

ARE 335 - Materials & Methods of Building Construction

1/10

UN 15005 Spring 2019
Mon/Wed/Fri 10-11 and Wed 11-12 in ECJ 1.322

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Office Hours: Fri. 3-4 pm or by appointment

Grader: TBA

Course Description and Academic/Learning Goals: The objective of this course is to introduce students to the properties and applications of engineered building materials and related construction methods. Emphasis is placed on 1) the development of a technical vocabulary; 2) awareness of different building/construction components, their properties, and their three-dimensional configurations; and 3) understanding of related manufacturing/ fabrication and site construction processes. A team-based design/build project will serve as the primary mechanism for further developing "hands-on" problem-solving and technical communication skills.

This course covers general building material properties, codes, and standards; and material-specific properties/construction methods pertaining to soils, foundations, concrete, metals, wood, masonry, enclosure systems, plastic components, and moisture/air control materials. In the context of buildings, emphasis is placed on *engineered* systems and materials, rather than on those systems designed primarily by architects (such as building finishes).

This course, by necessity, involves the introduction of a large number of new technical terms. Exams will emphasize both concepts discussed in class and technical vocabulary. Acquiring a technical vocabulary does not come easy for most and doesn't result from last-minute exam "cramming." Learning theory has proven that mental retention of new terms is most effective with repeated study and usage/application. Accordingly, please read assignments prior to class, review course notes periodically, ask questions for any clarifications needed, and try to make the new terms part of your class exercises, presentations, and working technical vocabulary.

Prerequisites: Registration in this course requires credit for CE 324P, *Properties and Behavior of Engineering Materials*

Textbook & Course Notes:

Simmons, H. Leslie, *Olin's Construction: Principles, Materials, and Methods*, John Wiley & Sons, Inc., New York. (any recent edition)

Course notes will be posted on the course Canvas website by no later than 8 pm on the evening prior to the lecture. It is recommended that students review the lecture material in advance of lectures and bring it to class for "highlighting" and supplementing as the material is discussed.

Grading Policy: How Academic/Learning Goals will be Assessed: The academic/ learning goals for this class will be assessed via two hourly exams, two team project submittals, and student attendance/punctuality, as explained further below.

Mid-Term Exam	26
Final Exam	26
Design/Build Project	
Design/Construction Planning Submittals	20
Procurement/Fabrication/Construction Submittals	20
Attendance/ Punctuality	8
	100 %

The course grade scoring criteria are as follows:

	B +	≥ 87.00	C +	≥ 77.00	D +	≥ 67.00	
A	≥ 93.00	B	≥ 83.00	C	≥ 73.00	D	≥ 63.00
A -	≥ 90.00	B -	≥ 80.00	C -	≥ 70.00	D -	≥ 60.00

Exams:

Dates for the two exams are provided on the attached schedule of topics/activities. Make-up oral exams will only be available to those with legitimate, documented medical reasons (as verified with a note from a physician).

Design/Build Project

Teams comprised of four students (each balanced with CE and ARE members) will execute Design/Build projects that may serve any one of the following functions:

- Dog house
- Furniture
- Scaled model of a structure

Each project should have a footprint area of between 2.5 and 4 square feet and a height of between 18 and 30 inches.

Teams will complete two different submittals associated with the Design/Build Project:

1. Design/Construction Planning (due in week 7)
2. Procurement/Fabrication/Construction (including a ppt presentation and video of fabrication, completed by week 15)

Each team will be assigned one of the following primary structural materials:

1. Wood: plywood/OSB (up to 2 teams)
2. Wood: dimensional lumber (up to 2 teams)
3. Metal: erector set model-scale components or similar (up to 2 teams)
4. Masonry: clay brick (model-scale)
5. Masonry: CMU (model-scale)
6. Reinforced concrete: CIP (up to 2 teams)
7. Reinforced concrete: precast or tilt-wall (up to 2 teams)
8. Plastic tubing/shapes (PVC)
9. 3-D printed (restricted to those already familiar with this technology)

The **primary design objective for the project is to creatively express the structural system** of your project. Thus teams are encourage to consider innovative structural systems/geometries such as waffle slab, trusses, shells, lamella, vaults/arches/domes, strut & tensile structures, suspended cable structures, modular components/replication, etc.

Secondary design objectives for the project include **design-for-constructability** and to incorporate **reused/recycled material**.

Design/Construction Planning Submittal

Each team's first hard copy submittals (and ppt. file) should contain the following elements:

- 7 scaled drawings:
 - floor plan or framing plan
 - 2 exterior elevations
 - 2 building/wall sections
 - 2 joint/connection details (large scale)
- brief technical description of each material/component (you should research specs for this)
- fabrication/construction schedule (bar chart or precedence network format)
- listing of assumed productivity rates for key fabrication/construction activities (with source citations and bibliography)
- fabrication/construction "quality checklist" (min. of 2 pp. in length; 4 different types of resources; with source citations and bibliography)

Assessment evaluations of design/construction planning submittal #1 will consider the following criteria:

- *quality and completeness/thoroughness* of drawings and construction planning documents (60%) (e.g., considering *proper use of materials and proper detailing*)
- *innovativeness* of design and use of materials, including creative/expressive structural design and use of recycled material (30%)
- *on-time* submittal (10%)

Several Wednesday lab sessions will be reserved for interim team meetings with the instructor in which project progress-to date will be discussed with all team members present. Attendance/participation in such meetings will be recorded. Teams may also schedule meetings with the instructor *outside of class hours* (via email appointment).

