

## MATH 1555 – Calculus for the Life Sciences – 4 hours

**Brief Description.** Taylor approximations, introduction to differential equations, linear algebra and introduction to multivariable calculus. Motivating examples drawn from life sciences.

**Text.** Such as *Calculus for Biology and Medicine*, by Neuhauser (3d Ed); Pearson, 2010.

### Topics

*Taylor approximations:* Taylor polynomials and their accuracy.

*Infinite series:* Convergence. Absolute convergence. Criteria for convergence.

*Differential equations:* First order separable equations. Equilibria and their stability. *Examples:* Growth models. Restricted growth: von Bertalanffy Equation. Logistic equation. Homeostasis. Levis model. The Allee effect.

*Multivariable calculus:* Functions of several variables. Limits and continuity. Partial derivatives. Tangent planes, differentiability and linearization. Systems of difference equations. *Examples:* Low temperature survival as function of metabolic rate and heat loss. Host-parasitoids models.

*Systems of differential equations:* Linear systems. Equilibria and their stability. *Examples.* Nonlinear autonomous systems. *Examples:* Compartment models. Lotka-Volterra model of interspecific competition. Model of neuron activity. Model of enzymatic reactions.

### Schedule of topics

Topic	Sections	Lectures
Discrete models, sequences and difference equations	2.1-2	3
L'Hopital's Rule. Antiderivatives	5.5,5.8	2
Integration and the fundamental theorem of calculus	6.1-3	6
Techniques of integration	7.1-4	6
Taylor approximations	7.6	2
Differential equations	8.1-2	6
Multivariable calculus	10.1-4	9
Systems of differential equations	11.1-3	8

### Learning Objectives:

Students develop knowledge and skills in:

- (1) Using Taylor polynomials and infinite series
- (3) Techniques of multivariable calculus.
- (4) Solving differential equations.
- (5) Using systems of differential equations in life sciences applications.