FST 639: Food Polymer Science
PROPOSED SYLLABUS - Fall 2012
Instructor: Andrew S. Ross
Contact details: 231A Crops Science Building, 541-737-9149, andrew.ross@oregonstate.edu

Total credits: 3 credit hours: 3 hours integrated classroom and lab per week

Prerequisites: With agreement of the instructor the course is open to all graduate students. Students will be expected to have a grounding in food chemistry, an ability to conduct database searches, and to comprehend articles from the scientific literature.

Unenforced pre-requisites
FST 422 or FST 522 or equivalent
FST 425 or FST 525 or equivalent

Textbooks: There is no textbook. Key reading material will be placed on closed reserve in the OSU Valley library or supplied as printouts or web-based resources for the assigned readings. Additional resources will be posted on blackboard.

Course Objectives
• To provide an entry point leading to an understanding of the underlying fundamentals of polymer science in the context of food processing, texture, and storage.
• The course is also designed as a stepping stone to more computationally based approaches to polymers.

General Learning Outcomes:
• By the end of the course, students should demonstrate an understanding of the theoretical bases of structure-function relationships of polymers and their relevance in selected food processing and storage operations.

• Demonstration of understanding will be accomplished through
  • Individual literature research,
  • Individual web-based research
  • Participation in discussion and delivery of instructional materials to the rest of the class - “learning by teaching”.
  • A minimum 15 minute oral presentation to the class on the critical review/term project.

Specific learning outcomes:
On successful completion students should be able to...
- Engage in discussions about fundamental polymer behavior and its importance in the context of food science and technology.
- Describe key fundamental behaviors of polymers and how these are relevant in food systems
- Evaluate and predict [within reason] polymer effects on solution viscosities
- Evaluate and predict [within reason] polymer effects on food and gel textures
- Demonstrate ability to summarize findings in writing and orally
Assessment:

- Student mastery of the outcomes will be demonstrated by a combination of:
  - participation in class discourse including online components, and mini-presentations to the class of key course concepts throughout the term 40%
  - a critical review or term project on a selected topic related to polymers 30%
  - an oral presentation of the term project or critical review 30%

- For the critical review/term project, three deadlines will be set at the beginning of the quarter.
- In the final week of coursework students will be required to present their findings orally in class.

The topic paper/critical review details see separate file

The oral presentation details: see separate file

Class participation rubric
This is a graduate level class – you are expected to contribute....

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<thead>
<tr>
<th>Criterion</th>
<th>Quality</th>
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<tr>
<td>Degree in which student integrates course readings into classroom participation</td>
<td>often cites from readings; uses readings to support points; often articulates fit of readings with topical skill (4 points)</td>
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<tr>
<td>Interaction/participation in classroom discussions</td>
<td>always a willing participant, responds frequently to questions; routinely volunteers point of view (4 points)</td>
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<tr>
<td>Interaction/participation in classroom learning activities</td>
<td>always a willing participant, acts appropriately during role plays, etc., responds frequently to questions; routinely volunteers point of view (4 points)</td>
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<tr>
<td>Demonstration of professional attitude and demeanor</td>
<td>always demonstrates commitment through thorough preparation, always arrives on time, often solicits instructors’ perspective outside class (4 points)</td>
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Accommodations for Students with Disabilities (from OSU Disability Access Services) Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098.

Expectations for Student Conduct/Academic Honesty
Participants in this class are expected to conduct themselves as dictated by official Oregon State University policy. Please see the following web page (from OSU Student Conduct & Community Standards) if you are unfamiliar with University expectations in this area, http://oregonstate.edu/admin/stucon/achon.htm

PROPOSED COURSE SCHEDULE
Week 1 Course introduction: curriculum contract, assessment rubrics, similarities between synthetic- and bio-polymers; overview of food polymers, their diversity and structures; molecular weight & degree of polymerization; polydispersity.

Week 2 Mobility of simple polymer chains; flexibility mechanisms, segmental memory, end-to-end vectors, radius of gyration, random walks, reptation.

Week 3 The states of polymers in solution, entanglements and c*, conceiving of foods as kinetic & metastable, and not thermodynamic equilibrium systems, state diagrams, introduction to the glass transition. Tg & the glassy and rubbery states;

Week 4 Thermal transitions; polymer crystal melting; viscosity; free volume; plasticization by water; maximal freeze concentration of solutes; diffusion limited behavior. Arrhenius and WLF kinetics. Rheology of polymer sols and gels; rubber-like polymer elasticity; discussion of entanglement as a requirement for gel formation and the effect of c* on sol properties.

Week 5 Starch as a system to view food polymer science concepts: Gelatinization, gels, and gelation: Discussion topic; Does starch need a glass to rubbery transition in amorphous granule regions before crystallite melting can occur?. Bread staling as a kinetic concept

Week 6 Pectins: structure, cell wall location and relation to food texture, hydrodynamic radius

Week 7 Proteins as polymers: behaviour at interfaces, gel formation: e.g. caseins and muscle proteins

Week 8 Food polymer applications, current and special topics

Week 9 Food polymer applications, current and special topics

Week 10 Student presentations of critical review/term project