Architecture 672
Future Building Skins: Advanced Applications in Architecture

Units: 3
Term: Fall  Day: Tue  Time: 4:00pm-6:50pm

Course Description for 672

Architecture 672a is proposed as a 3-unit course that meets once a week for 3 hours. The following describes the basic 672 course.

The course will focus on the development of novel façade system solutions—solutions responsive to the shortcomings of contemporary façade systems—with an emphasis on their application in both new and existing buildings.

The building façade system uniquely combines elements of performance and architectural expression like nothing else in architecture. It is a highly complex system that requires a detailed and comprehensive exploration of myriad, often competing, variables that converge at the building skin. Increasingly, architectural practice demands expert knowledge of the complexities of the façade system to realize building performance and budget goals. The façade system plays a defining role in a building’s appearance, a pivotal role in resilience and sustainability outcomes, and is critical to the health, wellness and productivity of building occupants. In addition, it typically represents 15-25% of a project’s construction budget. Façade system skills are vital for the successful practice of architecture in producing healthy, cost-effective, resilient and sustainable buildings and urban habitat.

Three predominant ongoing trends continue to drive change in façade system design: increasing geometric complexity, an expanding materials palette, and escalating performance demands as new legislation is introduced mandating improvements to the carbon performance of the building sector. These trends layer the fundamental building physics that each façade system design must accommodate, including the performative behaviors of thermal mechanics, water vapor and air transport in various materials, moisture and condensation management, and airflow and rainwater control. Best practice involves filtering new façade system applications—whether on new or existing buildings—through the performative and aesthetic requirements of a façade program.

Course content will include a critical assessment of contemporary building façade technology. Assignments will include novel façade system designs—responsive to identified shortcomings of the existing technology—and their application on new and existing buildings. A special assignment will focus on repositioning an existing building in
the local urban environment. Adaptive reuse and repositioning of existing building stock is currently one of the most important trends in urban real estate development. Old nonperforming buildings are being revitalized and reimagined in support of sustainable lifestyles focused not only on carbon performance and environmental impacts, but on life, work and wellbeing as an integral interconnected whole. People spend some 90% of their time indoors where day-to-day reality is largely shaped by the building skin, with its promise of daylight, natural ventilation and connection to nature. The design of new habitats in repurposed buildings will heavily on the façade system to realize project goals related to health, well-being, and productivity.

Students will learn to evaluate a proposed building project to define performance and aesthetic goals that anticipate occupant needs and support resilient and sustainable outcomes, while creating an optimal framework for decision making during the design development process. Students will develop basic system design and construction details in response to these goals. Design development processes will include sketching, computer-aided design and analysis, and physical modeling to study how components come together to form a whole. The work product should represent a holistic technical system clearly linked to the project goals.

**Learning Objectives**

**LO-1:** a critical assessment of contemporary façade technology that identified shortcomings that can be addressed through a creative problem-solving process.

**LO-2:** establishing a basis-of-design for a façade system development program that defines goals necessary to assure resilient and sustainable outcomes that meet the aspirations of owners and occupants.

**LO-3:** methods of inquiry and strategies for informed decision making and creative problem solving.

**LO-4:** a comprehensive, deep understanding of the critical role of the façade system in resilient and sustainable buildings and urban habitat.

**LO-5:** the ability to specify, detail and implement an advanced, forward-looking façade system solution to any specific building application.

**Prerequisite(s):** Course can be taken by undergraduate or graduate students of upper division standing

**Co-Requisite(s):** None

**Concurrent Enrollment:** None

**Recommended Preparation:** None

**Course Notes**

**The Class Ethos**

This is a broad-based survey course on the critically important building façade system. There is a scarcity of good textual material on this subject. The course will rely heavily on in-class presentations by the instructor and on visiting lecturers.

In addition to the required readings a general (non-required) reading list is also suggested above. There will be a short class discussion on the weeks required readings so it is important that you have read the material and engage in the discussion.
At its core, this is a class in critical thinking and creative problem solving. Not only will conventional façade design and delivery practices be reviewed, they will be challenged. The instructor asks that the class operate under the belief of a shared equality of intelligence and that all ideas deserve consideration. The instructor asks you to be empathetic toward your peers and to acknowledge everyone's contribution with kindness. And he encourages you to speak up for your ideas and try out new ones. Take outrageous positions. Fall on your face. Be wrong. Respectfully challenge and critique each other. Have fun!

**Technological Proficiency and Hardware/Software Required**

Zoom for online learning classes
Rhino for 2D and 3D drawing, Graphics and Presentation software as needed for your assignments and final project
Ability to sketch by hand is not required but will be useful skill to have in this class

**Recommended Readings**

Required readings will be available in the department library. If any reading is not available the required reading will be provided as a handout. You do not need to buy the books listed in the readings for this course.
You are responsible for having reviewed the required items read **BEFORE** the date listed on the syllabus (except for the first week of the semester). There will a 15 min discussion on the material in the required readings and there may be pop quizzes on certain readings. There may be additional readings and reference material required as the class progresses. Required readings are listed separately within the syllabus as they directly rate to specific homework assignments and class discussions.

