COURSE DESCRIPTION CARD - SYLLABUS

Course name
Dynamics of crank mechanisms [S1MiBP1>DMK]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
3/5

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
15

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

dr inż. Maciej Babiak

Lecturers

Prerequisites

Knowledge of mechanics including kinematics and dynamics, basic skills in the field of harmonic analysis and knowledge of the basics of machine construction. Basic knowledge of the operation of heat engines.

Course objective

Gaining basic knowledge on the intended and side effects of a crank system of an internal combustion engine. Acquainting with the justified selection of the number of cylinders and the way of their arrangement in order to obtain the optimal drive unit for a given means of transport. Acquiring the ability to calculate the desired and undesirable forces in a crank mechanism. Gaining knowledge on methods of improving the functioning of the piston mechanism in terms of improving the comfort of the car and reducing the negative impact of the engine on the environment.

Course-related learning outcomes

Knowledge:
Has basic knowledge of the basics of machine design and the theory of machines and mechanisms, including mechanical vibrations.
Has basic knowledge of the strength of materials, including the basics of the theory of elasticity and plasticity, stress hypotheses, calculation methods for beams, membranes, shafts, joints and other simple

structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in mechanical structures.
Has basic knowledge of the methods of linear measurements, measurements of stresses, strains, velocities, temperatures and fluid streams, including measurements of these quantities by electrical means.

Skills:
Can obtain information from literature, the Internet, databases and other sources. Can integrate the obtained information, interpret and draw conclusions from it, and create and justify opinions.
Can properly use modern equipment for measuring major physical quantities, used in machine research and production control.
Can use learned mathematical theories to create and analyze simple mathematical models of machines and their elements, and simple technical systems.

Social competences:
Is ready to critically assess his knowledge and received content
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 (lecture), final test (exercises).

Programme content

Basic ways of arranging cylinders in an internal combustion engine. Rules for selecting the number of cylinders and their arrangement depending on the intended use of the engine and the resulting requirements. Equations of motion, velocity and acceleration of elements of the piston-crank system. Mass distribution in the piston-crank system. The forces loading the elements of the piston-crank system. Influence of the internal combustion engine on its suspension and power receiver. Vibrations in the piston-crank system, their effects and methods of limiting.

Teaching methods

Informative (conventional) lecture (providing information in a structured way) - may be of a course (introductory) or monographic (specialist) character.
Problem lecture ("internal dialogue" of the lecturer with the student: understanding the problem, collecting premises, solving it).
Seminar lecture ("external dialogue" between the lecturer and the student; students participate in solving the problem) - the continuation of the lecture may be a seminar.
Working with a book (independent study of literature; non-linear notation recommended, e.g. using the mindmapping method - creating mind maps).
Conversation (teacher"s conversation with students in the form of questions on his part and students" answers: introductory, information, consolidation, control, presenting new messages).
Classic problem method (feeling of difficulty, formulating a problem, creating hypotheses, verification, summing up students" independent work).
Case study method (analysis of a specific case: illustrative - illustrative; problem-based - problem identification; open episode - giving a proposal for action).
Round table (free exchange of views between students and teacher).

Bibliography

Basic
1. Kevin Hoag, Brian Dondlinger, Vehicular Engine Design, wydawnictwo Springer 2016
2. ATZ/MTZ-Fachbuch, Cylinder components, wydawnictwo Springer 2016
3. ATZ/MTZ-Fachbuch, Pistons and engine testing, wydawnictwo Springer 2016
4. Alexander A. Stotsky, Automotive Engines, wydawnictwo Springer 2009
5. Köhler E., Verbrennungsmotoren – Motormechanik, Vieweg – ATZ-MTZ-Fachbuch, 8. Braunschweig/Wiesbaden 2002

6. Zima S., Kurbeltriebe. Vieweg GmbH. Braunschweig, Wiesbaden 1999
7. Iskra A., Dynamika mechanizmów tłokowych silników spalinowych. Wydawnictwo Politechniki Poznańskiej, Poznań 1995
Additional
1. Czasopismo MTZ - Motortechnische Zeitschrift, wydawnictwo Springer
2. Michael Trzesniowski, Handbuch Rennwagentechnik, wydawnictwo Springer 2017-2019
3. Michael Trzesniowski, Rennwagentechnik, wydawnictwo Springer 2014
4. Apostolos Papanikolaou, Ship Design, wydawnictwo Springer 2014
5. Klaus Schreiner, Basiswissen Verbrennungsmotor, wydawnictwo Springer 2015
6. Konrad Reif, Fundamentals of Automotive and Engine Technology, wydawnictwo Springer 2014
7. Mosakowski R., Zależności na parametry kinematyczne mechanizmu korbowego w nowym ujęciu, Archiwum Motoryzacji Nr 1/2, s. 21-28, 1999.
8. Taylor Ch., The Internal Combustion Engine in Theory and Practice, Volume 2, str. 240-305
9. Iskra A., Studium konstrukcji i funkcjonalności pierścieni w grupie tłokowo-cylindrowej. Wydawnictwo Politechniki Poznańskiej, Poznań 1996
10. Jędrzejowski J., Mechanika układów korbowych silników samochodowych. WKŁ, Warszawa 1972

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00