Abstract:

Direct design of cities is often regarded as impossible owing to the fluidity, complexity, and uncertainty entailed in urban systems. And yet, we do design our cities, however imperfectly. Cities are created objects, intended landscapes, that are manageable, experienced and susceptible to analysis (Lynch, 1984). Urban design as a discipline has been focusing on "design" in its professional practices. Urban form and sensuous quality contain human values and decisions (Lynch, 1981). It is analytically distinct from "science" related research that tends to ask positive questions such as how cities function. The course introduces how urban design integrates urban ecology, systems science, data analytics and emerging technologies for shaping urban environments. Cities can be regarded as an urban metabolism or complex systems, in which the metabolic processes, or flows and fluxes of energy, matter, water, organisms, transportation and human movement as well as social and economic activities, determine the physical forms and spatial configurations of cities (Baccini and Brunner, 2012). Once we connect properties of urban form and their ecological processes, we would better know how a city should be designed to contain flows in sustainable and resilient ways. New technologies have also changed the way we understand cities. Technologies enable urban designers and planners to digitally think of the non-digital aspects of cities by using computer simulation and modeling (Batty, 1997). Empowered by new tools and technologies, cities are now far more designable than ever before. Urban design is becoming data-driven. An ability to handle massive data captured in cities or arising from people, devices, buildings and infrastructures, is critical to address problems occurring in places, streets, neighborhoods and cities in the era of internet of things (IoT). Students will learn principles of cities as ecologically sustainable systems, and how design as a transformative approach makes our cities greener, resilient, energy efficient and more adaptable to unpredictable future changes.

The course is structured by five topics as the follows:

1) Urban design and urban form
2) Urban landscape ecology
3) Urban density and complex urban environment
4) Urban energy and metabolism
5) Urban systems design and smart cities

Students are expected to participate in lecture series, seminars, presentations and project design or research. Project Design focuses on urban design by group, 3-5 students per group. Research Paper aims to develop a term paper by individual. Four options are offered in Spring 2023:

1) Project Design A: Tokyo Nihonbashi Smart District
2) Project Design B: Georgia Tech Campus Carbon Neutrality
3) Project Design C: Airport City Systems Design
4) Individual Research Paper (students to select a topic within the scope of the syllabus)
## Course Schedule

### 1) Urban design and urban form
- **1/13** Urban design: a normative theory
- **1/20** Urban form: representation, perceptual quality and performance
- Seminar on urban form and design

### 2) Urban landscape ecology
- **1/27** Ecological urbanism and urban sustainability
- Seminar on urban landscape ecology – I
- **2/3** Seminar on urban landscape ecology - II
- Urban landscape ecology and landscape urbanism

### 3) Urban density and complex urban environment
- **2/10** Proposal due and presentation (8:00-11:00am, 2-3 pages & 3 minutes for each student)
- **2/17** High-density urban development and organized complexity
- High-density urban development – Tokyo (guest lecture from Prof. Akito Murayama)

### 4) Urban energy and urban metabolism
- **2/24** Urban energy systems
- Seminar on urban climate, air, energy, material and water - I
- **3/3** Seminar on urban climate, air, energy, material and water – II
- Design for urban metabolism

### 5) Urban systems design and smart cities
- **3/10** Urban systems design for smart cities
- Seminar on smart cities I
- **3/17** Digital engineering systems for smart cities (Guest lecture: Dr Fischer & Dr Balchans)
- **3/24** Spring break
- **3/31** Seminar on smart cities II

### Final Review and Submissions
- **4/7** Final Presentation I (ARCH6447 and ARCH4447, 8:00-12:00pm, group presentation)
- **4/14** Final Presentation II (ARCH4447 and CP6552, 8:00-12:00pm, group presentation)
- **4/28** Final Submissions (TBA)

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*1/28: Deadline to sign up for the assignment option: Project design A, B, C or Individual Research Paper. Students begin to form the project groups.

