GRSC 720 Extrusion Processing in Food and Feed Industries

Fall 2008

(revised 12/12/2008)

Instructor
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Lectures: MWF 10:30-11:20 am; SH301
Lab   : W   12:30-3:20 pm; SH301, BIVAP

Course description: 4 credits. The course is designed to provide the students with an understanding of extrusion technology and the ability to apply it to product development and production through a 'hands-on' approach. Emphasis will be placed on process analysis and problem-solving techniques. In the laboratory exercises, which will comprise a major component of the course, students will operate (with the help of the extrusion manager) pilot scale extrusion equipment to produce readily-recognizable commercial products such as corn puffs, breakfast cereal, pasta, pet food, etc. The laboratory sessions are designed to evaluate the effects of process and ingredient variables on properties of finished products for a more thorough understanding of the underlying theory and principles of extrusion technology. For the benefit of grad students, extra credit problems will be assigned in exams, homework assignments, etc. which will be open to all students.

A reproduction fee of $10.00 is to be paid by each student to Ms. Addie Lynn in SH203 by September 3rd (Wednesday).

Required text: *Extruders in Food Applications* Ed. *Mian N. Riaz*. Copies are available at Varney's Bookstore in Aggieville. Its also available on reserve at Hale Library and the Swanson Resource Room in Shellenberger Hall.
Other useful extrusion texts:
The Technology of Extrusion Cooking Ed. *N.D. Frame*
Extrusion Cooking. Technologies and Applications Ed. *Robin Guy*
Food Extrusion Science and Technology Eds. *J.L. Kokini, C.-T. Ho, and M.V. Karwe*
Extrusion Cooking Eds. *C. Mercier, P. Linko, and J.M. Harper*

Basis for evaluation:

Exams (closed book)
3 mid-term exams (scores from best two will be counted)   = 300
1 final exam   = 200

Home work assignments, quizzes   = 100
Lab work and reports   = 300
Term paper and presentation   = 100

Total   1000 points

Letter grades will be assigned according to the total number of points earned as follows:
A = 900-1000   B = 800-899   C = 700-799   D = 600 – 699
F < 600 points

Exams – will be based solely on material discussed in class. Part of the emphasis will be on problem solving and practical situations. A review will be conducted before each exam.

Home work assignments, quizzes – these will be administered through out the semester, in order to test understanding of course matter and to keep students prepared for the exams. Quizzes may be unannounced, so students are expected to be up-to-date with the course material.

Lab work and reports – this will be discussed in greater detail during the first lab class on August 27.

Term paper – students will be required to complete a minimum 10 page (typed, double spaced) term paper and will be required to present them in class at the end of the semester. The term papers will be due on December 10th. Students will be given a few general areas to choose their topic from.

Other Information

Kansas State University has an Honor System based on personal integrity, which is presumed to be sufficient assurance in academic matters one's work is performed honestly and without unauthorized assistance. Undergraduate and graduate students, by registration, acknowledge the jurisdiction of the Honor System. The policies and procedures of the Honor System apply to all full and part-time students enrolled in undergraduate and graduate courses on-campus, off-campus, and via distance learning. The honor system website can be reach via the following URL: www.ksu.edu/honor .

Any student with a disability that needs a classroom accommodation, access to technology or other assistance in this course should contact Disability Support Services and/or their instructor

