AT1: TECHNOLOGY + MAKING IN ARCHITECTURE

FALL 2014

CLASS DESCRIPTION

Where does technology emerge in architecture? Through scientific formulae, through digital simulation, through experimentation in making, through trial and error? Does technology influence architecture or has architecture always driven the necessary leaps in technology? To make architecture is to invent the future and technology has become a more forceful driver in digital age architecture than ever before. In AT1 we will explore the fundamentals of building technology and what it means to create bold, expressive and efficient built form and to gain the confidence to build these creations.

AT1 is the first course in the technology series at GSAAP and will provide a foundation for later discoveries in the AT curriculum. AT1 will serve as an introduction for the understanding of structural and environmental systems in architecture which will be explored in more depth in AT2 and AT3 courses, covering, respectively, advanced environmental and structural issues in architecture. AT4 and AT5 courses will explore in details both building envelope design and integrated systems design in architecture.

In AT1 the fundamentals of building technology will be studied in a series of lectures spanning historical progress in making in architecture, broadly split into the industrial, modern and digital eras. The fundamentals of building technology will be introduced in sequence starting with materials and construction methodologies, followed by structural and finally environmental technologies in architecture. In each of these areas of study, historical and transformative leaders in the development of technology will be reviewed. Technology + making derives from the individual, not merely the science. These critical connections and breakthroughs in invention will be explored and basic principles of building technology science uncovered.

Students will be assigned a semester long group case study that will develop their understanding of a specific technology breakthrough, associated influencer and built form examples. Case studies will be split into 2 in-class presentations through the semester as well as a formal case study report. Case studies will require construction of physical models and demonstrations of making in the material milieu of a specific building and technology.

CLASS INSTRUCTORS

Professor	Craig Schwitter	craig.schwitter@burohappold.com
Teaching Assistants:	Scott Overall	spo2107@columbia.edu (Lead TA and Recitation Leader)
	Jean Qin Guo	jqg2104@columbia.edu (Recitation Leader)
	Travis Heim	tsh2124@columbia.edu (Recitation Leader)

CLASS HOURS

Class time: Tuesday 9 – 1pm

Lecture: 9 – 11 am
Location: Avery 114
Recitation 11:15 – 12:45 pm
Location: Rooms TBD

RECITATIONS

Recitations will occur weekly following class. These classes will serve as smaller forums to review lecture material and provide more depth on technical principles. Sample problem solving will be encouraged in the recitations as preparation for homework assignments. Recitation periods will also be reserved for in depth review of case studies. Recitations timeslots will be used for extended classes for the case study presentations during weeks 5/6 and 10/11 during the semester.

ATTENDANCE

Formal sign in for classes will be required for the class. If you are not able to make class you must inform your TA or the professor directly as to reason. More than 2 absences from required classes will be grounds for low pass or incomplete grading.

HOMEWORK ASSIGNMENTS

There will be 6 homework assignments in the class. HW Assignments will be assigned and distributed after class and be turned in by 9am Tuesday morning the following week. Principles covered in HW assignments will be discussed during the recitations and sample problems will be discussed during recitations.

FINAL EXAM

A final take home exam will be given out to students at the end of the semester. Students are expected to work individually on their exams. Exams will be due during exam week, the week after final reviews. The final exam will cover topics from the course lectures and associated reading materials and will include both numerical problems, essay work and design studies.

GRADING:

HW (6)	30%
CASE STUDY 1	15%
CASE STUDY 2	25%
TAKE HOME EXAM	30%

High Pass	>90%
Pass	60 – 90%
Low Pass	50 – 60%
Fail	<50%

CLASS SCHEDULE AND LECTURE OUTLINE

9/2 LECTURE 1 TECHNOLOGY OF MAKING: FROM START TO FINISH

Topics: Intro to Making and AT Course Outline
HW: No Assignments

9/9 LECTURE 2 A SURVEY OF CONSTRUCTION MATERIALS AND METHODS

Recitation: Pick Case Study Teams and Subjects. Sample problem tutorials
HW: Assignment 1

9/16 LECTURE 3 PRINCIPLES OF FORCE AND MECHANICS 1

Era: Industrial
Influence: Hooke, Euler, Greeks, Romans and Beyond…
Recitation: Sample problem tutorials
HW: Assignment 2

9/23 LECTURE 4 PRINCIPLES OF FORCE AND MECHANICS 2

Era: Industrial
Influence: Hooke, Euler, Greeks, Romans and Beyond…
Recitation: Sample problem tutorials
HW: Assignment 3

9/30 LECTURE 5 EARLY ADVANCES: BEAMS AND COLUMNS

Era: Industrial
Influencers: Brunel, Paxton, Violett Le Duc, LaBrouste
Recitation: Group Case Study Reviews with Professor
HW: Case Study Work

10/7 LECTURE 6 INDUSTRIAL ERA ENTREPENEURS: FRAMES AND TRUSSES

Era: Industrial
Influencers: Gaudi, Eiffel, Nervi, Fuller,Maillart
Recitation: Group Case Study Presentation 1 (DAY 1)
HW: Case Study Work

