WSE 425/525: TIMBER TECTONICS IN THE DIGITAL AGE

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Texts Learning resources will be available through Canvas.

Credits: 4
Baccalaureate Core: This course fulfills the Baccalaureate Core requirement for the Science, Technology, and Society category. It does this by encouraging students to analyze the role of material science, information technology and manufacturing in shaping new developments in engineering and architecture. Students will use parametric design tools and digital fabrication techniques, and experiment with traditional and engineered wood products to deliver a team project in collaboration with UO Architecture students.

Class capacity: 16

Term: Spring

Schedule:
This class meets three times weekly (3 hours lecture, 2 hours lab)

Prerequisites: junior standing

Course description: An exploration of the advances in design, construction and fabrication of timber buildings. Includes experimentation with both physical and digital models and a final project, in collaboration with UO Architecture students. Lec/lab/studio.

Course Summary: "Tectonics" can be defined as the art of deploying construction technology in such a way that it forms an integral component of the design and actively helps to shape it. Three main factors determine a building's tectonics: the material, the tools, and the design. The use of computers is dramatically altering the traditional way the material is processed as well as the design process. At the same time, timber as a building material is living a "new life", with the development of advanced engineering wood products, which are opening up new technical and design possibilities. In this course you will learn how tectonics of timber construction can benefit of the use of digital tools, technologies and techniques. Through readings, lectures, discussion, writing and hands-on activities using both physical and digital models, you will be encouraged to think creatively and critically on how digital design tools can support the tectonic quality of timber buildings. Learning exercises will build partner relationships and

interdisciplinary perspectives, culminating in a small group project.

Class content and agenda:

Week	Topic
1	**Introduction to the course**
	Face to face meeting – Intro to the project - team building
	MpR - Materials in timber structures
	NC - Rhino-GH Workshop
2	MpR - **Columns, beams**
	NC - Parametric design of columns and beams
	NC - Parametric design – individual scaffolding
3	MpR - **Frames and Trusses**
	NC -Parametric design of Frames and Trusses
	MpR - Connections in timber structures - FABLAB policy
4	MpR - **Arches and Domes**
	NC -Parametric design of Arches and Domes
	NC - Parametric design – individual scaffolding
5	MpR - **Membranes, Shells and Gridshells**
	NC - Parametric design of Membranes, Shells, Gridshells
	MpR – Connections in timber structures
6	MpR - **Plates and folded plates**
	NC - Parametric design of Plates and folded plates
	Design and build – kick off meeting
7	Design and build
	Design and build
	Team - Design and build
8	Design and build
	Design and build
	Design and build - collective review
9	Design and build - individual/small group conferences
	Design and build – individual/small group conferences
	Design and build – plan final steps
10	Design and build
	Presentations - Exhibition – Project Booklet

Class format: This course is designed in collaboration with the University of Oregon, Department of Architecture, Prof. Nancy Cheng.
Different class formats will be delivered during the course, with the objective to enhance

interdisciplinary learning and collaboration.
Classes will be delivered as interactive lecture/hands-on sessions, including both remote collaboration, through in-class teleconferences, and face-to-face activities. There will be in total four face-to-face meetings with the Architecture students (details in the course program)

Course Objectives:
Synthesis and critical thinking learning objectives:

- Understand the interactions and demonstrate the synergy of material science, technology, architecture and engineering, through examples and applications in the design of wood structural systems;
- Understand the role of science and technology in shaping the architectural, engineering and construction (AEC) industry over time.
- Understand the historical evolution of the (AEC) industry, through examples and applications of design, manufacturing and construction strategies used in timber buildings;
- Develop a knowledge of digital techniques for the design, manufacturing and construction of advanced wood structural systems;
- Develop analysis and synthesis skills through the applications of design principles in small scale projects;
- Develop collaborative skills, through participation in interdisciplinary team work.

Measurable Student Learning Outcomes (LOs)**:**
After successful completing of this course, you <u>should be able to</u>:

- STS Bacc-core LOs: Articulate in writing a critical perspective on issues involving science, technology, and society using evidence as support (assessed outcomes: exploratory and project portfolios)
- STS Bacc-core LOs: Analyze the role of science and technology in shaping diverse fields of study over time (assessed outcomes: team project and blog posting)
- STS Bacc-core LOs: Analyze relationships among science, technology, and society using critical perspectives or examples from historical, political, or economic disciplines. (assessed outcomes: team project and blog posting)

- Recognize and describe various types of structural forms;
- Understand and evaluate the use of specific wood products/systems in a structure;
- Recognize and describe various type of tools/techniques for the design, manufacturing and construction of wood structural systems;
- Understand the role of digital design and manufacturing in innovative timber construction projects;
- Articulate in writing a critical perspective on the role of materials, digital technology, architecture and engineering, and emerging societal issues, such as sustainability, through examples and applications in the design of wood structural systems;
- Develop teamwork skills

Additional learning outcomes for graduate students:

- Apply modeling techniques for the design and analysis of timber structures.
- Develop cross-disciplinary communication skills.

