CIVE 569 - INTERMEDIATE DESIGN OF WOOD STRUCTURES **SPRING 2009**

INSTRUCTOR: Richard M. Gutkowski, PhD, P.E.
Professor, Dept. of Civil and Environmental Engineering
Colorado State University
A105 Engineering Research Center, A207C Engineering Building
Ph. 491-8291 (ERC) or 491-6606 (Main Campus)
FAX: 491-2788 E-mail: gutkowsk@engr.colostate.edu

Jeno Balogh, Ph.D.
Assistant Professor, Civil Engineering Technology Dept.
Metro State College of Denver
Ph. (303) 352-4971
Fax (303) 556-2972 E-mail: jbalogh@mscd.edu

CLASS MEETING TIME - T,TH 2:30-3:45 PM **LOCATION:** Titan Lab/
TLN Teleconference Room

REQUIRED TEXTS:

Timber Construction Manual
by T. Herzog, J. Natterer, R. Schweitzer, M. Volz, W. Winter
Birkhauser – Publishers for Architecture

National Design Specification for Wood Construction (NDS)-current or recent edition (including Supplement - Design Values Wood Construction) (also NDS Commentary is desirable, purchased separately).
American Forest and Paper Association (AF&PA), American Wood Council

RECOMMENDED REFERENCE TEXTS:

Design of Wood Structures, current or recent edition
by D. Breyer, K. Fridley and K. Cobeen
McGraw-Hill

Wood Engineering and Construction Handbook, current or recent edition
by K. F. Faherty and T.G. Williamson
McGraw-Hill

Timber Construction Manual, current or recent edition
American Institute of Timber Construction

TENTATIVE TOPICS:

1. INTRODUCTION TO AESTHETICS OF WOOD STRUCTURES
2. PROPERTIES AND ADVANCED MECHANICS OF WOOD AS A STRUCTURAL MATERIAL
3. [a]OVERVIEW - NDS CODE PROVISIONS: COLUMNS,BEAMS,BEAM-COLUMNS,CONNECTIONS
4. GENERAL CONSIDERATIONS FOR WOOD STRUCTURES
5. CONNECTION DETAILING FOR WOOD STRUCTURES
6. SYSTEMS CONFIGURATION OF WOOD STRUCTURES
7. SPECIAL STRUCTURES - CASE STUDIES
8. COMPUTER SIMULATION OF WOOD/TIMBER STRUCTURES – AxisVM SOFTWARE
9. CURRENT DEVELOPMENTS IN TIMBER STUCTURES
10. [b]NON-NUMERICAL AND NON-TECHNICAL ISSUES IN WOOD CONSTRUCTION
11. [c]FIELD TRIP
12. [d]SPECIAL TOPICS OR CASE STUDIES

13. [e]COMPREHENSIVE APPLIED PROJECT

COURSE OBJECTIVE:

The objective of the course is to develop capabilities to configure and design structural systems in heavy timber construction and innovative light-frame systems, with an emphasis on the former. (It is not a course about light-fame housing).

COURSE GOALS ARE TO:

1. Develop understanding of the uniqueness and complexity of wood as a construction material.

2. Evolve ability to develop member framing layouts for wood structural systems.

3. Advance qualitative development of connection details for joints and supports for wood structures.

4. Investigate innovative wood structures via field trip(s) and in class case studies involving actual structures (illustrating both good practice and poor practice).

5. Implement student independent investigation of special topics outside the main covered classroom subject matter.

6. Expand ability to understand load paths and conceive unique, complete wood structural systems in wood.

7. Implement contemporary computer-based analysis of structural systems.

8. Put learning into practice via a comprehensive applied design project involving a real or highly realistic design project.

9. Provide learning and assessment modes to help prepare students for written and verbal presentation of their engineering work for critique and evaluation by knowledgeable professionals.

APPROACH TO THE COURSE:

The course focuses on the development of student capability to configure complete wood and timber structural systems in contemporary times. It is a scaled-down version of the type of instruction given in an intensive 9-month comprehensive Special Masters course taught at the Institute of Wood Construction, Swiss Federal Institute of Technology in Lausanne, Switzerland. The primary instructor has had long term involvement in that course. The primary textbook is written by the principal instructors (professors, engineers, architects) of that course. That course includes six applied design projects. The CIVE 569 course includes some selected content used in that course and one such applied design project

Much of the course is qualitative but intensive, based on the assumption that the prerequisites have been met for implementing ordinary "design computations" for wood/timber members. That is normally learned in a typical undergraduate course on conventional wood design, one emphasizing the learning of the NDS and other specification type codes. A brief overview of the more applicable topics will be provided. It is also prerequisite that the student has a basic familiarity with wood products (types, typical sizes etc.) for usual light-frame wood and heavy timber construction, and ordinary member design processes in either wood directly or for steel and/or reinforced concrete, indirectly. It is assumed the student has class room education or outside experience with applicable design specification codes, preferably for all these materials but at least one of them. However, several overview lectures will be included to cover the basics of wood member and connection design according to the applicable design code. The instructor's experience is that with such background a student can learn to further apply, as might be needed, the design specification code on his/her own or with assistance outside the classroom, if one has had such prior learning, i.e. continue learning a wood-based code "on the fly" outside for the most part.