Lecture and Lab Schedule

Date	Type	Topic	Reading
08/25, Mon	Lec01	Course description; Introductory comments concerning lab and lecture design; Introduction of topic – history, products, raw materials.	
08/27, Wed	Lec02	Raw materials for extrusion processing	Frame- Chp.2
08/29, Fri	Lec03	Raw materials for extrusion processing (contd.); HW1	Frame- Chp.2
08/27, Wed	**Lab01**	**Orientation with the Extrusion Lab**	
09/01, Mon		*Holiday – Labor Day*	
09/03, Wed	Lec04	Raw materials for extrusion processing (contd.)	
09/05, Fri	Lec05	Fundamentals of extrusion processing	Frame –Chp.1 (pp. 1-25); Riaz - Chp. 1, 2
09/03, Wed	**Lab02**	**Raw materials**	
09/08, Mon	Lec06	Extrusion process variables	Riaz – Chp. 5
09/10, Wed	Lec07	Extrudate measurements	
09/12, Fri	Lec08	Extrudate measurements (contd.)	
09/10, Wed	**Lab03**	**Set-up, assembly and operation of single (X-20) and twin (TX-52) screw extruders**	
09/15, Mon	Lec09	Summary of extrusion process variables and extrudate measurements lectures	Riaz – Chp. 5
09/17, Wed	Lec10	Screw elements and extruder configuration; HW2	Riaz – Chp. 5
09/19, Fri	Lec11	Screw elements and extruder configuration	Riaz – Chp. 5
09/17, Wed	**Lab04**	**Field trip-Wenger**	
09/22, Mon		*No class*	
09/24, Wed	Lec12	Preconditioning	Riaz – Chp. 6
09/26, Fri	Lec13	Preconditioning (contd.) and HW#2 tips	
09/24, Wed		**NO LAB**	
09/29, Mon	Lec14	Ingredients – the industry perspective (Girish Ganjyal – MGP Ingredients)	
10/01, Wed	Lec15	Rheology and flow in extrusion	Articles
10/01, Wed	**Lab05**	**Pre-conditioner residence time**	
10/03, Fri	Lec16	Review for Exam I	
10/06, Mon		*Holiday- Fall Break*	
10/08, Wed		**Exam I**	
10/08, Wed	**Lab06**	**Single screw extrusion of direct expanded snacks**	
10/10, Fri	Lec17	Rheology and flow in extrusion (contd.)	
10/13, Mon	Lec18	Extrusion application – direct expanded snacks	Riaz – Chp. 9; Frame – Chp. 4
10/15, Wed	Lec19	Extrusion application – pasta	Extra Reading - Pasta and Noodle Technology
10/15, Wed		*Twin screw extrusion of pasta (canceled)*	
10/17, Fri	Lec20	Extrusion application – 3G snacks	Riaz – Chp. 9; Frame – Chp. 4

Date	Type	Topic	Reading
10/20, Mon	Lec21	Exam I discussion	
10/22, Wed	Lec22	Quiz#2; Mass and energy balance	Riaz –Appendix (pp. 205-219)
10/22, Wed	**Lab07**	**Twin screw extrusion of 3G snacks**	
10/24, Fri		*No class*	
10/27, Mon	Lec23	Mass and energy balance (contd.)	Riaz –Appendix (pp. 205-219)
10/27, Mon	**Lab08**	**Twin screw extrusion of pasta (make-up lab)**	
10/29, Wed	Lec24	Extrusion application – co-extruded snacks	Frame – Chp. 4
10/29, Wed	**Lab09**	**Twin screw extrusion of fish feed**	
10/31, Fri	Lec25	Extrusion application - Aquatic and animal feed	Frame – Chp. 5, Riaz – Chp. 4
11/03, Mon		*No class*	
11/05, Wed	Lec26	Review for Exam II	
11/05, Wed	**Lab10**	**Field trip – Frito-Lay, Topeka KS**	
11/07, Fri	Lec27	**Exam II**	
11/10, Mon	Lec28	Extrusion application – Aquatic and animal feed (contd.)	Frame – Chp. 5, Riaz – Chp. 4
11/12, Wed	Lec29	Extrusion application – Petfood	Frame – Chp. 5, Riaz – Chp. 4
11/12, Wed	**Lab11**	**Twin screw extrusion of texturized proteins**	
11/14, Fri	Lec30	Extrusion application – textured vegetable protein	Riaz – Chp. 9
11/17, Mon	Lec31	Extrusion application – textured vegetable protein (contd.)	Riaz – Chp. 9
11/19,Wed	Lec32	Extrusion automation (Brian Plattner – Wenger)	
11/19,Wed	**Lab12**	**Single screw extrusion of dry expanded dog food**	
11/21, Fri	Lec33	Extrusion process control - software and hardware (Michael Bachelor – Bachelor Controls)	
11/24, Mon	Lec34	Extrusion application – breakfast cereal (Brian Plattner – Wenger)	Riaz – Chp. 9; Frame – Chp. 3
11/26, Wed		*Holiday – Thanksgiving*	
11/28, Fri		*Holiday – Thanksgiving*	
12/01, Mon	Lec35	Drying	
12/03, Wed	Lec36	Drying (contd.)	
12/03, Wed	**Lab13**	**Twin screw extrusion of breakfast cereal** Review for Exam III	
12/05, Fri	Lec37	Drying (contd.)	
12/08, Mon		**Exam III**	
12/10, Wed	Lab38	Extrusion die design (Kaleb Beyer – Wenger)	
12/10, Wed	**Lab14**	**Co-extruded petfood using single and twin-screw extruders; Class presentations**	
12/12, Fri	Lec39	Review for final exam; Term papers due on 12/17/08	Frame – Chp. 6

FINAL EXAM – Monday, December 15, 11:50 a.m. - 1:40 p.m. SH301.