



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Nanomaterials in engine design

### Course

Field of study

Year/Semester

Design and operation of transport

2/3

Area of study (specialization)

Profile of study

Combustion Engines

general academic

Level of study

Course offered in

Second-cycle studies

polish

Form of study

Requirements

full-time

compulsory

### Number of hours

Lecture

Laboratory classes

Other (e.g. online)

15

0

0

Tutorials

Projects/seminars

0

0

### Number of credit points

1

### Lecturers

Responsible for the course/lecturer:

Responsible for the course/lecturer:

dr hab. inż. Jarosław Kałużny

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tel. 61-6652049

Wydział Inżynierii Lądowej i Transportu

ul. Piotrowo 3, 60-965 Poznań

### Prerequisites

Knowledge: Base knowledge in physics, according to the course for the faculty of mechanics; base knowledge in chemistry, according to the course for the faculty of mechanics

Competences: Ability to conduct self studies in literature; ability for creative usage of knowledge in various fields of physics, chemistry and engineering sciences

Social competences: Understanding of continuous personal development; understanding of the impact of engineering products on the human environment.



### Course objective

Analysis of the process of piston-cylinder friction. Hydrodynamic theory of lubrication.

### Course-related learning outcomes

Knowledge

Extending the competences in rapidly developed nanotechnology

Skills

The student can formulate and test hypothesis.

Social competences

The student becomes to be happy to start his activity striving public affairs

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Discussion during the lesson

Mutual or written exam

### Programme content

- Definition of nanomaterials, types of nanomaterials
- Application of nanomaterials in mechanical and electronics design
- Carbon allotropes
- Growth of carbon nanomaterials
- Carbon nanomaterials for friction reduction
- Results of the tests targeting application of carbon nanotubes in combustion engines, discussion
- Electron microscopy, types of microscopes, principles of imaging process
- EDX spectroscopy
- Raman Spectroscopy

### Teaching methods

various

### Bibliography

Basic

1. ACS Nano



2. Nano Today

Additional

1. Nature

2. Science

**Breakdown of average student's workload**

	Hours	ECTS
Total workload	30	1,0
Classes requiring direct contact with the teacher	15	0,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	15	0,5

<sup>1</sup> delete or add other activities as appropriate