

CE 470: BUILDING INFORMATION MODELING & INTEGRATED PRACTICE

Professor Teaching Assistant
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Spring 2020 Syllabus
Mondays, 3:30pm – 6:10pm, RTH 115

1. COURSE DESCRIPTION

Building Information Modeling (BIM) is a **process** focused on the development, use and transfer of a centralized data-rich virtual project model that facilitates documentation, design exploration, model-based quantity take-off and estimating, interference checking, construction coordination and sequencing, digital fabrication and building information visualization.

In this course, students will learn BIM's use in the architecture, engineering and construction (AEC) industry, examine geometry, spatial relationships, building information, quantities and properties of building components, and understand the benefit and improvement areas BIM process offers. Integrated Project Delivery (IPD) is a project delivery approach that is almost a prerequisite for successful BIM projects. It integrates people, systems, business structures and practices into a process that helps optimization of project results, increases value to the owner and end user, reduces waste, and maximizes efficiency through all phases of design, fabrication, construction and life-cycle of the structure.

This course focuses on the role of BIM in the AEC industry and it covers recent developments in the area of BIM and integrated practice, both of which have a great potential to better project outcomes and maximize efficiency. In addition, the course brings cutting edge and emerging technology solutions into the classroom and tries to link these solutions into the BIM environment.

2. COURSE OBJECTIVES

- Provide familiarity with current BIM technologies
- Provide understanding of the shift from 2D representation to 3D simulation
- Provide understanding of new means of coordination and collaboration of design and construction
- Provide understanding for linking and maintaining continuity of existing and designed BIM information and other vital information, such as vendors for specific materials, location of details and quantities required for estimation, bidding and scheduling, into the model
- Provide understanding of new project delivery systems and technologies for 'integrated practice'
- Provide an outlook to how innovative technologies could be integrated into the current AEC practices.

3. METHODS OF TEACHING

A combination of lectures, hands on software training, experiments with new technologies and discussions. Additional out of class time required for directed learning, course assignments and reviewing relevant material.

4. ATTENDANCE

Continuous attendance is critical for your success in this class as the class topics build on each other and attendance is part of the evaluation criteria. If you miss a class, it is your responsibility to ask at the next class what you missed or find out about topics covered. If you are late for class, it is your responsibility to make sure we check you present; if not you will not get credit for attendance. No more than 2 classes can be missed without proper documentation (e.g., doctor's report).

5. CLASS PARTICIPATION

Your participation in the class is part of the evaluation criteria. This is a highly interactive class. There is continuous interchange between the instructor, TA, guest lecturers and students. Questions and participation in discussions are highly encouraged.

6. CLASS COMMUNICATION

USC DEN course management system will be used for class communication, assignment submissions and reading materials.

7. TEACHING ASSISTANT

Ashrant Aryal

8. OFFICE HOURS

TA's Office Hours: Wednesdays, 10:30-12:30pm, KAP 217

Instructor's Office Hours: Mondays, 10:00-12:00, KAP 224C -> Please email me before you would like to meet me and for additional meeting times

9. RECOMMENDED TEXTBOOK

BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors- Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, 2nd Edition

10. REQUIRED SOFTWARE

We will use various software solutions in this course. Below is a list of solutions and instructions for downloading them.

Autodesk Revit 2019/20 – FREE for students: <http://students.autodesk.com/>

Autodesk Navisworks Manage 2019/20 - <http://students.autodesk.com/>

Please go to <http://students.autodesk.com>, register and download Revit and Navisworks Manage with your USC e-mail address. Please note that if you decide to use another version of Revit/Navisworks, it is important all team members to use the same version. Also, both of these software solutions are available on MyDesktop Enhanced VDI (virtual machine).

Revit and Navisworks are PC only, but can be used on a Mac with Boot Camp (ships free with your Mac: go to Applications/Utilities/Boot Camp Assistant) or Parallels (<http://www.parallels.com>) that allows a Mac to run Windows. NOTE: to run Revit on a Mac, you must have a copy of the Windows operating system.

Revit and Navisworks – software will be available on MyDesktop Enhanced VDI (virtual machine), instructions on using the virtual machine will be provided during the semester.

Solibri Model Checker – software will be available on MyDesktop Enhanced VDI (virtual machine), instructions on using the virtual machine will be provided during the semester.

Synchro Pro -software will be available on MyDesktop Enhanced VDI (virtual machine), instructions on using the virtual machine will be provided during the semester.

11. RELATED SOFTWARE

Graphisoft; ArchiCAD	http://www.graphisoft.com/archicad/
Bentley AECOSim	http://www.bentley.com/en-US/Products/AECOSim+Building+Designer/
Digital Project	http://www.digitalproject3d.com/

Tekla	http://www.tekla.com/us
VICO	http://www.vicosoftware.com/products/Vico-Office/tabid/85286/Default.aspx
IES	http://www.iesve.com/
Green Building Studio	https://gbs.autodesk.com/GBS/
Assemble Systems	http://assemblesystems.com/
Ecodomus	http://www.ecodomus.com
Innovaya	http://www.innovaya.com

12. RELATED BIM RESOURCES

Analysis, Research and Review - <http://www.aecbytes.com/>
AEC Technology - AECbytes
Building Smart Alliance - <http://www.buildingsmartalliance.org/>
National BIM Standard (NIBS) - <https://www.nationalbimstandard.org/>
BIM Forum - <http://www.bimforum.org/>
BIM and Integrated Design - <http://bimandintegrateddesign.com/>

13. REVIT RESOURCES

Revit Wiki On-line Help - <http://wikihelp.autodesk.com/Revit/enu/2013>
Revit City - <http://www.revitcity.com/index.php>
AUGI (Autodesk User Group International) - <http://forums.augi.com/> (navigate to Forums > AEC > Revit)
Club Revit - <http://clubrevit.com>
The Revit Kid - <http://therevitkid.blogspot.com/>
BIM Boom/ Revit 3D - <http://bimboom.blogspot.com/>
Tips and Tricks Series by AECbytes - <http://www.aecbytes.com/tipsandtricks/index.html>

14. ASSIGNMENTS

It is crucial that students turn in whatever they have on the due date. NO assignment will be accepted late. Assignments are due the beginning of the class as specified in the class schedule below. An incomplete grade will only be issued when a student is unable to complete the work because of documented illness. A letter from your physician will be required documentation. ALL ASSIGNMENTS ARE DUE **11:59AM** ON THE DAY INDICATED IN THE SCHEDULE.

Midterm Assignment: 2D drawings of a typical campus building will be provided to the students. Students (in teams) will model (architectural and structural) this campus building based on their Revit knowledge acquired through the in-class-tutorials and self-practice. Teams can divide the work by discipline or by floor or any other way they choose. The goal of this exercise is to understand the collaborative effort of modeling and coordination between different disciplines. A short report and milestone submissions (see the schedule below) are required with the submission of the BIM models. The report should clearly state each team member's contribution. More details will be provided.

Assignment 1: Each student will research one BIM authoring or specialty tool that is available in the market. Students will identify the tool they will research and inform the instructors by the date indicated in the schedule below. Students will prepare a report outlining the strengths and weaknesses of the tool they have selected. It is expected that students will do a bibliographical research and also download the software, import their model to their selected BIM authoring software and explore software functionalities and capabilities. A short presentation and a write up, on the above-mentioned areas as well as the interoperability issues between Revit and the selected software, will be prepared and delivered on the due date of the assignment.

Final Assignment: Teams will perform interference checking and 4D simulation using Navisworks, Solibri and Synchro. Teams will use the models (architectural and structural) they have developed in

their mid-term assignment. The MEP model of the building will be provided. Teams will present their work and findings on the pros and cons of each tool. In addition, the teams will research other BIM tools available for construction management and present their analysis. A short report and milestone submissions (see the schedule below) are required with the submission of the BIM models. The report should clearly state each team member's contribution. More details will be provided.

Extra Credit Assignment: Personal initiative and enthusiasm expressed for the subject matter taken up in this class shall be acknowledged via extra credit points. To receive extra credit points, submit a paragraph memo (e-mail) describing your extra credit activity, prepare and submit your extra credit activity, and you will receive extra points (5 points total). Extra credit activity is a great way to raise your grade. Examples of extra credit projects (please check with me or the TA if you have other ideas for extra credit):

- Participation in an immersive virtual reality experiment, summarizing your experience and how augmented/virtual reality will be integrated in the future of BIM (contact me or the TA for details)
- 5-minute video presentation of any additional building you modeled (self prepared)
- 5-minute video presentation of a productivity tip you learned (self prepared)

15. EVALUATION AND GRADING SCHEMA

Grades will be based on completeness and quality of assignments, attendance and participation. Additional breakdown for grading for each assignment will be provided in assignment descriptions that will be handed out during the semester.

- Midterm: 40%
 - Milestone 1: 5%
 - Midterm submission and presentation: 25%
 - Peer evaluation: 10%
- Assignment 1: 10%
- Final Assignment: 40%
 - Milestone 1: 5%
 - Final submission and presentation: 25%
 - Peer evaluation: 10%
- Participation in discussions: 10%
- TOTAL: 100%

Grade breakdown by percentage of possible 100 total points:

- A >=94% Work exceeds expectation, always attends class
- A- 90-93%
- B+ 87-89% Very good work, almost always attends class.
- B 84-86%
- B- 80-83%
- C+ 77-79% Good work, good attendance
- C 74-76%
- C- 70-73%
- D+ 69 - 67% Late, incomplete, or sloppy work, infrequent attendance
- D 64-66%
- D- 60-63%
- F <=59% Missing or copied work, poor attendance

15. CLASS STRUCTURE & SCHEDULE:

* Class sequence, dates topics and guest speakers are subject to change.

