G506 (Mathematical Ecology)

Year:	2016–2017
Code:	MATHG506
Level:	Advanced
Value:	15 UCL credits (= 6 ECTS credits)
Term:	1
Structure:	3 hours lectures per week
Assessment:	100% examination
Lecturer:	Dr SA Baigent

Course Description and Objectives

Mathematical models are used extensively in many areas of the Biological Sciences. This course aims to give a sample of the construction and mathematical analysis of such models in Population Ecology. The fundamental question to be addressed is: what natural (or human) factors control the abundance and distribution of the various populations of animals and plants that we see in Nature?

No special knowledge of Ecology is required or assumed. However, an interest in, and willingness to learn about, concepts and problems in this area are essential. Mathematical techniques used include calculus, mathematical methods and linear algebra, and those developed include the important qualitative technique of phase plane analysis which the course uses extensively.

This course is independent of MATHG505.

Recommended Texts

(i) *Elements of Mathematical Biology*, Mark Kot, CUP 2001.

(ii) *Evolutionary games and population dynamics*, Joseph Hofbauer and Karl Sigmund, CUP 2002.

(iii) *Mathematical Biology*, J.D. Murray, Springer-Verlag Biomathematics Texts, 1989.

(iv) *A Primer in Ecology*, N.J. Gotelli, Sinaur Associates Inc.

Detailed Syllabus

– Population models for a single species (discrete and continuous-time models). Constant and time-varying environments. Discrete-time population models; logistic map.

– Simple age-structured models. Stable age-structure. The Euler-Lotka demographic equation and its analysis using theory of non-negative matrices. Applications to the theory of life-history strategies.

– Basic phase plane and linear stability analysis. Two-species interactions: Competition, Cooperation and Predator-prey models. Holling's functional responses.

– Many-species interactions. General Lotka-Volterra models. Applications of Lyapunov functions.