

**University of Puerto Rico
Río Piedras Campus
College of Natural Sciences
Department of Mathematics**

**Course Syllabus
Second semester, academic year 2020-21**

Course information

Course title: Projects in Applied Mathematics
Course code: MATE 6700
Credits/hours: 3 credits/45 hours
Course prerequisites: Permission of the Director

Online course due to the COVID-19 emergency

Room: Virtual classroom via Google Meet, code: tjs-bfmy-qdj

Time: Monday and Wednesday 2:30-3:50 pm

Course web pages: [Moodle site](#)

Instructor: Mariano Marcano

Office: Virtual room via Google Meet, code: fvx-swpc-dio

Email address: mariano.marcano@upr.edu

Office hours: Monday 11:00 am -1:00 pm and Wednesday 1:00-2:00 pm

Professor's webpage: epsilon.uprrp.edu/mmarcano

Course description

Introduction to research in applied mathematics. Emphasis on the formulation and solution of problems from the real world in terms of mathematical models and the interpretation of those solutions in the context of the original problems.

In this course the real world problems are taken from biology. More specifically, this course will introduce techniques used in the construction, analysis, and evaluation of mathematical models of infectious diseases epidemiology.

Course objectives

After completing the course students will know how to:

1. Formulate mathematical models of real world problems.
2. Analyze and simplify the model equations.
3. Solve numerically the model equations.
4. Estimate model parameters.

5. Write a project proposal.
6. Prepare and give oral presentations.
7. Write applied mathematics reports.

Content outline and schedule

| Topic | Time |
|---|----------|
| 1. Course introduction. | 1.5 hour |
| 2. Introduction to mathematical modeling. | 1.5 hour |
| 3. Population dynamics models to study the transmission of infectious diseases. | 3 hours |
| 4. Diffusion reaction equations to study the spread of infectious diseases. | 3 hours |
| 5. Project topics. | 1.5 hour |
| 6. Submit project topic with a brief description (Wednesday, February 17). | |
| 7. Parameter control of model outcomes. | 3 hours |
| 8. Parameter estimation by means of nonlinear optimization. | 3 hours |
| 9. Proposal writing. | 3 hours |
| 10. Fellowship and scholarships opportunities. | 1.5 hour |
| 11. Submit project literature review (Wednesday, March 10). | |
| 12. Fellowship application preparation. | 3 hours |
| 13. Submit project proposal (Wednesday, March 24). | |
| 14. Research statements preparation. | 3 hours |
| 15. Evaluation and discussion of project proposals. | 3 hours |
| 16. Project updates and feedbacks. | 3 hours |
| 17. Oral presentation preparation. | 3 hours |
| 18. Report writing. | 3 hours |
| 19. Evaluation and discussion of research statements. | 3 hours |
| 20. Oral presentations of 50 minutes. (May 5, and 10) | 3 hours |
| Total: | 45 hours |

Instructional strategies

- The course will be taught online. The content of the course and supporting materials will be available to the student through the Moodle platform. The lecture notes will be in slide presentations. Video conferences will be conducted by Google Meet at the time of the course to discuss the class topics. To enter the video conference use the code: tjs-bfmy-qdj.
- Assignments will be uploaded to Moodle in pdf format, the students will download the files and, before the deadline, the students must upload the answers to Moodle in a single file. Grading and feedback will be available in Moodle to the student.
- A frequent asked question FAQ Moodle forum will be available to post any question

the student may have and answer questions posted by classmates. One point bonus (maximum two points) will be added to the corresponding homework of any student that answers completely and correctly a question of the forum.

- As alternative methods that do not require the physical presence of the students and the teacher in the classroom, we will use: discussion forums, recorded lectures, and video conferences.

Available and required learning resources

To take advantage of the course material and other resources in Moodle the student needs a personal computer with fast internet access, a PDF viewer, an internet browser, a word processor (L^AT_EX is free and suitable for writing mathematical expressions), and the high level programming platform MATLAB[®]/Octave. Octave is free and can be downloaded from the [GNU Octave site](#).

Course evaluation

The evaluation process will consist of an individual modeling project. Each student will give an oral presentation and prepare a written report. The grade will be computed as follows:

| | |
|-------------------|-------|
| Project topic | 5% |
| Literature review | 10% |
| Project proposal | 15% |
| Oral presentation | 30% |
| Written report | 40% |
| | <hr/> |
| | 100% |

Grading system

Pass or fail system.

Law 51: Rights of Students with Disabilities

Students with access to Vocational Rehabilitation Services should contact the professor at the beginning of the semester in order to plan any special arrangements and equipment necessary in accordance with the recommendations of the Office of Student with Disabilities (OSEI). In addition, any students with special needs or who require any type of assistance or special arrangements should contact the professor.

Academic Integrity

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009- 2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws.

Normativeness on discrimination by sex and gender in sexual violence form

The University of Puerto Rico prohibits discrimination based on sex, sexual orientation, and gender identity in any of its forms, including that of sexual harassment. According to the Institutional Policy Against Sexual Harassment at the University of Puerto Rico, Certification Num. 130, 2014-2015 from the Board of Governors, any student subjected to acts constituting sexual harassment, must come to the Office of the Student Ombudsperson, the Office of the Dean of Students, and/or the Coordinator of the Office of Compliance with Title IX for an orientation and/or a formal complaint.

Bibliography

1. Leah Edelstein-Keshet. *Mathematical Models In Biology (Classics in Applied Maths)*. SIAM, Philadelphia, 2005
2. Leonard Gillman. *Writing Mathematics Well*. The Mathematical Association of America, 1987.
3. Nicholas J. Higham. *Handbook of Writing for the Mathematical Sciences*. 2nd edition, Society for Industrial and Applied Mathematics (SIAM), 1998.
4. Frank C. Hoppensteadt and Charles S. Peskin. *Modeling and Simulation in Medicine and the Life Sciences (Texts in Applied Mathematics)*. Springer Verlag, 2nd edition (October 2001).
5. J. Mazumdar. *An introduction to Mathematical Physiology and Biology*. 2nd Edition, Cambridge University Press, 1999.
6. J. D. Murray. *Mathematical Biology*. 3rd edition, Springer, NY, 2002.
7. William Strunk Jr., E.B. White, and Roger Angell. *The Elements of Style*. 4th edition, Allyn & Bacon, 2000.

8. Kate L. Turabian. *A Manual for Writers of Term Papers, Theses, and Dissertations (Chicago Guides to Writing, Editing, and Publishing)*. 6th edition, University of Chicago Press, 1996.

Electronic references:

1. M. Marcano, *Introduction to MATLAB*, [preprint](#), 2007.
2. Negrón, P. V., *Un Vistazo a MATLAB*, [preprint](#), 2006.
3. I. Rubio, *CCOM introduction to LATEX*, [preprint](#), 2019.