Baseline Syllabus

Design 9 Studio  ARC 5362: Sustainability Studio  (6 Credits)

Instructors:  
Coordinators:  
Gray Read, Associate Professor,  
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http://faculty.fiu.edu/~readg/, office hours:  
T/Th 10:00 – 12:30  
Thomas Spiegelhalter, Associate Professor, email:  
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http://www.sustainabilitythomasspiegelhalter.com/re 
search/, office hours T/TH: 9:00-10:30  
MMC Sections: Gray Read, Claudio Salazar, Sara Pezeshk, Marilys Nepomechie. MBUS Sections: Thomas Spiegelhalter, Claudia Busch.

Description: Architectural Design 9 focuses on developing strategies for sustainable design which engages the landscape and the city. The studio is coordinated with the Department of Landscape Architecture and includes lectures on landscape topics and an in-class workshop. The project challenges students to envision the built elements of urban life in a net-zero-fossil energy or carbon neutral, sustainable Downtown Miami.

Hours and Format: Class meets on Tuesdays and Thursdays from 2:00 until 6:15. Studio format with required attendance at all lectures. Students are encouraged to do all their design work in studio and to keep models and drawings in the studio space.


Prerequisite: ARC 5361 Comprehensive Design (with a grade of B- or higher)

Digital Requirement: In the process of design, students must use parametric green building analysis software such as Revit, SketchUp or Rhino programs and plug-ins with cloud service modeling capabilities. See: http://www.autodesk.com/education/free-software/green-building-studio  Links to tutorials are below.
Accreditation
This studio meets several Student Performance Criteria for Professional Accreditation (http://www.naab.org/accreditation/home), as follows:

**Realm A: Critical Thinking and Representation.**

A. 2 Design Thinking Skills:
*Ability* to raise clear and precise questions, use abstract ideas to interpret information, consider diverse points of view, reach well-reasoned conclusions, and test alternative outcomes against relevant criteria and standards.

A.3 Investigative Skills:
*Ability* to gather, assess, record, and comparatively evaluate relevant information and performance in order to support conclusions related to a specific project or assignment.

A.4 Architectural Design Skills:
*Ability* to effectively use basic formal, organizational and environmental principles and the capacity of each to inform two- and three-dimensional design.

A.5 Ordering Systems:
*Ability* to apply the fundamentals of both natural and formal ordering systems and the capacity of each to inform two- and three-dimensional design.

A.6 Use of Precedents:
*Ability* to examine and comprehend the fundamental principles present in relevant precedents and to make informed choices about the incorporation of such principles into architecture and urban design projects.

**Realm B: Building Practices, Technical Skills, and Knowledge.**

B.1 Pre-Design:
*Ability* to prepare a comprehensive program for an architectural project that includes an assessment of client and user needs; an inventory of spaces and their requirements; an analysis of site conditions (including existing buildings); a review of the relevant building codes and standards, including relevant sustainability requirements, and an assessment of their implications for the project; and a definition of site selection and design assessment criteria.

B.2 Site Design:
*Ability* to respond to site characteristics, including urban context and developmental patterning, historical fabric, soil, topography, ecology, climate, and building orientation, in the development of a project design.

B.6 Environmental Systems:
*Ability* to demonstrate *and apply* the principles of environmental systems’ design, How design criteria can vary by geographic region, and the tools used for performance assessment. This demonstration must include active and passive heating and cooling, solar geometry, daylighting, natural ventilation, indoor air quality, solar systems, lighting systems, and acoustics.

**Realm C: Integrated Architectural Solutions.**

C.1 Research:
*Understanding* of the theoretical and applied research methodologies and practices used during the design process.
Schedule:

Week 1 Jan 9 & 11  Introduction: Precedent Studies: Choose building to study
Research Precedent, analyze graphically, and statistically – focus on environmental performance of tropical building with Drawings, diagrams and protocols

Week 2 Jan 16 & 18  Present Precedent Studies.
Due: Analytical diagrams of buildings used as models for project
Start of Pre-Design/ Site and building massing design
Programming and site analysis. Design Concept

Week 3 Jan 23 & 25  Continue site analysis, programming and building massing

Week 4 Jan 30 & Feb 1: Present Site Analysis and Program package. (B.1 Pre-Design)
Drawings, diagrams and protocols, Due:
1. Schematic Site and building design – preliminary sketch model
2. Programming: Narrative of use and inventory of spaces with their requirements and square footages, include footnotes to sources.
3. Site Analysis, including:
   a. Transportation access – transit, car, pedestrian
   b. Topography and buildings on site and in surrounding area
   c. Sun and shading diagram – show shading from adjacent buildings
   d. Climate data, soils data, diagram of prevailing winds
   e. Prevailing breezes modeled in 3D
   f. Site section extending across street into city
4. List of Zoning and Building Code Requirements for project
5. List of Sustainability standards and requirements

Week 5 Feb 5 & 8  Site and building Design
Lecture by Landscape Architect

Week 6 Feb 13 & 15  Integrated Site/Building Design, Infrastructure, Landscape and Building Design

Week 7 Feb 20 & 22  Mid-Review 1 Present Site Design (B.2 Site Design)
Schematic design of site and building
Drawings, diagrams and parameters, Due:
1. Site Information
   a. Site Plan with diagrammatic building design including structure diagram
   b. Site section with topography contour lines. Show feet or meters above sea level and potential storm surge and sea level rise impacts.
2. Diagram showing how design responds to context, including development patterns and existing fabric.
3. Site plan showing vegetation with topography contour lines, sections, with notes on planting for a specific eco-system group, for example hardwood hammock or mangrove wetland.
4. Site analysis for passive design strategies (also B.6 Environmental Systems)
   a. Solar radiation, reflections and heat transfer,
   b. Daylighting parameters
   c. Shading analysis
d. Wind analysis (directions, velocity, temperature, humidity, etc.)
e. Temperature, humidity and pressure concentrations

5. Drainage
   a. Site storm water management concept
   b. Hydrological drainage management concept

6. Treatment Concepts (B.6 Environmental Systems)
   a. Rainwater management treatment concept
   b. Black and brown water management treatment

Week 8 Feb 27 & Mar 1 Building Design

1. Architectural elements and parameters including the scale and proportion of zoning, room volumes, occupancy/activity schedules and facade features, indoor/outdoor connections, composition, and systems integration

2. Holistic design concept that demonstrates comfort for occupants and is sustainably compatible with the surrounding environment

Week 9 Mar 6 & 8 Building Design and Analysis

Week 10 Mar 13 & 15 Spring Break

Week 11 Mar 20 & 22 Building Design and Analysis

Week 12 Mar 27 & 29 Mid Review 2
Drawings Due:

1. Design Drawings, massing, plans, sections (always extend beyond building into existing site), 3D renderings (A.4 Architectural Design Skills)
2. Diagram of site characteristics before design and after (A.5 Ordering Systems)
3. Diagram of architectural ordering systems (orientation, circulation and structure)
4. Building Section showing: (B.6 Environmental Systems)
   a. Building systems (passive-active, hybrid)
   b. Materials
5. First Green Building Studio Baseline Scenario strategies (EUI, water, CO2e, etc.)

Week 13 April 3 & 5 Building Design and Analysis

Week 14 April 10 & 12 Building Design and Analysis

Week 15 April 19 Final Review
Drawings Due: All previous drawings, parameters and diagrams plus: eye level perspectives, illustrative section-elevation: one longitudinal section-elevation, two cross sections
1. Hydraulic Water/Storm water and Vegetation Strategy
2. Solar Studies, Daylighting, Acoustic and Interior Air Quality (B.6 Environmental Systems)
a. Section of main space showing solar radiation and daylighting control strategy and artificial lighting systems
b. Section of main space showing acoustic strategy.
c. Description of indoor air quality strategy.

