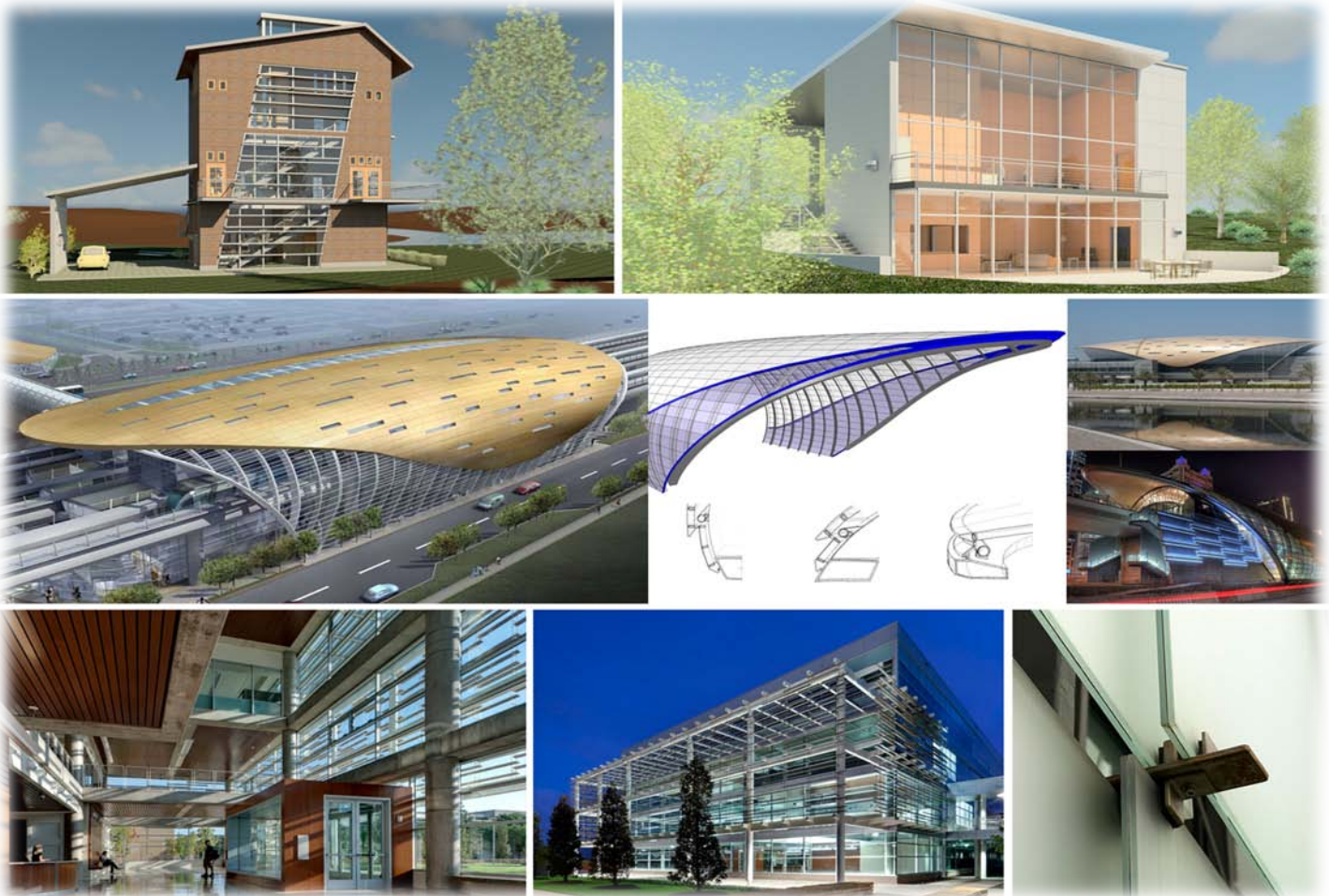


## Building Information Modeling

# BIM Methods

*"The Knowledge of Building Systems, Parametric & Computationally Driven Elements, Data Storage, and 3D Modeling"*



### Course Abstract:

Building Information Modeling (BIM) fundamentally changes the way we, as designers, have been traditionally taught to work from initial concept to documented work. Rather than starting with a series of separate drawings such as plan, elevation, and section that describes how our concept will exist in real 3D space, one now produces a unified digital 3D model that can generate all necessary presentation, analysis, and technical documentation.

