BIM is a critical tool for the profession, now and for the future.

This syllabus is for **SPRING 2010**. It will be updated soon for **spring 2011**. Although the new syllabus will not be the same as this older one, basic elements will be used again. The emphasis of the course is on building information modeling (BIM – using Revit): 2d / 3d coordination, parametric modeling, and interoperability including tools for conceptual modeling and energy calculations. For the best information about the course, please talk with students who have taken it before and ask for their honest appraisal. You can also contact me if you have questions.

Thanks!

Karen
Kensek
kensek@usc.edu
213-740-2081
Watt 307

Architecture 507
Theories of Computer Technology

Tentative Course Description and Syllabus for Spring 2010

Updated 7 January 2010

A computer-aided design system is most useful when the structured design inside the computer can be used for something besides merely producing a picture. As soon as the process of computer-aided design is considered as building a description of the object being designed rather than as a process of simply drawing the object, horizons become tremendously expanded. Ivan E. Sutherland (1973)

Contact
Please email or call Karen Kensek if you have questions. kensek@usc.edu 213-740-2081 Watt 307.

General Description
Architecture 507 is a three unit course that meets for the entire semester on Fridays from 9 am – noon. The course will focus on the quote from Ivan E. Sutherland. Essentially what Sutherland was proposing is a system similar to a fairly recent development in computer software called building information modeling (BIM). BIM is one of the hottest topics in the architecture profession today. Learn what it is, how to apply it, and how it relates to sustainable design issues and the AEC industry in general. This course also relies heavily on the knowledge already in the profession: guest speakers and field trips will be used to enrich the class content with up-to-date information. It is important that you attend class on-time! In addition to many hands-on computer sessions by the instructor, there will also be guest lecturers from both the profession and the software industry. They have spent considerable time and effort to come talk with the class. Listen, be attentive, and ask appropriate questions. They are valuable resources.

This course is applicable to upper division undergraduate students and graduate students who have a strong background in traditional CAD and three-dimensional modeling. The course applies to the MBS graduate certificate if you are a graduate student. The primary software used will be Revit Architecture. Other programs will also be used. The final grade of the course is based on the homework assignments (50%), final project (30%), final exam (10%), and participation (some of this will come from your feedback on the assignments and email responses to the instructor) (10%). It is your responsibility to read your email for general information about the course and specific inquiries from the instructor that must be replied to.

Because of the rapid advancements expected in the technological underpinnings of the course, every effort is made to provide instruction that adjusts to current conditions and is generic to computer hardware and software platforms. Although offered in the School of Architecture, the techniques taught are equally applicable to others with an interest in the applications of building information modeling. Building science majors, structural engineering students, construction management students, and others are strongly encouraged to enroll. It is assumed that students have a basic understanding of 2D CAD and 3D digital modeling. Please contact the instructor if you have questions.

Homework Assignments
Homework assignments come out on Friday's and are usually one week in length. Late assignments will not be accepted; turn in what you have on the due date at the beginning of class (9:00 AM). It will help you a lot if you read the entire homework assignment before you begin it, and then read it again as you are working on the assignment to refresh your memory, and read it again when you think that you are done to verify that you have the correct elements to turn in. Grades will be posted on Blackboard. There is also a final project and exam in this course.

LATE ASSIGNMENTS WILL NOT BE ACCEPTED; TURN IN WHAT YOU HAVE ON THE DUE DATE. There are no "make-up" assignments or extra credit. However, "additional credit" is available on each homework assignment.

You will need at least three USB flash devices or a combination of these: Flash drive, portable hard drive, hard drive. One is for your assignment, one as a backup, and one for turning in assignments if required. Label everything with your name and e-mail address. A USC e-mail account is also required for this course. Go on-line and verify that your USC account is working. Call 740-5555 if you have problems accessing your account. Read your e-mail at least once a day!