Week 17 April 24 & 26 Exam Week

Final Studio Package due including all Drawings and Protocols for ARC 5621:

3. Carbon Neutral design flow diagrams (B.6 Environmental Systems)
   a. Show the systems
   b. Performance concept

4. Passive / Active Hybrid Systems (B.6 Environmental Systems)
   a. Passive space conditioning
   b. Active HVAC / MEP

5. Floor and Façade section with R or U value calculation (B.6 Environmental Systems)

6. Building Section showing: (B.6 Environmental Systems)
   a. Building systems, performance units,
   b. Materials and surfaces


8. Renewable Energy Generation and Storage Design (B.6 Environmental Systems)

Grades Due: May 2

Links for Tools and Tutorial for Carbon Neutral Design Software Workflows
(Note: required minimum Laptop RAM is 16 better 32 or higher)

Generative, algorithmic D9-Building Information Modeling (BIM) Software Workflow Tools and Cloud-Based Platforms
(Note: Autodesk BIM Software + Platforms No. 1-5 are mandatory for ARC 5612 and 5621 Environmental Systems in Architecture 1-2 students exercises, assignments and final projects)

1. Autodesk® Revit BIM 2018 vers. 02 or newer
2. Autodesk® Dynamo Studio and Dynamo Player for visual programming, scripting, and automated nodes with REVIT 2018 and Fusion 360, Infraworks 360, Inventor, and Navisworks, 3d-Max (Note: Maya doesn’t work)
3. Autodesk® Green Building Studio is a flexible cloud-based algorithm, machine learning driven service that allows you to run building performance simulations to optimize resource efficiency and to work toward carbon neutrality earlier in the generative design process with industry leading engines such as DOE-2.2 + ASHRAE Standard140 Validation.
4. Autodesk® Flow 2014 or newer for exterior analysis design and optimizations
5. Autodesk® Computational Fluid Dynamics (CFD) 2018 or newer for interior analysis design and optimizations
6. Autodesk® Fusion 360 - Cloud-Based 3D CAD/CAM Tool, Manufacturing, Robotics, Additive Printing etc.
7. Autodesk® Stingray – Gaming software for excellent animations and movies
8. Autodesk® Robot Structural Analysis Professional
All Autodesk software, cloud-based platforms and plug-ins for educators, students, and educational institutions can be downloaded for free at this link:
https://www.autodesk.com/education/free-software/featured#free-software

More specific links:
https://www.autodesk.com/education/free-software/revit
https://gbs.autodesk.com/GBS/
https://insight360.autodesk.com/oneenergy
https://www.autodesk.com/products/fusion-360/students-teachers-educators?td=aexfusion
https://www.autodesk.com/education/free-software/dynamo-studio
https://www.autodesk.com/products/dynamo-studio/overview
https://www.autodesk.com/education/free-software/bim-360
https://www.autodesk.com/education/free-software/flow-design
https://www.autodesk.com/education/free-software/cfd

Revit plugins (selected):
http://dynamobim.org/gallery/
http://dynamobim.org/explore/

Fusion 360 plugins (selected):

Note: All Autodesk Interactive Tutorials are directly embedded under HELP within the software or Autodesk offers free Webinars, Autodesk University online courses and multiple blogs for real-time assistance.
Additional tutorials can be found for any topic on YouTube or FIU LYNDA

Biweekly Cloud-based workshops with Experts for firms, researchers, students
Local Miami based Autodesk Intl. DYNAMO-RHYNAMO-BIM-User Group
Sign up: https://www.augi.com/local-user-groups/group/dynamo-bim-user-group

Yearly Fee based Software for students and educators (maybe trial versions work for free):
Rhino: http://diva4rhino.com
Grasshopper Plugins: http://www.grasshopper3d.com/groups
Sketchup Green Studio - The IES VE SketchUp Plug-In
http://www.sketchup.com/green/analysis.html
Sefaira for SketchUp- Sustainability • Performance • Design:
http://sefaira.com/contact/
http://sefaira.com/sefaira-architecture/

General Online Information

Details+Systems Online Portal
(Languages: German, French, Spanish, Italian, English, Japanese, Swedish)
http://www.detail.de/thema_architecture-magazine-construction_57_en.htm English:
http://www.detail-online.com/

Reference Texts:
Useful Website Links:
DOE tools: http://apps1.eere.energy.gov/buildings/tools_directory/
ASHRAE: http://www.ashrae.org/
IESNA: http://www.iesna.org/
Energy Star: http://www.energystar.gov/
The 'Whole Building' Design Guide: http://www.wbdg.org/

Further Suggested Bibliography: