

## DAIRY PRODUCTS (3 credits)

FS 429/529 (WSU and UI)

**Pre-requisites:** CHEM 345; MBIOS 303.

This course is stacked FS 429/529. As a graduate level course it has different expectations for the student performance. It requires from the graduate students to learn extra topics (see Assignments).

**Semester:** Fall, 2014

**Meeting schedule:** M, W, F 11:10 a.m., Clark 151

**Instructor:** Giuliana Noratto, Ph.D.

Office location: FSHN Bldg. Room 238

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### Recommended Textbooks:

- *Dairy Science and Technology*, Pieter Walstra, Jan T.M. Wouters, and Tom J. Geurts, Second Edition, Taylor and Francis Group, 2006, is available at WSU Owen library and the bookstore at the WSU CUB.
- *Engineering Aspects of Milk and Dairy Products*, Jane Selia dos Reis Coimbra, Jose A Teixeira, Hoboken: Taylor and Francis. Online resource. Publication Date: 2010
- *Tetra Pak's Dairy Processing Handbook*. Online resource: [http://www.eng.ufsc.br/disci/eqa5216/material\\_didatico/DAIRYPH.PDF](http://www.eng.ufsc.br/disci/eqa5216/material_didatico/DAIRYPH.PDF)
- *W.H. Sperber, M.P. Doyle (eds.), Compendium of the Microbiological Spoilage of Foods and Beverages, Food Microbiology and Food Safety*. Online resource: DOI 10.1007/978-1-4419-0826-1\_2, C Springer Science+Business Media, LLC 200
- *Milk and Dairy Products as Functional Foods*, Ara Kanekanian. Society of Dairy Technology series. Publisher: Hoboken : Wiley. Publication (406 p.). Date: 2014. Online resource at wsu.edu libraries.

**Course Materials:** Class handouts, research/review papers and online resources

	<b>COURSE OUTLINE<sup>1</sup></b>	<b>READING</b>
<b>Week</b>	<b>Topic</b>	<b>Read before class</b>
1 (Aug 25-29)	Introduction, Course objectives. <b>1. Milk collection and handling</b> <i>1.1 Milk quality concepts</i> <i>1.2 Hazard Analysis/Critical Control Points (HACCP)</i>	Tetra Pak Dairy Processing Handbook (pg. 65)
2 (Sept 3-5)	<b>2. Milk Composition: Chemical, physicochemical, and nutritional properties</b> <i>2.1 Composition by specie</i> <i>2.2 Milk fat</i> <i>2.3 Milk proteins</i> <i>2.4 Milk carbohydrates</i> <i>2.5 Milk vitamins and minerals</i> <i>2.6 Standards for milk quality</i>	Tetra Pak Dairy Processing Handbook (pg. 18) <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 17)

<sup>1</sup> The course outline can be subjected to change over the course of the semester at the discretion of the instructor. However, any modification to the course material and sequence will be communicated to students in advance

3 (Sept 8-12)	<b>QUIZ I:Material until milk composition</b> <b>3. Cleaning and Sanitizing</b> 3.1 <i>Water requirements for farm and dairy industry</i> 3.2 <i>Types of cleaning: COP and CIP</i> 3.3 <i>Detergents</i> 3.4 <i>Disinfectants and sanitizers</i> 3.5 <i>Equipment</i>	Tetra Pak Dairy Processing Handbook (pg. 403)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 399)
4 (Sep 15-19)	<b>7. Microbiology of milk and dairy products</b> 7.1 <i>Bacteria growth</i> 7.2 <i>Bacteria classification</i> 7.3 <i>Typical spoilage microorganisms</i> 7.4 <i>Measures to decrease microbiological contamination</i> 7.5 <i>Methods to determine microbiological quality</i> <b>Review section</b> <b>EXAM I (lectures through microbiology of milk and dairy products)</b>	<i>Compendium of the Microbiological Spoilage of Foods and Beverages, Food Microbiology and Food Safety Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 175)
5 (Sep 22-26)	<b>4. Milk pasteurization</b> 4.1 <i>Methods of pasteurization</i> 4.2 <i>Homogenization</i> 4.3 <i>Standardization</i> 4.4 <i>Basic components of pasteurization systems</i> <b>5. Milk evaporation</b> 5.1 <i>Evaporator design</i> 5.2 <i>Multiple-effect evaporation</i> 5.3 <i>Evaporation efficiency</i>	Tetra Pak Dairy Processing Handbook (pg. 73, pg. 201)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 263)
6 (Sep 29-Oct. 3)	<b>QUIZ II on material up to milk drying</b> <b>Discussion of topics for assignment I</b> Milk Quality at Farm Level Novel technologies for milk processing. Sensory analysis of milk products	
7 (Oct. 6-10)	<b>6. Milk drying</b> 6.1 <i>Raw material and pre-treatment</i> 6.2 <i>Types of drying systems</i> 6.3 <i>Basic drying installations</i> 6.4 <i>Operating spray drying principles</i> 6.5 <i>Production of instant powder, packing and dissolving</i>	Tetra Pak Dairy Processing Handbook (pg. 133, pg. 361)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 314, 513)
8 (Oct 13-17)	<b>8. Whey processing</b> 8.1 <i>Whey sources</i> 8.2 <i>Whey fractionation of solids by ultrafiltration</i> 8.4 <i>Chromatographic isolation of whey compounds</i> 8.5 <i>Lactose recovery</i> 8.6 <i>Whey demineralization</i>	Tetra Pak Dairy Processing Handbook (pg. 331)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 341)

