and available.

LABORATORY COORDINATOR:

Dr. Yan Campbell
Office: Garrison Sensory Evaluation Lab Room 112
Phone: (662) 325-8366
Email: ycampbell@foodscience.msstate.edu

TEACHING ASSISTANT:

Morgan Von Staden
Office: Herzer Room 156
Phone: (662) 325-7698
Email: mev63@msstate.edu

TEXTBOOK: Hardbound Laboratory Notebook (with tear-out carbon pages)
Software for Word Processing and Spreadsheet
(For example: Microsoft Word and Excel)
Three ring binder for returned lab reports

HONOR CODE: I do support and abide by the Mississippi State University Honor Code. In this laboratory you will work with a group of fellow students to complete each week's assignment. In many cases, you may also share group data among   individual students. However, each assigned laboratory report is graded and each student is expected to work independently in performing calculations, making observations and in preparing the final written report. Finally, protect yourself and do not allow fellow students to borrow disks containing your lab reports.

LABORATORY GUIDELINES

1. You will be provided with a laboratory manual at the beginning of the semester. Be sure to read the laboratory protocol for each week's lab. Prior to class time so that you understand how to complete the experiment in a timely manner.

2. Proper preparation for each laboratory means that you have read and understood the laboratory handout prior to coming to class. Prior preparation will allow you to spend considerably less time in the laboratory actually performing the experiment.

3. Prior to beginning work on an experiment, gather together all of the equipment and materials that you will need to carry the laboratory exercise to completion. The lack of equipment or reagents at a critical time may lead to poor results or failure of the experiment. Practice good laboratory management principles.

4. All students are encouraged to wear laboratory coats or smocks to protect clothing as well as protective eyeglasses. Arrangements can be made to store your eyeglasses in the laboratory, if you wish. Please contact your laboratory instructor. Appropriate clothing and shoes (low heels and closed toes) must be worn in the lab. **No smoking, eating or drinking is allowed in the lab at any time (except during sensory evaluation). Keep cell phones in the silent mode (or turned off).**

5. At the conclusion of your experiment, please rinse all dirty glassware and place in the appropriate place; make sure your laboratory bench is left clean and in order.

GRADES:

Laboratory Reports	1200
Laboratory Notebook	400
Participation	100
Quizzes	300
	_____
TOTAL POINTS	2000

Grades: A=1800-2000 points
B=1600-1799 points
C=1400-1599 points
D=1200-1399 points
F= <1200 points

LABORATORY REPORTS:

1. All assigned laboratory reports can be submitted electronically by e-mail or as a printed copy by the beginning of class time. **Laboratory reports not submitted promptly by class time will be considered late.** Ten percent (10%) of the total possible grade will be deducted for each class day (24 hrs) that the report is late to a maximum of 50%.

2. The entire report (including all text and tables) must be prepared using word-processing software (for example, Microsoft Word). All graphs must be generated using computer spreadsheet programs (for example, Microsoft Excel) and incorporated into the word-processing file. Reports, which do not look professional, will be returned; a late penalty will be imposed until a satisfactory laboratory report is submitted.

LABORATORY NOTEBOOKS:

1. The purpose of a laboratory notebook is to accurately and legibly record experimental data and observations. Laboratory results are only as valuable as their written record. You should start now to develop good techniques recording in your laboratory notebook. All data obtained during laboratory must be recorded in a hardbound notebook. Copying from pieces of paper must be avoided because of possible copying errors, wasted time, and the danger of losing papers containing data. <u>A carbon copy of all your experimental data must be submitted at the conclusion of each lab period.</u>

2. The grade for your laboratory notebook will be based upon the following criteria:

You arrived prepared for the laboratory session and brought your laboratory notebook and laboratory manual.

All entries must be made in your notebook using an ink pen; no pencil entries allowed. The first page should contain your name, the names of your laboratory partners, a title for the experiment and the date on which it was performed.

Tables for recording your data should be prepared in advance of the laboratory session. Allow space for descriptive terms and remarks. Reference all tables and observations to the specific step in the experimental procedures described in your laboratory handout.

Any step in the procedure that involves weighing or measuring reagents, products or samples should be referenced to the step in the experimental procedures described in your laboratory handout. Be sure to indicate amounts or volumes of samples or reagents used in conducting your experiment. Be sure to also record any deviations from the experimental protocol described in your handout.