10/14 LECTURE 7 LONGER AND THINNER | ARCHES, SUSPENDED STRUCTURES, DOMES, SHELLS, NETS

Era: Modern
Influencers: Amman, Roebling, , Isler, Candela, Otto, Geiger, Schlaich
Recitation: Group Case Study Presentation 1 (DAY 2)
HW: Assignment 4

10/21 LECTURE 8 TALLER | HI RISE MAKING

Era: Modern
Influencers: Sullivan, Kahn, Robertson
Recitation: Sample problem tutorials
HW: Assignment 5

10/28 LECTURE 9 ENVIRONMENTS 1 : CONTROLLING COMFORT

Era: Modern
Influencers: Carrier, Fordham
Recitation: Sample problem tutorials
HW: Assignment 6

11/4 NO CLASS

11/11 LECTURE 10 ENVIRONMENTS 2 : ENERGY IN A CHANGING WORLD

Era: Modern
Influencers: Lovins, McDonough
Recitation: Group Case Study Reviews with Professor
HW: Case Study Work

11/18 LECTURE 11 SKINS: PRINCIPLES OF BUILDING ENVELOPES

Era: Modern
Influencers: Prouve
Recitation: Case Study Study Presentation 1 (DAY 1)
HW: Finalize Case Study Reports

11/25 LECTURE 12 ENVIRONMENTS 3 : ENERGY, FORM AND ADVANCED INTEGRATION

Era: Digital
Influencers: Gehry, Calatrava, Hoberman
Recitation: Case Study Study Presentation 1 (DAY 2)
HW: Finalize Case Study Reports

12/3 NO CLASS - Final Review Week

12/3 FINAL EXAM ISSUED

12/10 FINAL EXAM DUE (11:59pm)

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CASE STUDIES:

Case studies will be a fundamental part of AT1. Students will be expected to work in collaborative study and research teams for the length of the semester on the case study. Teams will be formed prior to the 2nd lecture class when case study assignments will be distributed to all teams. Grades for the case study will be shared for the team and will constitute 40% of the course overall grade.

Case studies are meant to explore in depth a technology breakthrough in architecture by exploring the background of the individuals who progressed and challenged the status quo. The case study will begin with research into an individual's connection to technology development, precursor work, and other elements of the construction industry practice that led to the technology development. The second part of the case study is the actually craft of making a model, or representative detail from the body of work of the case study individual.

Case studies will be presented to the class in a 10 minute short presentation format. Presentations will be collected and compiled as a reference document for future use for all class participants. Case studies will be presented following lectures on 4 of the lecture days, substituting for recitations on those days.

Case study presentation 1 will focus on an individual whose contribution to technology has made a significant impact to making in architecture. Student teams will be assigned an individual technologist

from the list below. Students will work with their recitation TA's and the class professor on case study research. Outlines of case study presentations will be required for review by TA's and professor in review sessions prior to case study in class presentations.

Case study 1 will research in depth the background of the technology influencer, including key projects, and other elements important to the study of the individual. Case study presentation 1 should also review specifics of how the technology and material or construction methodology behaves, including research on material properties, manufacturing techniques, use in fabrication, and finally its implementation in architecture. Case study 1 will require presenting the material background, individual background and the material demonstration in class as well as a powerpoint based research report.

Case study presentation 2 will be an exercise in making. A key project will be selected from the individual's portfolio and a physical model will be made to illustrate a section, detail, or other assembly from the project. Models can be any scale and dependent on the project and illustration required to understand the materials and key aspects of the project at hand. Case study presentation 2 will require presenting the model to the class as well as a powerpoint based research study on the project.

All case studies are to be formatted into case study reports at the end of the second presentation. Formats for the case study report will be provided in advance so that work during the semester can be captured in the report. Reports will be compiled for the class as a research tool.

Case studies will be reviewed with TA's and the professor at intervals leading up to the presentations to ensure research is progressing. A list of possible case studies is presented below. Case studies will be randomly assigned to teams during the 2nd class.

Influencer	Material	Era
Brunel	Iron/Steel	Industrial
Brunelleschi	Stone	Industrial
Eiffel	Iron/Steel	Industrial
Gaudi	Stone	Industrial
LaBrouste	Iron	Industrial
Le Duc	Stone	Industrial
Wren	Stone	Industrial
Arup	Concrete	Modern
Berger	Fabrics	Modern
Candela	Concrete	Modern
Dieste	Masonry	Modern
Fuller	Aluminum	Modern
Geiger	Fabrics	Modern
Happold	Timber	Modern
Isler	Concrete	Modern
Kahn	Steel/Concrete	Modern
Maillart	Reinforced Concrete	Modern
Nervi	Concrete	Modern
Otto	Cables	Modern
Piano	Timber	Modern
Prouve	Curtain Wall	Modern
Rice	Glass	Modern
Rogers	Steel	Modern
Torroja	Concrete	Modern
Balmond	Steel	Digital

Ban	Cardboard	Digital
Calatrava	Steel	Digital
Carfrae	Plastics	Digital
Heatherwick	Multiple	Digital
Hoberman	Aluminum	Digital
Kaplicky	Composites	Digital
Liddell	Fabric/Film	Digital
Macfarlane	Glass	Digital
Robertson	Steel	Digital
Schlaich	Glass	Digital