

# MATH483 - Scientific Visualization and Animation

Professors David Bernstein and Jim Sochacki

**Description:** This course will introduce students to the concepts of scientific visualization and animation. Specifically, it will consider ways to: represent curves and surfaces, use representations of curves and surfaces to create static and dynamic visual content, incorporate visualization and animation techniques into models of static and dynamic systems, and use visualization and animation to improve scientific understanding.

**Textbook:** There is no textbook for this course. The *OpenGL Programming Guide (v1.1)* is available online if you need it. Readings are on reserve.

**Outline:** (though specific topics and dates may change):

## Part I: Introduction

8/28	Coordinate Systems, Review of Analytic Geometry	Globus and Raible
8/30	Example: Cartography	
9/4	Introduction to Differential Equations	
9/6	Example: Trajectories	

## Part II: Visualization of Multi-Dimensional Shapes and Data

9/11	Parametric Curves and Surfaces I	
9/13	Parametric Curves and Surfaces II	
9/18	Example: Bezier Curves and Example: Animation and Tweening	
9/20	Parametric Curves and Surfaces III	
9/25	Guest Lecture: 3D Printers and Rapid Prototyping	
9/27	Parametric Curves and Surfaces IV	
10/2	Example: Functions from $\mathbb{R}^2$ to $\mathbb{R}^2$ , from $\mathbb{R}^3$ to $\mathbb{R}^3$ and from $\mathbb{R}^2$ to $\mathbb{R}^1$	
	Boring and Pang and Helgeland and Andreassen	
10/4	Example: Bezier Surfaces	
10/9	Presentation of Assignment 2	
10/11	Parametric Curves and Surfaces V	

## Part III: Visualization of Dynamical Systems

10/16	A Brief Review of Probability	
10/18	An Introduction to Markov Chains I	
10/23	An Introduction to Markov Chains II	
10/25	Visualization of Markov Chains	
10/30	Presentation of Assignment 3	
11/1	Diffusion and Dispersion: SIR and SIS Models I	
11/6	Diffusion and Dispersion: SIR and SIS Models II	

## Part IV: Final Project

11/8-11/15	Project Meetings	
11/20	Preliminary Presentation of Final Projects	
11/27	Public Exhibition	

11/29	Critique
12/4	Final Project Presentations
12/6	Final Project Presentations (cont.)

You are expected to come to class prepared to ask *and answer* questions on the topics above. Attendance is not mandatory but is strongly encouraged.

**Grading:** Final grades will be based on your performance on: 3 programming assignments (20% each) and 1 final project (40% total).

**Programming Assignments:** 3 programming assignments will be assigned during the semester.

Programming Assignment 1 , Due: 9/18 (Basics)

Programming Assignment 2 , Due: 10/9

(Animation and Visualization of Simple Dynamics)

Programming Assignment 3 , Due: 10/30 (Exploratory Visualization)

Make sure you read and understand all of the policies related to programming assignments.

**Office Hours:** You may meet with Prof. Bernstein during his [scheduled office hours](#) or you may schedule an appointment with him. You also may meet with Prof. Sochacki during his [scheduled office hours](#) or you may schedule an appointment with him.

**Software Development Tools:** There are a variety of different software development tools that you might find useful, including:

C/C++ Compilers, APIs, and Utilities

File Compression/Decompression Utilities

Text Editors

UNIX-Like Utilities

**Mathematical Tools:** There are a variety of different numerical and symbolic math tools that you might find useful:

Math Tools

