# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Analytical mechanics [S2MiBP1>MA]

## Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
1/1

Area of study (specialization)
Heavy-duty Machines

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
compulsory

## Number of hours

Lecture
15

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
0

## Number of credit points

2,00

## Coordinators

dr hab. inż. Bartosz Wieczorek prof. PP
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## Lecturers

dr inż. Mateusz Kukla
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dr hab. inż. Bartosz Wieczorek prof. PP
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## Prerequisites

Knowledge: Basic knowledge of higher mathematics, physics, mechanics, strength of materials, basics of machine construction Skills: The ability to solve problems, associate and use knowledge in practical engineering applications Social competences: Teamwork, logical and analytical problem solving, independence and the ability to make rational decisions

## Course objective

1. Provide students with knowledge of analytical mechanics, within the scope defined by the curriculum content appropriate for the field of study. 2. Developing students" skills: - analytical thinking, association and conscious use of computational methods, - modeling of physical phenomena with application in technology, - the use of computer techniques supporting modeling in mechanics, - independent drawing of conclusions and evaluation of the analyzed issue. 3. Shaping students" teamwork skills

## Course-related learning outcomes

Knowledge:
Has a basic knowledge of the mechanics of solids and discrete systems with many degrees of freedom, mathematical modeling of physical and mechanical systems based on d"Alembert"s principle and Lagrange"s equations, mathematical description of materials using constitutive equations.
Has extended knowledge of modern construction materials such as carbon plastics, composites, ceramics, in terms of their construction, processing technology and applications.
Has extensive knowledge of selected departments of technical mechanics related to the selected specialization.

Skills:
Can plan and carry out experimental research of specific processes taking place in machines and routine tests of a working machine or a vehicle from a selected group of machines.
Is able to carry out basic measurements of mechanical quantities on the tested working machine with the use of modern measuring systems.
Can perform a medium complex design of a working machine or its assembly using modern CAD tools, including tools for spatial modeling of machines and calculations using the finite element method.

Social competences:
Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.
It is ready to fulfill social obligations, inspire and organize activities for the benefit of the social environment.
It is ready to initiate actions for the public interest.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Written exam of the lecture, completion of exercises.

## Programme content

Fundamentals of analytical mechanics.
Examples of constraints and their classification.
Tensor of moments of inertia, equations of motion, Lagrange equations.
Elements of the theory of vibrations, vibrations of linear systems.
Analysis and synthesis of dynamical systems.
Kinematics and dynamics of spherical and complex motion, Coriolis forces.
Gyroscope.
Submission of turns.

## Teaching methods

Lecture with multimedia presentation. Exercises - tasks to be solved on the blackboard

## Bibliography

Basic
1. J.N. Hand, J.D.Finch, Analytical mechanics, Cambridge University Press, 1998.
2. C.S. Helrich, Analytical mechanics, Springer 2017.
3. J.S.Török, Analytical mechanics with an introduction to dynamical systems, Wiley 2000.
4. W. Derski; Mechanika techniczna cz. I, Wydawnictwo PP, Poznań 1972
5. R. Gutowski; Mechanika analityczna, PWN 1971
6. J. Leyko; Mechanika ogólna, PWN, Warszawa 1997
7. J. Misiak; Mechanika techniczna, WNT, Warszawa 1998
8. Z. Osiński; Mechanika ogólna, PWN, Warszawa 1997
9. R. Scanlan, R. Rosenbaum; Drgania i flatter samolotów, PWN, Warszawa 1964 M. Sperski; Mechanika, Wydawnictwo PG, Gdańsk 2002
Additional
1. D. Strauch, Classical mechanics, Springer, 2009.
2. J. Kowalski; Zbiór zadań z mechaniki z zastosowaniem do obliczania elementów maszyn, PWN 19762.

3. S. Wiśniewski; Dynamika maszyn, Wydawnictwo PP, Poznań 1972
4. K. Blankiewicz, M. Igalson; Zbiór zadań rachunkowych z fizyki dla studentów Wydziału Mechatroniki, Oficyna Wydawnicza PW 2004
5. R.H. Cannon jr. Dynamika układów fizycznych, WNT 1973

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 0 | 0,00 |
| Classes requiring direct contact with the teacher | 0 | 0,00 |
| Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation) | 0 | 0,00 |