Building Information Modeling is the culmination of building systems, parametric design, computational thinking, parametric planning, database management, and the fundamentals of digital 2D drawing and 3D modeling. Computer models are no longer objects that exist within virtual space; computer models are a collection of drawings and objects linked to databases containing the project information. Designers use the "I" within BIM to create an efficient, exploratory, data-driven design or create objects that hold descriptive information for later extraction.

In the descriptive sense, the information in the model is merely being used as a collection of data that describes specific objects. This information can be extracted at any point during the project process to provide drawing views or schedules of information with all parts updating in real-time when changes occur. In this traditional use of BIM, the goal is to visualize the parts of the project, save time, and minimize errors.

With the linkage of modeled objects to containers of information, however, it is possible to allow the data to drive the parts of the model and allow designers efficient exploratory methods of design. Data driven parts are elastic and adapt based on computational and conditional information. Systems can be made to conform to various conditions and that same elastic part can be made to vary in shape and size as it repeats along elements. The efficiency of

programming data into parts that drive their form and use allows designers more time to explore options and less time remodeling parts and pieces with each possible change.

Utilizing Revit 2014, students will form an understanding of the theoretical concepts, terminology, underlying database structures, and the technical tools required to design, analyze, document, and present from one unified BIM model. By the end of the course, students will have experience with a process of following projects from conceptual design to a form of technical documented representation and have the competency to obtain certification as an Autodesk Revit Architecture Certified Associate or Professional.

Software Proficiency: Although a plus, no previous knowledge of Revit is required for this class. A basic knowledge of computers and experience with other 3D modeling, Computational Methods, and CAD programs is preferred.

**Software Disclaimer:** Loss of project assignments and student work because of computer failure, errors, and corruptions are not an excuse for missed accomplishments. Students are required to maintain hourly/daily backups of their work on multiple personal devices external to the computer lab. Note that USB Sticks are unstable and should not be used as your primary backup.

Software Access: Students have free access to Autodesk Software at << <http://www.autodesk.com/education/free-software#> >> once registered with the Autodesk Education Community Website. Once login credentials are granted, download Revit 2014 from << <http://www.autodesk.com/education/free-software/revit> >> and install it on a personal computer. Refer to << <http://www.jrohdesign.com/revit/faqs/> >> to see if your computer meets the minimum system requirements.

Recommended Text: Vandezande, James; Krygiel, Eddy; Read, Phil. Mastering Autodesk Revit Architecture 2014. Indianapolis, Indiana: Wiley Publishing, Inc., 2013.

Class Website: This course utilizes a professor created website that contains the videos from class, previous classes, and various resources to aid in a student's understanding of the material. The website is also used to download class related files and turn in class projects and assignments. Students registered for the class will have access to the password protected sections of the website found at << <http://www.jrohdesign.com/revit/> >>. The username is << guest >> and the password is << youknowjroh2 >>.

**Website Disclaimer:** The website is **NOT AN EXCUSE** to miss class! Missing class counts against your participation grade and any abuse of substituting website viewing with actual attendance will result in removal of your login credentials.

Course Organization: The semester is divided into three parts. One to ensure the student has the essentials to work within the BIM Project Environment so that students feel comfortable to use BIM in other courses and in practice from the start of the course. The second part is designed to work through advanced modeling techniques within the Conceptual Design Environment and to challenge students to push the boundaries of BIM software. The third part is designed to expand upon the BIM Project and Component Environment so that students can master the various modeling tools and to use tools in a creative way beyond their originally designed intent.

Evaluation: Success in this course will be determined by the level of one's engagement in the semester's parts and presentation of projects. Other qualitative and quantitative factors that contribute to one's grade include the following: the level of intensity, enthusiasm, and focus exhibited in the work, the quality, craft, and organization of the work, creativity and complexity of the design, documented process, and proven technological competency. Attendance, preparedness, and timely resolution of work and assignments also are factors within one's grade. The following is the percentage breakdown of the course and grading:

Part XX:	Revit Essentials Orientation	10.0%
Part 01:	Adaptive Canopies and Structures	40.0%
Part 02:	Project Modeling and Parametric Components	40.0%
Participation:	Attendance, Preparedness, and Timely Resolution of Work	<u>10.0%</u>
		100.0%

Course Observations: Students want to know the basics and complexities of modeling in Revit while being able to convey their concepts in various documented techniques such as 2D drawings, 3D renderings, technical details, and methods for fabrication. This class's schedule of topics strives to meet these expectations

