

COURSE SYLLABUS

Polish name of a module	Mechanika II
English name of a module	Mechanics II
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>1 – BSc (EQF 6)</i>
Number of ECTS credit points	<i>5 ECTS</i>
Examination:	<i>A - assignment</i>
Available in semester:	<i>S – spring only</i>

Total number of hours per semester:

Lecture	Tutorial	Laboratory	Seminar	Project	Other
30	30	0	0	0	0

COURSE DESCRIPTION

COURSE OBJECTIVE

- O1. Introduction of students to the concepts of kinematics and dynamics of a rigid body within the framework of vector mechanics..
- O2. Development of students' skills in formulating and solving kinematic and dynamic equations of motion for a rigid body, as well as the ability to apply fundamental laws and principles (conservation of linear momentum, angular momentum, and mechanical energy) and energy methods to analyze the motion of a rigid body.
- O3. Acquisition of students' ability to analyze obtained solutions.

PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Knowledge of mathematics, particularly vector algebra, trigonometry, fundamental theorems concerning the geometry of planar figures and solids, and concepts from mathematical analysis (differentiation, function variability analysis, and integration).
2. Knowledge of the kinematics and dynamics of a particle within the framework of vector mechanics.
3. Ability to perform mathematical operations to solve given problems.
4. Ability to utilize various sources of information, including the Internet.
5. Skills in both independent and group work.
6. Ability to correctly interpret calculation results.

LEARNING OUTCOMES

LO 1 – The student has theoretical knowledge of the kinematics and dynamics of a rigid body.

LO 2 – The student is able to calculate mass moments of inertia for planar figures and solids, determine velocities and accelerations of a rigid body in translational, rotational, and planar motion, apply the laws of conservation of linear momentum, angular momentum, and mechanical energy to solve problems in rigid body dynamics, and calculate dynamic reactions in rotational motion about a fixed axis

COURSE CONTENT

Course type – LECTURES	Number of hours
L1-2 – Introduction to the kinematics and dynamics of a rigid body.	2
L3-6 – Mass moments of inertia – basic definitions and relationships. Steiner's theorem. Inertia ellipsoid.	4
L7-8 – Angular momentum of a rigid body in rotational motion. Principle	2

of angular momentum conservation	
L9-14 – Translational and rotational motion of a rigid body. Determining velocities and accelerations in translational and rotational motion of a rigid body. Planar motion of a rigid body.	6
L15-18 – Instantaneous center of rotation. Determining velocities in planar motion of a rigid body. Determining accelerations in planar motion of a rigid body.	4
L19-24 – Motion of a rotating body on an inclined plane with static and dynamic friction. Energy methods in the dynamics of planar motion of a rigid body. Koenig's theorem.	6
L25-30 - General motion of a rigid body. Angular momentum of a rigid body in general motion. Dynamic reactions in rotational motion about a fixed axis. Test.	6
SUM	30
Course type – TUTORIAL	Number of hours
T1-2 – Review of kinematics and dynamics of a particle.	2
T3-8 – Mass moments of inertia.	6
T9-12 – Angular momentum of a rigid body in rotational motion. Principle of angular momentum conservation.	4
T13-18 – Translational and rotational motion of a rigid body. Determining velocities and accelerations in translational and rotational motion of a rigid body. Colloquium I.	6
T19-24 – Planar motion of a rigid body. Determining velocities in planar motion using the instantaneous center of rotation method. Determining accelerations in planar motion of a rigid body.	6

T25-30 – Application of energy methods in the dynamics of planar motion of a rigid body. Dynamic reactions in rotational motion about a fixed axis. Colloquium II.	6
SUM	30

TEACHING TOOLS

1. Lectures using multimedia presentations.
2. Classroom exercises – examples of mechanics problems.
3. CUT e-learning platform and other tools for teaching on-line.

METHODS OF ASSESSMENT (F – FORMATIVE, P – SUMMATIVE)

F01 - Colloquium
F02 - Oral response
F03 - Participation in discussion (activity in classes)
P01 - Colloquium*
P02 - Test.

*) a prerequisite for receiving credit is to receive positive grades on all of the above listed items.

