GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Tribology, PG_00064832		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Division of Machine Design and Medical Engineering -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Michał Wasilczuk	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

E-learning hours included: 0.0

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	60	6.0	34.0	100

Subject objectives

Presenting knowledge concerning friction and wear with a special emphasis on modern bearing systems. In addition presenting the scientific methods used in friction and wear assessment.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W01] explains and describes, on the basis of general knowledge of the scientific disciplines forming the theoretical basis of Mechanics and Mechanical Engineering, the structure and principles of operation of mechanical systems and processes	The student is acquainted with contemporary knowledge concerning machine operation, including the wear and durability issues	[SW1] Assessment of factual knowledge
[K7_U03] plans and carries out experimental investigations to determine the parameters of devices, processes or systems in the field of Mechanical Engineering and Mechanical Engineering, appropriately selects methods, techniques and tools, interprets results and estimates measurement errors	The student is able to use contemporary knowledge to arrange the experiment to monitor machine operation	[SU1] Assessment of task fulfilment
[K7_U01] utilizes information obtained from the literature and other sources in the field of Mechanics and Mechanical Engineering and presents and analyses the results of solutions to technical problems in this field	The student is acquainted with contemporary knowledge concerning friction wear and machine bearing systems	[SU2] Assessment of ability to analyse information
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	The student is acquainted with contemporary knowledge concerning friction wear and machine bearing systems	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Lecture:
Fundamentals of friction and wear
Sliding beariing systems - theory and practice
Bearing materials and lubricants including the unconventional ones
rolling element bearings - theory and advanced issues of application
Environmental issues in tribology

Laboratory exercise:

Simulation of shaft vibrations in bearings.
Vibration diagnostics of rolling bearings.
Calculations of radial bearings using the Raymondi-Boyd method.
FEM calculations of radial bearings.
Experimental hydrodynamic testing of thrust bearings on the SON test stand.
Analysis of measurement data from thrust bearing testing on the SON test stand.
Calculations of thrust bearings in ANSYS.
Calculations of thrust bearings using the DIN standard.
Design of a bearing arrangement with preload.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>completed course of Machine Design</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>laboratory</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>written exam</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>Stolarski T.: Tribology in Machine Design. Butterworth-Heinemann 2000.
Lawrowski Z., Tribologia. Tarcie, zużycie, smarowanie Wydawnictwo Naukowe PWN, Warszawa 1993.
Bowden F., Tabor D.: Wprowadzenie do trybologii. Wydawnictwa Naukowo- Techniczne, Warszawa 1980.</td></tr>
<tr><td>Supplementary literature</td><td>Trybologia M. Hebda M, Wachal A.: Tribologia. Wydawnictwo WNT 1980

Barwell F. T.: Łożyskowanie Wydawnictwo WNT 1984</td></tr>
<tr><td>eResources addresses</td><td>Basic
https://www.kkiem.mech.pg.gda.pl/oacm/tribologia/ - supporting materials for laboratory exercises and the exam</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Critical shaft speeds - present: symptoms, hazards, and methods of avoidance.
What are the causes of rolling bearing damage?
What are the different forms of wear in rolling bearings?
How can fatigue damage to individual rolling bearing components be diagnosed during operation? What should be measured? How can conclusions be drawn from measurement results?
What are the two main forms of rolling bearing damage, how do they develop, and under what operating conditions can the bearing be used? How can the severity of damage be diagnosed for each of these forms?
Describe the mechanism of temperature increase in a hydrodynamic bearing following an increase in load.
What are the most important design problems of large thrust bearings - list them and briefly discuss countermeasures.
What are the benefits of using polymer sliding layers in hydrodynamic thrust bearings? Outline the two main methods of bonding the polymer to the pad substrate.
What is the effect of the pad support position on bearing properties and what is the problem of pad support position in reversible machines? Sketch some design solutions to minimize segment deformation in thrust bearings.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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