# Design Computation:
# Art, Objects & Space

Prof. Larry Sass
Monday & Wednesday 9:30-11:00 AM
(2-2-8) Credits
Room 1-150
https://canvas.mit.edu/courses/16399

**Course Description & Goals:**

This class will introduce course four majors and minors to the ways we use geometric modeling and output as part of design processing. We explore an array of foundational technologies weekly, this includes 3D Modeling, Computer Generated Rendering and Computer-Generated Animation. First, students will learn establish design principles and methods to explore ideas as part of each exercise. Although the medium for course is centered on computer modeling, application is guided by weekly design exercises, student presentations and instructor feedback. We will work on two projects throughout the term starting with a deep product analysis, ending with a useful, well designed, animated movie.

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This semester the class is aimed at exploring design of digitally fabricated chairs. Each student will conceptualize and develop an engaging and interesting design for a small chair assembled of wooden components. After we will learn how to computer model in detail and digital visualization with our designs through computer rendering and prototyping before fabricating the chair at full scale. Course enrollment is limited to maintain a studio like environment

**Who should take this course?**

This course is designed to introduce graduate and undergraduate students to computation through the lens of design. No prior computer experience is needed however, design experience is recommended.

Students are expected to complete 10 assignments, participate in class discussions and reviews, and share their design idea during the final review.
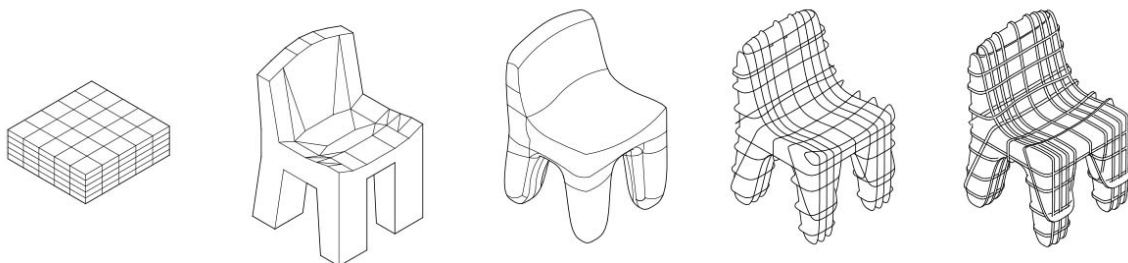
**Week 0**
- Analysis, Modeling & Prototyping
- Wed, Sept 7
- Introduction to Design Computation
  - Handout: Assignment 0

**Week 1**
- Mon. Sept 12
- **Architectural Design**
  - Due: Assignment 0 - Class Setup
  - Handout: Assignment 1 - Drawing a Chair

- Wed, Sept 14
- **Architecture: Points, Lines & Planes**

**Week 2**
Mon. Sept 19
- **Design Hierarchy**
  - Due: Assignment 1 - Drawing a Chair
  - Handout: Assignment 2 - Modeling a Chair

- Wed, Sept 21
- **Solid Modeling**

**Week 3**
- Mon. Sept 26
- **Design Prototyping**
  - Due: Assignment 2 - Modeling a Chair
  - Handout: Assignment Printing a Chair

- Wed, Sept 28
- **Mesh Modeling**

**Week 4**
- Mon. Oct 3
- **Visualization for Design**
  - Due: Assignment 3 - 3D Printing a Chair
  - Handout: Assignment 4 - Daylight Rendering a Chair

- Wed, Oct 5
- **Daylight Rendering**

**Week 5**
- Mon. Oct 10
- **Holiday - No Class**
  - Wed, Oct 12

- **Show & Tell**
- Due: Assignment 4 - Daylight Rendering a Chair

**Week - 6**
- Mon. Oct 17
- **Design Experience**
- Handout Assignment 5 - Design Experience

- Wed, Oct 19
- **Surface Modeling**

**Week 7**
- Mon. Oct 24
- **Design Functioning**
    - Due: Assignment 5 - Design Experience
    - Handout: Assignment 6 - Design Function

- Wed, Oct 26
- **Artificial Lighting/Animation**

**Week 8**
- Mon. Oct 31
- **Design Forming (ZOOM)**
    - Due: Assignment 6 - Design Function
    - Handout: Assignment 7 - Design Forming

- Wed, Nov 2
- **Show and Tell (Experience & Function)**

**Week 9**
- Mon. Nov 7
- **Designing Assemblies (N51-Woodshop)**
    - Due: Assignment 7 - Design Forming - Planar Model - 1st Pass
    - Handout: Assignment 8 - Assembly Design (CNC)

- Wed, Nov 9
- **MasterCAM**

**Week 10**
- Mon. Nov14
- **Design Review (N51 Woodshop)**
    - Handout: Assignment 9 Planar Model - 2nd Pass
    - Wed. Nov 16

