Illinois Institute of Technology  
College of Architecture  
Arch 497: Digital Design and Fabrication

_Syllabus:_ Fall 2006

_Instructors:_  
Thomas J McLeish  
mcleish@iit.edu

Chris Palmer

_Course Time:_  
Wednesday, 10:00-12:40

_Course Location:_  
3410-110

_Course Description:_ This course explores the design and fabrication of architectural components in contemporary practice. We will investigate through the design and prototyping of a custom architectural component [schedule subject to change]:

Students should be comfortable navigating a 3D digital environment and have some experience with 3D modeling. It is essential that the student with little or no CAD experience be willing to put additional time outside of class as the techniques covered will be new and will require the student to practice to become facile.

Students will be required to write a research paper on a relevant topic, fabricate design studies of an Architectural component, and produce a full-scale working prototype of a final design solution.

_Course Objectives:_ The primary objective for this course is to expose students to new technologies used in architectural practice and component design and fabrication - such that they can include them within their architectural palette and have a meaningful dialogue with those construction team members who specialize in these trades.

- Students successfully completing this course will demonstrate the following:
- An understanding of the broader implications of digital design and fabrication on architectural practice.
- An understanding of a variety of architectural materials and their use in digital fabrication.
- The ability to use 3D modeling tools to design, analyze, and fabricate an architectural component.
- The ability to prepare and transfer data between various modeling and fabrication tools.

_Course Format:_ Each class period will be divided into three parts: open discussion, lecture/tutorial, and open lab time. By the end of this course students will have made contact with Rhino 3D, 3D Studio MAX, MADCAM, AutoDesk Inventor 10, CNC Milling tools, Laser Cutter Prototyping, and more.

_Suggested Texts:_ Appropriate text excerpts will be provided as necessary. This will include white papers on fabrication process, research papers on use of new fabrication techniques in practice, and user guides for hardware and software used in the course.

_Student Evaluation:_ The following areas will be considered when determining final grades:

- **Assignments – 40%**  
  - 10 assignments will be given during the course. These will range from draft paper topics to submission of digital models to preliminary design prototypes for final project.
- **Research Paper – 20%**  
  - Topics in advanced digital fabrication.
- **Final Project – 30%**
- **Participation in class discussion – 10%**
- **Conditionals**  
  - Attendance in the course is mandatory. A second unexcused absence will result in a lower lettered grade. A third unexcused absence will result in a failing grade. Read the student handbook.
Illinois Institute of Technology  
College of Architecture  
Arch 497: Digital Design and Fabrication

Course Outline [subject to change]:

Week 1: Introduction
- Introduction to the course
  - Overview of the syllabus, course outline and student evaluations.
  - Overview of CAD/CAM use in practice.
- **Homework 1: Design tools demo. Bring a design tool reference to discuss**

Week 2:
- Readings discussion
- Parametric modeling, BIM, and Simulations
  - Catia, Revit, Arcade, Digital Project
  - Gehry, A. Zahner, Buro Happold, Ove Arup, SOM, Albert Kahn Associates.
  - Research topic assignments
- **Readings**

Week 3:
- Readings discussion
- Architectural Components: the system / Behavioral modeling
  - Introduction to Dr. Frames / behavioral analysis
  - Review of 3D Studio/Rhino
- **Readings**

Week 4:
- Readings discussion
- Architectural Components: the detail / Component analysis
  - Introduction to Inventor + Stress Analysis [ANSYS]
- Review of 3D Studio/Rhino
- **Homework 2: Research Topic Outline**
- **Readings**

Week 5:
- Readings discussion
- Fabrication methodologies
- Review of 3D Studio/Rhino

Week 6:
- **Midterm: Research Presentations**

Week 7:
- **Midterm: Research Presentations**

Week 8:
- Mold making.
- Use of CNC mill
- Preliminary design studies prototypes
- Submission of research paper

Week 9:
- Preliminary design studies prototypes

Week 10:
- Preliminary design studies prototypes

Week 11:
- Casting + Finishing
Illinois Institute of Technology
College of Architecture
Arch 497: Digital Design and Fabrication

Week 12:
- Casting + Finishing

Week 13:
- Student presentations of final project

Week 14: Review week
- Submission of final project.
Homework

1. Design tools demo
2. Research Outline
3. Research Presentation
4. Design sketch of system/part
5. Dr. Frames analysis/ACAD wire frame including load assumptions
6. Rhino model of part
7. Inventor + ANSYS analysis of part [Report], include loading assumptions, material, constraint assumptions.
8. Part mold: parting line, tool path, CNC cutting
9. Part casting: draft angle, sprue hole, riser, and shrinkage
10. Part finishing: filing, sanding, blasting, and polishing

Midterm project:

The midterm project submission is your research paper.

Final project:

The final project submission is to capture your experience of this process and shall consist of the following.

1. A 7 page documentation of part design/testing/fabrication process, hardcopy and PDF.
2. A 24"x24" presentation board illustrating 7 process points [below], using template provided. PDF and mounted on ¼" black foamcore.
3. A final part.

Process Points

1. Design sketch of system/part
2. Dr. Frames analysis/ACAD wire frame including load assumptions
3. Rhino model of part
4. Inventor + ANSYS analysis of part [Report], include loading assumptions, material, constraint assumptions.
5. Mold: parting line, tool path, CNC cutting
6. Casting: draft angle, sprue hole, riser, and shrinkage
7. Finishing: filing, sanding, blasting, and polishing