The following are the required readings for this course.
- Hodge, Brook. *Skin + Bones, Parallel practices in Fashion and Architecture*, MOCA

Suggested Additional Readings:
- Ayon, Angel. *Reglazing Modernism: Intervention Strategies for 20th-century Icons*
Description and Assessment of Assignments

In-Class Work:
Participation in classroom exercises is an important element of the education this class offers. These classroom exercises will be comprised largely of critical discourse and debate. You cannot receive credit for this in-class work if you are not present. Attendance is the precondition for receiving credit for the work that will be done in class.

In-Class Presentations
To begin developing the research skills as well as hone your oral speaking skills, you will be charged with delivering brief oral presentations of (5 to 10 minutes or less) to the class involving your research. These presentations, which will be directed by a prompt (that can be as broadly or narrowly construed as you like), ask you to explore the subject we are studying. These presentations provide context for the class’s discussion of the topic. The study of architecture, after all, is in no way narrowly limited to technology, but also includes cultural and political dimensions. Possible topics and sources will be suggested. In your research, you are expected to go beyond the sources provided. The class instructor is am looking for critical thinking in all aspects of your work. Audiovisuals are encouraged and the graphic quality of your presentations should reflect your aspirations to a highly visual profession.

Participation:
Class attendance and participation are critical. The grading structure (below) reflects this. The instructor will be looking for your active engagement and participation in the dialogue that will span this semester.

Assignments
Assignments will be made on a weekly basis. The instructor asks you to arrive at class having completed the assignment—and having thought through the significance and implications—in advance, and be prepared to discuss, ask questions, express opinions, and respond to the comments of your classmates with considered respect and intelligence.

Reading Assignments
Reading assignments will be made on a weekly basis. It is important that you have read the material before class as there will be discussions in class on the readings.

Final Project
The final project will test your comprehensive, deep understanding of the critical role of the façade system in resilient and sustainable buildings and urban habitat. The final project will involve the development of a conceptual design for a façade system. A detailed context will be defined. The deliverables for this assignment can take the form of a term paper, a narrative or a graphic novelette. To be discussed in class at the beginning of the semester. Upon completion of the project you will have the ability to specify, detail and implement an advanced, forward-looking façade system solution to any specific building application.

Grading Breakdown
<table>
<thead>
<tr>
<th>Assignment</th>
<th>% of Grade</th>
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<tbody>
<tr>
<td>Assignments and Attendance</td>
<td>10%</td>
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<tr>
<td>Mid term proposal</td>
<td>25%</td>
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<tr>
<td>In class presentations</td>
<td>25%</td>
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<tr>
<td>Final Project report and presentation board</td>
<td>40%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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**Grading Scale**

Course final grades will be determined using the following scale:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage Range</th>
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<tbody>
<tr>
<td>A</td>
<td>95-100</td>
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<tr>
<td>A-</td>
<td>90-94</td>
</tr>
<tr>
<td>B+</td>
<td>87-89</td>
</tr>
<tr>
<td>B</td>
<td>83-86</td>
</tr>
<tr>
<td>B-</td>
<td>80-82</td>
</tr>
<tr>
<td>C+</td>
<td>77-79</td>
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<tr>
<td>C</td>
<td>73-76</td>
</tr>
<tr>
<td>C-</td>
<td>70-72</td>
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<tr>
<td>D+</td>
<td>67-69</td>
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<tr>
<td>D</td>
<td>63-66</td>
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<tr>
<td>D-</td>
<td>60-62</td>
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<tr>
<td>F</td>
<td>59 and below</td>
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**Course-specific Policies**

**Assignment Submission**

Unless otherwise stated, all assignments should be double-spaced, typed in 10-point Arial font with one-inch margins. Works cited should employ Chicago format. Pages should be numbered in the upper right corner and have the following information:

Your Name:
Arch 672a: Semester/Year
Instructors names:
Date:
Assignment Name or Number (e.g. Take-Home Mid-Term)

**Grading Timeline**

Just as you promise to turn in your papers in a timely fashion to the instructor, the instructor promises to return them with comments to you. Mid and end of semester evaluations will be emailed to each student. Mid-semester
evaluations will be provided the week following semester break. End of semester evaluations will be provided during the last two weeks of the semester.

**Late work**

It is your responsibility to finish each assignment by its due date and time. The instructor is willing to consider giving extensions, but they must be for legitimate medical emergencies, documented by a letter from a doctor indicating that you were too sick to complete the work. If you turn in a paper late without having cleared it with the course instructor first, it will be marked down 1/3 of a grade for each day it is late and will receive no written comments. (Thus, if you hand in a paper on Friday that was due on Tuesday, and it merits a B grade, you will receive, due to the lateness penalty, a C).

**Technology in the classroom**

Rhino software is required for the course. Also, instructor asks that you check your email every twenty-four hours of the school/work week, as they will communicate with you through it. The instructor will provide his contact information to you.

