Subject Title: Glued Laminated Wood Structure

Course Basic Information	
Academic Unit:	**Civil Engineering Faculty**
Course title:	**Glued Laminated Wood Structure**
Level:	**MSc Master**
Course Status:	**Elective**
Year of Study:	**I – (first)**
Number of Classes per Week:	**2+2**
ECTS Credits:	**6**
Time /Location:	**According to time table**
Teacher:	**Prof. ass. Dr. Florim GRAJÇEVCI**
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Course Description:	Basic rules for structural forming member of glued laminated wood. Computation of special structural elements of glulam structure. Structural glulam wood Design, their member connections, erection design, supports. The verification of structural stability for special glulam wood structural system as it is "frame system".
Course Goals:	A theoretical Course aim to prepare the students for material property performances to be use for glulam wood structures. Design the different structural systems in base of glulam wood performances. Structural analysis and computation of each structural members form glulam wood material.
Expected Learning Outcomes:	- Analysis the actions and loads on glulam wood structures, use the safety partial coefficient for actions and material mechanical properties as per EC-1 and EC-5. Explain and counting the prefabricated glulam wood technological forming procedures, the specificity of glulaminated wood structures and the technical rules for forming the glulam structures. - Compute the simple structural elements, starting from single beam to geometry changes of structural members. - Compute the structural frame systems form glulam wood. - Compute the glulam structural Arch systems. - Design and compute the different support cases of structural members. - Design the bracing for different needs of the glulam

	wood structures.

Student Workload (should be in compliance with student's Learning Outcomes)			
Activities	**Hours**	**Days/weeks**	**Total Hours**
Lectures	2	15	30
Theory/ Lab Work/Exercises	2	15	30
Practical Work	0	0	0
Consultations with the teacher	2	2	4
Field Work	0	0	0
Test, seminar paper	2	3	6
Homework	2	15	30
Self-study (library or home)	2	10	20
Preparation for final exam	4	5	20
Assessment time (test, quiz, final exam)	2	1.5	3
Projects, presentations, etc.	1	7	7
Total			**150**

Teaching Methods:	- *Lectures, presentation with practical show cases of use the structural material and glulam structures.* - *Numerical exercises.* - *Semester Work Seminar with real cases.* - *Interactions during the lecture's presentations.* - *Groups exercises.*
Assessment Methods:	*During the semester time, are organizing the presentation of work progress were contains the assessment of:* - *Fist presentation 10%,* - *Second presentation 10%* *The semester work Seminar contain the maximum percentage of 50%.* *At the end of the course, the students work during the semester may take (70 to 75)% of course evaluation assessment.* - *The remedial 25 to 30 % the students have to defends the theoretical part of course.*
Literature	
Primary Literature:	*All presentation material – literature during the semester lecture. (electronic version)*
Additional Literature:	- *Werner, Zimmer., "Holzbau 1", Dach- und Hallentragwerke nach DIN und Eurocode, Berlin Aufl.-1996* - *Werner, Zimmer., "Holzbau 2", Dach- und Hallentragwerke nach DIN und Eurocode, Berlin Aufl.-1999* - *Eurocode 1* - *Eurocode 5* - *J. Porteous, A. Kemrani., "Structural Timber Design to Eurocode 5", 2007* - *Final draft, prEN 1995-1-1, Eurocode 5, "Design for Timber Structure" Part 1-1General Common rules and rules for*

	Buildings, December 2003 - *D. Breyer, K. Fridley, K. Cobeen., "Design of Wood Structure ASD", fourth edition, McGraw-Hill,* - *"Dissemination of information for training", En 1995, Eurocode 5: Design of timber structures, workshop 18-2o February 2008, Brussels* - *Leonardo da Vinci Pilot Project (CZ/06/B/F/PP/168007), Educational Material for Designing and Testing of Timber Structures – TEMITIS, "HANDBOOK 2 – According to Ec 5", Prague, October 2008* - *Ranta-Maunus, M. Fonselius, J. Kurkela, T. Toratti., "Reliability analysis of timber structures", Technical Research Centre of Finland, Espoo 2001* - *R. Boddenberg, Baustik und Holzbau, "Vorlesung Holzbau I", Wintersemester 2009/2010 Le Bois "L'architecture d'aujournad'hui", Paris* - *Georg Droge "Grundzuge des Holzebaues" Underwood & M. Hiuini "Structural deisgn", USA 1998*

