COURSE DESCRIPTION CARD - SYLLABUS

Course name

Mobile work machines

Course

Field of study

Mechatronics

Area of study (specialization)

Mechatronic design of machines and vehicles

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

Polish

Requirements

elective

Number of hours

Lecture

15

Laboratory classes

Other (e.g. online)

Tutorials

Projects/seminars

15

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Faculty of Mechanical Engineering

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Responsible for the course/lecturer:

Prerequisites

Knowledge: Has knowledge of the basics of machine design, technical drawing and the application and

use of computer-aided design tools. Has ordered, theoretically founded general knowledge of technical mechanics and strength of materials. Skills: Can use analytical, simulation and experimental methods to formulate and solve engineering tasks. He can formulate problems, use engineering methods in the analysis of technical issues. He can obtain information from the Internet, library and reading room and other resources. In particular, he can correctly indicate the sources of the necessary information. He can define the quality and usefulness of the information and data found. He can also integrate information obtained from various resources, interpret them, as well as draw conclusions and formulate and justify opinions. Social competences: Can interact and work in a group, assuming various roles in it.

Course objective

The aim of the course is to provide detailed knowledge about the construction of: mobile machines used in the forestry, horticultural, agricultural, construction industry or for road infrastructure service. During the course, the specificity of designing machines from the selected industry will be implemented on selected examples when designing, for example, lawn mowers, wood chippers, concrete mixers, rototillers, chainsaws or snow plows. The topics discussed are to be supplemented with a presentation of the functioning of the previously discussed components in machines and devices tested and designed by the Institute of Machine Design. Some of the solutions discussed are innovative structures that have been protected by intellectual property. The laboratories, during which students are to build selected functional units of machines and devices from real components, are to be a perfect complement to the information provided during the lecture, thus priming the acquired knowledge, while developing the imagination, awareness of the design engineer and manual skills.

Course-related learning outcomes

Knowledge

He has an extended knowledge of the strength of materials regarding the safety and reliability of mechanical structures, calculation of composite elements, frames and curved bars as well as thin-walled tanks and thick-walled vessels. Has knowledge of the basics of optimal structure design [K2_W03]. Has extended knowledge of control, including description of impulse and nonlinear systems, Z transform, impulse and nonlinear control, linearization methods and stability studies of impulse and nonlinear systems. Has a basic knowledge of the selection of control elements of impulse and nonlinear systems [K2_W05]. Has knowledge of technical mechanics on the theory of collisions, analytical mechanics, the use of constraints, generalized coordinates, Dirichlet's principle, vibrations of systems with many degrees of freedom, nonlinear vibrations, motion trajectory in phase space and elements of chaos theory [K2_W06]. Has extended knowledge of mechatronics, knowledge of the analysis and design of complex mechatronic systems, systems theory and technology, and the application of modeling and simulation in mechatronic design [K2_W09].

Skills

an obtain information from the Internet, literature, databases and other properly selected sources (mainly in English or another foreign language recognized as the language of international communication) in the field of mechatronics; is able to integrate obtained information, interpret it, as well as draw conclusions and formulate and justify opinions [K2_U01]. He can use computer systems to design and operate mechatronic devices. He can implement control systems in the real-time operating

system. He can use the basic methods of image processing and analysis. Can prepare software documentation [K2_U15] Is able to visualize a mechanical element in a 3D environment and to analyze the cooperation of elements shown in the drawing [K2_U19]. Can design complex mechatronic devices and systems, using modeling and simulations. He can plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions [K2_U14].

Social competences

Can obtain information from the Internet, literature, databases and other properly selected sources (mainly in English or another foreign language recognized as the language of international communication) in the field of mechatronics; is able to integrate obtained information, interpret it, as well as draw conclusions and formulate and justify opinions [K2_U01]. He can use computer systems to design and operate mechatronic devices. He can implement control systems in the real-time operating system. He can use the basic methods of image processing and analysis. Can prepare software documentation [K2_U15] Is able to visualize a mechanical element in a 3D environment and to analyze the cooperation of elements shown in the drawing [K2_U19]. Can design complex mechatronic devices and systems, using modeling and simulations. He can plan and carry out experiments, including measurements and computer simulations, interpret the obtained results and draw conclusions [K2_U14].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture: written test in the form of answers to the questions posed. A maximum of 1 point can be obtained for each question. Achieving a minimum score of 50% on all questions will be a condition for obtaining a pass. Project: getting credit for the completion of the project set in the first class along with its presentation in the last class.

