Mathematical and Computational Modeling in Biology and Physics
MATH 80770-01 – Spring 2006

MWF 3:00 – 3:50, 131 DeBartolo
Instructor: Mark Alber (631-8371) malber@nd.edu

Advanced course on applied mathematics methods with emphasis on modeling of biological problems in terms of differential equations and dynamical systems. Students will be working in groups on several projects and will present them in class at the end of the course.

SYLLABUS:

1. Diffusion Equation and Its Applications in Biology
2. Reaction Diffusion and Chemotaxis Models with Applications in Biology
3. Tumor Growth and Cell Proliferation
4. Enzyme Kinetics: Michaelis-Menten Theory
5. Hodgkin-Huxley Theory and Neural Networks
6. Biological Oscillators and Switches
7. Biological Waves
8. Belousov-Zhabotinskii Reaction

BOOKS:

Murray, James D., *Mathematical Biology I*. An Introduction, Series: Interdisciplinary Applied Mathematics, vol. 18, 3rd Edition 2003. Corr. 2nd printing, 2004, Hardcover, ISBN: 0-387-95228-4

Murray, James D., *Mathematical Biology II*. Spatial Models and Biomedical Applications Series: Interdisciplinary Applied Mathematics, Vol. 18, 3rd Edition 2003. Corr. 2nd printing, 2004, Hardcover, ISBN: 0-387-95228-4

Scott Camazine, Jean-Louis Deneubourg, Negel R. Franks, James Sneyd, Guy Theraulaz and Eric Bonabeau, *Self-Organization in Biological Systems*, Princeton University Press, 2003, ISBN: 0-691-11624-5

Peter Dayan and LF Abbott, *Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems*, The MIT Press, 1st Edition 2001, ISBN: 0-262-04199-5