## SCHEDULE OF TOPICS

*Topics and Schedule are Subject to Change.*

### PREFIX XX: REVIT ESSENTIALS ORIENTATION

(CRASH COURSE IN THE REVIT ARCHITECTURE TOOL RIBBON ESSENTIALS TO GET YOU GOING)



XX.01	2014-01-09	R	Introduction – The Class, Revit Interface, & Wall Constraints + <i>Assignment</i>
XX.02	2014-01-14	T	Basics Part 1 – Compound Walls, Wall Profiles, Stacked Walls, Doors, & Windows
XX.03	2014-01-16	R	Basics Part 2 – Curtain Walls/Doors, Floors, Roofs, & Ceilings + <i>Home Charette</i>
XX.04	2014-01-21	T	Basics Part 3 – Parametric Profile Families for Reveals, Sweeps, & Mullions + <i>Topography Tutorial</i>
XX.05	2014-01-23	R	Basics Part 4 – Rooms, Tags, Area, Drawings, Materials, & Cloud Rendering + <i>Home Project</i>

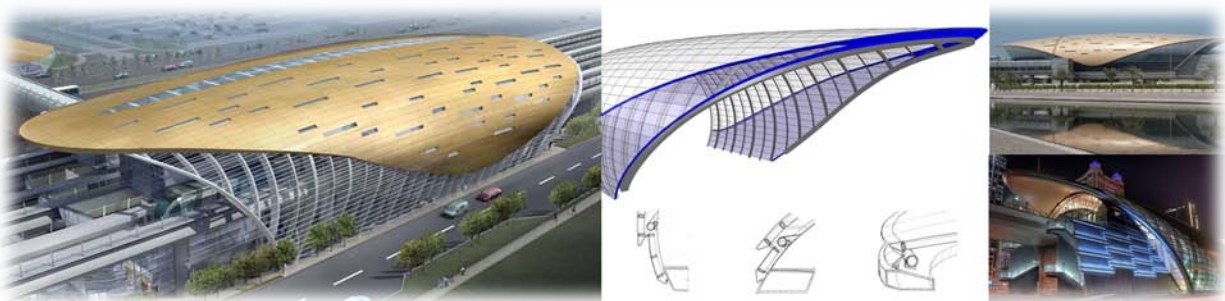
#### Home Project Requirements:

A 1,600 SF, 2 or 3-story (50-foot tall) maximum home will be designed, modeled, and placed on a site topography model with site landscaping. The model will contain at a minimum: compound walls, at least (1) stacked wall, at least (1) curtain wall, doors, windows, floors, roofs, ceilings, and at least (1) wall with reveals and sweeps. The project will be presented on (1)24x36 PDF sheet containing floor plans (with room tags showing areas), at least (1) section, and at least (2) exterior renderings at 9 megapixels. Project is due at the start of P1.01. Graduates are required to provide (1) additional section and (1) additional rendering.

### PART 1: ADAPTIVE CANOPIES & STRUCTURES

(LESSONS IN PARAMETRIC DESIGN & TECTONIC DETAILS USING THE REVIT CONCEPTUAL DESIGN ENVIRONMENT)

CASE STUDY: DUBAI METRO STATION by AEDAS



P1.01	2014-01-28	T	Controlled Parametric Section Curves + Surface Setup
P1.02	2014-01-30	R	Digitized Parametric Surface Techniques + <i>Surface Model Assignment</i>
P1.03	2014-02-04	T	Divided Surfaces, Main Voids, Curtain Panels, & Manual Panel Variation
P1.04	2014-02-06	R	Adaptive Point Panels & Random Voids Elements + <i>Assignment</i>
P1.05	2014-02-11	T	Adaptive Point Panels, Random Protrusions, & Random Material Shading
P1.06	2014-02-13	R	Adaptive Perimeter Edge Details + Curved Structural Elements + <i>Assignment</i>
P1.07	2014-02-18	T	Spider Clip Curtain Wall Assemblies Family Components
P1.08	2014-02-20	R	Spider Clip Curtain Wall Components for Curved Surfaces + <i>Assignment</i>
P1.09	2014-02-25	T	Displaced Views, Drawing Representations, & Project Help
P1.10	2014-02-27	R	Midterm Due for the <i>Canopy Project</i>

#### Canopy Project Requirements:

Design a parametric 2-layered canopy (structure + skin) based on your initial analog funky foam model and the case study shown throughout the class tutorials. The model will contain at a minimum: a parametric section curve family that generates the structure and skin, adaptive panels or curtain pattern panels,

adaptive structures, a spider clip system, and an attempt at randomizing patterns, voids, or material shading. The project will be presented on (1)24x36 PDF sheet containing at least (5) exterior renderings at 9 megapixels. The project is due at the end of class P1.10. Graduates are required to provide (2) additional renderings.

