Texas A&M University
Departmental Request for a New Course
Undergraduate • Graduate • Professional
Submit original form and attach a course syllabus.

1. This request is submitted by the Department of Biological and Agricultural Engineering

2. Course prefix, number and complete title of course: BAEN 622 - Unit Operations in Food Processing

3. Course description (not more than 50 words): Design of food process engineering systems; basic concepts of rheology and physical properties of foods; fundamentals of heat and mass transfer and process control

4. Prerequisite(s): Fluid Mechanics, Thermodynamics, Fluid Dynamics

5. Is this a variable credit course? ☑ Yes ☐ No If yes, from _______ to _______.

6. Is this a repeatable course? ☑ Yes ☐ No If yes, this course may be taken ______ times. Will the course be repeated within the same semester/term? ☑ Yes ☐ No

7. Has this course been taught as a 289/489/689? ☑ Yes ☐ No If yes, how many times? 2 Indicate the number of students enrolled for each academic period it was taught. 06C - 6, 07C - 3

8. This course will be:
   a. required for students enrolled in the following degree program(s) (e.g., B.A. in history)
   b. an elective for students enrolled in the following degree program(s) (e.g., M.S., Ph.D. in geography)

9. If other departments are teaching or are responsible for related subject matter, the course must be coordinated with these departments. Attach approval letters.

10. Prefix  Course #  Title (excluding punctuation)
    BAEN 622 UNIT OPNS IN FOOD PROC

    Lect.  Lab  SCH  Subject Matter Content Code  Admin. Unit  Acad. Year  FICE Code
    02  02  03  14  01  00  06  04  33  09 - 10  00 03 63 2
    Level 6

Approval recommended by:

Head of Department Date

Head of Department (if cross-listed course) Date

Submitted to Coordinating Board by:

Director of Academic Support Services Date

Chair, College Review Committee Date

Dean of College Date

Dean of College Date

Questions regarding this form should be directed to Sandra Williams at 845-8836.
OAR/AS – 04/07
1 of 5 B5
BAEN-622
UNIT OPERATIONS IN FOOD PROCESSING
(3 credit hours)
MWF 10:20-11:10 a.m. Scoates 216

Course Description: Design of food process engineering systems; basic concepts of the chemical and physical properties of foods; fundamentals of heat and mass transfer and process control.

Instructor: Rosana G. Moreira, Room 310 - Phone: 847-8794 - Scoates Hall
Teaching Assistants: rmoreira@tamu.edu

Prerequisites by Topic: Fluid mechanics, Thermodynamics, Fluid dynamics
Text: Class Handouts (http://baen.tamu.edu/users/rmoreira/rosananeew04/htmfiles/BSEN474new/Site07%20folder/Site07/index.html)

References:
- Geankoplis, C.J. Transport Processes and Unit Operations.
- Ally and Bacon, Inc. New Jersey.
- Current Food Processing/Food Engineering Journals
- Wall Street Journal

Grading

Homework/labs/j. critique 20%
Exam 1 20%
Exam 2 20%
10-page term paper 20%
Final 20%

Grade Scale
90-100 – A
80-89 – B
70-79 – C
60-69 – D
below 60 – F

Grades:

Journal Critiques - it will be a total of 5 journal critiques - if you worked in all of them it will add 3 points to the final grade. Score “0” for one missed.

Homework/Field Trips: Reports must follow the format that will be distributed in class.

Exams: All may have two parts: closed book (fundamentals) and open book (problems).

Additional Requirements for Graduate Students:

1. 10-page term paper: The term paper must not be longer than 10 pages and guidelines for the format as well as content will be distributed in class. A 10-min Power Point presentation will be part of the overall grade for the term paper.
2. Homework and exams will have more assigned problems than the undergraduate students.
3. Graduate students will have advanced problems in unit operations.
Absence: See University rules

Americans with Disabilities (ADA) Policy Statement: The Americans with Disabilities Act is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, Room B118 of Cain Hall., or call 845-1637.

Plagiarism: The handouts used in this course are copyrighted. By "handout", I mean all materials generated for this class, which include but are not limited to syllabi, in-class materials, and handouts. Because these materials are copyrighted, you do not have the right to copy the handouts, unless I expressly grant permission. As commonly defined, plagiarism consists of passing off as one's own the ideas, words, writings, etc., which belong to another. In accordance with this definition, you are committing plagiarism if you copy the work of another person and turn it in as your own, even if you should have the permission of that person. Plagiarism is one of the worst academic sins, for the plagiarist destroys the trust among colleagues without which research cannot be safely communicated.

