**ARCH 7030**

**College of Architecture / Georgia Institute of Technology Instructor: Daniel Baerlecken** [**daniel.baerlecken@coa.gatech.edu**](mailto:daniel.baerlecken@coa.gatech.edu)

**Spring Semester**

**ARCHITECTURE, MODELING AND MEDIA 3**

**Introduction to Rhinoceros, Grasshopper, Plugins**

**Course Description and Objectives:**

As Robin Evans pointed out: architects do not build, they draw. In that sense the choice of the design medium becomes essential and defines the boundaries for the design process.

The design process is affected by the tools and methods used by the designer. As software tools become more complex, methods must adapt, either through the creation of new tools or the manipulation of existing ones. The ability to know how to modify and develop the tool set is invaluable in this digital age of architecture.

This course is designed to introduce various modeling techniques, rendering techniques, model making tech- niques and parametric digital design.

**Learning Objectives:**

The course has two main components: a) skills in modelling, rendering and digital model making as well as parametric modelling and b) the application of digital techniques to the design of facade systems and structural systems. Digital technologies have shifted existing parameters: from standardisation to complex, non-standard, curvilinear systems. This change will be explored through exercises in parametric modelling.

The first component is skill-oriented and consists of weekly lectures followed by in-class activities or video tutori- als with assignments. Homework assignments on the material covered are given through T-Square.

The second component is research oriented and project based. Each student will develop a façade system in conjunction with her/his studio project. This component developed within workshops.

**References:**

* Ron K.C. Cheng,Inside Rhinoceros 4
* Markus Kuhlo, Enrico Eggert, Architectural Rendering with 3ds Max and V-Ray: Photorealistic Visualization
* Margaret Becker,Pascal Golay, Rhino Nurbs 3d Modeling
* Ron Cheng, Inside Rhinoceros 5
* Andy Payne, Grasshopper Primer
* David Rutten.Intoduction to Grasshopper Webinar
* Arturo Tedeschi, Parametric Architecture with Grasshopper - Primer guide
* Helmut Pottmann, Andreas Asperl , Michael Hofer , Axel Kilian , Daril Bentley,Architectural Geometry
* Achim Menges, Material Computation - Higher Integration in Morphogenetic Design Architectural Design
* Achim Menges and Sean Ahlquist, Computational Design Thinking: Computation Design Thinking

WEEK 1

M JAN 09

Introduction to Rhinoceros: Interface and Navigation Coordinate Systems, Viewports, Construction Planes, Units, Zoom Mouseworks, Selecting

Shortcuts

Saving, Menu Bar, Toolbars, Tool Boxes, Command Bar, Layers, Properties, Viewports, Status Bar Import

BackgroundBitmap, PictureFrame

W JAN 11

1-and 2-Dimensional Objects

Objects

Point, PointGrid, Line, PolyLine, Circle, Rectangle, Arc Operations

Group, Trim, Extend, Split, Join, Explode, PointsOn, PointsOff Transform

Move, Rotate, Scale, Mirror, Offset Multiply

Copy, Array, ArrayCrv, ArrayPolar, Divide Curve Basics

Inflection Points, Direction, Control Points, Degree Curve Creation

Curve, CurveThroughPt, InterpCrv, InterpcrvOnSrf, Curvature, DimRadius, Length, SoftEditCrv Analyze

Dir, Flip, Length, Distance, Angle, Radius, Curvature, Area, Dim, DimRotated, SelBadObjects Dimension

COA lecture Benjamin Ibarra Sevilla 6pm

Assignment 1: linework submission W JAN 18 (10 POINTS)

WEEK 2

M JAN 16

Martin Luther King, Jr. Day Holiday

W JAN 18

Primitives and Booleans

Sphere, Box, Torus Boolean Operations

Output 1 Rendering in Vray Material Editor Raster Files

namedView, viewCaptureToFile, Print

Export

Sectiontool, Make 2d Technical Drawing Display

Assignment 2: boolean landscape/ array landscape M JAN 23 (10 POINTS)