STUDENT WORKLOAD

Ref No.	Form of activity	Average number of hours to complete the activity
1. Contact hours		
1.1	Lectures	30
1.2	Tutorials	30
1.3	Laboratories	0
1.4	Seminars	0

1.5	Project	0
1.6	Office hours	0
1.7	Exam	0
Total contact hours:		60
2. Self-study hours		
2.1	Preparation for tutorials and the final test	35
2.2	Laboratory preparation, laboratory report preparation	0
2.3	Project preparation	0
2.4	Preparation for the final lecture test	20
2.5	Exam preparation	0
2.6	Literature review	10
Total self-study hours:		65
Total student workload:		125
TOTAL NUMBER OF ECTS POINTS FOR THE COURSE		5
Number of ECTS points which a student obtains in classes requiring direct teacher participation:		2,4
Number of ECTS points that a student obtains in practical classes, including laboratory and project classes:		1,2

PRIMARY AND SUPPLEMENTARY RESOURCES

1. B.Skalmierski: Mechanika, Wydawnictwo Politechniki Częstochowskiej 2002 (t. 1 i 2).
2. J.Misiak: Mechanika techniczna, Tom 2 - Kinematyka i dynamika, PWN Warszawa 2019.
3. J.Leyko: Mechanika ogólna, PWN Warszawa 2019 (t. 1 i 2).

4. T.Niezdziński: Mechanika ogólna, PWN Warszawa 2019.
5. H.Głowacki: Mechanika techniczna. Dynamika. Oficyna Wydawnicza Politechniki Warszawskiej Warszawa, 2001.
6. F.P.Beer, E. Russell Johnston: Vector Mechanics for Engineers. McGraw-Hill Publishing Company, 2016
7. Misiak J., Zadania z mechaniki ogólnej, część III, Dynamika, PWN, Warszawa 2017
8. Nizioł J., Metodyka rozwiązywania zadań z mechaniki, WNT, Warszawa 2019
9. Zbiór zadań z mechaniki ogólnej, pod red. Leyko J., Szmelter J., t. 2 Kinematyka i dynamika, PWN Warszawa 1978
10. Giergiel J., Głuch L., Łopata A., Zbiór zadań z mechaniki, metodyka rozwiązań, AGH Kraków 2001
11. Mieszczerski I.W., Zbiór zadań z mechaniki, PWN, Warszawa 1971

COURSE COORDINATOR (NAME, SURNAME, DEPARTMENT, E-MAIL)

dr inż. Tomasz Skrzypczak, Department of Mechanics and Fundamentals of Machine Design, tomasz.skrzypczak@pcz.pl
dr inż. Anna Jurczyńska, Department of Mechanics and Fundamentals of Machine Design, anna.jurczynska@pcz.pl

MATRIX OF LEARNING OUTCOMES

Learning outcome	Reference of the given outcome to outcomes defined for the entire program (CLO)	Course objectives	Course content	Teaching tools	Method of assessment
LO 1	K_W01	O1	L1-30	1, 3	P2
LO 2	K_U01	O2, O3	T1-30	2, 3	F1-F3 P1

FORMS OF ASSESSMENT– DETAILS*

Learning outcomes	Grade 2.0	Grade 3.0	Grade 4.0	Grade 5.0
LO 1, LO 2	The student has not acquired basic knowledge and skills in the field of kinematics and dynamics of a rigid body.	The student has partially acquired basic knowledge and skills in the field of kinematics and dynamics of a rigid body	The student has acquired knowledge and skills in the field of kinematics and dynamics of a rigid body. They can identify the appropriate method to solve problems related to kinematics and dynamics of a rigid body.	The student has thoroughly mastered knowledge and skills in the field of kinematics and dynamics of a rigid body. They can identify the appropriate method to solve problems related to kinematics and dynamics of a rigid body and can independently expand their knowledge and skills using various sources.

* A half grade of 3.5 is given if the student has achieved the learning outcomes for a grade of 3.0 but has not fully completed the learning outcomes for a grade of 4.0 .A half grade of 4.5 is given if the student has achieved the learning outcomes for a grade of 4.0, but the student has not fully completed the learning outcomes for a grade of 5.0.

OTHER USEFUL COURSE INFORMATION

1. Course topics, resources and literature are provided in classes, in the teacher's office, and in the USOS system.
2. Information on office hours is provided to students during the first class of a given course, and is also placed on website - www.wim.pcz.pl