

**HON 301 002 — PROSEMINAR: VISUALIZING MATHEMATICS**  
**W 3:00–5:30 — RGAN 202 (though sometimes we will meet in CB 313)**

**COURSE WEBPAGE:** [www.ms.uky.edu/~lee/visual05/visual05.html](http://www.ms.uky.edu/~lee/visual05/visual05.html)

**INSTRUCTOR:** Carl Lee, 967 POT, 257-1405, [lee@ms.uky.edu](mailto:lee@ms.uky.edu), [www.ms.uky.edu/~lee](http://www.ms.uky.edu/~lee)

**OFFICE HOURS:** Wednesdays, 1–2:30 pm, and also by appointment.

**TEXTS:**

1. Flatland: A Romance of Many Dimensions (Dover Thrift Editions), by Edwin A. Abbott.
2. Beyond the Third Dimension: Geometry, Computer Graphics, and Higher Dimensions (Scientific American Library Series) by Thomas F. Banchoff. (I don't believe the bookstore was able to order this, so you may want to hunt for used copies online. At least one copy will be on reserve in the Mathematics Library, which is located in the basement of Patterson Office Tower.)
3. Shapes, Space, and Symmetry (Dover), by Alan Holden.
4. Mathematical Snapshots (Dover), by Hugo Steinhaus.

**TOPICS:**

This course will be an opportunity to explore how various aspects of mathematics can be visualized by physical and virtual models, often in quite beautiful ways, and conversely how mathematics can be used as a tool in designing beautiful physical and virtual models. Here are some examples that we may look at, but some choice of topics will be guided by the interests of the class members.

- Symmetry: How many different kinds of wallpaper patterns are there? How can we recognize them?
- Polyhedra: What are they, and what role do they play in art, chemistry, etc.?
- Proofs without words: How can we “see” such formulas as the sum of the first  $n$  odd integers is  $n^2$ ?

- The fourth dimension: How can we visualize it?
- The Mandelbrot set: Some of us have seen it many times. What is it?
- Fractals: What are they, and how are some fractal images generated?
- Animations: What is some mathematics underlying animated films such as those produced by Pixar?

I hope that much of what we do will be motivated by the interests of individual class members. but we will begin with examining and modeling three- and four-dimensional polyhedra.

We will construct both physical and virtual models, using some free (but incredibly powerful) software, such as POV-Ray—see <http://www.povray.org>.

The prerequisite for the course is facility with algebra and geometry, and a willingness to learn more as needed. Calculus is not a prerequisite, but if you know it, you will find use for it! Knowledge of a particular computer programming language is not a prerequisite, but we will be learning how to use some computer programs that require some attention to logic and detail, so patience in this regard is likely to be needed.

At the end of the course it would be nice to host an exhibition! I don't yet know whether this will be possible.

### **GRADING:**

There will be weekly assignments of various sorts, including some reading, mathematics, and short-term projects. There will be a course project, the details of which will be provided later. with an anticipated due date of Wednesday, April 6. Given the course audience, I probably shouldn't need to say this, but attendance and participation is expected!

Assignments: 50%

Participation: 20%

Course Project: 30%

### **HOMEWORK:**

Clearly I expect the work that you submit to be your own. If you receive assistance from someone else, include a written acknowledgment. Such an acknowledgment is a professional

courtesy and will not affect your grade.

**IMPORTANT DATES:**

Wednesday, January 12, First day of classes

Monday, January 17, Martin Luther King, Jr., Birthday, academic holiday

Wednesday, January 19, Last day to add a class

Wednesday, February 2, Last day to drop a course without a grade

Monday, March 7, Midterm of the semester

Friday, March 11, Last day to withdraw

Wednesday, April 27, Last day of this course

**ABSENCES:**

Excused Absences: S.R. 5.2.4.2 defines the following as acceptable reasons for excused absences:

1. serious illness;
2. illness or death of family member;
3. University-related trips;
4. major religious holidays;
5. other circumstances the instructor finds to be “reasonable cause for nonattendance.”

Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day for adding a class.

**CHEATING AND PLAGIARISM:**

Be sure to properly acknowledge and cite all sources you use in your assignments and projects. It should go without saying that I expect academic honesty. Plagiarism and other forms of cheating is absolutely unacceptable. Students are reminded that the minimum penalty for either of these academic offenses is an “E” in the course, with suspension and dismissal also possibilities. It’s not worth it and it is damaging to your self-integrity, so don’t do it.