Georgia Institute of Technology - College of Architecture
ARCH 2211: Construction Technology and Design Integration I (undergraduate)

Course Materials: *Fundamentals of Building Construction: Materials and Methods,* Fifth Edition, by Edward Allen, Joseph Iano, John Wiley & Sons, Inc. 2009

Course Description and Objectives:
Construction Technology and Design Integration I is a foundation course in architectural technology which introduces students to the important relationship which has always existed between architectural design and the art of building.

 The success of any architectural design is predicated on the success of its construction practices, processes and methods. The architect's competent and innovative choices in regards a building's site, its materials, its engineering systems and assembly techniques constitute the *art of building*. And acquiring the knowledge to make such choices is the goal of this course.

 Architectural technology is considered as both a physical means of building and the critical context within which we build. In order to establish this context, students will be introduced to the historical, ontological, ethical and aesthetic dimensions of building. In this regard, issues of sustainabilty will play an important role throughout the course's development.

 The art of building will be presented typologically according to materials and methods. Typical building materials will be studied, such as concrete, steel, wood and glass, as will their methods of assembly, joinery, fabrication and building integration.

 Innovative materials such as plastics, polymers, films and gels, which are changing the very nature of construction, will also be investigated, offering students a view to technologically determined and engineered materials.

 As noted by our textbook author Edward Allen, every building must be successful both in regards its *construction and its performance.* Students will become aware of the variables which ensure both the physical stability of a structure but also its long term operations.

 Building Construction is not only a means of erecting buildings, it is also an avenue for the elaboration of an architectural language. The choice of architecture's matter – its materials – results in a rhetorical context within which the building is situated.

 Understanding the relationship between the empirical facts of building technology (the how's) and the larger phenomenal and cultural conditions of architectural design (the why's) will be the primary emphasis and learning objective of the course.

Course Content:
The course is structured in a sequence of lectures according to the following themes:

1. *The Building Process*: performance and construction / players and practices
2. *Unseen architecture*: foundations (soils, excavation, drainage, retaining walls, site preparation)
3. *Monolithic construction*: concrete (history, material properties, one and two-way frame systems, pretensioning)
4. *Unit construction*: masonry (stone, brick, concrete block)
5. *Wall **vs**. Frame, Wall **and** Frame* (monolithic and unit, reinforcing systems, composite systems)
6. *Hidden frames*: wood construction (light frame systems)
7. *Revealed frames*: heavy timber construction, engineered timber systems
8. *Heavy frames*: pre-cast structural systems and connections
9. *Skeletal frames*: Steel structures and connections
10. *Vertical skins*: Enclosure systems, cladding, glass, windows, thermal and moisture protection
11. *Horizontal skins*: roofs and roofing systems
12. *Environmental and Ethical Issues of Building*: hazardous materials, recycling, design and construction attitudes and alternatives

 Throughout the semester, emphasis will be on learning the terminology and definitions associated with each of these construction methods and materials.
 In addition, the technical and environmental characteristics of manufacture, fabrication, and field application applicable to each method/material will be addressed.
 PowerPoint presentations are designed to explain basic concepts and terms.
 Lectures will also include a variety of architectural examples, both historical and contemporary illuminating the building processes under discussion.
 Different construction materials and techniques will be compared and contrasted.

Course Requirements:

I. Assignments and Exams:
 The assigned readings from the textbook for each lecture are listed in the syllabus and this material should be read prior to each class.
 There will be three class-period long examinations given and one final examination. The exams are comprised of multiple choice, short answer, identification and sketch-type questions. Exams will cover material covered in class (30%), in the assigned readings (30%), and in the lecture presentations (30%). PowerPoints will be available to students for review before each class.
 There will be a series of short, in-class drawing/graphic assignments. These are intended to help students understand the sequence and hierarchy of construction and to improve sketching skills.
 Attendance is mandatory and is taken at each class. If a class must be missed you must have an approved University excuse submitted to the Teaching Assistant.

