MATH 497 – Special Problems in Mathematica

Course Description from Bulletin: Special problems. (Variable credit) (C)
Note: This specific version of the course will count for 3 credits.

Enrollment: Elective for AM and other majors

Textbook(s): *Wolfram Mathematica 8.0/9.0 Documentation Center*, Wolfram Research Inc.
The Mathematica Book, by Stephen Wolfram

Other required material: *Mathematica* 8.0/9.0

advanced level. As a side benefit, students should be well on their way to being prepared to take the new Wolfram student certification exam if they so choose.
2. Students will learn various topics in Mathematics from a point of view that stresses computation, experimentation, making conjectures, and visualization. The topics covered will include standard topics, but will in part be dictated by student interests. In other words, for this class, the individual choice of topics is less important than the way in which it is covered. That said, calculus, linear algebra, and differential equations are mandatory as they form part of the core of applied mathematics.
3. Students will learn how to use *Mathematica* as a tool for for modeling.
4. Students will be given the chance in this course to find a topic/topics of interest and fully explore it/them.
5. Students will improve their collaboration skills.
6. Students will improve their presentation and writing skills.

Lecture schedule: Two 75 minute lectures per week

Typical Day: This course will be partially "flipped". Students will be assigned topics to read and be expected to discuss, ask and answer questions about said topics. A brief lecture will follow, followed by in class problems to test the understanding of the topic. This will be followed by a discussion and mini presentations of solutions to the problems. These presentations will be done by the students themselves as much as possible. Homework will be assigned and collected weekly.

Course Outline:
1. An introduction to the *Mathematica* language and underlying principles behind programming in *Mathematica*.
2. An introduction to document creation in *Mathematica*, especially the creation of dynamic CDFs.

3. A more in depth exposition of the rule based, functional, and procedural programming paradigms in *Mathematica*.
4. Plotting functions, solving equations, iteration, recursion
5. Calculus
6. Linear algebra
7. Differential equations (ordinary and partial)
8. Multivariable & vector calculus
9. Approximation and interpolation
10. Dynamical systems
11. CDF and PDF, statistical models and analysis
12. Image processing and rendering
13. Graph theory
14. Number theory

Due to the nature of this course, there is flexibility in the above choice of topics and also the choice of ordering. These choices will in part be dictated by student interest.

Assessment:	Class Participation	5%
	Homework	30%
	Test	20%
	Final Exam/Project	45%

A note about the project: The structure of the final project is flexible as long as the result is substantial. If a student has a specific research topic that they are already interested in, then this would be an excellent choice for a project. One alternative to a research based project would be if the student wanted to create several smaller projects which illustrated concepts in Mathematics, Physics, or Engineering using *Mathematica*. It is hoped, but not required, that students be willing to add their projects to a shared IIT library of *Mathematica* code and materials that we are in the process of creating.

Syllabus prepared by: John Erickson in collaboration with Greg Fasshauer, Luis Larco, Barrett Leslie, and William Molchan.
Date: Nov. 30, 2012