Designed teaching plan:	
Week	**Week**
Week 1:	***Introduction*** • *Development time history and use of glued laminated wood material on structure.* • *Capability of glulam material.* • *Comparation of glulam with other structural materials.* ***Technological process of glulam forming materials*** • *Processing steps for forming of glulam.* • *Glulam Structure Constructive performances.* • *Glulam cross section types.* • *Technical rules for forming glulam.*
Week 2:	***Computing the simple glulam beams*** • *Presentation of different glulam simple beams.* •*Simple glulam beam with constant height.* • *Main principles for forming the support of simple glulam beams.*
***Week 3*:**	***Curves computation of glulam beams*** • *Knees beams, forming the curves.* • *Additionally, the appearing of Stress&Strain as a consequence of curving beams.* • *Numerical exams presentation.*
Week 4:	***Beams with different longitudinal geometry.*** • *Shear stress computation for the beam with longitudinal external slope site.* • *Bending stress and strain for glulam beams with different height.* • *The computation of maximum bending stress appears for the beams were no continual height.* • *Calculation of stability condition of beams in the apex zone.* • *Tension/Compression stress normal in grain on knees curved beams.*

Week 5:	***Simple glulam knees computation with h=constant.*** • *Projection of actions for main beams.* • *Computation of internal influence on structural system/element caused form external actions.* • *additional stress as a consequence of beam curves.* • *Computation of different possible deformation of glulam beams as are the vertical deflection and horizontal well.* • *Design and forming the simple beam knee geometry and their support.*
***Week 6*:**	***Simple glulam knees computation with different heigh.*** • *Projection of actions for main beams.* • *Computation of internal influence on structural system/element caused form external actions.* • *additional stress as a consequence of beam curves.* • *Computation of different possible deformation of glulam beams as are the vertical deflection and horizontal well.* • *Design and forming the simple beam knee geometry and their support.*
Week 7:	***Glulam Frame systems*** • *Frame glulam systems with column type of "V" form.* • *Way to forming the connection of beam and columns for frame systems of glulam.* • *Finger connection of beam/Column, internal redistributions of forces and moments.* • *Angle connection of Beam and Columns with dowels.* • *Redistribution on internal forces and bending moments in case of Beam/Column connection with dowels, Shear Forces.*
Week 8:	***Column/Beam connection Design thru dowel connectors.*** • *The maximum value of force projections for one dowel.* • *Computation of number of dowels in the connection cases.* • *Two rings cases with dowel.* • *Redistribution of internal shear force in case of two rings dowel connection.* • *Design of column and Beam for cases of the change of high at the support areas from shear forces.*
Week 9:	***Glulam arch frame structural elements*** • *Frame systems and forms of structure glulam arch.* • *Distribution of inner forces and bending moments for the arch frame systems for different scenario of actions.* • *For every critical cross sections of arch frame formulating of stability conditions.* • *Design and computation of the erection of the two-henge arch system. Connation with bolts.*
Week 10:	***Supports on glulam structural members*** • *Principal regulation for design of supports.* • *Philosophy of continuing the inner forces from position to new position.* • *Simple support design with one reaction.* • *Simple support design with two reactions.*
***Week 11*:**	***Joint form connections***

	• *Forming and Design of the simple junction, case connection of the structure with the foundation.* • *Different solution of junction Design.* • *Design of "gerber" joint on to the frame arch system.* • *Joints Design for longitudinal Beams.*
***Week 12*:**	***Stiffening Joint Design*** • *Forming and Design of the simple junction, case connection of the structure with the foundation.* • *Different solution of stiffening joint Design.* • *Computation case of stiffening joint, connection with capability of MTN thru bolts and steel plates.* • *Forming the connection of the three joint systems.* • *Different forming design of glulam frame systems connection with the foundation.*
***Week 13*:**	***Spatial Stability of glulam structure.*** • *Basic conceptual spatial stability of structural member and entire building.* • *Possible brace shapes in roof.* • *Technical rules – requirement for brace horizontal and vertical design in variations of main beams.*
***Week 14*:**	***Design of brace in depends of horizontal action directions.*** • *Design and computation of action in structure for case of lateral wall on frame system structure.* • *Analyzing and Design of external forces for brace joints.* • *Computation of inner forces for brace truss systems.* • *Design of cross section for brace members.*
***Week 15*:**	***Lateral stability control of structural members – beams with very high*** • *Deformation structural members in zone with high inner forces – zone where compression has appeared in internal site.* • *Forming the structural connection - cross section stability* • *Calculation of bracing members.*

Academic Policies and Code of Conduct:
Intensive Lectures and numerical teaching part, student's presentation during the lectures, semester work assignment and assessment. The students are not allowed to use the cellular phone during the teaching time.