SPRING BREAK 2014-03-03 TO 2014-03-07

*Milan Trade Fair (Case Study), Curtain Grid Patterns (Case Study), Fabrication Documents of Complex Surfaces (Case Study)*

## PART 02: PROJECT MODELING, & PARAMETRIC COMPONENTS

(LESSONS IN PARAMETRIC DESIGN & TECTONIC DETAILS USING THE REVIT PROJECT ENVIRONMENT)

CASE STUDIES REFERENCING THE UT STUDENT SERVICES CENTER / KUNSTHAUS BREGENZ



P2.01	2014-03-11	T	Concrete & Steel Structural Columns & Beams
P2.02	2014-03-13	R	Generic Models & Curtain Walls as Sun Shading Systems + <i>Assignment</i>
P2.03	2014-03-18	T	Zumthor Curtain Wall Panels
P2.04	2014-03-20	R	Skylights & Sloped Glazing as Wood & 2x2 Ceilings + <i>Assignment</i>
P2.05	2014-03-25	T	Rail Profiles, Baluster Families, & Custom Railings
P2.06	2014-03-27	R	Railings as Sunshades, Railroad Tracks, Structure, & Seating + <i>Assignment</i>
P2.07	2014-04-01	T	Stairs, Ramps, and Railings on Sloped Surfaces
P2.08	2014-04-03	R	Custom Stair Designs + <i>Assignment</i>
P2.09	2014-04-08	T	Parametric Families – Window Design
P2.10	2014-04-10	R	Parametric Families – Operable Door Design + <i>Assignment</i>
P2.11	2014-04-15	T	Parametric Families – Casework Design
P2.12	2014-04-18	R	Parametric Families – Countertops + <i>Assignment</i>
P2.13	2014-04-22	T	Model Groups & Condo Strategies
P2.14	2014-04-24	R	Lighting, Interior Daylight, & Interior Rendering
P2.15	2014-04-29	T	Conclusion & Project Help
P2.16	2014-05-06	T	Final Due for the <i>Condo Project</i>

### Condo Project Requirements:

Design a condo project that contains model groups for efficiency, parametric families, stairs, railings, and curtain walls or railings used beyond their original intent. The model group condo units will consist of a minimum (1) 800 SF unit having a foyer, kitchen, bathroom, living/dining room, and a bedroom; and (1) 1,600 SF unit having the same as the 800 SF unit but with two bathrooms and two bedrooms. The overall condo building will be approximately between 20,000 – 40,000 SF. Consider additional amenities that might be incorporated into your design such as: balconies, main lobbies, retail shops, restaurants, ballrooms, meeting rooms, fitness centers, business centers, spas, swimming pools, etc. The project will also contain (2) stairs connection all floors and separated at least by half the distance of the overall diagonal of the building footprint or a stair on each side of the building to keep it simple. The condo building can be placed on any context that you wish including a context used in this class, your studio, or past studios. You may also incorporate Revit elements developed from your own work in other classes as well. The project will be presented on (2) 24x36 PDF sheets with at least (1) overall typical floor plan that shows each unit type clearly identified, at least (1) overall section that shows each unit type clearly identified, at least (3) exterior renderings, and at least (3) interior renderings. Renderings should be 9 megapixels minimum. The project is due by 10:30 PM on class P2.16. Graduates are required to provide (1) addition floor plan, (1) additional section, and (2) additional exterior and interior renderings.

## LEVELS OF ACCOMPLISHMENT | GRADUATE

The Course Professor will govern the assessment and evaluation of student performance. Performance or status will be officially recorded, as per University policy, by submitting marks (Satisfactory/Unsatisfactory) at midterm and (A through C) at the end of the term. The interpretation of letter grades is as follows:

**A** - Extremely developed and accomplished work. The student's work is exceptional, exhibiting a rigorous, insightful understanding of the issues and concerns of the project. The inquiry and productions have been intense and focused. Graphic and three dimensional representation skills are excellent, oral and writing abilities are advanced. The work is complete, and presented on time in a sophisticated manner. Enthusiasm and initiative are high. The student is always in search of new ideas, greater development, producing more than is required.

