COURSE DESCRIPTION CARD - SYLLABUS

Course name
Pavement structures [S2Bud1-BDMiK>KN]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Road, Bridge and Railway Engineering

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
45

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

1. Knowledge: - has advanced knowledge in mathematics, physics and chemistry, which is the basis for subjects in the field of the theory of building materials and structures, technological processes and organizational and investment strategies (in the field of road and railway constructions); - knows the principles of analysis, construction and dimensioning of elements and connections in building structures (in the field of road and railway constructions); - has knowledge of the mechanics of solids, knows the principles of analysis of statics, stability and dynamics of structures (in the field of road and railway constructions). 2 Skills: - is able to classify construction objects (in the field of road and railway constructions); - can design elements and connections in complex construction objects (in the field of road and railway constructions); - is able to design complex construction details in building objects (in the field of road and railway constructions). 3 Social competences: - can - by carrying out specific tasks - work independently, cooperate in a team; - is responsible for the safety of own and team work; - acts in accordance with the principles of ethics.

Course objective

1) Acquainting students with technological solutions currently used in road and railway constructions in the field of materials and pavements. 2) Developing the ability to identify and solve significant technological problems, in particular solutions ensuring obtaining sufficient durability of road and railway pavements and taking into account the requirements of environmental protection. 3) Developing the ability to independently explore new issues and development trends in the field of road and railway pavement technology.

Course-related learning outcomes

Knowledge:
1. Knows the rules of analysis, construction and dimensioning of elements and connections in road and railway pavements
2. Has knowledge concerning the currently used construction materials and products in road and railway pavements, their properties and test methods, as well as the technologies of their production and incorporation
3. Knows the principles of design, construction and operation of road and railway pavements
4. Have detailed and theoretically based knowledge in the field of building physics, related to heat and moisture migration in road and railway buildings

Skills:
1. Can make an assessment and summary of loads acting on road and railway pavements
2. Is able to design complex construction details in road and railway pavements
3. Can use appropriate methods and tools to plan and conduct laboratory experiments leading to the assessment of the quality of the materials used and the assessment of the strength and durability of road and railway pavements

Social competences:
1. Is responsible for the reliability of the obtained results of his own work and the work of his team
2. Is ready to independently supplement and expand knowledge in the field of modern processes and technologies in road and railway construction
3. Is aware of the need for sustainable development in road and railway construction

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Students" knowledge and skills are assessed on the basis of a written test. Reports from the laboratory exercises carried out are assessed, together with the control of knowledge in this area.
Information on the form, date and duration of the exam is provided during the first lecture in the semester.

Programme content

Road and airfield pavement structures.
Railway pavement structures.
Laboratory tests of materials used in pavement structures.

Course topics

The development of technology and structure of road pavements and the environment.
Durability of road pavements. Pavement resistance to rutting, low-temperature cracks and fatigue cracks.
Porous, drainage and retention pavements - advantages and disadvantages.
Recycling of pavements.
Pavements on bridge structures.
Pavement maintenance technologies.
Thin asphalt layers.
Advanced laboratory testing methods for asphalt binders and mixtures.
Classification of railways (classic two-rail railways; unconventional railways).
Types of railway pavement structure and discussion of the meaning and role of its individual elements.
The problem of choosing the railway pavement.

Nominal and operational durability of the railway track.
Influence of temperature on the contactless track and operation of railway track elements (transfer of loads from the vehicle wheel to the track).
Necessary innovations in railways (minimization of the acoustic impact; limitation of the impact of railway lines on the migration of animals; drainage of water from the track; green tram tracks).

Teaching methods

Lectures with multimedia presentations
Laboratory exercises carried out in the Road Laboratory of the Institute of Civil Engineering

Bibliography

Basic
1. Radziszewski P., Sarnowski M., Technologia nowoczesnych nawierzchni asfaltowych, PWN 2023
2. Piłat J., Radziszewski P., Król J., Technologia materiałów i nawierzchni asfaltowych, WKŁ, Warszawa 2015
3. Gaweł I., Kalabińska M., Piłat J., Asfalty drogowe, WKŁ, Warszawa 2014
4. Piłat J., Radziszewski P., Nawierzchnie asfaltowe, WKŁ 2010
5. Radziszewski P., Piłat J., Sarnowski M., Król J., Kowalski K.J., Nawierzchnie asfaltowe na obiektach mostowych, OWPW, Warszawa 2016
6. Szydło A., Nawierzchnie drogowe z betonu cementowego, Polski Cement 2004
7. Czyczuła Wł.: Tor bezstykowy. Wydawnictwo Politechniki Krakowskiej, Kraków 2002
8. Bogdaniuk B., Towpik K.: Budowa, modernizacja i naprawy dróg kolejowych,, KOW, Warszawa 2010
9. Grulkowski S., Kędra Z., Koc Wł., Nowakowski M. J.: Drogi szynowe. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2013
10. Esveld C.: Modern railway track. Second Edition, Delft 2001
11. Sancewicz St.: Nawierzchnia kolejowa. PKP Polskie Linie Kolejowe S.A., Warszawa 2010
12. Praca zbiorowa pod red. J. Sysak: Drogi Kolejowe. PWN, Warszawa 1986
13. Towpik K.: Utrzymanie nawierzchni kolejowej. WKiŁ, Warszawa 1990

Additional
1. Stefańczyk B., Mieczkowski P., Mieszanki mineralno-asfaltowe, wykonawstwo i badania, WKŁ 2008.
2. Wymagania Techniczne WT-1 2014, Kruszywa do mieszanek mineralno-asfaltowych i powierzchniowych utrwaleń na drogach krajowych, GDDKiA Warszawa 2014
3. Wymagania Techniczne WT-2 2014, Nawierzchnie asfaltowe na drogach krajowych, GDDKiA Warszawa 2014 (cz. 1), 2016 (cz. 2)
4. Wymagania Techniczne WT-4 2010, Mieszanki niezwiązane do dróg krajowych, GDDKiA Warszawa 2010
5. Wymagania Techniczne WT-5 2010, Mieszanki związane spoiwem hydraulicznym do dróg krajowych, GDDKiA Warszawa 2010
6. WR-D-61, Katalog typowych konstrukcji nawierzchni podatnych i półsztywnych, Ministerstwo Infrastruktury, 2025
7. WR-D-62, Katalog typowych konstrukcji nawierzchni sztywnych, Ministerstwo Infrastruktury, 2025
8. WR-D-63, Katalog typowych konstrukcji nawierzchni jezdni przeznaczonych do ruchu bardzo lekkiego oraz innych części dróg, Ministerstwo Infrastruktury, 2022
9. Van M. A.: Stability of continuous welded rail track. Delft 1995
10. Siewczyński Ł.: Zagadnienia współpracy nawierzchni kolejowej z podtorzem gruntowym. Wydawnictwo Politechniki Poznańskiej, Poznań 1974
11. Towpik K.: Infrastruktura drogi kolejowej. Obciążenia i trwałość nawierzchni. Biblioteka Problemów Eksploatacji, Warszawa-Radom 2006
12. Łoś M.: Wpływ temperatury na pracę toru kolejowego. WKiŁ, Warszawa 1974
13. Basiewicz T.: Nawierzchnia kolejowa z podkładami betonowymi. Wydawnictwa Komunikacji i Łączności, Warszawa 1969

Breakdown of average student's workload

	Hours	ECTS
Total workload	115	4,00
Classes requiring direct contact with the teacher	75	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50