FNR 419 10
Furniture Product Development and Strength Design
Sem. 2., Class 2, lab 3, cr.3.

Instructor: Eva Haviarova, Associate Professor
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Office hours: by appointment

Class Time - Lectures: Monday & Wednesday, 10:30 to 11:30, FPRD 110
Class Time - Lab: Friday, 9:30 to 12:30, Wood Lab, FPRD 105

Course Description:

1. *Theoretical part*: We will address qualitative and quantitative principles of furniture construction; product development methodology and strength design principles; furniture joinery and product performance testing; product sustainability; end of life options; and material utilization.
2. *Laboratory part:* The course features hands-on laboratory exercises, evaluating furniture joints, and furniture structures. Students will be building creative customized products using traditional frame-type furniture methods.

Justification:
Graduates going into the furniture industry must be thoroughly familiar with the basic structures used in furniture production. They must also be well-grounded in the qualitative and quantitative principles of furniture construction. This course provides the background for students to undertake industrial technical product design of furniture. It also offers a limited background in product sustainability measures (Life Cycle Analysis).

Objectives of the Course: Students will learn to
1. Identify and specify appropriate furniture construction.
2. Determine whether the furniture has adequate strength, stiffness, and durability.
3. Determine whether the furniture will meet existing performance standards.
4. Determine product sustainability and propose material use.

Textbooks:
Selections from: "*Textbook of Product Engineering and Strength Design of Furniture*" by C.A. Eckelman (available via Brightspace).

The Complete Manual of Woodworking by Albert Jackson, David Day and Simon Jennings (available at bookstore).

Additional textbooks used by the instructor:
Wood Handbook: Wood as an Engineering Material. 1999. Forest Products Society. Reprinted from Forest Service, U.S. Department of Agriculture. An online version is available at: *http://www.fpl.fs.fed.us/documnts/FPLGTR/fplgtr113/fplgtr113.htm*

Wood and Wood Based Furniture Construction by Pavol Joscak. 2020. Technical University in Zvolen (provided by the instructor).

Tentative Course Schedule*:

Week		Topic
Week 1	Lectures *Lab*	Wood properties related to furniture construction *General safety in the wood research laboratory and individual safety training*
Week 2	Lectures *Lab*	Introduction to engineering design and design principles *Material utilization and lumber processing – Part 1*
Week 3	Lectures Lab	Classification and characteristics of furniture construction systems (furniture typology and used materials) *Material utilization and lumber processing – Part 2*
Week 4	Lecture Lab	Strength design principles and furniture construction. *Joint specimens preparation (dowel, square and round mortise and tenon)*
Week 5	Lectures Lab	Furniture joints (traditional - dowel, mortise and tenon and other types of joints and fasteners) *Joint specimens testing - bending test (dowel, square and round mortise and tenon)*
Week 6	Lectures Lab	Frame type construction (calculating chair strength external forces) *Building chairs of variable configurations (preparing parts)*
Week 7	Lectures Lab	Frame type construction (calculating chair strength internal forces) *Building chairs of variable configurations (joinery)*
Week 8	Lectures Lab	Furniture design – chairs; student projects *Building chairs of variable configurations (assembly)*
Week 9	Lectures	Furniture design – tables, upholstered furniture; Projects *Performance test on chairs*

Week 10	Lectures	Furniture design - case goods and shelving; Projects
	Lab	*Building cases of variable configuration – CNC router application*
Week 11	Lectures	Furntiure design - office furniture; Projects
	Lab	*Performance test on cases*
Week 12	Lectures	Performance testing of furniture: basic concepts, world standards, WRL based standards.
	Lab	*Student project - building custom chair – parts preparation*
Week 13	Lectures	Introduction to strength design software.
	Lab	*Student project - building custom chair – parts preparation and joinery*
Week 14	Lectures	Introduction to Life Cycle Analysis.
	Lab	*Student project - building custom chair – assembly and finishing*
Week 15	Lectures	Overview of strength design principles and sustainability in furniture product development
	Lab	*Student projects presentation*
		FINAL EXAM

* Instructor reserves the right to change covered material

Note: In this class, during laboratory exercises, you will learn to safely operate common woodworking equipment (table saw, radial arm saw, planer, jointer, drill press, sanders, etc.) and observe the operation of an industrial CNC router. You will use all this equipment to manufacture test specimens and to build furniture.

Grading:
This class will be taught as a problem and analysis design class with two lectures and one laboratory exercise per week. Students will be evaluated based on assignments, individual furniture design projects, quizzes, one exam, class participation, and attendance.

Undergraduate Students

Assignments (65%):		
Presentation 1 & 2	20%	(5% +15%)
Chair calculations 1 & 2	20%	(10% +10%)
Final project & PPT	25%	
Quizzes 4x	10%	(2.5% each)
Final exam	15%	
Class participation & attendance	10%	(5% + 5%)

Graduate Students

Assignments (65%):		
Presentation 1 & 2	20%	(5% +15%)
Chair calculations 1 & 2	20%	(10% +10%)
Final project & PPT	25%	
Quizzes 4x	10%	(2.5% each)
Final exam	10%	
Research Project/Article	**15%**	

Student grades, status, and progress can be discussed at any time upon request of either the student or the instructor. Grade appeal procedures are available by university policy.