Evaluation of Student Performance:
Your grade will be calculated based on the total number of points you have earned on your individual and group assignments plus any extra credit points divided by 1000.
Your grade will be based on the following scale:
A = 93-100% A- = 90–92% B+ = 87–89% B = 83-86% B- = 80–82% C+ = 77-79%
C = 73-76% C- = 70-72% D+ = 67-69% D = 63-66% D- = 60-62% F = below 60%

The list below indicates the course assignments and the relative points:

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	FINALS
	Blog 8	Blog 8	Blog 8	Blog 8	Blog 8	Blog 2x8	Blog 2x8	Blog 2x8	Blog 2x8	Blog 2x8
			Exploratory portfolio							Project portfolio 80
					Final Project progress 130		Peer Review of final project 150			Final Project 200

With
(A) 2 portfolio submissions* (200 points each) = 400 points total
(B) 3 project submissions (worth 130, 150, 200 points, respectively)= 480 points total
(C) 10 weekly teamwork/participation (blog discussion)=120 points total

* Written assignments with a minimum of 1250 words each plus references.
- The Exploratory portfolio should include a critical analysis of case studies, demonstrating the role of materials, digital technology, architecture and engineering in a specific societal context.
- The Project portfolio should effectively communicate and demonstrate the role of materials, digital technology, architecture and engineering in shaping the teamwork project.

Course Policy

Discussion Participation
Students are expected to participate in all graded discussions, having prepared by studying the required readings and other resources. You will need to participate in our discussions on at least two different days each week, with your first post due no later than Wednesday evening,

and your second and third posts due by the end of each week.

Class presence
Presence and punctuality are fundamental, to take part to interactive, collaborative exercises in class. Please send an email to explain your absence in advance. Students who are repeatedly absent or arrive late to the lecture or recitation will have their Discussions and Labs grade lowered.

Homework
Homework must be submitted on time for full credit. Late homework will be penalized at the discretion of the instructor.

Teamwork
Since this course is interdisciplinary, each team will be composed of students with different background and skills. Roles will be assigned to each team member, according to her/his specific area of expertise, skills and interest.
Everyone must give, and demonstrate, his/her own contribution to the group assignment. Graduate students are expected to take a leadership role in team efforts, coordinating tasks according to students' varied backgrounds and abilities. Ability to work in a team is one of the expected learning objectives of this course and the development of this ability throughout this course will be part of the grading.

Statement Regarding Students with Disabilities
Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If you, as a student, believe you are eligible for accommodations but have not obtained approval please contact DAS immediately at 541-737-4098 or at http://ds.oregonstate.edu. DAS notifies students and faculty members of approved academic accommodations and coordinates implementation of those accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations."

Statement Regarding Religious Accommodation
As instructors we are required to provide reasonable accommodations for sincerely held religious beliefs. It is incumbent on you to make us aware of the request as soon as possible prior to the need for the accommodation. See the Religious Accommodation of Students Policy.

Respect for Diversity: The richness of this class is based on the presence of students from diverse backgrounds and perspectives. It is my intention that all students will be well served by this course, that they feel safe and respected, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups.

Expectations for Student Conduct
Student conduct is governed by the university's policies; see Student Conduct and Community

Standards.

Academic Integrity
Students are expected to comply with all regulations pertaining to academic honesty. For further information, visit Academic or Scholarly Dishonesty, or contact the office of Student Conduct and Community Standards (SCCS) at 541-737-3656.

OAR 576-015-0020 (2) Academic or Scholarly Dishonesty:

a) Academic or Scholarly Dishonesty is defined as an act of deception in which a Student seeks to claim credit for the work or effort of another person, or uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another.

b) It includes:

(i) CHEATING - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.

(ii) FABRICATION - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.

(iii) ASSISTING - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone's grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).

(iv) TAMPERING - altering or interfering with evaluation instruments or documents.

(v) PLAGIARISM - representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work. Plagiarism includes but is not limited to copying another person's work (including unpublished material) without appropriate referencing, presenting someone else's opinions and theories as one's own, or working jointly on a project and then submitting it as one's own.

c) Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University's Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.