

## PKG 3103 Food Packaging

1. **Catalog Description** - Study of major technical, safety and legislative issues involved in modern food packaging practices. Physical and chemical properties of food packaging materials. Survey of modern packaging techniques for various food types.

2. **Pre-requisites and Co-Requisites:** CHM 2045

3. **Course Objectives:**

After successfully completing this course the student will be able to:

- a. Research and identify appropriate US food packaging regulations.
- b. Critically analyze food packaging approaches with regard to materials, preservation of food quality and safety, costs and benefits.
- c. Specify requirement and design packaging for various food types.

4. **Contribution of course to meeting the professional component of ABET:**

This course contributes 3 credit hours of approved technical elective credit.

5. **Relationship of course to ABET program outcomes:**

From the list of (a) through (k) program outcomes listed below, this course addresses (and assesses) outcomes (a), (e), (h).

ABET Program Outcomes:

- a. Apply knowledge of mathematics, science, and engineering
- b. Design and conduct experiments, as well as analyze and interpret data
- c. Design a system, component, or process to meet desired needs
- d. Function on multi-disciplinary teams
- e. Identify, formulate, and solve engineering problems
- f. Understand professional and ethical responsibilities
- g. Communicate effectively
- h. Understand impact of engineering solutions in a global and societal context
- i. Recognize the need for, and engage in life-long learning
- j. Understand contemporary engineering issues
- k. Use skills, and modern engineering tools necessary for engineering practice

6. **Instructor:** Dr. Bruce Welt

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Office Hours: MWF 2-3PM

7. **Teaching Assistant:** None

8. **Meeting Times:** MWF Period 5 (11:45 – 12:35)

9. **Laboratory Schedule:** N/A

10. **Meeting Location:** Frazier Rogers Hall, Room 110

11. **Material and Supply Fee:** \$0

12. **Textbooks Required:** None

13. **Recommended Reading**

- a. Food Packaging – Principles and Practices (2<sup>nd</sup> Edition), Gordon L. Robertson, 2006, ISBN 0849337755
- b. Food Packaging Science and Technology, Dong Sun Lee, Kit Yam, Luciano Piergiovanni, 2008, ISBN 978-0-8247-2779-6

**14. Course Outline (order and content may vary as required):**

- Sustainability
- History of food packaging
- RTD Milk Article - Packaging Polymers
  - Shelf life – Light and oxygen
  - HDPE vs PET
  - Clear/Opaque, Shrink label
  - Bottle sealing (conduction versus induction sealing)
  - Environmental issues
- Major Food Packaging Polymers
  - Chemical structure, chemical properties
  - Names (spelling counts)
  - In-class lab demos (nylon 6,6 and PVOH vs LDPE)
  - Polymers packaging production (extrusion, thermoforming, blow molding, injection molding, Heat sealing)
- Food Chemistry for Packaging Engineers
  - Temperature (sphere of influence)
  - Light, gases, vapors (sphere of control)
  - Major food constituent sensitivities (Lipids, Proteins, Carbs, Vitamins, Minerals)
  - Quality factors (color, aroma, texture, etc.) and practical end of shelf life determination.
  - Water activity – Moisture Sorption Isotherm Lab Demo
- Shelf life - Gas/vapor permeation (Mass Transfer)
  - Migration – Prediction, TOR
  - Fick and Henry (solubility) – OTR, WVTR (Arrhenius temperature sensitivity)
  - Oxygen limited shelf life estimation
  - Water limited shelf life determination
  - Lab demo – Measuring OTR and WVTR of packaging films
- Shelf life - Thermal
  - Arrhenius (chemical), Thermal Death Time (bio), Shelf life kinetics (Packaging)
  - Retort vs aseptic processing (HTST and UHT)
- Packaging Design - Modified Atmosphere Packaging
  - Low, high and balanced oxygen applications.
  - Produce aerobic vs anaerobic respiration
  - Lab Demo – Respiration measurement
- Metal Packaging
  - 2-piece (DRD, DWI) and 3-piece can fabrication
  - Double seam construction and inspection (industry training video)
  - Corrosion (internal and external)
    - Galvanic series/half cells (limits of predictability)
    - Nernst (ionic concentration)
    - Passivation

- Coatings (metallic and organic)
- Modes of failure
- Paper
  - Definition, production and recycling
  - As component of multi-layer
  - Moisture protection with wax or LDPE (dry end)
  - Moisture protection with additives (wet end)
  - Calendaring and super calendaring – grease “proof” papers
- Glass
  - Production and recycling (cullet)
  - Colors (light)
- Food Contact Regulations, Migration, Dietary Concentration
  - Testing
  - Regulations
  - Modeling
- Applications
  - Red meat
  - Fish
  - Coffee

15. **Attendance:** Mandatory

16. **Grading** – There will be 3 regular exams each worth 100 points. Homeworks, online discussions and quiz scores will be combined to account for 20%. The final exam will be comprehensive and optional (“if you like your grade after the 3<sup>rd</sup> exam, you can keep your grade). The final exam carries the weight of two regular exams. Without the final, total possible points is 300. With the final, total possible points is 500. The final exam DOES NOT replace your lowest grade.

17. **Grading Scale:**  $A \geq 90\%$ ,  $87 \leq B+ < 90$ ,  $83 \leq B < 87$ ,  $80 \leq B- < 83$ ,  $77 \leq C+ < 80$ ,  $73 \leq C < 77$ ,  $70 \leq C- < 73$ ,  $67 \leq D+ < 70$ ,  $63 \leq D < 67$ ,  $60 \leq D- < 63$ ,  $E < 60$

18. **Make-up Exam Policy:** Requires pre-approval. Make-up exams are rarely approved.

19. **Honesty Policy:** All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

20. **Accommodation for Students with Disabilities** – Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

21. **UF Counseling Services** –Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:  
a. UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.

- b. Career Resource Center, Reitz Union, 392-1601, career and job search services.
22. **Software Use** – All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.