Images, ARC 423/623 Student Work

ARC-423/623 ADVANCED BUILDING SYSTEMS

SYLLABUS | SPRING 2024

Class Meetings: Tues/Thurs 11:00-12:20AM | Slocum Auditorium
Instructor: Nina Wilson, PhD nwilson1@syr.edu | Slocum 324A
Office Hours: Tues/Thurs 9:00am-10:00am

Teaching Assistants:

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Meetings with TAs will be held during weekly Friday labs for project feedback, software demonstrations and tutorials, and troubleshooting. Additional meetings can be scheduled with TAs, as with the instructor, via email.

Overview:

ARC 423-623 will examine a range of integrative processes, physical principles, and theories of technology in the design and deployment of building systems (e.g., environmental, energy, structural, enclosure) that augment overall building performance across energy, environmental, life cycle, human wellness, and aesthetic criteria.

The course will engage technical concepts of design integration through a schedule of readings, lectures, and focused activities that articulate, characterize, and question historical and conventional interrelationships among structure, mechanical systems, details, and materials through a diverse selection of case studies and examples of architectural assemblies. The influence of policies, codes, and standards on the shaping of buildings, including widespread initiatives around human-environmental resilience, will be studied. In this course, we will explore modes of production, manufacturing of building components and assemblies, and delivery of projects, and will provide a basis of understanding of the impacts of each on design outcomes and on occupant experience of architecture.

Through the term project, the role and performance of building systems, details, and material choices relative to the deployment of architectural concepts within a building will be examined through drawing, diagramming, and quantitative assessment. Beyond the provision of analytical exercises, the course will require the application of fundamental physical and thermodynamic principles, a conversant level of understanding of which you will have gained in previous courses, to the solution of systems design problems contained within the case study project.

The term project, which will be completed in groups of 2-3, will be conducted in three parts over the course of the semester. Details of the term project will be provided in separate handouts pertaining to each submission.

The course schedule is organized into lectures, in-class exercises, reading and other topical discussions, and presentations. The primary means of investigation and evaluation in the course will be the term project, and secondarily, by individual submissions comprising brief sets of questions, drawing exercises, or contained design problems, to be submitted directly through Blackboard.

No electronic devices are permitted in class. Laptops, phones, and other devices are to be off and put away, excepting emergencies and special accommodations communicated to me through the Center for Disability Resources, or CDR (see section on CDR, p.8).

Prerequisites: Unless prior approval has been received from the relevant Program Director as well as your instructor, all students must have successfully completed the following courses before they may enroll in ARC 4/623:
- Undergraduates: ARC 322, ARC 308 Design
- Graduates: ARC 622

Undergraduate Credit Hours: 3 Credit Hours
Graduate Credit Hours: 3 Credit Hours; Graduate students are required to perform additional work in the term project in order to validate the distinction between ARC 423 and ARC 623; this distinction is described in detail in the Project Descriptions.

Learning Outcomes:

Through the successful completion of this course, students will be able to:
- Develop drawing and analysis techniques applying foundational principles of building envelope physics through construction and detailing;
- Understand analytical methods used to quantitatively and critically evaluate the performance of building envelope, structural, and mechanical systems;
- Understand contemporary and historical technology integration modes employed by architects to advance environmental, energy, and aesthetic goals;
- Analyze the role and performance of building systems relative to the deployment and articulation of architectural concepts

In addition, the course will fulfill the National Architectural Accrediting Board (NAAB) criteria as follows:

PC.3 Ecological Knowledge and Responsibility
How the program instills in students a holistic understanding of the dynamic between built and natural environments, enabling future architects to mitigate climate change responsibly by leveraging ecological, advanced building performance, adaptation, and resilience principles in their work and advocacy activities.

PC.5 Research and Innovation
How the program prepares students to engage and participate in architectural research to test and evaluate innovations in the field.

SC.3 Regulatory Context
How the program ensures that students understand the fundamental principles of life safety, land use, and current laws and regulations that apply to buildings and sites in the United States, and the evaluative process architects use to comply with those laws and regulations as part of a project.

SC.4 Technical Knowledge
How the program ensures that students understand the established and emerging systems, technologies, and assemblies of building construction, and the methods and criteria architects use to assess those technologies against the design, economics, and performance objectives of projects.