### Laboratory Hour and Office Hour
(Optional, Eco Urban Lab – ARCH EAST 304)
- Laboratory hours will be offered every Friday 11:15-12:30pm. Students can use Eco Urban Lab for project teamwork or discussion.
- Office hours will be offered for students who would like to have their feedback of project design or research paper after the midterm. Time is to be arranged.

### Learning objectives
Students will be exposed to the following theories, methods and tools and techniques:
- Foundations in urban design and urban systems design.
- Urban ecology for urban green and blue systems planning.
- Understanding of smart urban systems and their performance of energy, material, water, air and human flows in urban environments.
- Design techniques and problem solving for urban complex systems.

### Learning outcomes
Students who successfully complete this class will be able
- To be familiar with recent literature of urban design and smart city movement;
- To develop a research design for the performance measure of sustainable urban systems;
- To develop teamwork experiences for a sustainable urban design project;
- To complete a group project of urban ecological design or smart urban systems design, or alternatively an individual term research paper under the guidance of the instructor.

Criteria of Performance Evaluation
1. 15% weekly reading note and class attendance
2. 15% seminar participation
3. 15% proposal, including proposal in writing (2-3 pages) and presentation on 2/4
4. 15% final presentation
5. 40% final submission: project design report or research paper

Submission Requirements
1. Weekly readings
   The weekly readings are divided by “required” and “recommended”. Students are to complete “required” readings and submit a reading note (half to one page by WORD) before the class begins. (required on 1/20, 1/27, 2/3, 2/17, 2/24, 3/3, 3/10, optional on 1/13).
2. Seminars
   Students will select articles from the “Seminar” reading list. Each seminar reading will be assigned to at least one student for making presentation in the class. Students should upload the presentation slide of seminar reading before the class begins.
3. Proposal:
   Each student will submit individual work on: 1) an “idea paper” as a project proposal or an extended abstract of the term paper (2-3 pages for each student in WORD document, including figures), and 2) presentation (max 3 slides, 3 minutes for each student), to upload before the class begins on 2/10.
4. Presentation:
   - For Project Design, students will form small project groups, around 3-5 students for each group. Students will choose from one of the thee: 1) Project A: Tokyo Nihonbashi, 2) Project B: Campus Carbon Neutrality & CEAs, or 3) Project C: Atlanta Airport City. The Project Design aims to create an urban design master planning or site design, with a focus on creative urban design (ARCH6447/ARCH4447) or scenario planning based on GIS data analytics (CP6552), or a combination of both.
   - For Research Paper, individual student will present the progress of your research paper based on a topic that is within the scope of the five topics in the course outline.
   - Students will present Project Design or Research Paper by PowerPoints scheduled on 4/8 or 4/15 , no longer than 12 slides for each student. For the group project (e.g. 3 students), the total slides are no longer than 36 for the entire group.
5. Final Submission
   - Students for Project Design will develop the design work into a professional project report to incorporate individual writings and design images (portrait by InDesign). Individual contributions to the group work should be reflected in the report. The following work from ULI Competitions is a good reference for your project work deliverables in the final report: https://americas.uli.org/2021-uli-hines-student-competition-finalist-cattlyst-georgia-institute-of-technology/
   - Students for Research Paper will submit a term paper, no longer than 4,000 wordcount for undergraduate students (ARCH4447), and no longer than 5,000 wordcount for graduate students (CP6552 and ARCH6447)

The deadline of final submission will be on 4/28 (TBA). All submissions are to be uploaded to Microsoft TEAM folders. Hard copies are not required.
Reading List

**Topic 1: Urban design and urban form**

1. **Urban design: a normative theory (1/13)** - Weekly reading note submission is optional, not required.
   (required)
   (recommended)

2. **Urban form: representation, perceptual quality and performance (1/20)**
   (required)
   - Lynch K, 1981, “What is the form of a city and how is it made?” in *Good City Form*, MIT Press.
   (recommended)

2s. **Seminar on urban form and design (1/20)**
   (seminar)

**Topic 2: Urban landscape ecology**

3. **Ecological urbanism and urban sustainability (1/27)**
   (required)
   (recommended)
   - Burdett R, Sudjic D, eds. 2007, the part ‘Cities’ in *The Endless City: The Urban Age Project by the London
School of Economics and Deutsche Bank’s Alfred Herrhausen Society, Phaidon Press Ltd.


