

SYLLABUS OF A MODULE

Polish name of a module	Kinematyka, drgania i stateczność układów mechanicznych
English name of a module	Kinematics, vibrations and stability of mechanical systems
ISCED classification - Code	0715
ISCED classification - Field of study	<i>Mechanics and metal trades</i>
Languages of instruction	<i>English</i>
Level of qualification:	<i>2 – MSc (EQF 7)</i>
Number of ECTS credit points	<i>5 ECTS</i>
Examination:	<i>A - assignment</i>
Available in semester:	<i>A - autumn only</i>

Number of hours per semester:

Lecture	Tutorial	Laboratory	Seminar	Project	Others
30	0	45	0	0	0

MODULE DESCRIPTION

Module objectives

- O1. Acquiring basic skills in modeling and simulation of machine movement and mechanisms.
- O2. Acquiring practical skills in using Catia software.
- O3. To familiarize students with mechanical vibrations of damped or undamped systems with a finite number of degrees of freedom and continuous systems.
- O4. To familiarize students with the criteria for loss of stability.
- O5. Acquisition by students of skills in determining critical load and the frequency and form of vibrations of vibrating systems.

PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge in mathematics and physics.
2. Individual and group work skills.
3. Skills of correct interpretation and presentation of own activities.

LEARNING OUTCOMES

- LO 1 - has knowledge of kinematics, mechanical vibrations and stability of mechanical systems.
- LO 2 - can develop models of mechanical systems.
- LO 3 - can determine the parameters of mechanical systems.

MODULE CONTENT

Type of classes – LECTURES	Number of hours
Lec1-6 - Work in the Part Design module. Work in the Assembly Design module. Introduction to the Kinematics DMU module.	12
Lec7 - Introduction to the Drafting module.	2
Lec8 - Basic concepts of mechanical vibrations. Equations of motion of individual mechanical systems with one degree of freedom.	2
Lec9 -System with one degree of freedom (natural vibrations, stimulated vibrations, resonance transitions).	2
Lec10 - Vibrations of a damped oscillator (natural vibrations, stimulated vibrations).	2
Lec11 - Vibrations of the system with two degrees of freedom (two pendulums connected by a spring).	2
Lec12 - Vibrations of a double mathematical pendulum.	2
Lec13 - Beam vibrations as a continuous system (Hamilton principle, boundary conditions, natural frequency).	2
Lec14,15 - Beam vibration forms. Impact of compressive force on free vibrations of the column (kinetic stability criterion). Vibrations of the non-conservative system (Beck column). Test.	4

Type of classes– LABORATORY	Number of hours
Lab1, 2 - Part Design - part modeling.	6
Lab3-6 - Basics of mechanisms creation - assemblies. Simulation and nanalization of motion - a block on an inclined plane. Simulation and nanalization of movement - Maltese mechanism.	12
Lab7-10 - Motion simulation and analysis - collision detection. Simulation and analization of motion - planetary gear. Creating technical documentation for the Drafting module.	12
Lab11 - Vibrations of the system with one degree of freedom - damped and undamped (various initial conditions).	3
Lab12 - Determination of the free beam vibration frequency (various boundary conditions)	3
Lab13 - Determining the form of free vibration of the beam (various boundary conditions).	3
Lab14 - Characteristic curves in the plane: load - natural frequency.	3
Lab15 - Areas of divergent and flutter instability.	3

TEACHING TOOLS

1. lecture using multimedia presentations
2. computer hardware and computer software - CATIA, MathCad, Mathematica
3. examples of laboratory exercises

WAYS OF ASSESSMENT (F – FORMATIVE, S – SUMMATIVE

F1. assessment of preparation for laboratory exercises
F2. assessment of the ability to apply acquired knowledge while performing exercises
F3. assessment of reports on the implementation of exercises covered by the curriculum
F4. assessment of activity during classes
S1. assessment of the ability to solve the problems posed and the manner of presentation obtained results - credit for grade *
S2. test

*) in order to receive a credit for the module, the student is obliged to attain a passing grade in all laboratory classes as well as in achievement tests.