SC.6 Building Integration
How the program ensures that students develop the ability to make design decisions within architectural projects while demonstrating integration of building envelope systems and assemblies, structural systems, environmental control systems, life safety systems, and the measurable outcomes of building performance.

Syracuse University Shared Competencies:

Syracuse University's Shared Competencies are six university-wide learning goals that enhance undergraduate education through an integrated learning approach. Undergraduate students develop competencies through their major degree courses, liberal arts requirements, and co-curricular experiences. The Shared Competencies enable students to communicate their learning experience, provide pathways for academic development, and integrate different aspects of a Syracuse University education. Each competency includes corresponding framing language that communicates the content of that competency to educators and learners.

This course specifically addresses the following shared competencies:

Critical and Creative Thinking
Exploration and synthesis of ideas, artifacts, issues, and events to inform and evaluate arguments, develop new insights, and produce creative work. Reflection on, and application of divergent modes of inquiry, analysis, and innovation to research, knowledge, and artistic creation.

This course will specifically explore ideas and issues relating to the theoretical underpinnings of building systems development and evolution over time, and artifacts of built works completed by a global range of architecture, engineering, and construction teams. In this course, you should effectively develop insights relating to the ways in which we conduct analysis within the field and creatively interpret and visualize data for a non-technical audience, by synthesizing and folding data into conventional architectural drawings and compelling, multilayered compositions.

Scientific Inquiry and Research Skills
Application of scientific inquiry and problem-solving in various contexts. Analysis of theories, replication of procedures, and rethinking existing frameworks. Supporting arguments through research, data, and quantitative and qualitative evidence that can generate new knowledge.

In this course, we will analyze theories of relationships between architecture and systems, and interrogate the underlying assumptions upon which contemporary conventional systems paradigms are built. We will assess existing frameworks for the design and integration of building systems, and make evidence based claims regarding novel potential design and synthesis of alternative systems logics.

Information Literacy and Technological Agility
Identification, collection, evaluation, and responsible use of information. Effective, ethical, and critical application of various technologies and media in academic, creative, personal, and professional endeavors.

This course will emphasize the collection, evaluation, and use of original archival documentation, in addition to research conducted by the students through the development of term project and assignment work. In this course, a range of technologies will be used to conduct industry standard simulation and analysis exercises, and students will be expected to interpret and visualize data. Students will encounter data resources with embedded inequity and bias, and will be guided on how to adapt using rigorous assumptions in the absence of thorough and complete documentation on case study projects.

Required Texts and Tools:

No textbooks will be required for this course. Readings will be provided to you in PDF, which you are welcome to download and print or read and make notes in digital format. Excerpts from a range of relevant text sources will be provided. All assigned readings will be posted to Blackboard.

Referenced and further recommended texts include:
1. Allen, Edward and Iano, Joseph. Fundamentals of Building Construction Materials & Methods, 6th Edition, John Wiley & Sons, Inc. 2014.
2. Allen, Edward and Rand, Patrick. Architectural Detailing: Function, Constructability, Aesthetics, 3rd Edition, John Wiley & Sons, Inc. 2016.
3. Bachman, Leonard R. Integrated Buildings: The Systems Basis of Architecture, John Wiley & Sons, Inc. 2002.
4. Braham, William and Jonathan Hale, Eds. Rethinking Technology: A Reader in Architectural Theory. Routledge 2007. "*Surface Architecture" and other selected readings.*
5. Brookes, A. J, and C Grech. The Building Envelope. Butterworth, 1990
6. Daniels, Klaus. The Technology of Ecological Building. Birkhauser Verlag, 1997.
7. Daniels, Klaus. Advanced Building Systems, Birkhauser Verlag, 2003.
8. DeLanda, Manuel. Deleuze and the Use of the Genetic Algorithm in Architecture. Routledge 2007.
9. Janis, Richard and Tao, William K. Y. Mechanical and Electrical Systems in Buildings, 5th Edition, Pearson Prentice Hall 2014.
10. Kennedy, Sheila and Christophe Grunenberg. Material Presence: Return of the Real. Architectural Association, 2001.
11. Kieran, Stephen and James Timberlake. Refabricating Architecture: How Manufacturing Methodologies are Poised to Transform Building Construction. McGraw Hill 2003.
12. Kwok, Alison and Grondzik, Walter. The Green Studio Handbook. Routledge, 2018.
13. Latour, Bruno. Mixing Humans and Non-humans Together. Routledge 2007.
14. Moe, Kiel. Integrated Design in Contemporary Architecture. Princeton Architectural Press, 2008.
15. Moe, Kiel. Thermally Active Surfaces in Architecture. Princeton Architectural Press, 2010.
16. Steenson, Molly. Architectural Intelligence. MIT Press, 2017.
17. Tilder, Lisa and Beth Blostein, Eds. Design Ecologies: Essays on the Nature of Design. Princeton Architectural Press, 2010. *Selected readings.*
18. Vassigh, Shahin and Jason Chandler. Building Systems Integration for Enhanced Environmental Performance. J. Ross, 2011.