3s Seminar on Urban landscape ecology – I (1/27)
(seminar)

4s Seminar on Urban landscape ecology - II (2/3)
(seminar)

4. Urban landscape ecology and landscape urbanism (2/3)
(required)
(recommended)
- Field Operations, 2006, Fresh Kills Park: Master Plan, New York City Department of City Planning.

Topic 3: Urban density and systems complexity

5. Proposal Presentation (2/10)
(2-page proposal due in writing, and 3 minutes presentation for each student from 8:00am to 12:00pm)

6. High density urban development and organized complexity (2/17)
(required)
(recommended)

**Topic 4: Urban energy and metabolism**

7. **Urban energy systems (2/24)**
   (required)
   (recommended)

7s Seminar on urban climate, air, energy, material and water - I (2/24)
   (seminar)

8s Seminar on urban climate, air, energy, material and water - II (3/3)
   (seminar)

8. **Design for urban metabolism (3/3)**
   (required) - to select at least one from the two readings
   (recommended)


**Topic 5: Urban systems design and smart cities**

9. **Urban systems design for smart cities (3/10)**
   - to select at least one from the two readings

   **(recommended)**
   - GT Eco Urban Lab, 2020, Digital urban design tool box, Eco Urban Lab, Georgia Institute of Technology.

9s, 12s Seminar on smart cities (3/10, 3/31)
   - **(seminar)**

**Theme 1: Smart cities and urban data policy**
1. Kandt J, Batty M., 2020, Smart cities, big data and urban policy: Toward urban analytics for the long run, in *Cities*.
3-4. PCAST, 2016, President’s Council of Advisors on Science and Technology Report To The President: Technology and the Future of Cities, Source: PCAST, [www.whitehouse.gov/ostp/pcast](http://www.whitehouse.gov/ostp/pcast)

**Theme 2: Smart cities university laboratory**
6-7 UCL Centre for Advanced Spatial Analysis (CASA) – History and Current Projects [https://www.ucl.ac.uk/bartlett/casa/research/current-projects](https://www.ucl.ac.uk/bartlett/casa/research/current-projects)
9-10 MIT Senseable Cities Lab – Ongoing Projects - [https://senseabledb.mit.edu/labmap](https://senseabledb.mit.edu/labmap)

**Theme 3: Autonomous Vehicles driven future city design**
Theme 4: Smart cities as living laboratory - [https://www.sidewalklabs.com/toronto](https://www.sidewalklabs.com/toronto)
14-15 Sidewalk Toronto: The Urban Innovations
16-17 Sidewalk Toronto: Master Innovation & Development Plan

**Theme 5: Eco urban systems performance evaluation and certification**
18-20 Rueda, Salvado et al. 2015, Part I/ Part II - III/ Part IV - V, Ecological urbanism certification: urbanism certification with sustainability criteria, Barcelona Urban Ecology Agency.

10. **Digital engineering systems for smart cities (3/17)** - guest lecture, weekly reading note not required. (recommended)


13. Final Presentation I (4/7 - 8:00-12:00pm)
14. Final Presentation II (4/14 - 8:00-12:00pm)

**College of Design Faculty Statement on Diversity, Equity, and Inclusion**
The College of Design (COD) communities of faculty, staff, and students aspire to create and nurture an environment that is supportive of all backgrounds where different views and ideas are respected and encouraged. In all our pursuits, we commit to justice, diversity, equity, and inclusion.