**B** - Highly developed and considered work. The student's work is above average, exhibiting an in-depth understanding of the issues and concerns of the project. The inquiry and productions have been thorough. Graphic and three dimensional representation skills are well developed and precise, oral and writing abilities are above average. The work is complete, and presented on time in a thorough manner. Enthusiasm and initiative are shown. The student searches for new ideas, greater development, producing more than is required.

**C** - Competent work. The student's work is average, exhibiting a basic understanding of the issues and concerns of the project, but lacking depth in development. Graphic and three dimensional representation skills are adequate, oral and writing abilities are average. The work is complete, and presented on time, satisfying basic presentation requirements.

**U** – Unsatisfactory Work. The students work is weak, lacking depth in development at many levels, and not of passing quality. Intentions are not carried through. Graphic and three dimensional representation skills are weak, oral and writing abilities are limited. The work is incomplete, or presented late.

Attendance | Rules: Attendance is mandatory. Students shall be engaged in the course throughout the scheduled class period. Since the course will be conducted in an atmosphere of mutual respect and the instructor and student share responsibility for the collective culture of the class, all participants are expected to contribute to the course's intellectual life by attending to the following:

- Pro-active participation in all discussions, presentations (pin-ups), and reviews, as well as a mature response to deadlines, schedules, and targeted project completion. As a student, you shall be aware that professors are not inclined to step-by-step tutorial based instructions. Students need to take risks and be responsible for their own project.
- Respectful interaction at all times and circumstances of this course. Be mindful of your conduct when engaged in experiences and discourses with those who differ from you in appearance, race, ethnicity, beliefs, gender, sexuality, style, politics, or intellectual position held. All students are required to abide by the UNC Charlotte Sexual Harassment Policy as referenced at << <http://www.legal.uncc.edu/policies/ps-61.html> >> and the policy on Responsible Use of University Computing and Electronic Communication Resources as referenced at << <http://www.legal.uncc.edu/policies/ps-66.html> >>. Sexual harassment, as defined in the UNC Charlotte Sexual Harassment Policy, is prohibited, even when carried out through computers or other electronic communications systems, including course-based chat rooms or message boards.
- All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online as referenced at << <http://www.legal.uncc.edu/policies/ps-105.html> >>.
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Students with Documented Disabilities: Students in this course seeking accommodations to disabilities must first consult with the Office of Disability Services and follow the instructions of that office for obtaining accommodations.

## LEVELS OF ACCOMPLISHMENT | UNDERGRADUATE

The Course Professor will govern the assessment and evaluation of student performance. Performance or status will be officially recorded, as per University policy, by submitting marks (Satisfactory/Unsatisfactory) at midterm and (A through F) at the end of the term. The interpretation of letter grades is as follows:

**A** - Extremely developed and accomplished work. The student's work is exceptional, exhibiting a rigorous, insightful understanding of the issues and concerns of the project. The inquiry and productions have been intense and focused. Graphic and three dimensional representation skills are excellent, oral and writing abilities are advanced. The work is complete, and presented on time in a sophisticated manner. Enthusiasm and initiative are high. The student is always in search of new ideas, greater development, producing more than is required.

**B** - Highly developed and considered work. The student's work is above average, exhibiting an in-depth understanding of the issues and concerns of the project. The inquiry and productions have been thorough. Graphic and three dimensional representation skills are well developed and precise, oral and writing abilities are above average. The work is complete, and presented on time in a thorough manner. Enthusiasm and initiative are shown. The student searches for new ideas, greater development, producing more than is required.

**C** - Competent work. The student's work is average, exhibiting a basic understanding of the issues and concerns of the project, but lacking depth in development. Graphic and three dimensional representation skills are adequate, oral and writing abilities are average. The work is complete, and presented on time, satisfying basic presentation requirements.

**D** - Underdeveloped, unresolved work. The student's work is below average, lacking depth in ideas and development, but of passing quality. Graphic and three dimensional representation skills are weak, oral and writing abilities are limited. The work is incomplete, or presented late.

**F** - Unsatisfactory Work. The student's work is weak, lacking depth in development at many levels, and not of passing quality. Intentions are not carried through. Graphic and three dimensional representation skills are weak, oral and writing abilities are limited. The work is incomplete, or presented late.

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