9 (Oct 20-24)	<b>QUIZ III</b> (material covered until whey Processing) <b>9. Dairy products processing</b> <i>9.1 Condensed milk</i> <i>9.2 Cultured milk products</i> 9.2.1 Cultures and starter manufacture 9.2.2 Yogurt a. Milk standardization, additives, and cultures b. Stirred, drinking, set, and frozen yogurt 9.2.3 Kefir 9.2.4 Cultured cream 9.2.5 Buttermilk	Tetra Pak Dairy Processing Handbook (pg. 353, 241)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 497, 507, 357)
10 (Oct 27-31)	<i>9.3 Dairy ingredients: Processing and nutritional- functional applications to food industry</i> <i>9.3.1 Casein</i> <i>9.3.2 Lactose</i> <i>9.3.3 Butterfat</i>	Tetra Pak Dairy Processing Handbook (pg. 395, 279) <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 537, 489)
11 (Nov 3-7)	<i>9.4 Cheese manufacturing</i> 9.4.1 Definition and classification 9.4.2 Cheese making process 9.4.3 Additives in cheese milk 9.4.4 Rennet and other enzymatic systems 9.4.5 Processing lines for hard and semi-hard cheese	Tetra Pak Dairy Processing Handbook (pg. 287)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 587)
12 (Nov 10-14)	<i>9.5 Ice cream manufacturing</i> 9.5.1 Process 9.5.2 Formulation <i>9.6 Butter manufacturing</i> 9.6.1 Sweet and cultured (sour) cream butter 9.6.2 Batch and continuous production 9.6.3 Experimental buttermaking methods	Tetra Pak Dairy Processing Handbook (pg. 385, 263)  <i>Dairy Science and Technology</i> , Pieter Walstra, et al, 2006 (pg. 458, 467)
13 (Nov 17-21)	<b>QUIZ IV</b> (material covered until butter manufacturing) <b>10. Milk products as functional foods</b> <i>10.1 Definition of Functional Foods</i> <i>10.2 Identification of health promoting bioactive compounds in dairy products</i> <i>10.3 Bioactive Peptides</i> <i>10.4 Probiotic Bacteria</i> <i>10.5 Galactooligosaccharides</i> <i>10.6 Conjugated linoleic acid</i> <b>Assignment I:</b> <i>Written report summarizing relevant findings in a topic relevant for dairy</i>	Milk and Dairy Products as Functional Foods, Ara Kanekanian, 2014

	<i>industry</i>	
14 (Nov 24-28)	<b>THANKSGIVING VACATION</b>	
15 (Dec 1-5)	<b>Assignment I:</b> Oral presentation summarizing relevant findings presented within written report <b>11. Dairy farm and industry effluents: Waste management</b> <i>11.1 Characteristics of dairy farm effluents</i> <i>11.2 Characteristics of dairy industry effluents</i> <i>11.3 Waste water treatments</i>	Tetra Pak Dairy Processing (pg. 415)  Handbook: Dairy Effluents
16 (Dec 8-12)	<b>Assignment II:</b> Oral presentation on alternative processes to treat effluents from dairy farms and industry <b>Review session</b>	
17 (Dec 15-19)	<b>EXAM II (lectures not covered in Exam I)</b>	