In addition, the Building Energy Exchange (BE-Ex), Urban Green NYC, and other useful resources online will be referenced in class, and students are encouraged to access them.

Various learning tools available through Blackboard will be used in this course. You are encouraged to visit Blackboard and familiarize yourself with the structure of the course site and the use of its many features, in order to enable your full participation in the course.

In addition, Rhino 7, Grasshopper, ATHENA, EnergyPlus, and various plugins and web-based tools will be used in the course. Advance notice will be given to ensure that you have **working access** to all tools well in advance of deadlines. Therefore, no late work will be accepted on the basis of software issues.

Semester Course Schedule:

	Readings (to be completed before Tues. class)	Tuesday Class 11:00am - 12:20pm	Thursday Class 11:00am - 12:20pm
1		1/16	1/18
		Course Overview Project Part I Introduction *Team Organization and Document Access*	Building Systems Fundamentals Review *Teams Finalized and Study Buildings Selected*
2		1/23	1/25
	R1: Yu, Mayine Braham	Material + Structural Enclosures I	Material + Structural Enclosures II
3		1/30	2/1
	R2: Allen/Iano, Kieran/Timberlake	Fabricating (and Refabricating) Architecture	In-class Exercise: Designing with Masonry
4		2/6	2/8
	R3: Daniels/Janis	Environmental Controls I: Low-carbon Heating and Cooling	Guest Lecture: Multiscalar Indoor Environmental Conditions, *Dr. Jianshun Zhang*
5		2/13	2/15
		Analytical Methods for Performance-driven Design	**Project Deadline 1** Energy Modeling Tools Workshop
6		2/20	2/22
	R4: Moe/Kwok	Environmental Controls Part II: Energy, Buildings, Systems, and Infrastructure	Designing and Developing Details
7		2/27	2/29
	R5: Vassigh/Chandler, Kere	Graduate Research Presentations	*ARC-409 Studio Mid Reviews*
8		3/5	3/7
	R6: Mostafavi	*ARC-607 Studio Mid Reviews*	Systems-integrated Façades
X		3/12	3/14
		Spring Break	
9		3/19	3/21
	R7: Steenson, Kennedy	Design Optimization: Criteria, Tools, and Methods	**Project Deadline 2** Multi-variable Optimization Workshop
10		3/26	3/28
		Competition Day 1: Building Systems Charrette	Competition Day 2: Building Systems Charrette
11		4/2	4/4
	R8: Ryan	Guest Lecture: TBA	Deep Energy Retrofits Systems Integration
12		4/9	4/11
	R9: Latour, DeLanda	AR, AI, and Occupant-centric Systems Environments	Emerging Construction Techniques and Project Delivery Models
13		4/16	4/18
	R10: Tilder & Blostein	Interim Project Pin-up Group 1	Interim Project Pin-up Group 2
14		4/23	4/25
		Research Symposium	**Final Project Deadline**
15		4/30	5/2
		ARC-498/698/998 Reviews	*ARC-409 Reviews*

Schedule subject to change with reasonable notification

Assignments and Grading:

The total course grade will comprise evaluation of the knowledge you will be exposed to through lecture and reading, the development of your abilities to critically assess systems-related theory and practice, and the development of a well-reasoned and well-integrated proposal for an existing building coupled with evidence-based analysis. The means of evaluation will be two (2) exams, the term project with three (3) deadlines, and ongoing project communication through weekly updates and feedback. Online participation in course activities and discussion is mandatory. Exams will be completed on Blackboard, and will cover material that has been reviewed in lecture, readings, and discussion. Timely submission of project materials is critical; no late work will be accepted.