PLEASE NOTE THAT YOU ARE EXPECTED TO COMPLETE ALL HOMEWORK ASSIGNMENTS BY YOURSELF USING THE SOFTWARE THAT HAS BEEN ASSIGNED. COPYING OTHER PEOPLE'S FILES OR TURNING IN WORK THAT YOU DID NOT COMPLETE YOURSELF WILL RESULT IN A FAILING GRADE.

READINGS

Please keep up with the readings! These include handouts, pdf files that are downloadable from Blackboard, and books on reserve in the AFA library. Please note that there are readings (required and optional) and reference material that you may skim as necessary to help you with the assignments and understanding of the material.

Required Readings: You are responsible for having the required items read by the date listed on the syllabus. There may be pop quizzes on the material in the required readings. The reading should be completed **BEFORE** the class date on the syllabus.

BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers, and Contractors; Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston; copyright 2008. TH437.B53 2008. On reserve at the AFA Library.

- Read Chapter 2: BIM Tools and Parametric Modeling
- Read Chapter 5 **or** 6 **or** 7
  - Chapter 5: BIM for Architects and Engineers
  - Chapter 6: BIM for the Construction Industry
  - Chapter 7: BIM for Subcontractors and Fabricators
- Read Chapter 8: The Future: Building with BIM
- Chapter 9: BIM Case Studies (**read 9.0** and **one** of the other sections)
  - 9.0 Introduction to BIM Case Studies
  - 9.1 Flint Global V6 Engine Plant Expansion
  - 9.2 United States Coast Guard BIM Implementation
  - 9.3 Camino Medical Group Mountain View Medical Office Building Complex
  - 9.4 Beijing National Aquatics Center
  - 9.5 San Francisco Federal Building
  - 9.6 100 11th Avenue, New York City
  - 9.7 One Island East Project
  - 9.8 Penn National Parking Structure
  - 9.9 Hillwood Commercial Project
  - 9.10 U. S. Courthouse, Jackson, Mississippi

Green BIM: Successful Sustainable Design with Building Information Modeling, Krygiel, Eddy and Nies, Bradley, copyright 2008. On reserve at the AFA Library.

- Chapter 2: Building Information Modeling, pp. 26 – 52
- Chapter 6: Sustainable BIM: Building Systems, pp. 165-208

Introducing Revit Architecture 2008: BIM for Beginners, Eddy Krygiel, Greg Demchak, and Tatjana Dzambazova, copyright 2007. AFA NA 2728.K79 2007. On reserve at the AFA Library.

- Chapter 12: Advanced Topics: the section on Families.

Performative Architecture • Beyond Instrumentality, edited by Branko Kolarevic and Ali M. Malkawi, copyright 2005. AFA TH 453.P47 2005. On reserve at the AFA Library. Read **ONE** of these four chapters**.**

- Chapter 6: Performance Simulation; Research and Tools (Malkawi)
- Chapter 10: Non-Standard Structural Design for Non-Standard Architecture (Kloft)
- Chapter 13: Performativity: Beyond Efficiency and Optimization in Architecture (Rahim)
- Chapter 14: Computing the Perfomative (Kolarevic)

Kensek, Karen (editor), **Building Information Modeling + Sustainable Design**. Proceedings of BIM BOP 2008: the Second Annual Symposium on Building Information Modeling, July 2008. (on Blackboard. BIM BOP 2008.pdf) If the proceedings are available for BIM CON!FAB 2009, they will be posted on Blackboard also.

SOFTWARE

If you have your own computer, please download the following software. Contact Enrique if you have problems (ebarajas@usc.edu). The software will also be available on computers in the University labs or in the School of Architecture for those who do not own a computer. Unless otherwise listed, these programs only run under **Windows**. You may be using other software for the final project.

Revit Architecture 2010 (free), students.autodesk.com -- we will be using this program **first** and all semester! I strongly encourage you to download this program as soon as possible. If you have problems downloading the Autodesk software as the file sizes are very large, please talk with Enrique Barajas (ebarajas@usc.edu, 213-740-3602) as he might have a local version that you can download instead.

Revit MEP 2010 (free), students.autodesk.com

Revit Structures 2010 (free), students.autodesk.com

NavisWorks Manage (free), students.autodesk.com

Ecotect (free), students.autodesk.com. Read the installation guide and how to register in the reference documents.

Green Building Studio (free), students.autodesk.com. Read the installation guide and how to register in the reference documents.

Optional

Solibri (free for test version – don't download yet). Read the installation guide and how to register in the reference documents. DProfiler and Synchro might also have free demos available.

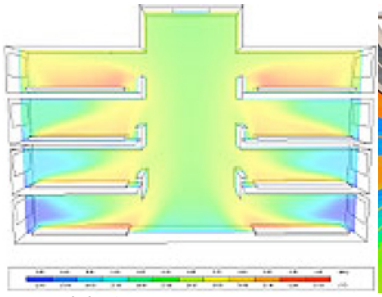
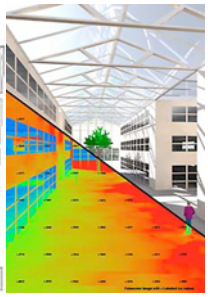
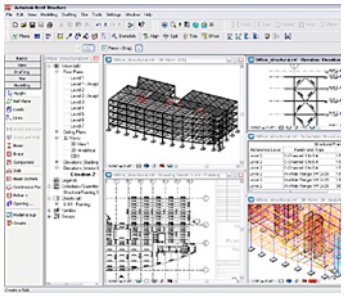
REFERENCE DOCUMENTS

There is a wealth of software documentation that you should download from Blackboard. Some is from the software companies; other documents have been written by students. Other reference material will be uploaded as necessary over the course of the semester.The syllabus includes useful links to the reference material. **Please find a fast Internet connection and download the material on Blackboard. They are listed under Content.**

It is your responsibility to keep up with the readings both in the library and the provided reference documents as they will help you to understand both the course material and the homework assignments.

** More reference materials for Autodesk products including Revit are available at

http://students6.autodesk.com/?nd=m_learning
http://revitcity.com/index.php, bimworld.com
http://autodesk-revit.blogspot.com/
http://www.augi.com
http://seek.autodesk.com/
www.turbosquid.com

images from autodesk.com, iesve.com, and aec.cadalyst.com

January 15 WPH B36

Lecture: Course Introduction. What is BIM?
Lab: User interface. BIM – 2d/3d coordination, interoperability, custom families including a simple title block

Homework 1: getting started
GSG_Revit_Architecture_2010.pdf

Read: **Green BIM:** Chapter 2: Building Information Modeling, pp. 26 – 52

Reference: Autodesk Reference Manuals
These references are **extremely** useful; skim all of these so that you have some idea of what is in them. Occasionally the syllabus will refer to a specific chapter but this is just general information – you should be familiar with the contents of these and use them often to help you in completing the homework assignments.
Revit 2010 User Guide rac_help.pdf
Revit 2010 TutorialsArchitectureImpENU.pdf
Revit 2010 FamiliesGuideArchitectureImpENU.pdf

Revit 2010 User Guide rac_help.pdf (Chapters 2 and 4)

January 22 WPH B36

Lecture: Parametric Modeling
Lab: Introduction to Revit
Home: Wall, Door, Window, Component, Column, Roof, Ceiling, Floor, Curtain System, Stairs, Text
Modify: including holes and sub-objects and "sketching"
Introduction to Families: system, components (hosted/not hosted), model in-place; simple edits to a door family (and look at template file)
Misc: sheets, introduction to view properties, title blocks

Homework 1 due
Homework 2: building components, site, introduction to massing and families

Read: Revit 2010 FamiliesGuideArchitectureImpENU.pdf (Chapter 2)

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 13)

January 29 WPH B36

Lecture: Parametric Modeling, continued.
Lab: Home, Massing, Site

Read: **BIM Handbook:** Chapter 2: BIM Tools and Parametric Modeling

February 5 WPH B36

Lecture: BIM as Database (graphic and non-graphic).
Guest lecturer
Lecture: BIM in the Profession
Lab: Views, Rooms and Area (versus Spaces), and Schedules
Import/Export if there is time

Homework 2 due
Homework 3: Creating a BIM House

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 15)
06 DWG Extraction and Basic Modeling Tutorial Files TJ Tutay
06 DWG Extraction and Basic Modeling TJ Tutay.pdf
07 Basic Scheduling TJ Tutay.pdf

February 12 WPH B36 **Lecture**: Construction Documentation Issues
Guest lecturer
Lab: Annotate (Dimension, Details, Text, Tag), View (Sheet Compositions), Misc (sheet index, cropping views, family schedule on sheet with images)

Homework 3 due
Homework 4: Rooms, Schedules, Views, and Detailing

Reference: Revit 2010 User Guide rac_help.pdf (Chapters 5, 6, 17, 18)

February 19 WPH B36 **Lecture**: Rendering and Animation
Lab: perspectives, rendering, walkthrough animations, solar animations, design options (if time)

Homework 4 due
Homework 5: Rendering and Animation

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 5 – pp. 156 – 168, Chapters 19 and 22)
08 Design Options and Basic Scheduling TJ Tutay.pdf

INTRA- AND INTER- OPERABILITY

February 26 WPH B36 **Lecture**: Construction Phasing and Master Planning Sequencing
Guest lecturer
Lecture: BIM in the Profession
Lab: phasing, clash detection, and introduction to NavisWorks
Introduction to Synchro, Solibri, Quantity Take-off (if time)

Homework 5 due
Homework 6: Construction Phasing

Read: **Performative Architecture.** Read **ONE** of these four chapters**.**
Chapter 6: Performance Simulation; Research and Tools (Malkawi)
Chapter 10: Non-Standard Structural Design for Non-Standard Architecture (Kloft)
Chapter 13: Performativity: Beyond Efficiency and Optimization in Architecture (Rahim)
Chapter 14: Computing the Perfomative (Kolarevic)

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 23)
Navisworks_2010_overview_brochure.pdf
Navisworks_Handout Boren Huang.pdf
Navisworks-Get_Started_2010_get_started.pdf

Optional Reference:
Synchro Getting Started Guide.pdf
Synchro Handout Boren Huang.pdf
Synchro instructions to download trial Boren Huang.pdf
Synchro_User_Guide Boren Huang.pdf

Solibri brochure.pdf
Solibri_handout_by Stan Zhao.pdf

March 5 WPH B36 **Lecture**: BIM +
Lab: intra/inter operability: lighting, energy, carbon footprint
Revit MEP, Green Building Studio, Ecotect, 3ds Max
Introduction to DProfiler and Revit Structure (if time)

Homework 6 due
Homework 7: Performative BIM

Read: Green BIM: Chapter 6: Sustainable BIM: Building Systems, pp. 165-208

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 24)
Green Building Studio - getting_started.pdf
Green_Building_Studio Ryan Hansanuwat.pdf
Green_Building_Studio_2008.pdf

Ecotect_analysis_2010__installation_and_getting_started.pdf
Ecotect_analysis_2010_activation.pdf
Ecotect_analysis_detail_brochure.pdf

3ds max lighting analysis handout Ryan Hansanuwat.pdf
3ds max_daylight simulation.pdf

Additional Reference: Autodesk Sustainable Design Curriculum
Lesson 1: Modeling and Sustainability: Revit to Ecotect (gbXML, DXF, IFC)
Lesson 2: Modeling the Sustainable Building Site: Weather Files
Lesson 3: Building Placement
Green Building Studio: massing
Ecotect: Right-To-Light Massing Studies
Lesson 4: Modeling Human Comfort: Weather Tool
Lesson 5: Optimizing the Design of the Building Envelope for Sustainability
Ecotect: day lighting
3dsmax: day lighting
Lesson 6: Modeling the Design of the MEP Systems for Sustainability
Green Building Studio, Ecotect, Revit MEP

Optional Reference:
DProfiler instructions Yang Shen.pdf
DProfiler-exporting_revit Yang Shen.pdf

Revit_Structure_handout_by Stan Zhao.pdf
Revit_Structure_and_bim.pdf

March 12 TBA **Field Trip**

Homework 7 due

Read: **BIM Handbook:** Chapter 5 **or** 6 **or** 7
Chapter 5: BIM for Architects and Engineers
Chapter 6: BIM for the Construction Industry
Chapter 7: BIM for Subcontractors and Fabricators

March 15-19 **Spring Break**

COMPONENT BASED DESIGN: CONCEPTUAL DESIGN AND FAMILIES

March 26 WPH B36

Lecture: Free Form Design
Guest lecturer
Lecture: BIM in the Profession
Lab: Conceptual Massing, Misc (floors, walls, roofs, panelization, importing from Rhino)

Final Project, part 1

Reference: Revit 2010 User Guide rac_help.pdf (Chapters 11 and 12)
Revit 2010 conceptual modeler.pdf
Revit 2010 conceptual_design_modeling white paper.pdf
01 Conceptual Massing TJ Tutay.pdf
02 Formal Direct Manipulation TJ Tutay.pdf
03 Pattern-Based Panels TJ Tutay.pdf
04 Pattern-Based Panels - Pt 2 TJ Tutay.pdf

05 Complex Form-Based Massing Rhino Import TJ Tutay.pdf
Rhino to Revit 2010 Mana Mohammadkhani.pdf

Additional Reference: Autodesk Conceptual Design Curriculum
Lesson 1: Geometric Exploration
Lesson 2: Parametric Exploration
Lesson 3: Component Exploration

April 2 WPH B36

Lecture: Family Development
Lab: more on parametric modeling

Read:
Introducing Revit: Chapter 12: Advanced Topics: the section on Families.

Reference: Revit 2010 User Guide rac_help.pdf (Chapter 9)
Revit 2010 FamiliesGuideArchitectureImpENU.pdf

April 9 WPH B36

Lecture: Complex Family Development
Guest lecturer
Lecture: BIM in the Profession
Lab: use of formulas and shared parameters; creating and assigning sub-categories; visibility of components within a family

Final Project, part 1 due
Final Project, part 2

COURSE SYNTHESIS

April 16 WPH B36 **Lecture**: BIM Options
Guest lecturers

Final Project, part 2 due
Final Project, part 3

Read: **BIM BOP 2008** (skim)

April 23 WPH B36 **Lecture**: BIM in Construction Management
Guest lecturer

Read: **BIM Handbook:** Chapter 9: BIM Case Studies (**read 9.0** and **one** of the other sections)

9.0 Introduction to BIM Case Studies
9.1 Flint Global V6 Engine Plant Expansion
9.2 United States Coast Guard BIM Implementation
9.3 Camino Medical Group Mountain View Medical Office Building Complex
9.4 Beijing National Aquatics Center
9.5 San Francisco Federal Building
9.6 100 11th Avenue, New York City
9.7 One Island East Project
9.8 Penn National Parking Structure
9.9 Hillwood Commercial Project
9.10 U. S. Courthouse, Jackson, Mississippi