WARNING: Late assignments and make-up exams will be granted only if arrangements are made with the instructor before the due date of the assignment or exam.

Class attendance:
It is the student's responsibility to know what was covered (including notes, handouts, and homework) in class during any absence. Contact the instructor if you anticipate extended absence.

Laboratory:
The student will be exposed to hands-on experience in a woodworking shop under the instructor's and technician's supervision. The main goal of the exercise is to develop a feel for wood as a material and learn to process it with woodworking machines into joints and furniture specimens, which will be tested and evaluated. The student will also be encouraged to work on one project (furniture piece) of his own. Strong emphasis is put on safe working habits in the woodworking shop.

Safety in the Woodshop:
All safety procedures established by the Wood Research Lab must be followed. No one can work in the lab without completing safety training. We use the HIS platform for general safety, which is required by Purdue University. In addition, the laboratory technician will implement the WRL safety protocol and, after training and examination, will sign off on using each specific piece of equipment. WRL safety page: https://ag.purdue.edu/department/fnr/lab-sites/woodresearch/about-us/safety.html

Cheating:
The student is obligated to solve the home problems on his own; however, assistance (working together) is legal and sometimes necessary for learning efficiency. Cheating on quizzes and exams and plagiarism will not be tolerated and will be dealt with according to the university policy.

What is Plagiarism?
The Council of Writing Program Administrators (CWPA) states that plagiarism "occurs when a writer deliberately uses someone else's language, ideas, or other original (not common knowledge) material without acknowledging its source". Thus, whenever a person chooses to repeat the exact words written by another author, that person must mark them with quotation marks ("") and provide a citation to the original source. Two excellent sources of additional guidance are:

1. Michael Harvey, *The Nuts and Bolts of College Writing* (Hackett Publishing Co.)
2. Gordon Harvey, Writing with Sources: *A Guide for Students* (Hackett Publishing Co.)

Use of AI:
Academic dishonesty includes using Artificial Intelligence to write your assignment. If students are permitted to use AI for an assignment by the instructor, they must disclose how and where they used it. Instead of using openAI to edit your assignments, we encourage students to use Grammarly or Hemmingway Editor. AI technology is evolving, so this policy is subject to change and will be updated on Brightspace.

Paper and Classroom Presentation (graduate students only):
A list of research topics will be provided from which each graduate student will select one for a research paper. Students may also suggest a topic in which they are personally interested. This paper must be typewritten and is expected to be of very high quality. The research paper will provide the basis for a 20-minute classroom presentation.

Best Practices in the Case of Campus Emergency:
Emergencies due to weather or other circumstances may necessitate a change in the course. Mass communication on email or text messaging will be developed to alert students of the cancellation of class or assignments. Information help is available at: http://www.itap.purdue.edu/tlt/faculty/

Please sign up for emergency text alerts. Text message sign-up procedures can be found at: http://www.purdue.edu/securepurdue/

Updates and emergency information will also be posted on Purdue's home page: http://www.purdue.edu/

Emergency Procedures Guide (EPG) can be viewed at: https://www.purdue.edu/emergency_preparedness/flipchart/index.htm

The Emergency Preparedness website is at:
http://www.purdue.edu/emergency_preparedness/

Specific building information is found in the Building Emergency Plan (BEP). The BEP is normally maintained by the Building Deputy (FPRD Bldg. Tracey Simerman - 494 3615. "Shelter in place" means that students should not leave the building when the outdoor sirens are sounded. Moreover, if the building fire alarms are activated, everyone must evacuate the building and should proceed to their emergency assembly area as specified in the BEP.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs, and values expressed by students and staff involved in this course. We support Purdue's commitment to diversity and welcome individuals of all ages, backgrounds, citizenships, disabilities, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences.

Nondiscrimination -- The existing Purdue University Nondiscrimination Policy: *Purdue University is committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life.*

*Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in (*http://www.purdue.edu/purdue/ea_eou_statement.html*) which provides specific contractual rights and remedies.*

Anti-Harassment Policy -- Strictly following and interpreting existing University Policy: *Purdue University is committed to maintaining an environment that recognizes the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding and mutual respect; and encourages its members to strive to reach their potential. The most effective way to work toward preventing Harassment is through education that emphasizes respect for every individual.*

Harassment in the workplace or the educational environment is unacceptable conduct and will not be tolerated. Purdue University is committed to maintaining an educational and work climate for faculty, staff and students that is positive and free from all forms of Harassment. This policy addresses Harassment in all forms, including Harassment toward individuals with legally protected status for reasons of race, gender, religion, color, age, national origin or ancestry, genetic information or disability and Harassment toward individuals for other reasons such as sexual orientation, gender identity, gender expression, marital status or parental status. The University will not tolerate Harassment of its faculty, staff or students by persons conducting

business with or visiting the University, even though such persons are not directly affiliated with the University.
Purdue Anti-Harassment Policy (III.C.1): http://www.purdue.edu/policies/ethics/iiic1.html