COURSE DESCRIPTION CARD - SYLLABUS

Course name

Dynamics of crank mechanisms

Course

Field of study

Construction and Exploitation of Means of Transport

Year/Semester

3/5

Area of study (specialization)

Internal Combustion Engines

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

polish

Form of study

part-time

Requirements

compulsory

Number of hours

Lecture

9

Laboratory classes

9

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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

A student has extended basic knowledge necessary to understand specialized subjects and specialist knowledge about the construction, construction methods, manufacturing and operation of a selected group of working, transport, thermal and flow machines covered by the WMRT specialization profile, in particular:

1. Food and refrigeration machinery

2. Working machines (construction and agricultural)

3. Motor vehicles

4. Mass transport vehicles

5. Mechatronic systems

6. Internal combustion engines

7. Aircraft engines

8. Thermal techniques

9. Virtual design engineering

Program modules related to the above-mentioned specializations are optional and selected by the student in the form of packages of elective subjects.

A student has a basic knowledge of the tribological processes occurring in machines, i.e. friction, lubrication and wear.

A student 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, use of modern construction materials.

Skills

A student 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.

A student can search in catalogs and on manufacturers' websites ready-made machine components to be used in his own projects.

A student is able to use learned mathematical theories to create and analyze simple mathematical models of machines and their elements, and simple technical systems.

A student can use computer office packages for editing technical texts, including formulas and tables, technical and economic calculations using a spreadsheet and running a simple relational database.

A student can competently advise on the selection of a machine for a given application in the industry covered by the selected specialty, based on the acquired knowledge about a given group of machines.

A student can prepare and present a short verbal and multimedia presentation devoted to the results of an engineering task.

A student is able to organize and substantively manage the process of designing and operating a simple machine from a group of machines from the group covered by a selected specialty.

Social competences

A student is ready to critically assess his knowledge and received content.

A student is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in the event of difficulties in solving the problem on his own.

A student is ready to fulfill social obligations and co-organize activities for the benefit of the social environment.

A student is ready to initiate actions for the public interest.

A student is willing to think and act in an entrepreneurial manner.

A student is ready to fulfill professional roles responsibly, including:

- compliance with the rules of professional ethics and requiring this from others,

- care for the achievements and traditions of the profession.

Methods for verifying learning outcomes and assessment criteria

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	90	3,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam, project preparation) [1]	60	2,0

[1] delete or add other activities as appropriate