April 30 WPH B36 **Lecture**: What is BIM?
Lab: final exam review

FP3 due

Read: **BIM Handbook:** Chapter 8: The Future: Building with BIM

May 7 **WATT 1** **Final exam, 8 am – 10 am.**

RELIGIOUS HOLIDAYS

The University of Southern California recognizes the diversity of our community and the potential for conflicts involving academic activities and personal religious observation. The University provides a guide to such observances for reference and suggests that any concerns about lack of attendance or inability to participate fully in the course activity be fully aired at the start of the term. As a general principle students should be excused from class for these events if properly documented and if provisions can be made to accommodate the absence and make up the lost work. Constraints on participation that conflict with adequate participation in the course and cannot be resolved to the satisfaction of the faculty and the student need to be identified **prior to the drop/add date for registration**. After the drop/add date the University and the School of Architecture shall be the sole arbiter of what constitutes appropriate attendance and participation in a given course.

Please contact Karen Kensek at kensek@usc.edu **by the end of the second week of class** if you anticipate conflicts with religious holidays including missing lectures, inability to finish homework assignments on-time, or other items that may hinder your work in this class.

REHABILITATION ACT (LAB 504) AND THE AMERICANS WITH DISABILITIES ACT (ADA)

The University of Southern California is committed to full compliance with the Rehabilitation Act (Lab 504) and the Americans with Disabilities Act (ADA). As part of the implementation of this law, the University will continue to provide reasonable accommodation of academically qualified students with disabilities so those student can participate fully in the University's educational programs and activities. Although USC is not required by law to change the "fundamental nature of essential curricular components of its programs in order to accommodate the needs of disabled students," the University will provide reasonable academic accommodations. The specific responsibility of the University administration and all faculty serving in a teaching capacity is to ensure the University's compliance with this policy. The general definition of a student with a disability is any person who has "a physical or mental impairment which substantially limits one or more of such person's major life activities," and any person who has "a history of, or is regarded as having, such an impairment." Reasonable academic and physical accommodations include but are not limited to: extended time on examinations; substitution of similar or related work for a non-fundamental program requirement; time extensions on papers and projects; special testing procedures; advance notice regarding book list for visually impaired and some learning disabled students; use of academic aides in the classroom such as note takers and sign language interpreters; early advisement and assistance with registration; accessibility for students who use wheelchairs and those with mobility impairments; and need for special classroom furniture or special equipment in the classroom.

Obtaining Accommodations

Physical Accommodations

Students with physical disabilities should contact Disability Services and Programs (DSP) prior to or during the first week of class attendance or as early in the semester as possible. The office will work with classroom scheduling, the course instructors and their departments, and the students to arrange for reasonable accommodations.

Academic Accommodations

Students seeking academic accommodations due to a physical or learning disability should make the request to the course instructor prior to or during the first week of class attendance, as well as registering with DSP as early in the semester as possible. Course instructors should require that a student present verification of documentation when academic accommodations are being requested. For assistance in how to provide reasonable accommodations for a particular disability, course instructors are encouraged to consult with Disability Services and Programs (DSP). Students requesting academic accommodations who do not have DSP documentation should be referred to that office.

Summary

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. **Please be sure the letter is delivered to Karen Kensek by the end of the second week of class**. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday.

Disability Services & Programs: (213) 740-0776

STATEMENT ON ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A:

http://www.usc.edu/dept/publications/SCAMPUS/gov/

Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at

http://www.usc.edu/student-affairs/SJACS/

Here is a website link for assistance in avoiding plagiarism:

http://www.usc.edu/student-affairs/student-conduct/ug_plag.htm

Specifically for graduate students, but also useful for undergraduate students:

http://www.usc.edu/student-affairs/student-conduct/grad_ai.htm

ACCREDITATION STATEMENT

"The USC School of Architecture's five year BARCH degree and the two year M.ARCH degree are accredited professional architectural degree programs. All students can access and review the NAAB Conditions of Accreditation (including the Student Performance Criteria) on the NAAB Website.

http://www.naab.org/accreditation/2004_Conditions.aspx

2010 IMPERATIVE STATEMENT

The design should engage the environment in a way that dramatically reduces or eliminates the need for fossil fuel.