**Academic integrity**

Taking the words of another author and passing them off as your own undermines both your learning process and the academic community of which you are now a member. If you are caught plagiarizing, you will receive a failing grade for this course, and you may also be dismissed from USC. Generally, to avoid plagiarism you must do the following: give credit to the proper sources for any ideas you reference that are not your own; avoid turning in papers written for another class; and be careful when you work with tutors, friends, or family members, as if the person helping you alters your work substantially, this is plagiarism as well. For a complete definition of what constitutes plagiarism, see your SCampus Student Guidebook (in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b). If you have further questions, don’t hesitate to ask the instructor.

**Attendance**

The instructor wants you to succeed in this course. If you need accommodations for documented medical reasons, or religious reasons or other accommodations, please contact the instructor during office hours. For medical absences a letter from your doctor explaining the medical situation(s) is required. The instructor will work with you to plan reasonable accommodations. Please discuss with the instructor as early as possible any other support you may need.

**Classroom norms**

While The instructor is happy to have you use laptops, tablets, and other electronic reading/writing devices in class, they ask that you please restrict your usage to only materials relevant to class and to please keep your phones silent and away for the duration of class.

**Course evaluation**
Two surveys will gather student opinions about the course: the mid-semester evaluation and the standard USC course evaluation survey at the end of the semester. Your opinion is valued and can make a difference in how this course is conducted; please give your honest and constructive recommendations.

**Course Schedule: A Weekly Breakdown**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics/Daily Activities</th>
<th>Readings/Preparation</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Week 1</strong>&lt;br&gt;LO-1</td>
<td><strong>Introduction and course description</strong>&lt;br&gt; <strong>Lecture 1:</strong> Sustainababble: Sustainability and the façade system in buildings and urban habitat&lt;br&gt; A critical assessment of the current state of buildings and their façade systems.&lt;br&gt; <strong>Reading discussion</strong></td>
<td>Chapter 3: Why Skins: Building sustainability and the relevance of the façade zone.&lt;br&gt; Mic Patterson, <em>Skin and retrofit: Challenging the sustainability of curtainwall practice in tall buildings</em>, PhD dissertation, 2017</td>
<td>none</td>
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<tr>
<td><strong>Week 2</strong>&lt;br&gt;LO-1&amp;2</td>
<td><strong>Adaptive Capacity and the forces of obsolescence</strong>&lt;br&gt; <strong>Lecture 2:</strong> How long should a building and its façade last&lt;br&gt; <strong>Reading discussion</strong>&lt;br&gt; <strong>Assignment 1:</strong> How long should a building last</td>
<td>Chapter 4: Skin deep durability: Extending service life and quality of curtainwall systems to enhance sustainability of buildings and urban habitat. Mic Patterson, <em>Skin fit and retrofit: Challenging the sustainability of curtainwall practice in tall buildings</em>, PhD dissertation, 2017:</td>
<td>none</td>
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<tr>
<td><strong>Week 3</strong>&lt;br&gt;LO-2&amp;4</td>
<td><strong>Resilient Skins</strong>&lt;br&gt; <strong>Lecture 3:</strong> Understanding resilience in buildings, their façade systems and urban habitat&lt;br&gt; <strong>Reading Discussion</strong>&lt;br&gt; <strong>Assignment 2:</strong> Building resilience assessment</td>
<td>Chapter 6: Supple skins: A methodology and framework for considering façade system resilience. Mic Patterson, <em>Skin fit and retrofit: Challenging the sustainability of curtainwall practice in tall buildings</em>, PhD dissertation, 2017:</td>
<td>Assignment 1</td>
</tr>
<tr>
<td><strong>Week 4</strong>&lt;br&gt;LO-1,2,3&amp;4</td>
<td><strong>Retrofit Skins</strong>&lt;br&gt; <strong>Lecture 4:</strong> Adventure (and motives) in façade renovation&lt;br&gt; <strong>Reading Discussion</strong>&lt;br&gt; <strong>Assignment 3:</strong> Local Repositioning Candidate</td>
<td>Chapter 7: Vintage skins: Retrofitting the tall face of Modernism. Mic Patterson, <em>Skin fit and retrofit: Challenging the sustainability of curtainwall practice in tall buildings</em>, PhD dissertation, 2017:</td>
<td>Assignment 2</td>
</tr>
<tr>
<td>Week</td>
<td>LO</td>
<td>Lecture</td>
<td>Section</td>
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<tr>
<td>8</td>
<td>2,3,4</td>
<td>Design Innovation and creative Problem solving</td>
<td>An Engineer Imagines. Rice, Peter.</td>
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<tr>
<td>9</td>
<td>2,3,5</td>
<td>Material Matters</td>
<td>final project research</td>
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<tr>
<td>10</td>
<td>2,3,5</td>
<td>Prototypes, Mockups and models</td>
<td>Case studies in rapid prototyping and robotic fabrication and construction</td>
</tr>
</tbody>
</table>
Statement on Academic Conduct and Support Systems

Academic Conduct:
Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, “Behavior Violating University Standards” policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

**USC Emergency Information**

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

**USC Department of Public Safety** – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu