COURSE DESCRIPTION CARD - SYLLABUS

Course name
Designing autonomous vehicle subsystems [S1MiBP1>PPPA]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
30

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of technical drawing, machine construction, car construction and car mechanics. Knowledge of the basic principles of carrying out strength and fatigue analyzes. Understanding the basic principles of design. Ability to adapt the calculation process to the task performed, the selection and use of dependencies in the field of traction calculations, geometric structures, strength and fatigue. Spreadsheet support. Determining the hierarchy and schedule of tasks when designing typical mechanical structures. The ability to identify problems and solve computational and construction dilemmas. Independence.

Course objective

Provide students with basic information on the design of vehicle systems and components, in particular the methods of designing mechanical car drive systems and their components.

Course-related learning outcomes

Knowledge:
M1_W05 Has basic knowledge of the basics of machine design and the theory of machines and mechanisms, including mechanical vibrations.
M1_W18 Is aware of the latest trends in machine construction, i.e. automation and mechatronization,

automation of machine design and construction processes, increased safety and comfort of operation, the use of modern construction materials.

Skills:
M1_U02 Can search in catalogs and on manufacturers" websites ready-made machine components to be used in his own projects.
M1_U16 Can create a system diagram, select elements and perform basic calculations using ready-made computational packages of mechanical, hydrostatic, electric or hybrid machine drive system.

Social competences:
M1_K02 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.

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 on the lecture material, completion of laboratory classes based on the documentation of the tasks performed.

Programme content

The specificity of drive systems of autonomous vehicles (passenger cars, delivery vans and trucks).
Classification of design solutions for drive systems in passenger cars.
Design of disc couplings - calculation algorithms for: geometry of the clutch disc, durability of the friction clutch and clutch pressure (diaphragm and multi-coil) springs.
Types of mechanical gearboxes. Selection of basic geometrical parameters of gears and teeth. Materials and their heat treatment. Tooth checking for fatigue strength. Ways of taking into account variable loads. Synchronizers: synchronizing torque, synchronization time and heat loads.
Calculations of (helical and hypoid) bevel gear final drives. Selection of basic parameters for differential and axle bevel gears in differentials.
Planetary gears in automatic drive systems - selection of geometrical parameters.
Calculations of hydrodynamic clutches and torque converters. Characteristics of clutches and converters and their selection for vehicles with automatic transmission.
Selection of rolling bearings in the vehicle transmission system: in the gearbox, in the final drive, and in the road wheels. Determination of the fatigue life of rolling bearings taking into account equivalent dynamic bearing loads.
Design of drive shafts and joints. Kinematics and dynamics of asynchronous universal joints and synchronous joints. Cardan shafts: vibrations and load on supports.
Geometric and strength calculations of steering systems, including power steering systems.
Classification of braking systems, disc and drum brakes. Calculations of components and brake control system.

Teaching methods

1. Lecture: multimedia presentation. 2. Laboratory classes: preliminary design development of vehicle subsystems, strength and durability calculations and modification of previously adopted subsystems.

Bibliography

Basic
1. Jaśkiewicz Zb., Projektowanie układów napędowych pojazdów samochodowych, WKiŁ, Warszawa, 1982
2. Jaśkiewicz Zb., Wąsiewski A., Układy napędowe pojazdów samochodowych: obliczenia projektowe, OWPW, Warszawa, 2002
3. Poradnik inżyniera samochodowego (red. Jaśkiewicz Zb.), WKiŁ, 1990
Additional
1. Stańczyk T.L., Lomako D., Komputerowe obliczenia zespołów samochodów i ciągników, WPŚ, Kielce, 2004
2. Zając M., Układy przeniesienia napędu samochodów ciężarowych i autobusów, WKiŁ 2008
3. Micknass W., Popiol R., Sprenger A., Sprzęgła, skrzynki biegów, wały i półosie napędowe, WKiŁ 2012

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	45	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00