- Due: Assignment 8 - Assembly Design (CNC)
- **Digital Photography**

**Week 11**
- Mon. Nov 21
- **Thanksgiving – No Class**

- Wed, Nov 23
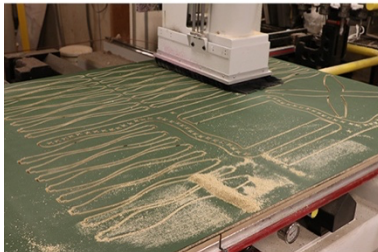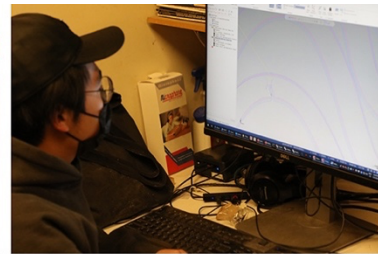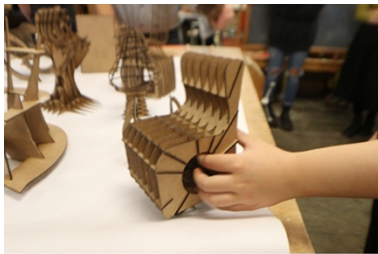- **Thanksgiving– No Class**

**Week 12**
- Mon, Nov 28
- **Show & Tell**
    - o  Due: Assignment 9 Planar Model - 2nd Pass
    - o  Handout: Assignment 10 CNC Chair

- Wed, Nov 30
- **NO CLASS**

**Week 13**
- Mon, Dec 7
- Due: Assignment 10 CNC Chair
- **Show & Tell**

**Learning Objectives**
- Three principal modeling techniques (Surface, Solid & Mesh)
- Fundamentals of design prototyping through visualization
- Fundamentals of daylight and artificial lighting computer rendering
- Digital Fabrication
- Book Recommendation

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**Instructional Method**

Students are charged to learn design and computation as system of production with each exercise. We follow a five-step process to solve a one problem or task for each of the 10 exercises leading to a functional chair at the end of the term. Each exercise students learn a new method of modeling, rendering or machining a chair. The five steps for each exercise and tools are listed below:

a) *Assign a Problem:* A problem related to one aspect of designing a chair is presented, for example, how should a chair be designed, structurally to support a person.
b) *Review:* We review a variety of existing chairs as a way to learn how three and four legged chairs are supported.
c) *Demonstration:* I demonstrate how to draw, model, render or fabricate a structurally sound chair in class, for each class they can download and copy a 3D model that I post on the class site in order to guide them through the process. Class.
d) *Homework:* Students are provided with an instruction in the form of steps and manuals. Tools for homework are graphical manuals with steps, animations and links to Youtube in support of CAD modeling & technical methods.

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**Architectural Graphics** by *Francis D K Ching*
- https://www.wiley.com/en-us/Architectural+Graphics%2C+6th+Edition-p-9781119035664 (Links to an external site.)

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**Grading is based on**
- Combination of 10 exercises & attendance allow you to maintain an "A"
- Quality of exercises count overall
- Time to complete assignments also count - late assignments count against your "A"
- Missing classes will count against your final grade
- Risk Taking is encouraged!

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**Time**
- Time is not a measure of excellence. The course is 12 Units
- 2 Hours Lecture
- 2 Hours Lab
- 8 Hour Assignment
- Email me if the assignment is taking more than 5 hours

## Attendance

- We meet approximately 24 times within the semester online only
- A maximum of 3 absences allowed, this includes lab times
- You are expected to be present on Zoom (no screen savers)
- **THANKSGIVING - No Class Nov 22-Nov 28**
- **We will meet Monday - Nov 29th**

## Course Fee

- $120 - collected by Inala Locke four weeks into the semester.
- We will stock and store materials for you.
- This fee will be charged to your MIT Account.
- This fee entitles you to the following:
    - 3D Printing Plastic                              $20
    - 3 Masonite Sheets (16" x 31")             $15
    - 1 Small Plywood board ( 16" x 31")        $15
    - 1 Large Plywood board (48" x 96" x1/2")    $120
                      Total                              **$170**

## Canvas

- We build assignments in canvas all assignments are loaded there. I often place a demonstration of the assignment online for them to use as a guide.

## Laptop Setup (Your computer)

- You will need to use your own laptops for this course
- Best if your computer is less than 4 years old and you will need at least a gig of space for software and images.
- PROCESSOR: core i7 - 4 cores
- HARD DISK: SSD (no old mechanical spinning drive)
- 60GB free space
- RAM: 16GB
- Laptop support – stoa@mit.edu

## Software

- Take 2 Hours to Setup your computer (Download Software)
- **Rhino https://www.rhino3d.com/download (Links to an external site.)**
- **AutoCAD** http://Autodesk.com (Links to an external site.)
- **3D Studio Max http://Autodesk.com (Links to an external site.)**
- **VMWare**
    - VMWare Fusion (Mac) - https://ist.mit.edu/vmware/fusionLinks to an external site.
    - Links to an external site.VMWare Workstation (PC/Linux) - https://ist.mit.edu/vmware/workstationLinks to an external site.
    - Links to an external site.Student Windows 10 VM for Educational Use Maintained by IS&T
    - https://ist.mit.edu/windows/10/student-vmLinks to an external site.
- **IS&T -** https://ist.mit.edu/windows/10/student-solidworks-vmLinks to an external site.
    - Links to an external site.Student Windows 10 VM Maintained by IS&T (Base version) - https://ist.mit.edu/windows/10/base-vmLinks to an external site.