WEEK 3

M JAN 23

Surfaces

SrfPt, EdgeSrf, PlanarSrf, Plane, Loft, Patch, Sweep1, Sweep2 Contouring

Contour

Multi-step Geometry

Tube, Pipe, ExtrudeCrv, ExtrudeSrf, Fin, Ribbon Intermediate Transformations

Project, Cap, MakeHole, CutPlane

Assignment 3a: surface landscape – lofted surface submission W JAN 25 (10 POINTS)

W JAN 25

Mesh

Mesh, ReduceMesh, MeshSplit, MeshTrim QuadMesh

Assignment 3b: mesh landscape – Landscape from triangles and quads submission M Jan 30 (POINTS)

WEEK 4

M JAN 30

Pointset reconstruction

Delaunay Voronoi 3DVoronoi PixelGrid OcTree QuadTree Network ConvexHull

SpanningCircle

W FEB 01

Output 2: Physical Production

Fabricate, Laser cutting

Assignment 4: algorithmic landscape submission W FEB 08 (10 POINTS)

WEEK 5

M FEB 06

WORKSHOP I

You will model the topography of your studio project with the tools learned in week 1-4

W FEB 08

WORKSHOP I

You will model the topography of your studio project with the tools learned in week 1-4

COA lecture Lisa Iwamoto 6pm

Assignment 5: topography submission M FEB 13 (20 POINTS)

WEEK 6

M FEB 13

Plugins

Electric Field Simulation PanelingTools

W FEB 15

Output 3: Physical Production Fabricate, Zcorp

COA lecture Mimi Hoang 6pm

F FEB 17

COA lecture Patrik Schumacher 5pm

Assignment 6: model making submission M FEB 20 (10 POINTS)

WEEK 7

M FEB 20

Workshop II:

Each student will model a building with its different components: walls, columns, floor slabs, windows, mullions, stairs, ramps

W FEB 22

Workshop II:

Each student will model a building with its different components: walls, columns, floor slabs, windows, mullions, stairs, ramps

COA lecture Marcos Cruz 6pm

Assignment 7: case study submission M FEB 27 (20 POINTS)

WEEK 8

M FEB 27

Interface Grasshopper Objects

Persistent Data Management Volatile Data Inheritance Data Stream Matching

W FEB 29

Scalar Component Types Operators

Conditional Statements

COA lecture Bill Sharples 6pm

WEEK 9

M MA 05

Range vs. Series vs. Interval Functions & Booleans Functions & Numeric Data Trigonometric Curves

Lists & Data Management Weaving Data

Shifting Data

W MA 07

Exporting Data to Excel Vector Basics

Point/Vector Manipulation

COA lecture Francisco Rodriguez 6pm

Assignment 8 submission M MA 12 (20 POINTS)

WEEK 10

M MA 12

Using Vector/Scalar Mathematics with Point Attractors (Scaling Circles) Using Vector/Scalar Mathematics with Point Attractors (Scaling Boxes)

W MA 14

Curve Types Curve Analytics

Assignment 9 submission M MA 26 (20 POINTS)

M MA 19

Spring Recess 2012

W MA 21

Spring Recess 2012

F MA 23

Spring Recess 2012

WEEK 12

M MA 26

Surface Diagrid Uneven Surface Diagrid Surface Types

Surface Connect

W MA 28

Paneling Tools

COA lecture Mark Mueckenheim 6pm

Assignment 10 submission M AP 02 ( 20 points)

WEEK 13

M AP 02

W AP 04

Workshop III:

Façade. Develop a parametric façade system in connection with your studio project using parametric tools in Grasshopper

WEEK 14

M AP 09

W AP 11

Workshop III:

Façade. Develop a parametric façade system in connection with your studio project using parametric tools in Grasshopper

WEEK 15

M AP 16

W AP 18

Workshop IV:

Model making. Build a large model of your façade.