II. **Evaluation**

The final grade will be determined as follows:

Course attendance (recorded) 10%
Exam #1 15%
Exam #2 15%
Exam #3 15%
In-class Sketch Problems (4) 20%
Final Exam 25%

Total 100%

COURSE OUTLINE and ASSIGNMENTS

W 1 Course Introduction: Themes/Syllabus/Requirements
The Building Process: Performance/Construction
Reading: Chapter 1, pp3-27
Constraints and Concerns: Codes, Zoning, MasterFormat, LEED, Testing

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W 2 Unseen Architecture: Foundations / Soils / Testing / concepts and methods
Reading: Chapter 2, pp29-55
Foundations: Deep Systems, Sitework, Retaining Walls, Drainage
Reading: Chapter 2, pp56-83
SKETCH PROBLEM #1 (20 minutes)
Monolithic Construction:
Concrete, stone and brick masonry: "the architecture of walls"

W 3 Concrete: the material and its history, properties and concepts of reinforcing
Reading: Chapter 13, pp515-551
Concrete: Architecture and engineering examples - "Forms and Formwork"
Concrete Frames: Sitecast Systems Part I
Reading: Chapter 14, pp553-570
Concrete Frames: Sitecast Systems Part II
Reading: Chapter 14, pp571-609

W 4 EXAM *Review*: Building processes and constraints, foundations and excavation systems, concrete and concrete framing systems
Course Content 1, 2, 3 and Book Chapters 1,2,13,14
EXAM #1

W 5 Unit Construction: stone, brick, and block masonry
Reading: Chapter 8, pp297-335
Brick Masonry: materials and production, sizes, techniques-walls and spans
Reading: Chapter 8, pp297-335
Stone and Concrete Masonry: materials and types, techniques, uses
Reading: Chapter 9, pp337-375
Masonry Walls: loadbearing and cavity wall, detailing issues, problems
Reading: Chapter 10, pp377-409

W 6 SKETCH PROBLEM #2 (20 minutes)
Wall vs. Frame Construction / Wall and Frame Construction
Wood: As material and system. Industry, environment, design roles
Reading: Chapter 3, pp85-130(*Progress Grades Due*)
Light (Hidden) Frames: history of wood systems, techniques, new trends
Reading: Chapter 5, pp161-207
Wood Light Frame II: sheathing, insulation, engineered systems
Reading: Chapter 5, pp209-219

W 7 Wood Light Frame III: Finishing the frame. Exterior and Interior finishes, windows, doors
Reading: Chapter 6, pp221-253, Chapter 7, pp255-295 Pre Exam 2
EXAM 2 Review: Unit and Light Frame construction. Brick, stone, block masonry. Wood in building, wood light frame systems
Course Content 4, 5, 6 and Book Chapters 3, 5, 6, 8, 9, 10

W 8 EXAM #2
Heavy (Revealed) Frames: Structures and Tectonics
Heavy Timber construction: mill construction, history, engineered products

Reading: Chapter 4, pp135-159
Engineered Heavy Timber: Case studies in design and construction

W 9 Fall Recess
Pre-cast Concrete Frames: fabrication, stressing, components, connections
Reading: Chapter 15, pp611-641
Pre-Cast Systems: construction process, design goals, new applications
Reading: Chapter 15, pp643-649

W 10 Steel Construction: history, material processes, shapes and components, joining methods, moment and shear concepts
Reading: Chapter 11, pp411-430
Steel (Skeletal) Frames: connection types, construction process, fireproofing
Reading: Chapter 11, pp431-487
SKETCH PROBLEM #3 (20 minutes)
Skins and Envelopes: Introduction to cladding and glass. “Glass Dreams”
Architectural trends and technical issues
Reading: Chapter 17, pp707-741

W 11 Glass: History, material processes, energy issues, windows and doors
Reading: Chapter 18, pp747-781
Cladding Design Concepts: Issues, requirements, testing
Reading: Chapter 19, pp783-807
Cladding Systems I: masonry and pre-cast curtain walls, EIFS
Reading: Chapter 20, pp809-833

W 12 SKETCH PROBLEM #4
Cladding Systems II: glass and metal / curtain wall technologies
Reading: Chapter 21, pp839-867
Roofing: Steep and low-slope systems, materials and trends
Reading: Chapter 16, pp651-705

W 13 Exam *3* Review: Heavy Frames (pre-cast and timber), Steel, Roofing
Course Content 7, 8, 9, 11 and Book Chapters 4, 11, 15, 16
EXAM #3

W 14 New Materials and Innovative Material Practices
Film: Construction documentary or Design documentary
THANKSGIVING HOLIDAY

W 15 Sustainability and Green Building Practices: Projects and Performances
Energy Review of Materials, Systems: Production, recycling, toxicity, cost
Reference: AIA Environmental Resource Guide
Final Exam Review and Final Discussion *Last Day of Class*
Skins: cladding, Glass, Curtain Wall systems (heavy and light)
Course Content: 9,10 Book Chapters: 17, 18, 19, 20, 21.

W 16 M-F Jury Week No Class

W 17 Final Exams Week
FINAL EXAM will be scheduled by the Institute