



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Methodology of emission tests of hybrid drives [S2MiBP1-HSN>MBENH]

### Course

Field of study

Mechanical and Automotive Engineering

Year/Semester

1/2

Area of study (specialization)

Hybrid Powertrain Systems

Profile of study

general academic

Level of study

second-cycle

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

### Number of hours

Lecture

30

Laboratory classes

0

Other

0

Tutorials

0

Projects/seminars

0

### Number of credit points

2,00

### Coordinators

prof. dr hab. inż. Jacek Pielecha  
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### Lecturers

### Prerequisites

KNOWLEDGE: the student has basic general knowledge about the construction of the surrounding world and the laws that govern it SKILLS: the student is able to integrate the obtained information, interpret it, draw conclusions, formulate and justify opinions SOCIAL COMPETENCES: the student is aware of the social and economic importance of internal combustion engines

### Course objective

Introduction to the methodology of testing the functional properties of transport environmental pollutants and the emission of toxic compounds from hybrid drives

### Course-related learning outcomes

Knowledge:

Has extended knowledge of thermodynamics and fluid mechanics to the extent necessary to understand the principle of operation and calculations of thermodynamic and flow processes occurring in working machines such as heating, cooling, drying, thermal and pressure agglomeration, etc., pneumatic transport, energy conversion, etc.

He has extended knowledge of modern construction materials such as carbon plastics, composites,

ceramics, in terms of their construction, processing technology and applications.  
He has in-depth knowledge of the construction, principles of operation and classification of machines from a selected group.

#### Skills:

He can write a service manual and a safety manual for a designed work machine or vehicle from a group of machines selected within the specialty

He can estimate the potential threats to the environment and people from the designed working machine and vehicle from a selected group

Is able to plan and conduct experimental studies of specific processes occurring in machines and routine tests of a working machine or a vehicle from a selected group of machines

Is able to perform a medium complex design of a working machine or its assembly using modern CAD tools, including tools for spatial modeling of machines and calculations using the finite element method

#### Social competences:

He 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 consult experts in the event of difficulties in solving the problem on its own

Is willing to think and act in an entrepreneurial manner

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:

Discussion with the use of illustrative materials related to the methodology of environmental pollution measurements. Written exam

### Programme content

Methods for measuring toxic compounds in the exhaust gas (analyzers: NDIR, FID, CLD, MPD, chromatography elements, measurement of solid particles, opacimeters). Standards and methods of testing the emission of toxic compounds of conventional and hybrid drives; tests of vehicles with a total mass of less than and over 3500 kg, tests of engines for other than automotive use, forecasts for the development of standards and test methods. Polish legislation on pollutant emissions, including hybrid drives. Pollution measurement methods in the drives of road, rail and sea transport units (mainly hybrid). Fundamentals of unconventional research methods (fast photography, VIDEO technique, emission and absorption techniques, laser, etc.). Measurement methods used in static tests. Methodology of research tests intended for dynamic research. Methodology of pollutant measurements in real conditions of hybrid drive traffic. Construction and operation of mobile analyzers for the measurement of gaseous compounds and solid particles (in terms of mass, number and diameter distribution).

### Course topics

none

### Teaching methods

problem lecture / conversation lecture / lecture with multimedia presentation

### Bibliography

#### Basic

1. Pielecha J. (red.), *Badania emisji zanieczyszczeń silników spalinowych*. Wydawnictwo Politechniki Poznańskiej, Poznań 2017
2. Merkisz J., Pielecha J., Radzimirski S., *New Trends in Emission Control in the European Union*. Springer Tracts on Transportation and Traffic, Vol. 1, 2014.
3. Merkisz J. Fuć P., Pielecha J., *Metody pomiaru emisji związków szkodliwych spalin w rzeczywistych warunkach ruchu pojazdów samochodowych*. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa–Poznań 2014.

#### Additional

1. Merkisz J., Pielecha I., Alternatywne napędy pojazdów. Wydawnictwo Politechniki Poznańskiej, Poznań 2006.

#### 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 |