RTU Course "Numerical Analysis in Engineering Mechanics"

15325 Teorēt.mehānikas un materiālu pretestības katedra

General data

Code	MTM341
Course title	Numerical Analysis in Engineering Mechanics
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
Responsible instructor	Vība Jānis
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Maximum auditorium capacity	25
Maximum number of students per semester	50
Abstract	Analysis of functions and functionals. Extreme values. Optimisation tasks. Numerical analysis of simple analytical expression and experimental data. Analysis and operation of physical and engineering systems by using mathematical techniques. Dynamic analysis of mechanical, hydraulical and thermal systems. Response of these systems to inital conditions, and to transient, steady and random inputs. Stability. Analysis of simple feedback systems.
Goals and objectives of the course in terms of competences and skills	To acquaint students with the fundamentals of numerical analysis. This aim is achieved fulfilling the following tasks: 1st Analyzing the fundamental relationships of numerical analysis; 2nd Teaching students how to solve the task on numerical analysis applying the computer software. 3rd Improving students' knowledge of physics and mechanics in the fields related to vibro techniques and machinery. 4th Providing students with the skills required to be proficient in the calculations of technical and mechanical engineering objects applying the numerical analysis methods.
Structure and tasks of independent studies	Within the framework of the present study subject the students should perform the independent work on the following themes: 1st Solving static and kinematic tasks applying the MathCAD program. 2nd Modelling the planar mechanism dynamics tasks applying the Working Model simulation software. 3rd Calculating the force applying the Solid Work software program.
Recommended literature	Моисеев Н.Н. Иванилов Ю.П. Столярова Е.М., Методы оптимизации., "Наука",1978. г., 351. стр.; E.Lavendelis. Optimālu vibromašīnu sintēze., Zvaigzne, 1970. g., 250.lpp.
Course prerequisites	Math. Mechanics. Physics.

Course outline

Theme	Hours
Introduction. 3D surface analysis. Searching of teh extreme analytically and with the help of computer.	4
Drop into the air and analytical analysis with the help of computer.	4
Data approximation with small squares. Draw curves with the help of computer.	4
Function analysis by Fourier series. Draw curves with the help of computer.	4
One degree of freedom oscillation analysis. Computer Simulation.	4
Two degrees of freedom fluctuation analysis. Computer Simulation.	4
Different bilinear system modelling with the help of computer simulation.	4
Shock modelling with the help of computer systems.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
At the end of the course students will examine the mechanical process modelling in nature in different forms.	Laboratory work.
At the end of the course students will be able to provide examples of object motion and equilibrium of the numerical modelling techniques.	Questions in the practical work
At the end of the course students will be able to analyze the experimental data.	Questions at the end of the lecture.
At the end of the course students will be able to distinguish the advantages of the numerical analysis against the analytical methods.	Assessment test
At the end of the course students will be able to formulate a mechanical, electro mechanical and continuous media site analysis tasks.	Assessment test

At the end of the course students will be able to assess the numerical analysis engineering mechanics problems.	Exam

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	1.0	1.0	0.0		*	