

ABE 6615
Advanced Heat and Mass Transfer in Biological Systems (3 credits)
Spring 2018

Analytical and numerical technique solutions to problems of heat and mass transfer in biological systems. Problems involving non-homogeneous, irregularly-shaped products and products with respiration and transpiration.

Topical Outline

1. Analytical heat transfer theory

- Fundamental conduction, convection and radiation
- Differential heat conduction equation
- Solutions for plates, spheres, cylinders and semi-infinite bodies
- Advanced heat conduction solutions

2. Finite difference methods

- Discretization of derivatives
- Various finite-difference schemes (explicit, implicit, alternating directions, etc.)
- Simulation of transient heat flow in non-homogeneous biological materials of spherical shape (one-dimensional), irregularly-shaped (multi-dimensional) under different boundary conditions.
- Effect of internal heat generation due to respiration
- Effect of evaporative cooling

3. Cooling of bulk loads of fruits and vegetables

- Methods
- Computer Simulation

4. Mass Transfer

- Fick's Law
- Transpiration of fruits and vegetables
- Effects of vapor pressure deficit, air movement, respiration, size, shape, surface structure
- Mathematical modeling of transpiration
- Procedures for measuring transpiration rates
- Modified atmosphere packaging (MAP): diffusion of gases in and out of a MAP containing fresh fruits and vegetables

5. Freezing of food Products

6. Drying of agricultural products

7. Reference Materials

- Luikov, A. V. 1968. Analytical Heat Diffusion Theory, Academic Press, New York, 685p.
- Various technical papers

8. Grading

Homework assignments: 100%

9. Grading Scale: A [90-100%], A- [87-90%], B+ [84-87%], B [80-84%], B- [77-80%], C+ [74-77%], C [70-74%], C- [67-70%], D+ [64-67%], D [60-64%], D- [< 60%]

10. 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.

11. 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.

12. UF Counseling Services

Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

13. 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.