

## **ABE 6986: Applied Mathematics in Agriculture & Life Sciences**

Spring 2017

Credits: 3

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### **Catalog Description:**

Mathematical methods, including regression analysis, graphical techniques, and analytical and numerical solution of ordinary and partial differential equations, relevant to engineering in agriculture and the related sciences.

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### **Pre-requisites/Co-requisites:**

*MAP2302: Elementary Differential Equations or equivalent.*

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### **Course Objectives:**

- Increase competence with applied math as a tool of science and engineering.
- Discuss complementary structure (physics & math) of theories and models.
- Enhance capability with analytical and numerical procedures.
- Develop appreciation for conceptual foundations for math models.
- Broaden professional ability as Agricultural and Biological Engineers.

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### **Instructor:**

Richard V. Scholtz, III

Office location: 107 Rogers Hall

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E-mail address: [rscholtz@ufl.edu](mailto:rscholtz@ufl.edu)

Office Hours: Monday, and Friday (12:30 – 1:30 pm) or by appointment.

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### **Class Materials Required:**

**Textbook:** No official text.

Lecture notes and other handout materials will be provided, as it becomes available, via e-learning at <http://elearning.ufl.edu>, look under ABE6986 in Canvas.

**Material Fees:** None.

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### **Class Materials Suggested:**

**Books:**

Abramowitz, M. and I. A. Stegun. 1965. *Handbook of Mathematical Functions*. Dover Publications, New York. ISBN-10: 0486612724

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|----|-----------|--------------------------------------------------------------------------------------------------------------------------------------|
| 15 | 2/8/2017  | § 4.6: Application                                                                                                                   |
| 16 | 2/10/2017 | § 5: Integral Transforms - § 5.7.1: Continuous Stirred Reactor                                                                       |
| 17 | 2/13/2017 | § 5.7.2: Series Continuous Stirred Reactors - § 5.7.5: Spring and Damper with Step Input                                             |
| 18 | 2/15/2017 | Free Period                                                                                                                          |
| 19 | 2/17/2017 | Examination I                                                                                                                        |
| 20 | 2/20/2017 | § 5.7.6: Spring and Damper with a Temporary Force - § 5.7.9: Free Damped Motion                                                      |
| 21 | 2/22/2017 | § 5.7.10: Simultaneous Ordinary Differential Equations - § 5.9.2: Convective Transport with Chemical Reaction                        |
| 22 | 2/24/2017 | § 5.9.3: Chemical Transport with Dispersion, Convection, and Reaction - § 5.9.4: Chemical Transport with Heterogeneous Kinetics      |
| 23 | 3/6/2017  | § 5.9.5: Process Analysis of Overland Flow Treatment of Wastewater - § 5.9.7: Chemical Transport Across a Porous Membrane            |
| 24 | 3/8/2017  | § 5.9.8: Heat Conduction in a Semi-infinite Conductor - § 5.9.10: Heat Conduction in a Cylinder <i>*End of Second Exam Material</i>  |
| 25 | 3/10/2017 | § 5.10: Fourier Transforms - § 5.13: Inverse Laplace Transforms by Integration in a Complex Plane                                    |
| 26 | 3/13/2017 | § 5.14: Applications: Part 4 - § 5.14.1: Overland Flow Treatment of Wastewater                                                       |
| 27 | 3/15/2017 | § 5.14.2: Short Hand Procedure for Convective Diffusion - § 5.14.3: Heat Transfer with Insulation and Convection Boundary Conditions |
| 28 | 3/17/2017 | § 5.14.4: Heat Transfer with Insulation and Flux Boundary Conditions                                                                 |
| 29 | 3/20/2017 | Free Period                                                                                                                          |
| 30 | 3/22/2017 | Examination II                                                                                                                       |
| 31 | 3/24/2017 | § 5.14.5: Cross Flow Heat Exchanger - § 5.14.6: Electrical Circuit                                                                   |
| 32 | 3/27/2017 | § 6: Numerical Solutions of Ordinary Differential Equations - § 6.3: Taylor Series Method                                            |
|    | 3/28/2017 | <b>Project Paper Due (at midnight on Canvas)</b>                                                                                     |
| 33 | 3/29/2017 | § 6.4: Runge-Kutta Method - § 6.6: Simultaneous Equations                                                                            |
| 34 | 3/31/2017 | § 8.1: Stability and the Method of Singular Perturbation                                                                             |
| 35 | 4/3/2017  | § 6.6: Application                                                                                                                   |
| 36 | 4/5/2017  | § 7: Numerical Solutions of Partial Differential Equations - § 7.1: Explicit Method <i>*End of Third Exam Material</i>               |
| 37 | 4/7/2017  | § 7.2: Implicit Method - § 7.3.1: Heat Transfer Along a Uniform Conductor                                                            |
| 38 | 4/10/2017 | § 7.3.2: Langmuir-Hinshelwood Kinetics - § 7.3.3: Heat Transfer through a Cylinder                                                   |
| 39 | 4/12/2017 | § 8.2: Matrix Inversion by the Thomas Algorithm & § 7.3.4: Heat Transfer through a Cylinder with Offset Internal Insulation          |
| 40 | 4/14/2017 | Free Period                                                                                                                          |
| 41 | 4/17/2017 | Free Period                                                                                                                          |
| 42 | 4/19/2017 | Examination III                                                                                                                      |
|    | 4/26/2017 | <b>Project Paper Reviews (at midnight on Canvas)</b>                                                                                 |

**Announcement Policy:** Students will be held responsible for *all* announcements made in class, which includes *any and all* changes to this syllabus and the course lecture schedule. Students are expected to attend all lectures and any guest speakers scheduled.

Students should also strive to think and act as professionals. Students should extend all guests professional and common courtesy.

In the process of enrolling and registering for classes at the University of Florida, every student has signed and presumably understands the following statement: "I understand that the University of Florida expects its students to be honest in all their academic work. I agree to adhere to this commitment to academic honesty and understand that failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University." The following information will be placed on examinations. On my honor, I have neither given nor received unauthorized aid on this examination.

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**Use of Library, Personal References, PC Programs and Electronic Databases:**

These items are university property and should be utilized with other users in mind. Never remove, mark, modify nor deface resources that do not belong to you. If you're in the habit of underlining text, do it only on your personal copy. It is inconsiderate, costly to others, and dishonest to use common references otherwise.

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**Software Use:**

All faculty, staff and students 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 hold ourselves and our peers to the highest standards of honesty and integrity.

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**UF Counseling Services:**

Resources are available on-campus for students having personal problems or lacking clear career and academic goals which interfere with their academic performance. These resources include:

1. University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling;
  2. Student Mental Health, Student Health Care Center, 392-1171, personal counseling;
  3. Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling;
  4. Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.
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