

## Programme of study – Doctoral School No 4

Warsaw University of Technology ECTS Catalog

<b>Description of course</b>	
Code of course	
Name of course	Navigation systems
Version of course	2021.
<b>A. Place of the course in system of studies</b>	
Level of education	PhD studies
Form and mode of studies	Full-time; part time
Profile of studies	Academic profile in mechanical engineering
Specialisation	
Place of teaching of course	Faculty of Power and Aeronautical Engineering
Place of realization of course	Faculty of Power and Aeronautical Engineering
Coordinator of the course	Prof. dr hab. inż. Janusz Narkiewicz
<b>B. General characteristic of the course</b>	
Block of courses	
Group of courses	
Type of course	elective
Language of course	English
Nominal semester	
Time of completion in the academic year	summer semester
Preliminary requirements	Base knowledge and skills in mathematic (matrix calculus, ordinary differential equations, stochastic methods), fundamentals of mechanics.
Limit of students	
<b>C. Effects of education and manner of teaching</b>	
Purpose of course	To get acquainted with mathematical methods in navigation and attitude determination as a background for their applications to various mobile platforms (land, water, air, space)
Effects of education	see Table 13.
Form of didactic studies and number of hours per semester	Lecture 20 h
	Exercise type of course 0 h
	Laboratory 0 h
	Project type of course 10 h~
	Computer lessons 0 h
Contents of education	The subject covers 20h lecturing and 10 h supervised project. During lectures the fundamentals of navigation and attitude determination methods will be explained illustrated by examples of operating systems. Next the sensors used in mobile platforms will be reviewed. The final part of the lectures is devoted to explain the selected mathematical methods used for attitude and navigation sensor fusion. The objective of the project part of the subject is student short self-study on selected topic and then developing own system, preparing short report and presentation for a seminar of all students participating uin the subject.
Methods of evaluation	Exam. Report and presentation of the project results.
Methods of verification of effects of education	See Table 13.
Exam	Test
Literature	Literature will be given for each lecture based on relative chapter of the text / monography book. Books should be available in university or faculty library. Specialized literature references will be given for the projects.

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Website of the course	Will be created and operated each semester the subject is running
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### Students activity

Number of ECTS credits	
Number of hours of students work to achieve effects of education	<p>1) The number of hours that requires the presence of a lecturer – 35 , including:</p> <ul style="list-style-type: none"> <li>• lectures -20 hours;</li> <li>• projects - 10 hours;</li> <li>• consultancy meetings - 5 hours.</li> </ul> <p>2) The number of hours of student work - 60, including:</p> <ul style="list-style-type: none"> <li>○ systematic preparation for lecturers - 10 hours</li> <li>○ lectures attendance – 20 hours</li> <li>○ work on the project - 20 hours;</li> <li>○ preparing for exam - 10 hours.</li> </ul>
Number of ECTS credits on the course with direct participation of academic teacher	<p>2 ECTS credits - 35 hours, including:</p> <p>a) attendance at the lectures -20 hours;</p> <p>b) project preparation and presentation -10 hours</p> <p>c) project consulting meetings - 5 hours.</p>
Number of ECTS credits on practical activities on the course	<p>2 ECTS credits - 35 hours, including:</p> <p>a) attendance at the design exercises - 10 hours;</p> <p>b) consultancy meetings - 5 hours.</p> <p>c) individual work on the project - 20 hours.</p>
<b>E. Additional information</b>	
None	

Table 13. Learning outcomes	
<b>General academic profile - knowledge</b>	
Code of effect:	<b>W2</b>
Description:	She / he knows the background of the methods, sensors, errors of navigation and attitude systems, sensor integration and data fusion.
Verification:	Test.
Field of study related learning outcomes	
Area of study related learning outcomes	
<b>General academic profile - skills</b>	
Code of effect:	<b>UI</b>
Description:	She / he is capable to develop mathematical and simulation model of the system containing various sensors and various data processing algorithms..
Verification:	Project.
Field of study related learning outcomes	
Area of study related learning outcomes	