The CIVE 569 course also requires a basic understanding of wood as a complex structural material, so some modest time will be spent on that aspect. Wood is a biological based material and, consequently, has unique non-isotropic material behavior. Some of that is included in lecture, but also by being given reference sources for more information.

NOTES: (Referring to the Course Topics List):

[a]The emphasis in this course is on applied wood engineering and evolving capacity to conceive and design wood/timber structural systems. It is the philosophy of the primary instructor that emphasizing the "nitty-gritty" of design code provisions hampers the conceptual process. But one eventually needs to size members for the design project activity. The prerequisite undergraduate course is intended to educate on details of the applicable "design code" for wood members - as related to light frame wood and heavy timber construction. It is presumed you have such knowledge in some way but also understood it may not be the case, if you were unable to access a basic wood design course. The pre-requisite (or an equivalent) might not be enforced (with instructor permission on a case by case basis) as a courtesy to self-motivated students. Use of some of the applicable code provisions will be overviewed via several accelerated lectures. Beyond that, as mentioned above, it is considered to be a manageable self-study learning process outside the direct scope of the CIVE 569 course.

[b]The external setting for promoting use of wood, a forest-based resource for structural purposes can be challenging, as well. Certain misconceptions about wood contribute to a diminution of its perceived range of range of application, e.g. "wood is primarily a material for light frame construction" or "forest products destroy trees" or "wood readily burns". Students may examine some of these or similar issues via preparation of brief comment/position papers on assigned topics. Short presentations might be used, too. Alternatively, a group discussion might be used. The intent is to be realistic, in that these issues can and do arise when trying to convince owners to do a major timber-based project. So it is an aspect of your course project as well.

[c]A one-day Saturday field trip within Colorado is usually planned in order to have students examine actual in-place wood constructions. Normally, one site in the trip is directly pertinent to the applied design project. Students will document the site visits via brief, general summary reports of their observations. This is a "weather permitting" activity and contingent on how the flow of the project unfolds, time-wise. Depending on the project location, it could evolve to a close by trip during the class week to just the project site.

[d]In lieu of some subjects in the course topic a), more engineering oriented

topics or case studies might be assigned as independent investigations.

[e]The applied design project will be an exercise involving either a real situation or a very realistic representation of one. In Spring 2007 it was a large theater complex for a theater group in Ft. Collins. The project will be done by a small team approach (3-4 students per team). In previous years it has been a bridge or a restaurant. It will involve conception, system configuration, manual and computer-based structural analysis, member design, connection configuration, structural drawings, and a reduced size physical model. Periodic short team written status summaries and/or verbal progress reports (briefings) are involved, for instructor feedback at periodic time points. A final written documentation and a verbal presentation are required. The instructor will provide assessment of the final report and qualified professionals outside the course usually participate in evaluating it and the team presentations.

REQUIREMENTS:

Class enrollment is limited to a small number, due to physical (room size) and functional (for achieving a desired “team meeting room” setting) limits. It also affords alternatives to usual modes of academic work and its evaluation. Thus, the following is tentatively planned and subject to possible/likely adjustment:

Written HW/Computer Work/Quizzes:

One educational emphasis is on self-motivated, professional external learning to augment class room lectures and other instruction vehicles. Very little traditional textbook homework problems are anticipated. Many aspects of the course are not readily reduced to simple HW exercises, anyway. Computer education on AxisVM, a commercial software package, is intended for use in the applied design project project. Some computer-based "HW" exercises are inherent, but the need to use the software in the project is the primary incentive to learn it.

Self-Learning Exercises:

Each student (possibly in pairs) may be required to conduct some additional reading/research and self-learning to expand upon topics initially introduced in class, matched to his/her observed individual interests, capabilities and potential benefit; but set by the instructor. Briefings to the class on at least one, and written submittal of work on both might be a component.

Case Studies:

The vast majority of these will be presented by the instructors, but students may be assigned one. As an example, each student (or possibly paired students) may be required to examine a real bridge or building or other type of timber structural system as case study and present it to the class, perhaps coming from the Timber Construction Handbook (Herzog et. al). The philosophy is that while less intensive than "theory," the insight from real applications (both good and inferior) is invaluable.

Examinations:

No written examinations are planned. The Final Examination will be the presentation of the term project, with requirements to be set later in the course.

GRADING:

The following is the anticipated, but very tentative, grading distribution. It is based on projection of certain extent of differing activities, so that could change as the course is dynamic and evolves over the duration of the semester:

HW/Computer Exercises	5-10%
Self Learning Exercises/Case Study	30-25%
Term Project Activity (including written reports)	45-50%
Final Examination	20-15%
TOTAL	100-100%

NOTE: If any grading category is reduced in extent of work assigned, then there might be a reduction in credit that would be proportionally moved to the other categories.