Information (and assessment criteria) for the 2nd project procurement/fabrication/construction submittal will be provided at a later date.

Grades for this effort are on a team-basis. The project workload should be evenly and fairly distributed among all team members. The **instructor should be informed** of any situations where one or more team members fails to "deliver their share." In such situations, corrective actions will be taken, including the possibility of the instructor requesting from each student peer assessments of relative contributions.

Caution! Teams/students are solely responsible for the safe acquisition and application of materials, tools, and equipment associated with their project. The course instructor has NO responsibility for logistics/fabrication/construction safety or its supervision. REMEMBER: SAFETY FIRST!!

Attendance/Punctuality & Participation

Attendance will be recorded at the **start of class** on a periodic and random basis. Students are expected to avoid tardy arrivals to class.

Official Notices**Disability statement**

The University of Texas at Austin provides, upon request, appropriate academic accommodations for qualified students with disabilities. For more information, contact the Division of Diversity and Community Engagement, Services for Students with Disabilities, 512-471-6259 (Videophone: 512-410-6644) or <http://diversity.utexas.edu/disability/>.

Course Instructor Survey/Evaluation

An evaluation of the course and instructor will be conducted at the end of the semester using the approved UT Course/Instructor evaluation forms.

Undergraduate student Drop policy

From the 1st through the 12th class day (4th class day in the summer sessions), an undergraduate student can drop a course via the web and receive a refund, if eligible. From the 13th (5th class day in the summer sessions) through the university's academic drop deadline, a student may Q drop a course with approval from the Dean, and departmental advisor.

Emergency Preparedness Plan

Emergency Preparedness means being ready. It takes an effort by all of us to create and sustain an effective emergency preparedness system. You are your own best first responder. Please use <https://preparedness.utexas.edu/welcome-emergency-preparedness> as a resource to better understand emergency preparedness at the university, and how you can become part of and contribute to the preparedness community. To monitor emergency communications for specific instructions go to utexas.edu/emergency. To report an issue (none emergency) call 512-471-4441. In case of emergency, call 911.

Scholastic Dishonesty:

Scholastic dishonesty will not be tolerated. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

Schedule of Topics, Readings, Activities, and Due Dates

(Text chapter sections for assigned readings are shown in parenthesis)

<u>Wk #</u> <u>Monday date</u>	<u>Monday 10-11 am</u>	<u>Wednesday 10-12 noon</u>	<u>Friday 10-11 am</u>
1 Jan 21	HOLIDAY	Course Introduction; LAB: Project submittal #1 assignment; Team formation	Going metric (25); Gen Material Properties (24)
2 Jan 28	Gen Material Properties (24); Materials & the Environment;	Building Codes & Standards (1.2, 1.3); LAB: Project team meetings	Quality Responsibility; WTC Lessons;
3 Feb. 4	Soils, Foundations, & Earthwork (21.1-21.5)	FLOAT DAY	Soils, Foundations, & Earthwork
4 Feb 11	Soils, Foundations, & Earthwork	Soils, Foundations, & Earthwork; Videos LAB: Project team Meetings	Concrete (3)
5 Feb 18	Concrete	LAB: Project Team Meetings	Concrete
6 Feb 25	Concrete	FLOAT DAY	Concrete; Videos
7 Mar. 4	Metals (5)	LAB: Project submittal #1 presentations; Exam Review	Metals
8 Mar 11	MID TERM EXAM	Metals; LAB: Project submittal #2 assignment; Lab safety briefing	Metals
9 Mar 18	SPRING BREAK	SPRING BREAK	SPRING BREAK
10 Mar 25	NO CLASS	NO CLASS	NO CLASS
11 Apr. 1	Metals; Videos	FLOAT DAY	Wood (6.1-6.11)
12 Apr 8	Wood	Wood; LAB: Project team meetings	Wood
13 Apr 15	Wood; Videos	Masonry (4.1-4.10) LAB: Project team meetings	Masonry
14 Apr 22	Masonry	FLOAT DAY	Masonry; Videos
15 Apr 29	Plastics (6.13)	Exterior Envelope (7.4, 7.5, 8.5); LAB: Project team meetings	Moisture & Air Control (7.1, 7.2, 7.8, 7.9)
16 May 6	Moisture & Air Control	LAB: Project submittal #2 presentations	Course Feedback; Exam Review;

Final Exam: Saturday, May 18, 2 pm (Location: TBA)