Advanced Topics in Applied Mathematics (Math 583): The Mathematics of Infection and Immunity

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Prerequisite: Graduate standing

Course website, on Blackboard: Go to http://learn.wsu.edu, log in with your WSU Network ID and password, and select this course. Any changes or announcements will appear on the course website. Check the website regularly for updates.

Course Description
Disease processes are complex and often entail a system of interrelated mechanisms. Mathematics has been used to successfully disentangle many of these processes, leading to advances in our understanding of infection, disease, and immunity. This course will provide the opportunity to delve into the theory, methods, and techniques in the mathematical modeling of infection and immunology, and it offers an improved understanding of this expanding field. Topics include deterministic and stochastic models, immunological networks, agent-based modeling, data analysis, computational implementation, and examination of current literature.

Course Objectives and Student Learning Outcomes
- Acquire understanding of mathematical tools and techniques used in modeling immunology, infection and disease.
- Develop familiarity with the methods of analysis of mathematical models and the implementation of computational methods.
- Critically evaluate research articles that use mathematical modeling in the immunological and infectious disease literature.

Course readings consist of journal articles, software tutorials, and selected readings distributed via Blackboard.

Course Pedagogy
Forms of instruction include lecture, class discussion, computer labs, and presentations on research articles and class projects. Class discussion will be encouraged on current readings from the literature.

Required assignments
- Research article presentations on papers from the literature describing model construction, analysis, simulation, results, and interpretation.

- Computer labs on model simulation (using Excel, R, Berkeley Madonna, Matlab, Mathematica, or other relevant programs).
- Final class project and presentation

Grading:

Research article presentations	30%
Computer lab exercises	20%
Final project/presentation	35%
Participation	15%
Total	100%

Course Assessment:
Letter grades will be assigned as follows:

92.5 - 100% = A
89.5 - 92.4% = A-
86.5 – 89.4% = B+
82.5 – 86.4% = B
79.5 – 82.4% = B-
76.5 – 79.4% = C+
72.5 – 76.4% = C
69.5 – 72.4% = C-
66.5 – 69.4% = D+
59.5 – 66.4% = D
< 59.4% = F

Attendance, Participation, and Late Work Policy: Students are expected to attend all scheduled class times and contribute to class discussions. A student who must miss a class should notify the instructor and provide a reason for the absence. Late assignments must be pre-arranged and are subject to grade reduction.

Students with Disabilities: Reasonable accommodations are available for students with documented disabilities or chronic medical conditions. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center at Washington Building 217; Phone: 509-335-3417 to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information contact a Disability Specialist on your home campus. **Pullman or WSU Online**: 509-335-3417 http://accesscenter.wsu.edu, Access.Center@wsu.edu

WSU Safety Measures and Emergency Notification: Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "Alert, Assess, Act," protocol for all types of emergencies and the "Run, Hide, Fight" response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able). Please sign up for emergency alerts on your account at MyWSU. For more

information on this subject, campus safety, and related topics, please view the FBI's Run, Hide, Fight video and visit the WSU safety portal.

Academic Integrity: Academic integrity is the cornerstone of higher education. As such, all members of the university community share responsibility for maintaining and promoting the principles of integrity in all activities, including academic integrity and honest scholarship. Academic integrity will be strongly enforced in this course. Students who violate WSU's Academic Integrity Policy (identified in Washington Administrative Code (WAC) 504-26-010(3) and -404) will receive a zero on the assignment, may be given a grade of F for the course, will not have the option to withdraw from the course pending an appeal, and will be reported to the Office of Student Conduct. Cheating includes, but is not limited to, plagiarism and unauthorized collaboration as defined in the Standards of Conduct for Students, WAC 504-26-010(3). You need to read and understand all of the definitions of cheating: http://app.leg.wa.gov/WAC/default.aspx?cite=504-26-010. If you have any questions about what is and is not allowed in this course, you should ask the course instructor before proceeding. If you wish to appeal a faculty member's decision relating to academic integrity, please use the form available at conduct.wsu.edu.

Course Outline (subject to change):

8/20	Week 1	Introduction to immunological and infectious disease modeling
8/27	Week 2	Population dynamics and SIR model
9/3	Week 3	Lotka-Volterra and competition models
9/10	Week 4	Steady-states, R_0, and basic model of virus infection
9/17	Week 5	Scientific papers: literature searching, reading, analysis, presentations
9/24	Week 6	Individual presentation/article discussion
10/1	Week 7	Individual presentation/article discussion
10/8	Week 8	Individual presentation/article discussion
10/15	Week 9	Individual presentation/article discussion
10/22	Week 10	Linear stability analysis, viral dynamics
10/29	Week 11	Nonlinear stability analysis, simulation
11/5	Week 12	Final project work
11/12	Week 13	Final project work
11/19		Fall break (No class)
11/26	Week 14	Final presentations
12/3	Week 15	Final presentations

**Schedule and readings subject to change*