STUDENT'S WORK LOAD

L.p.	Forms of activity	Average number of hours required for realization of activity
1. Contact hours with teacher		
1.1	Lectures	30
1.2	Tutorials	0
1.3	Laboratory	45
1.4	Seminar	0
1.5	Project	0
1.6	Consulting teacher during their duty hours	0
1.7	Examination	0
Total number of contact hours with teacher:		75
2. Student's individual work		
2.1	Preparation for tutorials and tests	0
2.2	Preparation for laboratory exercises, writing reports on laboratories	40
2.3	Preparation of project	0
2.4	Preparation for final lecture assessment	0
2.5	Preparation for examination	0
2.6	Individual study of literature	10
Total number of hours of student's individual work:		50
Overall student's work load:		125
Overall number of ECTS credits for the module		5,0
Number of ECTS points that student receives in classes requiring teacher's supervision:		3,0
Number of ECTS credits acquired during practical		3,4

classes including laboratory exercises and projects :	
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BASIC AND SUPPLEMENTARY RESOURCE MATERIALS

1. Nader Zamani CATIA V5 FEA Tutorials,2008
2. Jaecheol Koh CATIA V5 Design Fundamentals: A Step by Step Guide, 2010
3. CATIA – technical documentation.
4. Rao V. Dukkupati, J. Srinivas: Textbook of Mechanical Vibrations, Prentice-Hall of India Private Limited, New Delhi, 2004
5. L. Meirovitch: Fundamentals of Vibrations, McGraw-Hill Higher Education, 2001

MODULE COORDINATOR (NAME, SURNAME, DEPARTMENT, E-MAIL ADDRESS)

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MATRIX OF LEARNING OUTCOMES

Learning outcome	Relating specific outcome to outcomes defined for entire programme (PEK)	Module Objectives	Module content	Teaching tools	Ways of assessment
LO1	K_W01, K_W03, K_W07	O2, O3, O4	Lec8- 15	1	F4, S2
LO2	K_W01, K_U03, K_U07	O1	Lec1- 15 Lab1- Lab15	1, 2, 3	F1-4, S1, S2
LO3	K_U03, K_U07	O5	Lab7- Lab15	2, 3	F1-3, S1

ASSESSMENT- DETAILS

Learning outcomes	Grade 2	Grade 3	Grade 4	Grade 5
LO 1	Student is unable to determine the equations describing the oscillating motion and is unable to determine the frequency, form of vibration of mechanical systems and the critical force of slender systems.	Student has partly mastered the knowledge of vibration and stability of elastic systems.	Student has mastered the knowledge of mechanical vibrations, is able to choose the right method for determining the frequency and form of mechanical vibrations. The student is also able to determine the critical force of slender elastic systems.	Student has very well mastered the knowledge of the material covered by the curriculum, independently acquires and extends knowledge using various sources.
LO 2	Student has not mastered the ability to develop models of mechanical systems.	Student has partly mastered the ability to develop models of mechanical systems.	Student has mastered the ability to develop models of mechanical systems.	Student has mastered the ability to develop models of mechanical systems very well.

<p style="text-align: center;">LO 3</p>	<p>Student has not prepared the report / The student cannot present your results research.</p>	<p>Student has prepared a report from the exercise, but cannot interpret and analyze the results of its own research.</p>	<p>Student has prepared a report from the exercise, he can present the results of their work and analyze them.</p>	<p>Student has prepared a report from the exercise, he can comprehensively present, and discuss the results achieved.</p>
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* A midterm grade of 3.5 is assigned when the student fully meets the learning outcomes for a grade of 3.0, but has not fully mastered the learning outcomes for a grade of 4.0. A midterm grade of 4.5 is assigned when the student fully meets the learning outcomes for a grade of 4.0, but has not fully mastered the learning outcomes for a grade of 5.0.

ADDITIONAL USEFUL INFORMATION ABOUT MODULE

1. All the information for the students of this degree course are available on the website of the Faculty: www.wimii.pcz.pl as well as on the web pages given to students during the first class of a given module.
2. The information on the teachers' duty hours is provided to students during the first class of a given module.