Faculty of Civil and Environmental Engineering					
Study programme:	**Civil Engineering**	Degree level: full-time programme:	**Bachelor's degree**		
Specialization		Diploma path:	**-**		
Module name:	**Strength of Materials**				
Module type:	**obligatory**	Semester: **3**	ECTS **6**	Module ID:	**ENB03420**
No. of hrs in semester:	L - 30 C - LC- 1 P- 30 SW- S-				
Prerequisites:	*Complete with prerequisites or "-"*	mathematics, phisics, theoretical mechanics			
Aims and objectives:	*Students get theoretical basis of the strength of materials which enable to solve basic engineering problems.*				
Teaching methods:	*lecture, project, laboratory*	*Assessment:*	*Evaluation must be relevant to the intended learning outcomes*		
		lecture – written exam, project – project completion, laboratory - raports			
Module content:	*Definitions of stress and strain. Stress and strain components. Linear elastic constitutive equations. Moment of inertia of an area. Parallel axis theorem. Principal axes and principal moment of inertia. Stress, strain, and deformation of axially loaded bars . Statically indeterminate problems. Analysis of torsion of circular bars. Shear stress distribution. Internal forces diagrams for beams, frames and arches. Bending and transverse shear stress. Normal and shear stress distribution. Elastic curve of neutral axis of the beam. Evaluation of beam deflection and slope: Double integration method, Conjugate Beam method. Strain energy. Principle of virtual work. Application of energy theorems for computing deflections in beams. Combined loading. Eccentrically loaded short columns. Core section. Column buckling. Euler's theory of long columns. Labolatory: tensile test, impact test, hardeness tests, buckling test, strain measurement module test.*				

Learning outcomes	*learning outcomes*	*Relevance to the programme learning outcomes*
LO1	Students can calculate moment of inertia and principal axes	K_B1_W05, K_B1_W09, K_B1_U12
LO2	Students can determine stress, strain, and deformation in the case of axially loaded bars and torsional circular bars.	K_B1_W05, K_B1_W09, K_B1_U12
LO3	Students determine bending and transverse shear stress and draw stress diagrams	K_B1_W05, K_B1_W09, K_B1_U12
LO4	Students gain tools to solve deflection problems using double integration method, conjugate beam method or energy methods.	K_B1_W05, K_B1_W09, K_B1_U12
LO5	Students attain basic knowledge of the combined loading beams, eccentrically loaded short columns and column buckling.	K_B1_W05, K_B1_W09, K_B1_U12
LO6	The students have knowledge in the area of testing of materials and components of structural elements experimentally	K_B1_W05, K_B1_W09, K_B1_U12
LO7	Student is responsible for the experiments results	K_ B1_K05
LO8		

student workload	lecture attendance	15 x 2h =	30
	participation in classes, laboratory classes	15 x 3h =	45
	preparation for classes , laboratory classes	15 x 1h =	15
	homework	15 x 3h =	45
	participation in student-teacher sessions related to the class	5 x 1h =	5
	preparation for and participation in exam		20
		TOTAL:	160
quantitative indicators	Student workload - activities that require direct teacher participation : 30h+45h+5h+2h=82	82	ECTS
			3.0
	Student workload - practical skills activities 45h+5h+15h+45h=110	110	4.0
basic references:	*1. Subbanarasu Divakaran Vijay K Garg , Strength of Materials, London, Asia Publishing House, 1969.* *2. John Case The late John Case; A Chilver; Henry Chilver; C. T. F Ross; Carl T. F. Chilver,A Ross :Strength of Materials and Structures 1999* *3. Granet I.: Strength of materials for engineering technology*		
supplementary references:	*1. Jastrzębski P., Mutermilch J., Orłowski W.: Wytrzymałość Materiałów. Arkady. Warszawa. 1985* *2. Dyląg Z., Jakubowicz A., Orłoś Z.: Wytrzymałość Materiałów t.1 i 2. Wyd. Naukowo-Techniczne. Warszawa. 1996* *3. Bandyszewski W.: Wytrzymałość materiałów : przykłady obliczeń. Cz.1 i 2. Wyd. PB. Białystok 2007.* *4. Grabowski J., Iwanczewska A.: Zbiór zadań z wytrzymałości materiałów.Wyd. PW. Warszawa. 2006.*		

learning outcomes	*methods of assessing learning outcomes*	type of class (if more than one) where the outcomes are assessed
LO1	written exam (lecture), project,	
LO2	written exam (lecture), project, lab raport	
LO3	written exam (lecture), project, lab raport	
LO4	written exam (lecture),	
LO5	written exam (lecture), project, lab raport	
LO6	lab raports	
LO7	lab raports	
LO8		

Department:		Group instructors:	dr inż. Joanna Krętowska
Date:	22.01.2015	Coordinator:	dr inż. Joanna Krętowska

L - lecture C - class LC - laboratory class P-project
SW - specialization workshop S - seminar