Biological Modeling 2021 Spring 生物系統模擬	
Course Code:	DIC 8029
Credits	Three (lectures: 3 hr per week)
Organizers	Sheng-Feng Shen
Time	Friday 09:00-12:00
Place	Room 212, Computer and Information Networking Center, NTU Campus
Student Limit	30
Description	The course material is designed to be interdisciplinary, integrating biology, ecology, mathematics and environmental sciences. While the main course material is based on classic ecological modeling textbooks and articles, these analytic methods are applicable to multi-faceted research questions. The material builds from a single population and then extends to the ecosystem level, including species interaction, climate changes and disease as well as molecules interactions within cells. Regular modeling exercises are required (1 unit as practice). After equipped with modeling skills, students have to develop their own research questions and use modeling and data mining approaches to solve their questions. Instructors will guide students through the question-solving processes.
Purpose	The goal of this course is to introduce mathematical and statistical approaches to study biological systems as well the interactions of abiotic and biotic components. This is a course for students with basic knowledge of statistics, calculus, and ecology. This is a sequential course of Mathematics for Life Scientists (or equivalent). We will introduce various model types, building blocks of models, and the ways to construct models. We will teach computer languages to simulate and analyze these models as well as data. The course has a hands-on work component. Students will carry out modeling and data analysis exercises on a regular basis. Finally, students will develop their own model and applications.
Grade	20 % Assignments 25 % Midterm Exam 25 % Final Exam 20 % Class participation 10 % Attendance
	Students will carry out modeling and data analysis exercises on a regular basis. Students need to make presentations of their homework. We will also teach the presentation skills. Finally, students will develop their own models and applications. For the final project, students need to first prepare and discuss their proposals with the instructors. Through the discussing processes students will develop constructive and logical thinking.
Textbooks and References	A Primer of Ecology (4th edition) Nicholas J. Gotelli

Week	Date	Topic
Week 1	2/26	Introduction to programming and modeling
Week 2	3/5	Introduction to evolutionary model and optimization
Week 3	3/12	Self-consistent model in evolution 1
Week 4	3/19	Self-consistent model in evolution 2
Week 5	3/26	Dynamic programming
Week 6	4/2	No class : Adjust holiday
Week 7	4/9	Evolutionary game theory
Week 8	4/16	Adaptive dynamics
Week 9	4/23	Mid-term exam
Week 10	4/30	Adaptive dynamics
Week 11	5/7	Density-dependent regulation (stock-recruitment)(1 page proposal due)
Week 12	5/14	Age-structured models: yield-per-recruit, Virtual Population Analysis
Week 13	5/21	Individual-based modeling
Week 14	5/28	Species interactions and food chain
Week 15	6/4	Disease model and AIDS
Week 16	6/11	Alternative stable state and On and off of cell cycle
Week 17	6/18	Climate Change
Week 18	6/25	Final exam
		*Topic of each week may change depends on the lecturers