Food Chemistry

http://www.personal.psu.edu/jnc3/fdsc400/fdsc400.shtml

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Course Objectives: "*It is desirable to establish an analytical approach to the chemistry of food formulation, processing and storage stability, so that facts derived from the study of one food or model system can enhance our understanding of other products*." Owen Fennema, 1996

The goal of this class is to enable students to understand foods as mechanistic, chemical systems. All the phenomena observed in preparing food can, in principle, be understood in classically chemical terms. Understanding how chemical systems behave enables us to better control them to meet our many needs. Students will enter the class with a basic knowledge of chemistry and leave understanding how it applies to food. As well as understanding the important chemical basis of food quality, successful students will develop a conceptual framework to understand unfamiliar phenomena in terms of food chemistry. Achievement of these goals requires both an accumulation of facts and the development of an analytical approach to food quality.

In the context of a degree in Food Science, this course is designed to build upon the core courses taken (General, Organic and Biochemistry and Physics) and allow the students to apply scientific principles to understanding the properties of foods and the important changes occurring during processing and storage. The course is intended to give students a toolkit of core concepts they can use in the higher level processing classes. While the course is primarily designed as part of the Food Science major, it is expected to be useful for non-food science students taking it as a practical application of chemical principles.

The student-based learning objectives of this course are.

1. Students will be able to use the basic language of food chemistry competently and provide real examples as illustrations of the terms (see Appendix for a partial list)
2. Students will be able to recognize in real examples the underlying physicochemical mechanisms responsible for food functionality and be able to use their knowledge of Food Chemistry the important control points and consequences of the reactions.

The course prerequisite is BMB 211. By passing this prerequisite, students are expected to be familiar with the structures of the key biomolecules (i.e., proteins, lipids, carbohydrates).

Grading: Credit will be available for the following activities. More information on the deadlines and grading policies will be provided in class sessions and online.

First examination - Physical Chemistry	100
Second examination - Food Polymers	100
Third examination - Small Molecules (+comprehensive questions)	100 (+50)
Assignments	100
Total	**450**

Letter grades will be assigned based on the percentage total score according to the typical PSU system, i.e.: 100.0-93.0=A, 92.9-90.0=A-, 89.9-87.0=B+, 86.9-83.0=B, 82.9-80.0=B-, 79.9-77.0=C+, 76.9-70.0=C, 69.9-60.0=D, 0-59.9=F.

Exams: Exams will be during normal class periods unless otherwise announced. The typical exam format is a series of short answers and longer format questions requiring a paragraph or two to answer. I will be available to discuss grades during office hours for a week following return of papers. After this time the results will be permanently recorded. Make up examinations will only be granted in exceptional circumstances and only at my discretion. The senate policy on academic integrity and honesty applies throughout this class.

Assignments: A variety of homework, in-class assignments, short tests, and presentations will be set during the course and, as far as possible, will be posted online. The total number of marks available over the semester will be 120, of which a maximum of 100 can be earned. So if you fail to turn in work or flunk an exercise it may still be possible to gain a good score. On the other hand if you achieve your 100 points before the end of the semester you can, if you wish, simply stop doing assignments. Assignment problems have been known to re-appear in the comprehensive final. All assignments have a deadline. Late work will not be graded and will receive a score of zero. In all but the most extreme circumstances there will be no opportunities to make up late work or missed deadlines. The 20 bonus points available in part exists to allow you to miss or avoid a few assignments and still get maximum credit. Again the "one week rule" applies; I will happily review my grading decisions for up to one week after the papers are returned after which scores are final.

Textbook: The main required reading for this course is a notes packet that can be downloaded in PDF form from the course website. This is required reading for the class and you are encouraged to print a copy for your use.

"Food Chemistry" (ed. Owen Fennema, 3rd ed., Marcel Dekker, New York) is a recommended supporting text for the class. This book is densely written and in places confusing - in many ways not ideal for the class. Don't panic. It is comprehensive and will provide a useful reference for higher-level classes and a career in the food industry. Students looking for an easier general text may like to consider "Principles of Food Chemistry" (John deMan, 3rd edition, Aspen Publishers Inc., Gaithersburg, Md.). Other material may be provided in class.

Web Material: Many of the lectures will have supporting material posted on-line. The content of these pages will change during the semester to reflect the material presented in class. There is also an announcements section where class notices will be posted. It is expected you will check this at least twice a week.

Timetable: A provisional timetable is provided below. This will be subject to alteration throughout the semester and you are advised to keep track of the current online version.

Office Hours: I will be available in 103 Borland from 3:30-5:00 p.m. on Wednesdays. However, I often find it much more practical to meet with individuals or small groups by appointment. If you send me an email I will try to arrange a mutually convenient time within a week. Later in the semester I will arrange review sessions to go over some of the more difficult material.

Final Thoughts: Education is not a passive process. Some things you can do to improve your experience (and performance) in this class are:

- **Get involved**. Ask and answer questions in class. Take five minutes after each session and try to answer separately the questions "What were the key points?" and "Do I understand them?"
- **Communicate**. Talk to your classmates; if you can jointly identify an area that is unclear it may be possible to allocate more class time to review it. Talk to your instructor; let me know how the class is progressing for you.
- **Keep up**. There is a certain amount of work in your own time required to succeed in this class (how much depends on you). Many people find putting in a little time before and after each class is much more efficient than all-night sessions before exams.
- **Cultivate your interest**. Science can be difficult (and at times dull) but is the best way we have to understand the physical world about us. Try to see your time in this course as an opportunity to learn more about the fantastic complexity and elegance of nature (as well as a requirement for Food Science majors!).

Provisional Timetable

		Class Title
Aug	31	Introduction and orientation
Sept.	1	**1. Basic chemical kinetics**
	3	Applied chemical kinetics: Cooking peas
	5	LABOR DAY
	8	Guest lecture – Dr. Zoumas
	10	Applied chemical kinetics: Refugee bars
	13	Applied chemical kinetics: Computer lab (69 Willard)
	15	Applied chemical kinetics Computer lab (71 Willard)
	17	**2. Properties of solutions**
	20	Water microstructure
	22	Water activity
	24	Moisture sorption
	27	State diagrams and freezing
	29	Molecular mobility and the glass transition
Oct	1	Example: Candy manufacturing
	4	Examination 1
	6	**3. Introduction to Dispersions**
	8	Emulsions and foams
	11	Surfaces
	13	Colloidal forces
	15	STUDY DAY
	18	**4. Protein Structure**
	20	Introduction to polymers
	22	Protein denaturation
	25	Protein functionality
	27	Applied food colloids: Whey protein stabilized emulsions
	29	Applied food colloids: Whey protein stabilized emulsions
Nov.	1	**5. Monosaccharide and polysaccharide structure**
	3	Starch and cellulose
	5	Polysaccharide manufacturing: Computer lab (TBA)
	8	Other gums - presentations
	10	Other gums - presentations
	12	Examination 2
	15	Browning reactions I
	17	Browning reactions II (examples)
	19	**6. Lipid molecules**
	22	Oxidation
	24	THANKSGIVING
	26	THANKSGIVING
	29	Antioxidants
Dec.	1	Chocolate and crystallization
	3	Taste
	6	Aroma
	8	Color I
	10	Color II