COURSE		**STRENGTH OF MATERIALS II**		
LECTURER		Prof.dr. Mustafa Hrasnica		
STUDY	***STATUS***	***SEMESTER***	***LECTURES L+E***	***ECTS***
B - CE	compulsory	3	2+2	5

LEARNING OBJECTIVES

- Provide education on stress and strain analysis for simple and complex states of stresses in structural elements, as well as on design conditions and procedures for individual stress states. Explain basic buckling problems. Introduction in the field of non-linear analysis, especially consideration of elastic-plastic beam.

LEARNING OUTCOMES

- Understanding the nature of individual simple stress states: bending, torsion, and shear. Capability to calculate appropriate stress and strain components and to perform design procedures by allowable stress method.
- Same competences for complex stress states, combination of axial and bending stresses.
- Perception of the buckling problems at slender elements in compression, especially bars.
- Understanding the basics of inelastic bending of beams, ultimate load and capacity.

COURSE CONTENT

- Bending. Bernoulli's hypothesis. Flexure of cross-section, normal stresses distribution. Axial, mixed and polar moments of inertia. Principal axes and moments of inertia. Ellipse and radius of inertia. Calculation of shear stresses. Principal stresses. Section modulus, design. Thin-walled beams. Shear center. Design of connections at complex steel section.
- Deflection of beams. Differential equation of elastic beam. Boundary conditions. Moment-area method or Mohr's analogy.
- Torsion. Elements with circular cross-section. Shear stresses, twist angle of cross-section. Failure types due to pure torsion. Elements with rectangular and thin-walled cross-section, torsion of tube. Design.
- Compound stresses. Biaxial (skew) bending, neutral axis, distribution of stresses, design. Element exposed to eccentric axial force and beam exposed to lateral and axial loading, neutral axis, distribution of stresses, design. Core of the cross-section.
- Buckling of bars in compression. Nature of problem. Euler's bar, critical forces, buckling lengths for basic types of column restraints. Critical stress, slenderness of bars, Euler's hyperbola in linear and non-linear range of the behaviour. Eccentrically loaded columns n and bending of the slender beam-column. Design, interactive method.
- Curved beams. Normal stresses due to bending, comparison with straight beam.
- Basics of non-linear analysis. Inelastic bending of beams, general stress-strain relation, elastic-plastic beam, moment of yielding, ultimate resisting moment, plastic section modulus, deformations, plastic hinges, residual stresses. Ultimate beam load, design, bending and axial load simultaneously, interaction diagrams for yielding and plasticity.

RECOMMENDED LITERATURE

1. Branislav Verbič, *Otpornost materijala*, Građevinski fakultet u Sarajevu.
2. Other contemporary textbooks about *Strength of Materials* or *Mechanics of Solids*.

Examination procedure:

Tests during the term (min. two), evaluation of compulsory homeworks.

Evaluation: Work during the term, min. 50%, final exam max. 50 % of the final grade.