<b>Student Learning Outcomes:</b> At the end of this course, students should be able to:	<b>Course topics that advance these learning goals</b>	<b>This objective will be assessed primarily by:</b>
<b>Utilize</b> information and critical thinking to <b>integrate</b> basic concepts regarding milk quality. <b>Recognize procedures</b> needed to preserve milk quality. <b>Identify</b> hazards and critical control points to preserve milk quality from farm to consumers.	1. Milk collection and handling. 2. Milk Composition.	Class discussions, review session, and Quiz I
<b>Understand</b> how cleaning and sanitizing can influence the quality of milk and dairy products.	3. Cleaning and Sanitizing	Class discussions, in-class participation
<b>Utilize</b> sources of information and critical thinking to <b>integrate</b> unit operations needed to produce value added milk products	4. Milk pasteurization 5. Milk evaporation 6. Milk drying Guest lectures	Class discussions, in-class participation, review session, Quiz II
<b>Understand</b> conditions favoring growth of spoilage microorganisms in milk products and <b>recognize procedures</b> to ensure consumer safety and product quality	7. Microbiology of milk and dairy products	Class discussions, in-class participation
<b>Use</b> scientific information to <b>define concepts</b> and <b>to explain</b> principles applied in milk products and milk by-products industrialization  <b>Recognize procedures</b> needed to ensure processing efficiency in dairy industry	8. Whey processing 9. Dairy products processing	Class discussions, in-class participation, review sessions, Quiz III and IV

<p><b>Critique</b> and <b>evaluate</b> relationship bioactive compounds in milk products and human health. <b>Compare</b> advances in biological sciences and dairy industry.</p> <p><b>Utilize</b> sources of scientific information. <b>Contribute</b> to teamwork to <b>produce</b> a written assignment and <b>to develop</b> oral communication skills</p>	<p>10. Milk products as functional foods</p> <ul style="list-style-type: none"> <li>• Research/review paper written assignment</li> <li>• Oral presentation of research/review paper</li> </ul>	<p>Class discussions, in-class participation.</p> <p>Written assignment on research/review paper</p> <p>Oral presentation of relevant information from research/review paper</p>
<p><b>Outline</b> a scientific approach. <b>Apply</b> problem solving skills</p> <p><b>Use</b> communication skills to <b>express relevant</b> concepts in a succinct and technically sound form</p>	<p>11. Dairy farm and industry effluents and waste management</p> <ul style="list-style-type: none"> <li>• Oral presentation of research/review paper</li> </ul>	<p>Oral presentation of relevant information from research/review paper</p>

### Course Description

Dairy Products provides the tools for students to learn how to transform milk into high quality products. Students will acquire a thorough understanding of milk composition, milk chemistry, milk microbiology, milk processing, unit operations, and alternative technologies for whey processing. Students will be able to recognize procedures needed to produce high quality dairy products and alternative technologies for whey processing, production and isolation of health promoting bioactive compounds from milk and dairy products. In addition, students will be exposed to the problematic of dairy farm and industry effluents, the alternative technologies for waste management to protect and improve the environment.

### Required Assignments and Grading Policy

**Assignments** for undergraduate and graduate students differs:

**Graduate students** are expected to write a **review paper** about the most recent data on a topic of interest and in a concise form, and to present the most relevant data to their peers.

**Undergraduate students** are expected to work on a **research paper** on a topic relevant to dairy industry, to write a summary of most relevant results and to present the most relevant data to their peers.

Class quizzes	(30%)
Assignment I ( <i>written 10%, oral 10%</i> )	(20%)
Exam I	(20%)
Assignment II	(10%)
<u>Exam II</u>	<u>(20%)</u>

**Total points** **100**

- *Participation in class discussions will be rewarded with bonus points to leverage grades from quizzes*

**Grading scale: A = 90%-100%, B = 80%-89%, C = 70%-79%, D = 60%-69%, F < 60%**

**Late assignments:** Late work will be accepted only if the student is unable to complete their work on time due to circumstances beyond their control and have the documentation to back up those circumstances.

### **Attendance Policy**

Class attendance and participation are mandatory. It is each student's responsibility to acquire missed lecture handouts and notes. It is the policy of the Office of Student Affairs to assist students during crisis situations where they are unable to notify their instructors prior to a hurried emergency departure. The Office of Student Affairs will send professors an "Emergency Notification" in those instances where the student will be away for more than two days.

### **WSU Reasonable Accommodation Statement**

Students with disabilities: Reasonable accommodations are available for students who have a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist on your home campus: **Pullman or WSU** Online: 509-335-3417 <http://accesscenter.wsu.edu>, [Access.Center@wsu.edu](mailto:Access.Center@wsu.edu)

### **WSU Academic Integrity Statement**

Academic integrity will be strongly enforced in this course. Any student caught cheating on any assignment will be given an F grade for the course and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions.”

**Instructor-Specific Expectations.** Cell phones, text messaging, and laptop use in class is not allowed. Late arrivals to class are strongly discouraged.

**Instructional Methods.** Students are expected to collaborate. Written assignments will be developed in groups. Oral presentations will be peer reviewed.

**Angel Website.** Course materials or communication with students will be through Angel Website