COLUMBIA UNIVERSITY
Graduate School of Architecture, Planning and Preservation

MODULAR ARCHITECTURE: STRATEGY / TECHNOLOGY / DESIGN
A4788
Professor David Wallance AIA
Fall 2016

SYLLABUS *UPDATED 28 SEPTEMBER 2016*

OVERVIEW

We are on the cusp of an unprecedented and transformative change in the way we design and build our cities. Over the last decade interest in modular architecture has surged, and architects will increasingly be called upon to design multi-story urban buildings using modular techniques. To design in a modular language requires a fundamental shift in thinking at the conceptual level as well as a working knowledge of modular technology. This course will focus mainly on a studio design problem, in which you will develop a modular solution to a multi-story urban infill building on a site in located in NYC. In order to gain familiarity with concepts of modular architecture, the first two classes will consist of a lecture and a field visit to a recently constructed modular building. The balance of the semester will be devoted to the design problem, and we will work in a studio format.

The lecture will survey the history of modular architecture and will include case studies. In addition to an examination of design strategies and construction methods, we will cover related topics, including transportation, process engineering, industrial supply chain concepts, site logistics, scheduling and costs. We will delve into questions of cultural acceptance and the stigma commonly associated with "modular". The organization and politics of construction trade unions and their impact on modular adoption will be considered. We will survey the field of contemporary modular architecture and form a conceptual framework within which to categorize various approaches.

Our method will be inter-disciplinary, and we will learn to think in terms of business strategy, financing, marketing and sales, as well as the more familiar terrain of design and building technology. We will speculate on how the role of the architect might evolve if an industrialized approach to building were to become normative. Finally, we will evaluate modular architecture critically, and will consider questions such as: Would the widespread adoption of modular architecture inevitably lead to homogenization and dull uniformity? Can it be a tool for urban revitalization? Is it adaptable to a range of climates? Does it offer sustainable solutions? Can modular architecture be expressive of cultural distinctions?

During the last eight weeks of the semester you will design a multi-story modular pod hotel located on the Gowanus Canal in Brooklyn. You will work on the design problem in teams of three or four. We will meet weekly to review progress. The weekly critiques will emphasize conceptual clarity and technical rigor. The final presentation will be a fully developed design, including details and three dimensional analytical drawings. In addition, a narrative report will include a discussion of the design intention and its genesis.

Pre-requisite: Students must have completed Architectural Technology 5. Exceptions may be granted on a case by case basis and will depend on previously completed technical coursework and experience.

PART ONE: MODULAR STUDIES

WEEK **00** – BRIEF MEETING BEFORE TECH AND VISUAL STUDIES PRESENTATIONS

Part 1 – Introduction to course

Part 2 – Homework Assignment #1

WEEK **01** – LECTURE

Part 1 – History

1. Modular ideologies in modern architecture.
2. Historical overview: 1850-1970. Paxton's Crystal Palace. Cast-iron architecture. The Sears house. Maison Domino. The Lustron House. Levittown. Techbuilt. Habitat. The Nakagin Capsule Tower.
3. Contemporary overview 1970-present

Part 2 – Theory

1. Definitions
   a. Pre-fabrication
   b. Manufacturing
   c. Modular
   d. Flat-pack Modular
   e. Volumetric Modular
2. Spatial Strategies
   a. Spatially Determinate
   b. Spatially Indeterminate
3. Tectonic Strategies
   a. Structural Core System
   b. Aggregated Module System
   c. Frame and Panel System
   d. Plug-in Megaframe System
   e. Volumetric Unit System
4. Project Delivery Strategies
   a. Contract Modular
   b. Pod Modular
   c. Kit-o-parts Modular
5. Enterprise Strategies
   a. Closed Systems
   b. Open Systems
   c. Operating Systems

Part 3 – Discussion

Part 4 – Homework Assignment #2

WEEK **02** – FIELD TRIP

Part 1 – Class will meet to tour a recently completed modular project (location to be determined).

Part 2 – Homework Assignment #3

WEEK **03** – SITE VISIT

Part 1 – Class will meet at 5:30pm at Union Street Bridge, Brooklyn.

Part 2 – Discussion

PART TWO: DESIGN PROBLEM

With a grasp of the lecture material and the required reading, the students will go on to develop a volumetric modular system of their own design. The program will be a micro-unit or pod hotel located on the Gowanus Canal in Brooklyn. The following outlines work to be completed in advance of each class.

WEEK **04** – CONCEPT DESIGN

- Plans, sections, and isometric or axonometric views at 1/2" scale for each type of unit with functional detail responding to program requirements. Present two alternatives for each.

WEEK **05** – CONCEPT DESIGN

- Reiterate unit layouts with module dimensions established based on conversations with your critic.
- Present a series of alternative stacking studies, with modules drawn as simple "wire frames" in 3D (interior lines hidden). Include site model in 3D. Minimum of 3 distinctly different alternatives

WEEK **06** – CONCEPT DESIGN

- Reiterated stacking studies
- Full building floor plans at 1/8" scale with all program elements including circulation and cores. Locate shafts for system risers.
- Façade / image concept studies

WEEK **07** – DESIGN DEVELOPMENT

- Integrate façades into massing studies
- Chassis structural system concept – gravity and lateral loads
- Reiterate stacking, with structural load path diagrams for gravity and lateral loads

WEEK **08** – DESIGN DEVELOPMENT

- Façade system development
- Reiterate façades integrated into massing
- Unit interiors development
- HVAC and plumbing stack

WEEK **09** – DESIGN DEVELOPMENT

- Fully developed modules in 3D
- Large scale 3D exterior details
- Two perspective views
- Presentation storyboard

WEEK **10** – DESIGN DEVELOPMENT

- Catalog of module types
- Reiterate modules in 3d
- Reiterate large scale 3D exterior details
- Reiterate perspective views
- Reiterate presentation storyboard

WEEK **11** – DESIGN DEVELOPMENT

- Preliminary presentation review

WEEK **12** – FINAL REVIEW

MINIMUM PRESENTATION REQUIREMENTS:

- Site plan: 1/20" = 1'-0"
- Floor plans: 1/8" = 1'-0"
- Elevations: 1/8" = 1'-0"
- Sections: 1/8" = 1'-0"
- Enlarged Module Plans, Elevations, Sections: 1/2" = 1'-0"
- Modules in 3D view
- Catalog of Module Types
- 3D Large-scale Exterior Details (two required)
- Interior 3D Views (optional)
- Exterior 3D Perspective Views (two required) (an 1/8 inch scale physical model may be substituted for this requirement)

FINAL REPORT:

A narrative report is to be turned in at the end of the semester, on the day of the Final Review. The report should include a discussion of the design intention and its genesis; response to site, context and environmental conditions; the modular strategy chosen and why; method of transportation; general approach to site staging and construction logistics; description of technical systems (structural, envelope, mechanical). Include examples, with images, of one or more precedents that influenced the specific approach to modular architecture and discuss what was learned and adopted, and perhaps what was rejected from those precedents. Discuss how the formal aspects of the design are related to modular technology. Include data substantiating conformance to program, i.e. unit mix and square footage. Include reduced-size presentation drawings.