TBA

Final review + upload to t-square ( 100 POINTS)

Assignment 1: linework submission (10 POINTS)

Assignment 2: boolean landscape/ array landscape (10 POINTS)

Assignment 3a: surface landscape – lofted surface (developable ribbons) (10 POINTS)

Assignment 3b: mesh landscape – Landscape from triangles and quads (10 POINTS)

Assignment 4: algorithmic landscape (10 POINTS)

Assignment 5: topography (20 POINTS)

Assignment 6: model making (10 POINTS)

Assignment 7: case study (20 POINTS)

Assignment 8 (20 POINTS)

Assignment 9 (20 POINTS)

Final review + upload to t-square ( 100 POINTS)

Attendance ( 30 POINTS)

total 270 points

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | 10 points | 20 points | 30 points | 100 points | 270 points |
| A | from | 10 | 20 | 30 | 100 | 270 |
| A | to | 8 | 16 | 24 | 80 | 216 |
|  |  |  |  |  |  |  |
| B | from | 7 | 15 | 23 | 79 | 215 |
| B | to | 6 | 12 | 18 | 60 | 162 |
|  |  |  |  |  |  |  |
| C | from | 5 | 11 | 17 | 59 | 161 |
| C | to | 4 | 8 | 12 | 40 | 108 |
|  |  |  |  |  |  |  |
| D | from | 3 | 7 | 11 | 39 | 107 |
| D | to | 2 | 4 | 6 | 20 | 54 |
|  |  |  |  |  |  |  |
| F | from | 1 | 3 | 5 | 19 | 53 |
| F | to | 0 | 0 | 0 | 0 | 0 |

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Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. All Georgia Tech students should familiarize themselves with and abide by the Georgia Tech Honor Code <http://www.catalog.gatech.edu/rules/18/>.

Student work that presents the ideas or words of others as the student’s own adversely impacts the whole school and may lead to immediate dismissal. Academic dishonesty, including cheating, plagiarism, commissioning academic work by others, or performing academic work on behalf of another student, is strictly prohibited. All persons in the classroom are expected to behave with courtesy towards others and in a way that does not interfere with the regular conduct of the class. Cell phones are to be turned off when students enter the classroom and should remain off for the duration of class: <http://www.catalog.gatech.edu/rules/19/>

# Special Needs

# Any student with a disability, that may require accommodation, should contact Office of Disability Services at 404-894-2563 or visit <http://disabilityservices.gatech.edu> to make an appointment to discuss his or her special needs and obtain an accommodations letter. He or she should also schedule an appointment to speak with the course instructor.

# Emergencies

In case of emergency (e.g., fire, accident, or criminal act), please call the Georgia Tech Police at 404-894-2500. Please note that Perry Minyard, IT Support Administrator for the College of Architecture, is also a firefighter and an Emergency Medical Technician (EMT) certified in performing CPR.

# Ownership

Physical copies of student work submitted to the school to satisfy course requirements—including, but not limited to digital files, papers, drawings, and models—become the property of the school. It is assumed as no obligation to safeguard such materials and may, at its discretion, retain them, return them to the student, or discard them.

# Archiving

In some courses, selected students may be required to submit physical examples of their work or digital examples (on a clearly labeled CD), no later than one week after the end of term, to their instructors or administration for archiving. By enrolling, each student grants a license to reproduce and display his or her work. This is a chance for students to have their work shown online and potentially featured in forthcoming publications.

# College of Design Facility Rules and Guidelines

Please consult the Georgia Tech Student Handbook regarding the use of facilities and all Institute policies. Aerosol sprays of any kind are strictly banned from the studio and surrounding areas. A new spray painting booth is now in operation in the College of Design shop, on the ground floor of the East Architecture Building.

Shop Use: All students using shop facilities must first have completed an orientation. Safety first, always! Noise should be kept to a minimum. Music may be listened to only through headphones, including evenings and weekends.

Studio Housekeeping: Students should feel free to organize their space creatively and expressively, but with respect to others around them. Try to prevent clutter from becoming a nuisance, distraction, or a hazard. The cleaning staff makes every effort to determine what is and is not trash, but their job can be made easier if you keep drawings and models off of the floor.