Blackboard will be used to communicate all information pertaining to readings, project requirements, and to record grades for the course. Friday class meetings will function as in studio, with progress presentation and critique from your TA or the instructor. Your project progress will be submitted weekly, and assessed as part of the total Project Grade.

Unless or until university policy changes regarding on-campus or remote teaching modalities, in-person attendance in class is mandatory. Attendance will be taken via sign-in sheet for each class. It is the student's responsibility to ensure that he/she/they are signed in each class period. Two unexcused absences will result in flagging via SUccess. Three unexcused absences will result in a full letter grade penalty, in addition to counseling with the instructor regarding withdrawal from the course. Four unexcused absences will result in automatic failure of the course

Your work may be used by faculty and teaching assistants in the future for educational purposes. Your registration and continued enrollment in this course constitute your permission per Syracuse University policies.

Grading will be distributed as follows:

- Project (Total): 60%
  - o Rubrics with clear evaluation criteria and the weighting of different components will be provided for each of the three phases of the project

- Individual Exercises: 30%
- Discussion and Presentation: 10%
- Opportunities for Extra Credit may be integrated into the semester, and will be announced in class *only*

The following standard grading scale will be used for conversion of numeric grades:

Grades	Grade Points/Credit	Percentage Range (UG)	Percentage Range (Grads)
A	4.0	94 - 100	94 - 100
A-	3.66	90 - 93	90 - 93
B+	3.33	87 - 89	87 - 89
B	3.0	84 - 86	84 - 86
B-	2.66	80 - 83	80 - 83
C+	2.33	77 - 79	77 - 79
C	2.0	74 - 76	74 - 76

C-	1.66	70 - 73	70 - 73
D	1.0	60 - 69	N/A
F	0.0	0 - 59	0 - 69

University Attendance Policy

Attendance in classes is expected in all courses at Syracuse University. It is a federal requirement that faculty promptly notify the university of students who do not attend or cease to attend any class. Faculty will use Early-Semester Progress Reports and Mid-Semester Progress Reports in Orange SUccess to alert the Registrar and Financial Aid Office on non-attendance. For more information visit:

Students: Information for Students: Non-attendance or Stopped Attending

Attendance in classes is expected in all courses at Syracuse University. Students are expected to arrive on campus in time to attend the first meeting of all classes for which they are registered. Students who do not attend classes starting with the first scheduled meeting may be academically withdrawn as not making progress toward degree by failure to attend. When a student has missed a significant portion of coursework, and they were not academically withdrawn from the class, they should confer with their instructor or advisor to explore options, including withdrawal from the course. Instructors set course-specific policies for absences from scheduled class meetings in their syllabi. Students should also review the university's religious observance policy and make the required arrangements at the beginning of each semester.
https://policies.syr.edu/policies/university-governance-ethics-integrity-and-legal-compliance/religious-observances-policy/

Academic Integrity:
Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice. Instances of academic dishonesty will result in failure of the course and disciplinary review.

Religious Observances:
SU religious observances notification and policy, found at http://hendricks.syr.edu/spiritual-life/index.html recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holidays according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance provided they notify their instructors before the end of the second week of classes for regular session classes. For fall and spring

semesters, an online notification process is available for students in My Slice / StudentServices / Enrollment / MyReligiousObservances / Add a Notification.

Disability Statement:
Syracuse University values diversity and inclusion; we are committed to a climate of mutual respect and full participation. There may be aspects of the instruction or design of this course that result in barriers to your inclusion and full participation in this course. I invite any student to contact me to discuss strategies and/or accommodations (academic adjustments) that may be essential to your success and to collaborate with the Center for Disability Resources (CDR) in this process.
If you would like to discuss disability-accommodations or register with CDR, please visit Center for Disability Resources. Please call (315) 443-4498 or email disabilityresources@syr.edu for more detailed information.
The CDR is responsible for coordinating disability-related academic accommodations and will work with the student to develop an access plan. Since academic accommodations may require early planning and generally are not provided retroactively, please contact CDR as soon as possible to begin this process.