Be sure to record any changes in sensory characteristics of a product that occur while conduction your laboratory experiment. Again, be sure to reference all observations to steps in the laboratory procedures.

LABORATORY SCHEDULE: Mondays 3:00 – 4:50 pm

DATE	EXPERIMENT
January 22th	Lab 1. Major Food Components in Milk
January 29th	Lab 2. Non-Enzymatic Browning
February 5th	Lab 3. Carbohydrate Crystallization
February 12th	Lab 4. Starch/Gelatinization & Gelation
February 19th	Lab 5. Pectin Gels
February 26th	Lab 6. Protein Characterization / Properties
March 5th	Lab 7. Soy Protein Functionality
March 12th -16th	SPRING BREAK☺
March 19th	Lab 8. Flour Protein/Dough Formation
March 26th	Lab 9. Lipid Absorption
April 2th	Lab 10. Lipids/Shortening Ability
April 9th	Lab 11. Chromatography
April 16th	Lab 12. Candy Production

FNH 8163   FLAVOR AND FOOD ACCEPTANCE   SPRING 2015

Instructor: <u>Dr. Wes Schilling (Lecture)</u>
                        Office: Room 104 Herzer Building
                        Phone: 325-2666
                        e-mail: schilling@foodscience.msstate.edu

Class Time: Lecture Classes: 11:00-12:15 pm Monday, Wednesday

Office Hours: Open office hours; you should feel free to call prior to making a visit to make sure that we are in our offices and available. Questions may also be submitted by e-mail.

Textbook: **Meilgaard et al. 1991 (4th edition) or 1999 (4th edition): Sensory Evaluation Techniques**
Suggested Readings from Flavor Applications (Source Book of Flavors, 1994, 1999)
Several handouts and readings will be provided

Software: Students will be required to use spreadsheets for data handling and graphical presentations. Microsoft Excel is preferred but students may use any spreadsheet that has regression analysis subroutines and graphical output. Access to and use of Statistical Analysis Software (SAS) will also be required. Examples of how to analyze sensory data and chromatographic data will be covered.

Attendance: Attendance is mandatory for all sessions. Excused absences will only be granted by the instructor <u>prior</u> to the start of the class. Unexcused absences will result in a "zero" grade for all assignments associated with that class.

Objective: This course is designed to acquaint students with the basic understanding of food and flavor acceptance characteristics from both a sensory evaluation standpoint and an instrumental standpoint as well as to relate the two of these together by a combination of interactive **LECTURES** and **HANDS ON** research experience. This class will cover data collection and statistical analysis for this type of work.

Learning Outcomes: **For students to have a general understanding of sensory science, instrumental analysis of flavor volatiles, and flavor chemistry. For students to be able to understand how to conduct sensory evaluation tests, instrumental volatile analysis, experimental design, statistical analysis, and interpretation of sensory and volatile analysis data. For students to be able to understand the principles that are used as well as to perform the basic statistical analyses that are used to analyze consumer sensory data, trained sensory data, and gas chromatography data.**

Honor Code: I support the Honor Code at Mississippi State University and expect all students to work independently and abide by all its policies.

CLASS PROJECTS

<u>Class Project Number 1</u>: You and 1 or 2 other students will pick a food product that you are interested in and you will determine the volatile compound profile, odor active compounds present, sensory descriptors, and consumer acceptability for that product. You will need to meet with Dr. Yoon and I to discuss the project. We will help you design the project. Then you will conduct the experiment and you will have a 3-5 page paper. Your paper will only consist of a Materials and Methods, data analysis section and graphs or tables representing your data, and students should work together to conduct the research and statistical analysis (as appropriate) but should work alone on their write-up of the project.

<u>Class Project Number 2</u>: You and 1 or 2 other students will receive a comprehensive data-set from research conducted at Mississippi State University. As a group, you will be required to conduct statistical analysis on this research. Then, each student should work on their own to write a results and discussion paper on the dataset, demonstrating that they have an understanding of the acceptability of the food products as well as a general understanding of the data.

HOMEWORK ASSIGNMENTS

1) Paper Review and Discussion: Each student will be provided with a research paper in which they will be required to conduct a written review of the paper. The student will review the paper as if they had received it from an editor (Journal of Food Science, Journal of Sensory Studies, etc.) and were asked to determine if it is acceptable for publication. The student will also give an oral presentation where they will discuss the paper for 10-15 minutes and describe the objectives of the study, how the study was conducted, and the major findings of the study.

2) Three short assignments will be given related to laboratory/hands-on classes that deal with thresholds, difference tests, descriptive tests, texture profile analysis, and GC analyses.

GRADES

All missed examinations will be given a grade of "zero" with the following exceptions: a. where arrangements have been made <u>prior</u> to the examination; b. illness (doctor's excuse required); c. serious family problems or illness (documentation required). Your final grade will be based upon the following scale:

Midterm Examination	20%
Final Examination	20 %
Participation	5 %
Attendance	5 %
Homework Assignments	20 %
Paper Review Written (5 %)	
Paper Discussion Oral (5 %)	
Lab Assignments (3) (10 %)	
Projects (2)	
Project 1	15 %
Project 2	15 %
Statistical Analysis (5 %)	
Written Paper (5 %)	
Oral Presentation (5 %)	

$$\text{TOTAL} \ = \quad \underline{\hspace{3cm}}$$
$$100\%$$

NOTE: THE FINAL EXAMINATION WILL BE A COMPREHENIVE TAKE HOME EXAMINATION.

Course Schedule (Subject to Change)

Class Topic	Date	Reading Assignment
1) Intro to Class (Course Expectations, History of Sensory Evaluation and Flavor Chemistry)	January 8th	Powerpoint, Syllabus
2) Importance of Statistics in Sensory Science, Flavor Chemistry, and Food Science	January 10th	Powerpoint, Handout
3) Sensory Attributes and Perception, Test Rooms, Product, and Panel Factors Affecting Sensory Verdicts	January 17th	Powerpoint, 8-22, Ch 2 23-36, Ch 3 37-42, Ch 4
4) Overall Difference Tests	January 22nd	Powerpoint, 60-98, Ch 6.1
5) Attribute Difference Testing	January 24th	Powerpoint, 99-122, Ch 6.2
6) Determining Thresholds (Lab Assignment)	January 29th	Powerpoint, 124-133, Ch. 7
7) Affective Tests/Consumer Testing	January 31st	PowerPoint, 201-226, Ch. 8
8) Consumer Testing/Cluster Analysis	February 5th	PowerPoint, Journal paper*
9) Selecting and Training Panel Members	February 7th	Powerpoint, 135-151, Ch. 8
10) Descriptive Analysis Techniques	February 12th	Powerpoint, 188-200, Ch. 9
11) Descriptive Analysis Techniques Class Activity (Lab Assignment)	February 14th	
12) Labeled Magnitude Scale and Ranked Data Class Activity	February 14th	Powerpoint, 43-57, Ch. 5
13) Midterm	February 19th	
14) Flavor Industry	February 21st	Handout 1 Source Book of Flavors (SBF)
15) Flavor Chemistry	February26th	Handouts 2 and 3 SBF
16) Volatile Extraction Techniques	February 28th	Handouts 2 and 3
17) Instrumental Analysis of Volatiles	March 5th	Handouts 2-3 SBF
18) Merging Instrumental Analysis with Flavor Chemistry	March 7th	Handouts 2-5 SBF, etc
Spring Break	March 10-18th	
19) GC Lab-SPME, Purge and Trap and GCO	March 19th	Lab Handout, Lab report
20) How to Review a Research Paper Class Discussion Project 1	March 21st	Powerpoint
21) Principal Components Analysis	March 26th	Powerpoint, Handouts
21) Preference Mapping (Descriptive/Consumer)	March 28th	Powerpoint, Handouts
22) Real World Applications-Dry Cured Ham	April 2nd	PowerPoint
23) Real World Applications-Yogurt, Cheese Class Project 2 Discussion	April 4th	Powerpoint
24) Research Paper Reviews Due	April 9th	
25) April 12th-25th Assistance with Projects, By appointment and during class time: scheduled meetings twice a week		
26) Final Oral Presentations Receive Take Home Test (Due by noon on May 3rd)	April 25th	

Final Exam: Discussion Question test showing that you have learned concepts discussed pertaining to sensory evaluation, experimental design, and flavor chemistry