Fall 2018

ID 216-101: Modeling and Prototyping

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Course Overview:

ID216 Modeling and Prototyping is the first in a series of two classes for second year Industrial Design students. Both fall into the category of “skill classes”. While a measure of inventiveness and creativity are expected from students, the objective of this class is mastery of the skills we cover. ModPro will introduce students to the fundamentals of computer modeling with emphasis on a workflow that is conducive to revision and refinement. The physical modeling portion of the class will focus on techniques students can use to explore and refine form during development, as well as methods and materials for preparing presentation models.

Homework load will be around 3 hours per week for an average student. It is not uncommon for some students to spend extra time on homework in the early weeks of the semester. Investing this extra time at the outset is a prudent course, as this class is the foundation of a career-long learning process.

A Word About 3D CAD:

Computer aided design is rooted in the drafting table, straight edge, and spline weights of our progenitors; tools whose mastery required devoted study and practice. In my time as a designer I have both witnessed and experienced “3D CAD Paralysis”. This crippling obstacle arises whenever a designer tries to think in CAD alone, allowing this tool to supplant creative thought.

The mind is the greatest creative instrument at our disposal. The computer is a powerful aid, but a poor stand-in.

The primary objective for our study of digital modeling is to ensure that our intent is not pushed aside by our abilities or understanding of our tools. We will set objectives and train ourselves to see obstacles clearly that we might plot routes around them.

For Students of Varying Abilities:

I am open to tailoring coursework on an individual basis to students who require a more advanced course of study. Reach me by email and explain your situation/capabilities before the second week of the semester.

Course Objectives:

- Develop operational command of SolidWorks' basic functions including: Model Planning, Parametric Drawing, Part Creation and Manipulation, Technical Drawing, Basics of Assemblies, File Management, Basic Rendering
- Become familiar with tools in the Model Shop. Learn to choose the appropriate tool based on objectives and use it in accordance with the guidelines of safe practices
- Practice hand-modeling techniques in conjunction with sketching to develop 3D thinking
- Plan and execute project's development through ideation, sketching, hand modeling, 3D modeling, 3D Printing, and presentation model
Required Supplies - Many of these are likely to overlap with studio requirements. You will use all of these supplies throughout your time at NJIT and beyond. Coursework requirements will not be relaxed for unprepared students. Get this stuff soon.

- 6-Inch Calipers, digital recommended
  Must be read in both Metric and Imperial. Any $40 digital pair will last the semester if treated well
- 6-Inch Metal Machinist Ruler with Metric and Imperial Markings (Mitutoyo makes a good one)
- Large Snap Blade Knife & Blades (Olfa 5003 recommended because of its awesome locking knob)
- Small Snap Blade Knife & Blades (Olfa 5019 recommended)
- Cutting Mat
- Stanley Surform 21-115
- Sandpaper 80, 120, 220
- Respirator Mask with cartridges that filter VOC’s
- Dust Masks (optional, but inexpensive and more comfortable for simple tasks like sanding)
- SMOOTH drawing paper (Hammermill 24lb Laser Print paper recommended)

Leave the cold-press sketchbooks in art class! We will be pinning up, so if you draw in a book get ready to tear out lots of pages.

Various other supplies, such as paint and modeling materials will need to be acquired throughout the semester to the tune of about $200.

Weekly Schedule

Week 1 - The Development Workflow, Intro to Model Shop
  Introduction to model shop facilities & rules, names/functions/operation of tools
  Bandsaw, Table, Miter Saw, Lathe, Drill Press, Sanders, Hand Tools
  Planning techniques and goal-setting for multi-stage projects
  Gant Chart, Critical Path Analysis
  In Class - Orthographic comprehension assessment (not graded)
  Homework - Orthographic Visualizations, Model Shop Worksheet

Week 2 - Intro to Solidworks
  Introduction to Solidworks’ interface, basics of sketching, and several simple modeling functions.
  Workspace setup & hotkeys.
  Sketching toward the Fully Defined Condition, Dimensions & Relations. Extrude Boss/Cut, Revolve/Revolve Cut
  In Class - SW Demo of
  Homework - SW-Simple Primitives, acquire 2” unskinned EPS foam (home improvement store)

Week 3 - Foam Intro, Sketch-Driven Parametric Modeling
  Creating volumetric forms by manipulating EPS foam
  Surform, Knives, Sandpaper
  Introduction to parametric sketching and its impact on model behavior
  Circular Pattern, Radial Pattern, Fillet, Solid Body Persistence, Appearances, Feature Dependency & Parent/Child Relations, Convert Entities
  In Class - Demo of foam-forming techniques, SW-Demo of parametric modeling
  Homework - SW-Remote, Three Foam Forms
Week 4 - Foam Finishing, Working with Sketch & Model References
  Techniques for refining foam's appearance
    Joint Compound, Primer, Spray-paint, Clear-coat
  Demonstration of alternatives to direct numerical input for controlling features
    Lofts, Reference Geometry, Up to Point/Vertex/Surface, From Surface, Offset from Surface, Through All
  In Class - Demo of Foam, SW Demos and practice
  Homework - SW-SuperDantendo Controller

Week 5 - Table Saw, Miter Saw & Lathe Demo, Further Work with Revolves
  Students will be shown safe use of the table and miter saws. Lathe setup will be demonstrated, following a drawing to produce an accurate result
  Additional solid body functions + curves
    Extrude Thin, Revolve Thin, Shell, Boolean Operators, Sweep, Spiral, Projected Curve
  In Class - Demo Lathe, Demo of Techniques Used to Model a Water Bottle
  Homework - SW-Vacuum Bottle with Lid

Week 6 - Triage & Time-Travel
  Students will use SolidWorks' feature tree to make revisions as an alternative to hack and slash modeling, and coping with any errors that arise
  Roll Back Function, Manipulating Parent/Child Relationships, Model Surgery
  In Class - Demo Model Surgery
  Homework - SW-Revision Project

Week 7 - Foamcore
  Through demonstrations and practice, students will learn the strengths and weaknesses of foamcore
  Foamcore, Cutting Jigs, Cleverness
  In Class - Demo Foamcore
  Homework - Wearable Foamcore VR Headsets

Week 8 - 3D Printing, Prop Project; Planning
  Beginning of a three-week project from sketch to physical model of an original hand-held movie prop
  In Class - 3D Print Setup, Written Project Plan, Research/Sketching
  Homework - Concept Outline, Gant Chart

Week 9 - From Paper to 3D and Back
  Students will use Solidworks' Sketch Picture function to guide a computer model, then use SW to create a set of 1:1 scale drawings
  Sketch Picture, Drawing Basics
  In Class - Demo 2D-3D-2D Iterative Process, Exercise
  Homework - Continued work on Prop Project, Prepare Presentation

Week 10 - Prop Project; Progress Review, Metrology
  Students will each give a curated three minute class presentation on their concept, plan, and progress. Students will use measuring tools and planning to reproduce an existing object in Solidworks
  Strategic vs Tactical use of the Smart Dimension Tool, Calipers
  In Class - Presentations, Demo Measuring Existing Objects
  Homework - Complete Prop Project Deliverables

Week 11 - Project Presentations, All Deliverables Due
Students will make a five minute presentation of their concepts.
In Class - Presentations
Homework - Writing Instrument Placeholder & Tool Holder Models

Week 12 - Thanksgiving Break

Week 13 - Assemblies, Casting, Final Project Introduction
Students will use Solidworks’ Assembly feature to visualize their writing instruments in their tool holder models
Assembly, File Linking
Students will explore the process of casting and develop a plan that will allow them to successfully create a mold for their Tool Holder
Draft Angles, Casting Silicone, Plaster Cloth, Mother Molds
In Class - Demo Casting, Demo Assembly Setup, Constraints, and File Structure
Homework - Constrained Assembly, Physical Model of Tool Holder for use in Casting

Week 14 - Castings, Vacuum-Forming, & Presentation Boxes
Students will have class-time available for completing the final project
Vacuum Former
In Class - Demo Vacuum Forming, Work on Final Projects
Homework - Final Project

Week 15 - Last Class
Students will present their projects in class
In Class - Final Project Review