Stay Safe Pledge:
Syracuse University's Stay Safe Pledge reflects the high value that we, as a university community, place on the well-being of our community members. This pledge defines norms for behavior that will promote community health and wellbeing. Classroom expectations include the following: wearing a mask that covers the nose and mouth at all times, maintaining a distance of six feet from others, and staying away from class if you feel unwell. Students who do not follow these norms will not be allowed to continue in face-to-face classes; repeated violations will be treated as violations of the Code of Student Conduct and may result in disciplinary action. Further guidance, including tips on how to address students who are not upholding these requirements, may be found in The Stay Safe Pledge: Guidance for Faculty, TAs, and Instructional Staff.

Use of Class Materials and Recordings:
Original class materials (handouts, assignments, tests, etc.) and recordings of class sessions are the intellectual property of the course instructor. You may download these materials for your use in this class. However, you may not provide these materials to other parties (e.g., web sites, social media, other students) without permission. Doing so is a violation of intellectual property law and of the student code of conduct.

Student Mental Health:
Mental health and overall well-being are significant predictors of academic success. As such it is essential that during your college experience you develop the skills and resources effectively to navigate stress, anxiety, depression, and other mental health concerns. Please familiarize yourself with the range of resources the Barnes Center provides (https://ese.syr.edu/bewell/) and seek out support for mental health concerns as needed. Counseling services are available 24/7, 365 days, at 315-443-8000.

Academic Integrity:
Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on

attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. Syracuse University students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

The Violation and Sanction Classification Rubric establishes recommended guidelines for the determination of grade penalties by faculty and instructors, while also giving them discretion to select the grade penalty they believe most suitable, including course failure, regardless of violation level. Any established violation in this course may result in course failure regardless of violation level.

Discrimination and Harassment:
Federal and state law, and University policy prohibit discrimination and harassment based on sex or gender (including sexual harassment, sexual assault, domestic/dating violence, stalking, sexual exploitation, and retaliation). If a student has been harassed or assaulted, they can obtain confidential counseling support, 24-hours a day, 7 days a week, from the Sexual and Relationship Violence Response Team at the Counseling Center (315-443-8000, Barnes Center at The Arch, 150 Sims Drive, Syracuse, New York 13244). Incidents of sexual violence or harassment can be reported non-confidentially to the University's Title IX Officer (Sheila Johnson Willis, 315-443-0211, titleix@syr.edu, 005 Steele Hall). Reports to law enforcement can be made to the University's Department of Public Safety (315-443-2224, 005 Sims Hall), the Syracuse Police Department (511 South State Street, Syracuse, New York, 911 in case of emergency or 315-435-3016 to speak with the Abused Persons Unit), or the State Police (844-845-7269). I will seek to keep information you share with me private to the greatest extent possible, but as a professor I have mandatory reporting responsibilities to share information regarding sexual misconduct, harassment, and crimes I learn about with the University's Title IX Officer to help make our campus a safer place for all.

Faith Tradition Observances:
Syracuse University's Religious Observances Policy recognizes the diversity of faiths represented in the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their traditions. Under the policy, students are given an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance, provided they notify their instructors no later than the academic drop deadline. For observances occurring before the drop deadline, notification is required at least two academic days in advance. Students may enter their observances in MySlice under Student Services/Enrollment/My Religious Observances/Add a Notification.

Academic Rules/Academic Work:
Educational use of student work: I intend to use academic work that you complete this semester in subsequent semesters for educational purposes. Before using your work for that purpose, I will either get your written permission or render the work anonymous by removing identifying material.

Tutoring:
The School of Architecture offers free individual and small group tutoring for students enrolled in ARC 423/623. Students can get information about tutoring by emailing Gus Nascimento at

ghnascim@syr.edu. There is no minimum grade requirement for this service. Whether you are looking to improve your grade, receive additional help understanding the course content, or improve your studying and academic skills, tutoring is an excellent resource and strongly encouraged.