#	Date	Topics	Software Assignments
1	1/13	COURSE INTRODUCTION Course overview Student survey BIM INTRODUCTION What is BIM and what is NOT BIM? Why is BIM important? How BIM is changing the AEC industry? Uses of BIM	
2	1/20	MARTIN LUTHER KING DAY	NO CLASS
3	1/27	BIM AUTHORIZING: Introduction and Modeling Basics (Revit) Interface/navigation Building elements (walls, doors, windows, floors, roofs, etc.)	
4	2/3	COLLABORATION IN BIM How to collaborate in a BIM environment Cloud based collaboration Sharing models	
5	2/10	BIM AUTHORIZING: Modeling (Revit) Structural systems	Submit the work for midterm - milestone 1 Choose your alternative BIM tool and report to the Instructor/TA
6	2/17	PRESIDENTS DAY	NO CLASS
7	2/24	BIM AUTHORIZING: Modeling (Revit) Circulation (stairs, etc.) Documentation (sections, elevations, 3D views, schedules, quantities, etc.)	
8	3/2	INTEGRATED PROJECT SESSION Team Presentations	Midterm assignment due
9	3/9	BIM for CONSTRUCTION MANAGEMENT Uses of BIM by contractors and construction managers during the construction phase Guest Speaker: TBD FUTURE TRENDS IN BIM Use of virtual environments for design exploration Data management & Cloud based BIM	

		Laser scanning and BIM Computer aided manufacturing/fabrication	
10	3/16	SPRING BREAK	NO CLASS
11	3/23	STUDENT PRESENTATIONS Software environments/solutions Pros/cons of different BIM tools	Assignment 1 due
12	3/30	CONSTRUCTION COORDINATION (Navisworks & Solibri) Principles of IPD Model integration Interference checking Identifying/resolving issues	
13	4/6	CONSTRUCTION COORDINATION (Navisworks & Solibri) Principles of IPD Model integration Interference checking Identifying/resolving issues	Submit the work for final - milestone 1
14	4/13	4D CONSTRUCTION SEQUENCING (Navisworks and Synchro) 4D simulation	
15	4/20	4D CONSTRUCTION SEQUENCING (Navisworks and Synchro) 4D simulation	
15	4/27	INTEGRATED PROJECT SESSION Team Presentations	Final assignment due
		Final is due on the schedule date of the final exam	Extra credit assignment due

16. ACADEMIC RESPONSIBILITIES

Students with Disabilities

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 me as early in the semester as possible. Your letter must be specific as to the nature of any accommodations granted. DSP is located in STU 301 and is open 8:30 am to 5:30 pm, Monday through Friday. The telephone number for DSP is (213) 740-0776.

Academic Integrity

The University, as an instrument of learning, is predicated on the existence of an environment of integrity. As members of the academic community, faculty, students, and administrative officials share the responsibility for maintaining this environment. Faculties have the primary responsibility for establishing and maintaining an atmosphere and attitude of academic integrity such that the enterprise

may flourish in an open and honest way. Students share this responsibility for maintaining standards of academic performance and classroom behavior conducive to the learning process. Administrative officials are responsible for the establishment and maintenance of procedures to support and enforce those academic standards. Thus, the entire University community bears the responsibility for maintaining an environment of integrity and for taking appropriate action to sanction individuals involved in any violation. When there is a clear indication that such individuals are unwilling or unable to support these standards, they should not be allowed to remain in the University." (Faculty Handbook, 1994:20)

Academic dishonesty includes: (Faculty Handbook, 1994: 21-22)

1. **Examination behavior** – any use of external assistance during an examination shall be considered academically dishonest unless expressly permitted by the teacher.
2. **Fabrication** – any intentional falsification or invention of data or citation in an academic exercise will be considered a violation of academic integrity.
3. **Plagiarism** – the appropriation and subsequent passing off of another's ideas or words as one's own. If the words or ideas of another are used, acknowledgment of the original source must be made through recognized referencing practices.
4. **Other Types of Academic Dishonesty** – submitting a paper written by or obtained from another, using a paper or essay in more than one class without the teacher's express permission, obtaining a copy of an examination in advance without the knowledge and consent of the teacher, changing academic records outside of normal procedures and/or petitions, using another person to complete homework assignments or take-home exams without the knowledge or consent of the teacher.

The use of unauthorized material, communication with fellow students for course assignments, or during a mid-term examination, attempting to benefit from work of another student, past or present and similar behavior that defeats the intent of an assignment or mid-term examination, is unacceptable to the University. It is often difficult to distinguish between a culpable act and inadvertent behavior resulting from the nervous tensions accompanying examinations. Where a clear violation has occurred, however, the instructor may disqualify the student's work as unacceptable and assign a failing mark on the paper.

Return of Course Assignments

Returned paperwork, unclaimed by a student, will be discarded after a year and hence, will not be available should a grade appeal be pursued following receipt of his/her grade.