Course title: Strength of Materials II

Course Basic Information	
Academic Unit:	**Faculty of Civil Engineering**
Course title:	**Strength of Materials II**
Level:	**Bachelor**
Course Status:	**Mandatory**
Year of Study:	**2nd Year | 4rth Semester**
Number of Classes per Week:	**2+2**
ECTS Credits:	**6**
Time /Location:	**According to the timetable**
Teacher:	**Professor assistant Arton D.Dautaj**
Contact Details:	e-mail; arton.dautaj@uni-pr.edu, www.fn.uni-pr.edu
Course Description:	Strength of materials is a branch of applied mechanics that deals with the behaviour of solid bodies subjected to various types of loading. Furthermore, it studies deformations, strain and displacement of deformable bodies and their components. Understanding these sizes for different levels of forces provides a picture of the behaviour of these structures and a safe design of various structures such as: buildings, dams, bridges, ships, planes, etc. In this course there are addressed combined axial torsion and bending loads, . Other important issues that are addressed are: Stability of columns, Combined loading, application of energy methods, Thin-Walled Pressure Vessels and elastic plastic analysis, Failure Criteria, impact loading etc.
Course Goals:	Main aim of strength of materials is analysis and stability of the columns, determination of stresses and deformations under combined loadings, applications of energy method in solving statically indeterminate bearing structures. applying the principle of minimum potential energy. Design of the beams and different hypothesis on Yield and Failure Criteria.
Expected Learning Outcomes:	After completing this course, students will be able to: - design column under compression loads, determine stress and stress under combined loading, -Determining of strain energy for various loading. -knowing to solve statically indeterminate systems using Energy method, unit load method and Castilano's Method. -Is able to design elements under complex loading -Design of the rods and beams with different Yield and Failure Criteria. -Design of elastic- plastic beam, design of thin walled reservoirs etc.

Student Workload (should be in compliance with student's Learnign Outcomes)			
Activity	**Hours**	**Day/ Week**	**Total**
Lectures	2	15	30
Theory/ Lab Work/Exercises			
Practical Work	2	15	30

Consultations with the teacher			
Field Work	0.5	6	3
Test, seminar paper			
Homework	2	4	40
Self-study (library or home)	1	15	15
Preparation for final exam			15
Assessment time (test, quiz, final exam)			26
Projects, presentations, etc.			
Total			**160**

Teaching Methods:	*Lectures, exercises during class using different materials, one project work in group of 2-3 students (independent work), individual homework*
Assessment Methods:	Limit course passing higher than 60%; Student attendance 5%; Individual assignments completed in class 5%; Individual assignments completed at home 5%; Evaluation from the tests 35%; Final Exam 60%
Primary Literature:	[1] Strength of materials, second part. authors: Fetah Jagxhiu [2] Solved problem in strength of materials II, authors: Fetah Jagxhiu dhe Arton D.Dautaj
Additional Literature:	[3]. R.C.Hibbeler: Mechanics of Materials, [4]. William A. Nash: Strength of Materials, New York, London...Melbourne, Toronto, Otava. 1998 [5]. ROY R. CRAIG, JR.: MECHANICS OF MATERIALS, John Wiley & Sons, Inc,USA

Designed teaching plan	
Week	**Title of the Lecture**
Week 1:	**Buckling of Columns.** Stability of elastic systems. Buckling of straight columns, Euler equation, Euler buckling stress and domain of uses of Euler expression. References [1,3]
Week 2:	**Buckling of Columns**, Inelastic Buckling of Ideal Columns, Design of Centrally Loaded Columns. [1,3]
***Week 3*:**	**Combined loadings,** Definitions and types combined loads, Unsymmetric Bending. Tension and compression of short columns. Normal and shear stresses, deformation and design of short columns.
Week 4:	**Combined loadings,** Cross section core State of stresses and deformations and design of short columns caused by combined loadings.
Week 5:	**Combined loadings,** Combined Axial and Bending Loads. The Secant Formula, Eccentrically Loaded Columns Combined Bending and torsional loads. General Combined Loadings
Week 6	**Tensor Analysis,** Tensor Analysis an overview, Transformation of co-ordinates, Second order tensors, Addition, subtraction and multiplication of tensors, Contraction, Croneker symbols
***Week 7*:**	**Principles and energy methods**. Introduction, External Work and Strain Energy, Nonlinear elastic body. Stiffness and flexibility coefficients Stiffness and flexibility matrices. Elastic body under two forces. Strain Energy expressed in stress components
Week 8:	**Principles and energy methods**. Elastic strain energy for various types of loading. Work–Energy method for Single Loads. Reciprocity theorems. Betti's and Maxwell's theorem,.

Week 9:	**Applications of energy methods.** Principle of virtual work or principle of virtual force. Internal works caused by different loading (axial, bending, torsion and shear forces). Principle of virtual displacement. Work and Strain Energy for various of loading
Week 10:	**Applications of energy methods.** Potential energy method. Stationary potential energy. Stationary complementary potential energy
***Week 11*:**	**Applications of** Castigliano's Theorem. Calculating Deflections of Trusses and beams by Castigliano's Theorem. .Unit load method.
***Week 12*:**	Energy method applied to the Statically Indeterminate Beams. Ritz's method. **Impact Loading**
***Week 13*:**	**Thin-Walled Pressure Vessels**. Cylindrical Vessels. Spherical Vessels, Examples
***Week 14*:**	**Yield and Failure Criteria.** Introduction. Maximum Normal Stress Theory, Maximum strain theory. Maximum Shear Stress Theory, Maximum Distortion Energy Theory, Mohr's Failure Criterion-Mises theory.
***Week 15*:**	**Introduction to analysis of elastic-plastic beams,** The models of ideal materials. Yield Criteria .Analysis of beams made by ideal elastic-plastic materials. Elastic-plastic analysis of axial rod, Elastic-plastic analysis of torsion and bending beam, Residual stresses

Academic Policies and Code of Conduct
Rules of conduct: *1. Regular attendance during lectures and exercises is compulsory,* *2. Following up general faculty ruling and peace,* *3. Turning of mobile phones during classes,* *4. Entering in to the classroom on time,* *5. The student has no right to be absent more than 3 class hours during the semester without justification.* *6. Preparation and conducting the case studies in line with theoretical knowledge and presentation the findings in class. Students who have prepared and presented during the classes and pass the exam complete the subject duties and will be granted with passing grade.*

Note | If a student has more than 3 class assignments evaluated below 50% he/she loses the right on taking the final exam. Evaluation is done from 0-100 %.