Introduction to Food Engineering Processes (11:400:302, 4 credits)
Instructor: Michael Rogers
rogers@aesop.rutgers.edu

TA: Karthikeyan (JS) jayes@eden.rutgers.edu

The purpose of this course is to provide students with the concepts and principles of engineering along with their applications to processing. This course is designed to cover fundamental principles of mass and energy balance, thermodynamics, fluid mechanics, heat and mass transfer, as well as application of these principles to food processing operations. Special emphasis made on the development of students ability to quantitatively evaluate processing parameters and efficacy.

Learning objectives: Upon completion of the course students will:

1. Define and explain the basic engineering concepts and unit operations used in food processing

2. Be able of evaluating material and energy balance in food processing industry.

3. Correctly analyze the mass and energy transfer phenomena that occur in the entire food processing system

4. Acquire a fundamental understanding of heat and mass transfer mechanisms.

5. Develop their problem solving skills including quantitative approach; Increase the basic understanding of selected unit operations in food processing;

e-College: There is a e-College web page associated with this course. Students who are on the class roster can access the web page by logging into Sakai at http://www.rutgersonline.net. Check the class web page for announcements and grades. Lecture notes will be provided on e-College prior to the lecture.

Any questions about the material should be addressed to the instructor or TA.

Office Hours: I have an open door policy (room 221). If I am there feel free to come and ask questions. If I am not there just email me to set up an appointment. Due to the nature of the course material it is much easier to discuss problems in person whenever possible.

About the Textbook and course materials: Introduction to Food Engineering, Fourth Edition (Food Science and Technology) R. Paul Singh, Dennis R. Heldman that includes the chapters covered in this course. If the student chooses to use a prior edition, it is the student's responsibility to overcome any difficulties associated with using a book other than the one prescribed for this course such as chapter numbering, problems, or material. Some additional materials will be provided in form of class notes, web sources and excerpts from professional publications. They will be available through the class web.
Introduction to the course

Food Product Development Basics
Heat transfer
Steady state heat transfer.
Thermal processing
Non-thermal processing of the food
Separation processes

Food Product Development Basics
Material Balances
Thermodynamics and Perfect Gas Law
Energy Balances
Fluid Mechanics. Friction loss in pipes, fittings and valves

Heat transfer
Steady state heat transfer.
Unsteady-state heat transfer; prediction of product temperature during heating and cooling in containers.
Freezing of foods; thermodynamics of phase change in foods, properties of frozen foods.
Freezing of foods; system description, freezing time prediction, freezing system design.
Storage of frozen foods; design considerations for freezing of foods and storage of frozen foods; shelf life of frozen foods.

Thermal processing
Thermal processing concepts; kinetic parameters, influence of temperature on inactivation of microbial populations.
Applications of thermal processing to liquid foods; Pasteurization, aseptic processing.
Process calculations; use of mathematical methods to determine process times.

Mass transfer
Introduction to mass transfer; steady-state diffusion in solids
Convective mass transfer.
Mass transfer; unsteady-state diffusion in solids, typical applications in foods.

Separation processes
Concentration of liquid foods; introduction to evaporation systems
Membrane separation systems; reverse osmosis and ultrafiltration applications, system design.
Review of mass and energy balances during food dehydration.
Food dehydration; system description, prediction of drying times.
Extrusion processes for food products; types of extruders and description of extrusion operations.
Extrusion system design; factors influencing extruder Operations, demonstration.
GRADING AND EVALUATION

Grade Components:

Laboratory works (30%)
Seminar Quizzes (10%)
Midterm Exam (25%)
Final Exam (35%)

Letter Grade: A= 90-100% B=80-89% C=70-79% D=60-69% F<60%

Cheating/Academic Dishonesty
All Academic Integrity issues will be considered accordingly to the Academic Integrity Policy http://academicintegrity.rutgers.edu/integrity.shtml

Students with Disabilities
Students with disabilities or special needs should contact the professor and the teaching assistant within the first three days of class. This will allow for appropriate accommodations to be made.

LABS

Are to be completed in 12-point font double spaced. Length requirements are to be adhered to! Producing a lab report which is too long will have marks deducted.

Introduction: 2 pages consisting of a short introduction on the major topics covered, the advantages and disadvantages of the technique, industrial applications and a short purpose of the lab. This should contain references (books and journal articles NOT Wikipedia)

Methods: 1 page consisting of what was done during the lab.

Results: This consists only of tables and figures. There should be no text other than the titles that go above tables and below figures. If plots are being used, they should contain properly labeled axis, R2 values and other relevant information.

Discussion: Maximum 5 pages, there may not be a need to use all five pages. This should discuss what was observed, if this was expected, if not then why did our results not work, sources of error for the experiments and any questions that are asked in the lab outline.

Conclusions: ½ page that summarizes the major findings.

Works cited: Unlimited and must be in the Journal of Food Science Format. Avoid websites!
If they are considered late, a 10% deduction for every day it is late will be taken. It is your responsibility to hand in your assignment on time.