Programme content

Lecture: Lecture 1 - Classification, types, design methodology and innovations in garden machines The content of the lecture includes the presentation and discussion of the full classification of machines and devices for the implementation of activities used in horticultural and backyard farms. The lectures will also discuss design methodology and mechatronic innovations, which have been intensively developed and introduced into production in recent years. For example: mowers, trimmers, brushcutters, intelligent garden systems, etc. with combustion and electric drives. Lecture 2 - Classification, types, design methodology and innovations in forest machines The content of the lecture includes the presentation and discussion of the full classification of machines and devices for the implementation of activities used in forest management. The lectures will also discuss the design methodology and mechatronic innovations, which have been intensively developed and introduced into production in recent years. For example: chainsaws, logs for wood, harvesters, etc. with combustion and electric drives. Lecture 3 - Classification, types, design methodology and innovations in construction machines. The content of the lecture covers the principles of operation and detailed construction of elements of units and assemblies that make up the construction of construction machines. The lectures will also

discuss the design methodology and mechatronic innovations, which have been intensively developed and introduced into production in recent years. Examples include: concrete mixers, wall plastering systems, machines and devices supporting the construction of reinforced concrete structures (vibrating bars, floor floats) etc. with combustion and electric drives. Lecture 4 - Classification, types, design methodology and innovations in machines for road infrastructure service. The content of the lecture covers the principles of operation and detailed construction of elements of units and assemblies that make up the construction of machines for road infrastructure maintenance. The lectures will also cover design methodology and mechatronic innovations. For example: snow plows, sweepers, striping machines, etc. with combustion and electric drives. Lecture 5 - Classification, types, design methodology and innovations in low-power agricultural machines. The content of the lecture covers the principles of operation and detailed construction of elements of units and assemblies that make up the construction of machines for low-power agricultural work. The lectures will also cover design methodology and mechatronic innovations. For example: tillers, light garden vehicles, equipment modules for farm tractors with their own drive or which are independent mechanisms (sprayers, spreaders), etc. with combustion and electric drives. Lecture 6 - Classification, types, design methodology and innovations in low-power orchard machines. The content of the lecture covers the principles of operation and detailed construction of elements of units and assemblies that make up the construction of machines for horticulture. The lectures will also cover design methodology and mechatronic innovations. For example: systems for automatic pruning of tree and shrub branches, vines, automatic fruit harvesting, fruit ripeness recognition, fruit segregation systems, etc. with combustion and electric drives. Lecture 7 - An invited lecture or a visit to a production plant related to the above subject A lecture conducted by an invited industry specialist or a tour of the production plant combined with a lecture, which will present an interesting solution / design solutions for the selected / selected devices used to perform activities in the previously described industries. Lecture 8 - Assessment As part of the credit, students will be asked to answer the questions in writing. Projects: Design classes 1 - Introductory classes During the course, students will be divided into subgroups and each of them will receive a project topic to be implemented during the course. Design classes 2 The content of the course includes a discussion of the methodology of calculating elements and assemblies that make up the construction of garden machines, e.g. lawn mowers, with a selection of the above-mentioned. Design classes 3 The content of the course includes a discussion of the methodology of calculating elements and assemblies that make up the construction of forest machines, e.g. wood chippers, together with the selection of the above-mentioned. Design classes 4 The content of the course covers the methodology of calculating elements and assemblies that make up the construction of construction machines, e.g. concrete mixers, together with the selection of the above-mentioned elements and assemblies. Design classes 5 The content of the course includes a discussion of the methodology of calculating elements and assemblies that make up the construction of machines for the operation of road infrastructure, e.g. snow plows, along with the selection of

Teaching methods

Lecture: information lecture, seminar lecture

Design classes: project method, demonstration

Bibliography

Basic

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2. Więsik J. 2015. Urządzenia techniczne w produkcji leśnej. Tom 1. Maszyny i urządzenie do pozyskania i transportu drewna. Wydawnictwa SGGW, Warszawa, s. 590.

Uzupełniająca

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9. Bolton W., Mechatronics : a multidisciplinary approach, Pearson/Prentice Hall, 2008.

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3. Botwin M. 1993. Podstawy użytkowania maszyn leśnych. Wydawnictwa SGGW, Warszawa, s. 123.

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7. Dietrich M., Podstawy budowy maszyn cz. 2, Wydawnictwo PW 1985

8. Biały W., Maszynoznawstwo. WNT, Warszawa 2006

9. Kijewski J., Miller A., Pawlicki K., Maszynoznawstwo, WSiP

10. Tomas J. Maszyny rolnicze, Dragon Edukacja 2018

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for project classes, preparation for exam, project preparation) [1]	20	1,0

[1] delete or add other activities as appropriate