Cheating: For many years, Aggies have followed a Code of Honor in an effort to unify the aims of all Aggies toward a high code of ethics and dignity. It functions as a symbol to all Aggies, promoting understanding and loyalty to truth and confidence in each other.

Aggies do not lie, cheat or steal; nor do they tolerate those who do.

If you have any questions regarding plagiarism or cheating, please consult the Texas A&M University Student Rules, under the section Scholastic Dishonesty.
BAEN-622 - UNIT OPERATIONS IN FOOD PROCESSING

Course Outline

Rheology of Foods
i. Introduction
ii. Stress and strain behavior in materials
   a. Needs for rheological data in Food Industry
   b. Hookean solids
   c. Newtonian liquids
   d. Factors affecting Newtonian viscosity
iii. Non-Newtonian materials
   a. Time-independent materials
      - apparent viscosity/
   b. Time-dependent materials
      - thixotropic and rheopetic materials
   c. Methods of measuring viscosity
   d. Viscoelastic materials

Pipeline Design for Liquid Foods
i. Tube flow equations
   a. Newtonian
   b. Power-law
   c. Bingham plastic
   d. Herschel-Bulkley
ii. Mechanical energy balance
   a. General equation
   b. Friction factor evaluation
   c. Kinetic energy evaluation
   d. Losses in valves and fittings
   e. Criteria for laminar flow
   f. Concept of effective viscosity
iii. Selection of optimum pipe diameter
iv. Selection of positive displacement pumps - Waukesha pumps

Heating and Cooling Process -- Review
i. Thermal properties of food
   a. Specific heat equations
   b. Thermal conductivity equations
   c. Measurement of thermal properties
ii. Steady-state heating and cooling
iii. Unsteady-state heating and cooling
   a. Method of solution characterized by Biot number
   b. Lumped parameter approach
   c. Heisler charts
   d. Anomalous objects and ellipsoids

Freezing of Foods
i. The freezing process
   a. Freezing point depression
   b. Rates of freezing and thawing
   c. Typical food freezing curve
ii. Ice crystal formation and growth
iii. Variation in thermal properties during freezing
   a. Apparent specific heat
   b. Density
   c. Thermal conductivity
iv. Physical and chemical consequences of freezing
v. Enthalpy changes during food freezing
   a. Heldman method
   b. Experimental data
vi. Freezing time prediction equations
   a. Plank's method
   b. Cleland and Earle method
   c. Numerical method
   d. Freezing Equipment
   e. Freezing storage
vii. Refrigeration systems - review

Drying of Foods
i. The drying process
   a. Thermal properties of drying air (equations)
   b. Psychrometric chart
   c. Equilibrium moisture content/water activity
   d. Fan-system curves
   e. Simple drying time calculation
ii. Drying time prediction equations
   a. Thin-layer drying
      - constant rate period
      - falling rate period
   b. Deep-bed drying
      - energy & mass balance equations
iii. Dryer used in food industry
   a. Cabinet dryer
   b. Tunnel dryer
   c. Puff dryer
   d. Spray dryer
   e. Fluidized bed dryer
   f. Freeze dryer
iv. High temperature dryers used for grain
   a. Mixed flow dryer
   b. Concurrent-flow dryer
   c. Counter-flow dryer
   d. Mixed flow
   e. Rotary dryer

Deep-fat Frying
i. Introduction
ii. Mass Transfer
   a. Water evaporation
   b. Oil absorption
iii. Heat Transfer
   iv. Physical Changes
      a. Oil degradation
      b. Food texture

Extrusion of Foods
i. Introduction
ii. Type
   a. Single-screw
   b. Twin-screw
iii. Flow characterization
   a. Flow equations
   b. Continuity equation
   c. Volumetric extruder output
   d. Corrected flow equations
   e. Corrected volume flow rate
f. Isothermal non-Newtonian flow
iv. Kinetic viscosity model for extruded proteins (before exiting die)
   a. Shear rate effects
   b. Temperature effects
   c. Moisture effects

Thermal Processing
i. Introduction
ii. Microbiology of thermal processing
   a. Food characteristics
   b. Properties of the environment
   C. Destruction of microorganisms
iii. Aseptic processing
   a. The system and its elements
   b. Characteristics of specific elements
   c. Mathematical description of the process