# BCN 5905 Advanced Building Information Modeling

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**CLASSROOM:** RNK 106/201

**OFFICE**: RNK 325/338                   **OFFICE HOURS**: By Appointment

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## COURSE DESCRIPTION

This course will cover the fundamental principles and practices of using building information models for model management, including quantification, scheduling, and coordination. The course will also present the use of advanced information systems in the construction context, such as parametric modeling, creating infrastructure models, and reality capture. The goal of this course is to develop the students' understanding of how cloud-connected tools, collaboration tools, and advanced construction technologies can transform and improve the construction management process to aid in project success.

## COURSE OBJECTIVES

1. Associate construction schedules with building information models and create videos to showcase the developed models and the construction process.
2. Coordinate models from different disciplines and work on solving clashes within a coordination meeting.
3. Develop infrastructure models that incorporate geographic information systems, building models, and civil engineering models.
4. Create architectural, structural, and systems parametric families in Revit.
5. Develop an understanding of the different reality capture techniques and use Recap Pro to register scans.
6. Explain the benefits of generative design in the architecture, construction, engineering, and operations industry.
7. Explore several technologies that use building information models in different project stages, such as virtual reality, augmented reality, digital twins, robotics, manufacturing, energy analysis and facility management platforms.
8. Complete class group project to develop an immersive environment or digital twin for a structure.

## REQUIRED SOFTWARE

You are required to install the software on your personal computers. All software are available free of charge.

1. Autodesk Software available through the Autodesk Education Community
   http://www.autodesk.com/education/home
   a. Create a free account, using your ufl.edu account, and download the following software,
      i. Revit 2023
      ii. Recap Pro
      iii. Navisworks Manage 2023

      iv.  Infraworks 2023
       v.  TwinMotion
     vi.  Tandem
2. Autodesk Construction Cloud Platform
   a. Access to the online platform will be provided by the instructor at the start of the course and access will be removed following the end of the course.
3. CMBuilder
   a. Create a free account, using your ufl.edu account, and download CMBuilder
4. Lumion
   a. Create a free account, using your ufl.edu account, and download Lumion

# GRADING CRITERIA

## Assignments

The assignments in this class are designed to encourage you to go beyond the lecture and explore different tools to apply in your models. All assignments are individual. Students are expected to submit their assignments by the due date. The class has 8 assignments. Each assignment is worth 10%. Assignments are due by the time specified on Canvas. **Late assignments are not accepted.**

## Final Project

The final project in this course is intended to be an opportunity for you demonstrate the skills you have acquired over the course of the semester. The project is divided into a research component and a model development component. The project is worth 20% of the grade.

## Grade Distribution

The grade of the class is computed as follows:

| Description | Percentage of Final Grade |
|---|---|
| Assignments | 80% |
| Final Project | 20% |
| **Total** | **100%** |

The letter grades will be computed according to the following scale:

| | |
|---|---|
| A  = 90.0 AND ABOVE | C  = 70.0 to 76.9 |
| A⁻ = 87.0 to 89.9 | C⁻ = 67.0 to 69.9 |
| B  = 80.0 to 86.9 | D  = 60.0 to 66.9 |
| B⁻ = 77.0 to 79.9 | E  = below 60 |

**ACCESSING UNIVERSITY ACADEMIC POLICIES AND CAMPUS RESOURCES**

To support consistent and accessible communication of university-wide student resources, please use this link to academic policies and campus resources: **https://go.ufl.edu/syllabuspolicies.**

# CLASS SCHEDULE

| Week | Date | Course Topic | Assignment Due |
|------|------|--------------|----------------|
| **BUILDING INFORMATION MODELING** | | | |
| 1 | | **Course Overview:**<br>• Syllabus and schedule review<br>• Overview of the required software<br><br>**Revit Overview:**<br>• Review of architectural, structural, and mechanical modeling<br>• Review of project information and organization | |
| 2 | | **Advanced Architectural Modeling in Revit:**<br>• Family Editing<br>• Masses | |
| 3 | | **Advanced Structural Modeling:**<br>• Reinforcement<br>• Steel Connections<br>• Using Revit and Advance Steel together<br>• Using Allplan<br><br>**Advanced Mechanical Modeling:**<br>• Heating and Cooling Loads<br>• Autodesk Insight | **Assignment 1:** Architectural Model |
| 4 | | **BIM for Heavy Construction**<br>• Infraworks and Revit<br>• CMBuilder<br><br>**Site Layout**<br>• Autodesk Point Layout<br>• Robotic Total Station | **Assignment 2:** Structural Model |
| **PROGRAMMING AND GAME ENGINES** | | | |
| 5 | | **Intro to Programming**<br>• Writing your first computer program using AI | |
| 6 | | **Dynamo**<br>• Getting started<br>• Interaction with Revit | **Assignment 3:** Coding using C# |
| 7 | | **Game Engines**<br>• **Unity**<br>• **Understanding basic animation principles**<br>• **Creating a simple application** | **Assignment 4: Dynamo Script** |
| **IMMERSIVE/INTERACTIVE VISUALIZATION** | | | |

| 8 | | **Virtual Reality** | **Assignment 5:** Unity Application |
|---|---|---|---|
| | | • VR applications<br>• VR Hardware and Software<br>• Revit Live<br>• Unity + Oculus Rift + HoloLens 2<br><br>**Augmented Reality**<br>• AR Applications<br>• AR Hardware and Software<br>• AR with HoloLens<br>• AR with Magic Leap | |
| **SIMULATION** | | | |
| 9 | | **4D Simulation in Synchro**<br>• Introduction, getting started, importing files<br>• Scheduling<br>• Creating simulations | |
| **ROBOTICS AND AUTOMATION** | | | |
| 10 | | **3D Printing**<br>• Intro to additive manufacturing<br>• Intro to 3D printing technologies & materials<br>• Design and print using Fusion | **Assignment 6:** Synchro Application |
| **REALITY CAPTURE** | | | |
| 11 | 4/10 | **Photogrammetry**<br>• Introduction<br>• Scanning an object<br>• Processing scans<br>**Laser Scanning**<br>• Getting started<br>• Scanner settings<br>• Indoor scanning<br>• Outdoor scanning<br>• Processing scans | **Assignment 7:** 3D object print out of scaled model |
| 12 | | **ReCap and Revit**<br>• Using point cloud data in Revit<br>• Processing point clouds | |
| 13 | | **Digital Twin Development**<br>• Data Management Plan<br>• Data Collection, Storage and Accessibility | **Assignment 8:** BIM Model of Point Cloud data |
| 14 | | **BIM to Digital Twin Transition**<br>• LOD for DT<br>• Data Integration<br>• Simulation and Optimization | |
| **WRAP-UP** | | | |
| 15 | | **Final Presentation**<br>• Class reflections<br>• VR/AR Immersive Environment or DT Project Presentations | **Final Project:**<br>Choice of Immersive Environment Or Digital Twin |

**\*\*_This syllabus represents the current course plans and objectives.  As the semester progresses, those plans_** _may need to change to enhance the class learning opportunity._
**_Such changes, clearly communicated, are not unusual and should be expected._**