GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00070547		
Field of study	Civil Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	8	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Transportation Engineering -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Dawid Ryś	
	Teachers	dr hab. inż. Dawid Ryś dr inż. Cezary Szydłowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	0.0	30

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=4632

Moodle ID: 4632 Diagnostyka i utrzymanie nawierzchni drogowych (PG_00070547) https://enauczanie.pg.edu.pl/2025/course/view.php?id=4632

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	0.0	0.0	30

Subject objectives

The aim of the course is for students to become familiar with and understand the principles and methods used in the diagnostics of asphalt and concrete pavements. Students will acquire analytical skills and the ability to interpret the results of diagnostic tests, as well as develop competencies in making decisions regarding the selection of appropriate maintenance technologies. In addition, the course aims to introduce students to various technologies used for pavement strengthening, reconstruction, and pavement recycling.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_K04] Engages in independent lifelong learning and individually follows the development of science and technology in the field of civil engineering.	Participates in laboratory work. Attends lectures.	[SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
	[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	Conducts research using specialized equipment for pavement diagnostics (e.g., FWD). Conducts laboratory tests of road materials.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
	[K6_K03] Can effectively, clearly and unambiguously convey information, describe activities and communicate their results/ outcomes to engineers or a wider audience using appropriate communication methods and tools.	Prepares reports on conducted laboratory and field tests. Works in a team.	[SK2] Assessment of progress of work [SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills
	[K6_W03] Demonstrate knowledge and understanding of the processes, established standards and design methods in the civil engineering subject area and of their limitations.	Uses legal regulations and standards related to pavement diagnostics and maintenance. Applies standards for conducting field and laboratory tests.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K6_K01] Is aware of the key aspects of professional, ethical and social responsibility related to management, business operation, decision making and opinion formulation in civil engineering.	Conducts research together with the group and carries out group tasks.	[SK1] Assessment of group work skills [SK2] Assessment of progress of work [SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice

Subject contents	Course content – lecture **Lecture 1:** Introduction to the lectures, functional properties of pavements, introduction to diagnostics. **Lecture 2:** Pavement diagnostics: deflection measurements Benkelman Beam, FWD, TSD, deflection normalization. **Lecture 3:** Pavement evenness transverse and longitudinal; IRI; rut depth. **Lecture 4:** Assessment of surface condition visual inspection, damage scoring and normalization, macrotexture. **Lecture 5:** Assessment of skid resistance, rolling resistance, and noise measurements. Winter maintenance and control of icy conditions. **Lecture 6:** Assessment of pavement thickness using ground-penetrating radar (GPR), destructive testing, laboratory evaluation of drilled core samples. **Lecture 7:** Design of pavement strengthening using the deflection method and the mechanistic method. **Lecture 8:** Recycling of asphalt pavements using hot recycling technology. **Lecture 9:** Recycling of asphalt pavements using cold recycling technology; recycling of rigid pavements. **Lecture 10:** Pavement condition diagnostics, pavement maintenance planning, reactive and proactive pavement maintenance. Course content – laboratory **Laboratory 1.** Introduction to laboratory classes, pavement diagnostics and skid resistance properties: macrotexture testing using the profilometric method and measurement of the pavement friction coefficient with the British Pendulum Tester. **Laboratory 2.** Pavement diagnostics and bearing capacity measurement: testing the bearing capacity of aggregate pavements using a Light Weight Deflectometer (LWD), flexible pavements using a Falling Weight Deflectometer (FWD), and assessment of load transfer between concrete slabs. **Laboratory 3.** Pavement diagnostics and bearing capacity analysis: analysis of flexible pavement deflections, deflection normalization, and evaluation of structural layer parameters based on back-calculation methods. **Laboratory 4.** Pavement diagnostics and surface condition assessment based on visual inspection of pavement defects. **Laboratory 5.** Pavement diagnostics and automated surface condition evaluation using the LCMS-2 vehicle, including measurements of transverse and longitudinal pavement roughness, International Roughness Index (IRI) and rut depth. **Laboratory 6.** Pavement maintenance: recycling of asphalt pavements using hot technology and testing of reclaimed asphalt pavement (RAP), including determination of the black curve, white gradation curve and asphalt content, as well as the design of asphalt mixtures with RAP. **Laboratory 7.** Pavement maintenance: hot recycling of asphalt pavements and preparation of asphalt mixtures containing reclaimed asphalt pavement. **Laboratory 8.** Pavement maintenance: laboratory testing of asphalt mixtures with RAP, including air void content, stiffness modulus and indirect tensile strength. **Laboratory 9.** Pavement maintenance: cold recycling of asphalt pavements, design of mineral-cement-emulsion (MCE) mixtures and preparation of MCE mixtures.

	Laboratory 10. Pavement maintenance: laboratory testing of MCE mixtures, including air void content, stiffness modulus and indirect tensile strength.
Prerequisites and co-requisites	Knowledge from previous semesters is required in the fields of Road Construction Technology, Geometric Road Design, Road Pavement Structures, and Road Materials.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test from lectures and laboratory	60.0%	60.0%
Attendance at laboratory classes and passing the research report,	100.0%	40.0%

Recommended reading

Basic literature	Thom N., Principles of pavement engineering, Thomas Telford Publishing Ltd, 2008
Supplementary literature	Cudworth D., Rahman M., Deterioration and Maintanance of Pavements, Thomas Telford Publishing Ltd, 2023 Malik R., El- Korchi, T., Pavement Engineering Principles and Practice, CrC Press, 2022
eResources addresses	Basic https://www.gov.pl/web/gddkia/diagnostyka-stanu-nawierzchni - Methodology of the diagnostic systems suficient for national roads https://www.gov.pl/web/infrastruktura/wr-d - Requirements in the field of pavement maitanance

Example issues/ example questions/ tasks being completed

1. Discuss the method of normalization of pavement condition indicators.
2. Discuss the method of testing reclaimed asphalt pavement (RAP) and determining the gradation curves, the so-called white curve and black curve.
3. Explain the limitations in the application of cold recycling technology for asphalt pavements.
4. Indicate the correct answer regarding the pavement roughness indicator IRI: A) IRI is the longitudinal profile of the pavement B) IRI is expressed in units of mm/m C) IRI as a profile is expressed as deviations (mm) from the road axis D) IRI can only be measured with a dedicated device equipped with an accelerometer

Practical activites within the subject	Field exercises

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