Course title: Masonry Structure

Course Basic Information	
Academic Unit:	**Civil Engineering Faculty**
Course title:	**Masonry Structure**
Level:	**MSc**
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**
Contact Details:	*e*-mail: florim.grajcevci@uni-pr.edu
Course Description:	Basic rules for masonry structure forming. Resistance calculation – bearing capacity for separate masonry walls. Principles for design of masonry structures, their members, behavior of separate masonry structural elements, their member materials (masonry unites and mortar). The stability of masonry structures against the different actions.
Course Goals:	A theoretical module aims to prepare the students for material properties for creating the masonry walls. Main principles for computation of masonry walls for different work cases. Computation of wall resistance in bearing, shear and bending work. Design of the Building structure with masonry members.
Expected Learning Outcomes:	- Analysis the action for masonry structures, partial safety coefficient base on EC-1 and EC-6. Compose and explain the technological forming process of masonry structures, their performances and technical rules for forming masonry. - Bearing Capacity Computation of masonry wall, Shear Wall and bending wall. Also, the different combine of walls depending from actions. - Compute the dimensions of walls, as are the height, thickness and longitudinal effective dimensions of the wall. - Design and compute the necessary stiffness for masonry walls.

Student Workload (should be in compliance with student's Learning Outcomes)			
Activities	**Hours**	**Days/Weeks**	**Total**
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:	- *T. Paulay, M.J.N. Priestley, Seismic Design of Reinforced Concrete and Masonry Buildings,* - *Design Guide Handbook for EN 1996, Design for Masonry Structures, September 2008, Department for Communities and Local Government: London* - *N. Taly, Design of Reinforced Masonry Structures, Second Edition, McGraw-Hill Company 2010* - *Eurocode 1* - *EN 1996-1-1:2005, Eurocode 6 – Design of Masonry Structures, Part 1-1:General rules for reinforced and unreinforced masonry structures,* - *DD EN 1996-1-3:2001, Eurocode 6 – Design of Masonry Structures, Part 1.3:General rules for building – Detailed rules on lateral loading,* - *BS EN 1996-2:2006, Eurocode 6 – Design of Masonry Structures, Part 2: Design considerations, selection of materials and execution of masonry,* - *BS EN 1996-3:2006, Eurocode 6 – Design of Masonry Structures, Part 3: Simplified calculation methods for unreinforced masonry structures* - *W.M.C. McKenzie, Design of Structural Masonry, British*		

	Library2001 - *D. Anderson, S Brzev, Seismic Design for Masonry Buildings, Canadian Concrete Masonry Producers Association, April 2009* - *D. Breyer, K. Fridley, K. Cobeen., "Design of Wood Structure ASD", fourth edition, McGraw-Hill,* - *E.D. Jovanoska, Sidani Konstruciji, Shkup 2007*
Designed teaching plan:	
Week	**Lectures offered**
Week 1:	***Introduction*** • *In the past and current use of masonry in Building in Country level.* • *Masonry material members (Masonry unit and mortar).* • *Comparation of masonry structures with different material structure.* ***Terms - and Definitions for masonry*** • *Separate structural members from masonry.* • *Construction properties for forming of masonry structural walls.*
Week 2:	***Unit for creating the masonry – structural wall*** • *Clay masonry Unit* • *Calcium-Silicate masonry Unit* • *Aggregate Concrete masonry Unit* • *Autoclaved Concrete masonry Unit* • *Manufactured Stone masonry Unit* • *Dimensioned Natural Stone masonry Unit*
***Week 3*:**	***Mortars for masonry walls*** • *Types of mortars* • *General Purpose mortar* • *Thin layer mortar.* • *Lightweight mortar of density*
Week 4:	***Technical conditions for forming the masonry walls*** • *General Classifications in depends from the unit groups* • *Bearing capacity walls* • *Partition walls - nonstructural.* • *General classification of walls.* • *Unreinforced and reinforced walls.*
Week 5:	***Work Classification walls*** • *Way to forming the unit walls with different units, layers.* • *Cave unit walls – shell unit.* •*double walls.* • *stone walls.*
***Week 6*:**	***Bearing capacity structure with masonry wall*** • *Reinforced concrete wall in structural system.* • *Arrangement of RC wall for different shape in plot of building* • *Horizontal mezzanine systems on RC masonry structures in seismic prone areas.*
Week 7:	***Characteristic strength values in compression of masonry*** • *Characteristics values as per EC 0* • *Contribution of masonry unit and mortar on the bearing capacity walls.* • *Theoretical value for characteristic masonry strengthening.* • *Experimental way for computing the characteristic pressure values of*

	masonry.
Week 8:	***Design of Masonry Structures – in frame works*** • *Analyzing the different actions on masonry structures as per EN 1991.* • *Limit state for masonry structures, EN 1990, EN 1991 and EN 1996.* • *Terms and definitions of ULS and SLS.*
Week 9:	***Algorithm for bearing capacity wall*** • *Various computation and steps for computation of wall dimensions, material properties, behavior etc.*
Week 10:	***Scrambled wall models – broken walls*** • *Bed and other mortar layers* • *stress continues shape.* • *strengthening mortar classes.*
***Week 11*:**	***Visiting the site – existing, historical and cultural building in country*** • *Daly tour with students, around the city*
***Week 12*:**	***Masonry strength*** • *Characteristic shear strength, f_{vk1}, f_{vk2} .* • *Characteristic bending strength, f_{xk1}, f_{xk2} .* • *Characteristic anchored strength, f_{b0k}*
***Week 13*:**	***Elasticity Modulus*** • *Values of elasticity modules* •*creep and yield masonry coefficient* ***Design and computation of unmasonry structures –Structural analysis*** •*computation model of masonry behavior* •*imperfections* •*Second theory effects* •*Effective high of wall* •*effective masonry width* •*longest wall limitation for strengthening* •*effective thickness of wall*
***Week 14*:**	***Reinforced wall – vertical loaded*** • *buckling of reinforced wall* •*effective masonry beam span*
***Week 15*:**	***Masonry structures under the seismic actions*** • *earthquake actions on structures.* • *breaking mechanism.* • *Structural masonry vulnerability.* • *Structural masonry Behavior under the earthquake strange.*

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.