Math 493
Fall 2016

Instructor : Maria R. D’Orsogna
Lectures : alternate Fridays 10:00 - 12:00 in room tba
Office hours : By appointment
Contact : dorsogna@csun.edu or (818) 617 - 2991
Meeting times: : Sept. 2, 16, 30; Oct. 14, 28; Nov. 11, Dec. 2, 9

Course description:
Math 493 is a student seminar class. We will study current topics in applied mathematics with a special emphasis on biological and sociological modeling. We also have a series of guest lectures from postdocs and graduate students. You will attend talks, ask questions, prepare summaries and critiques, give oral presentation(s) to the class on a topic of your choosing. All your work must be typed in Latex, so please download it and learn how to use it. It is important for you to write in a clear, logical manner; give clear, concise and well-structured account of your chosen topic; show that you understand the key issues; give examples to support and/or to question hypothesis and results; give a full bibliography and appropriate referencing; write in correct, standard English. The following are *suggested* topics. If there is any other topic you wish to study, please let me know. You should do a thorough literature search and find the most current research papers that apply. Use the papers/books below as starting points, and take your time researching in the library. You may want to perform your own simulations or calculations if you are curious. If books are cited, please select a chapter.

1. Models of transport and movement:
Learn about different transport modes in biological systems, such as the random unbiased and biased walk, the telegrapher’s equation, discrete and continuum limits, and ways

2. The Ising model:

Learn about this basic modeling system (together with its extensions, the Potts model and the Heisenberg model) and how it is used in various contexts. This topic is many many textbooks. Some of them are “Exactly Solved Models in Statistical Mechanics” (R. J. Baxter, 1982) and “Introduction to Modern Statistical Mechanics” (David Chandler, 1987) For applications, one can use gang activity modeling in ”Ising Model for Gang and Graffiti” (Othman Ayouche, et al Imperial College London); Social applications of two-dimensional Ising models (Stauffer, American Journal of Physics, 2008); “Application of the ising model to hemoglobin” (W. Yap, H. Saroff , Journal of Theoretical Biology 1971)

3. Clustering, growth and nucleation:


4. Random sequential adsorption and car parking models:

5. Cancer modeling and treatment:


6. Swarming:

Learn about models of interacting particles that can be used to represent flocks of birds, school of fish and locust swarms. Possible starting sources are “State transitions and the

7. Oscillations in the human body – sleep and blood circulation


8. HIV and other viruses:


9. The immune system:

Learn about how the immune system works. Possible starting sources are A basic mathematical model for the immune response (H Mayer, Chaos, 1995); “Modelling viral and immune system dynamics” (Alan Perelson, Nature Reviews Immunology, 2002)

10. Opinion and voter dynamics:


Tentative schedule:

Sept. 16, 30 – guest lectures and discussion
Oct. 14 – student class presentations
Oct. 28, Nov. 11 – guest lectures and discussions
Dec. 2, 9 – final student presentation