Course Unit Descriptor

Study Programme: Technical Mechanics and Technical Design

Course Unit Title: Analytical mechanics

Course Unit Code: M44031

Name of Lecturer(s): Srboljub Simić

Type and Level of Studies: Bachelor level

Course Status (compulsory/elective): compulsory

Semester (winter/summer): winter

Language of instruction: English

Mode of course unit delivery (face-to-face/distance learning): face-to-face

Number of ECTS Allocated: 8

Prerequisites: None

Course Aims:

Acquaintance with fundamental principles of analytical dynamics, method of stability theory and analysis of dynamical systems and bifurcation theory.

Learning Outcomes:

Students acquire knowledge of derivation of mathematical models based upon methods of analytical mechanics; they apply the methods of stability theory in the analysis of engineering systems; they acquire knowledge of the theory of dynamical systems and bifurcation theory and their application in engineering practice.

Syllabus:

Lagrange-D'Alembert's principle. Lagrangina equations of the firs and second kind. Electro-mechanical analogies. Hamiton's canonical equations. Routh's equations. Elements of stability theory. Perturbations and variational equations. Lyapunov stability. Lyapunov's direct method: stability theorems, Chetayev's instability theorem. Stability of equilibrium and stationary motion. Linearized stability analysis. Dynamical systems in the phase plane. Stationary points. Orbital stability and limit cycles. Elements of bifurcation theory. Basic bifurcation patterns. Reduction of order in the neighborhood of bifurcation point.

Required Reading: Relevant literature in English, tbd

Weekly Contact Hours: 4	**Lectures: 2**	**Practical work: 2**

Teaching Methods:

Lectures, exercises, consultations. During the lectures basic method and principles of analytical dynamics, stability theory and bifurcations are explained. During the exercises examples are solved which illustrate the application of general principles. More involved examples are demonstrated by computer simulations. During the semeter students have homework exercises. Three colloquiums are organized during the semester which can be treated as substitution for the written part of exam.

Knowledge Assessment (maximum of 100 points):

Pre-exam obligations	points	**Final exam**	points
Lecture Attendance	5	Oral part of the exam	30
Exercise Attendance	5		

Homework	20		
Colloquim Exam	40		
The methods of knowledge assessment may differ; the table presents only some of the options: written exam, oral exam, project presentation, seminars, etc.			