



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Braking systems

### Course

Field of study

Year/Semester

Transport

1/1

Area of study (specialization)

Profile of study

Railway Transport

general academic

Level of study

Course offered in

Second-cycle studies

Polish

Form of study

Requirements

full-time

elective

### Number of hours

Lecture

Laboratory classes

Other (e.g. online)

30

0

0

Tutorials

Projects/seminars

15

0

### Number of credit points

3

### Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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### Prerequisites

**KNOWLEDGE:** the student has a basic knowledge of railway braking systems. In addition, he knows the construction and the operating characteristics of the main braking devices and the principle of automatic operation railway brake

**SKILLS:** the student is able to use the acquired knowledge to calculate the brakes and then to designing the car brake system

**SOCIAL COMPETENCES:** the student is able to cooperate in a group, organize a repair process and production in its main outline.



The student is able to determine the priorities important in solving the tasks set before him

### Course objective

The aim of the course is to learn the practical principles of braking trains and equipment operation implementing this process and operational recommendations. Moreover, learning about the principles of conducting research station and training ground railway brakes.

### Course-related learning outcomes

#### Knowledge

Student has advanced detailed knowledge of selected issues in the field of transport engineering

Student has knowledge about development trends and the most important new achievements of means of transport and other, selected, related scientific disciplines

#### Skills

Student is able to plan and conduct experiments, including measurements and simulations, interpret the obtained results and draw conclusions as well as formulate and verify hypotheses related to complex engineering problems and simple research problems

Student is able - in accordance with a given specification, taking into account non-technical aspects - to design a complex device, system in the field of transport engineering or a process and to implement this project - at least in part - using appropriate methods, techniques and tools, including adapting the existing or developing new ones tools

#### Social competences

Student understands that knowledge and skills become obsolete very quickly in the field of transport engineering

Student understands the importance of using the latest knowledge in the field of transport engineering in solving research and practical problems

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

For discussion, ongoing preparation and activity in class. Written exam for lectures and written exam for classes.

### Programme content

Requirements for modern railway brakes, definitions and concepts of braking, braking systems of rail vehicles, including PN, EP, ED, R, Mg, their scope of application, advantages and disadvantages, operational recommendations, experimental methods of determining the braking weight of wagons, characteristics of pneumatic devices and friction - wear materials for brake pads and disc brake linings, test stands and test programs, rules and standards for assembling trains.

### Teaching methods

1. Lecture with multimedia presentation,



2. Exercises - solving problems.

### Bibliography

#### Basic

1. Piechowiak T., Hamulce pojazdów szynowych. Wydawnictwo Politechniki Poznańskiej, Poznań 2012.
2. Ścieszka S.F., Hamulce cierne. Zagadnienia materiałowe, konstrukcyjne i tribologiczne, Wydawnictwo Gliwice-Radom 1998.
3. Przybyszewski M., Elektryczne zespoły trakcyjne. Wydawnictwo WKŁ, Warszawa 2017.

#### Additional

1. Grzesikiewicz W.: Hamulce pojazdów szynowych. Wydawnictwo Politechniki Warszawskiej (skrypt), Warszawa 1982.
2. Kalinowski A., Orlik A.: Wagony towarowe i hamulce. WKŁ, Warszawa 1981.
3. Miatluk M., Kamiński Z., Układy hamulcowe pojazdów obliczenia. Wydawnictwo Politechniki Białostockiej, Białystok 2005.
4. Janiak M., Kalinowski A.: Konstrukcja i eksploatacja wagonów kolejowych. WŁK, Warszawa, 1980.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	45	1,5
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) <sup>1</sup>	45	1,5

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