Załącznik nr 2 do Zarządzenia Nr 915 z 2019 r. Rektora PB

COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Faculty of Electrical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Electrical and Electronics Engineering</td><td colspan="2">Degree level and programme type</td><td>master's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="6">-</td><td colspan="2">Study profile</td><td>-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Antennas and Propagation</td><td colspan="2">Course code</td><td>IS-FEE-20006S</td></tr>
<tr><td colspan="2">Course type</td><td>elective</td></tr>
<tr><td rowspan="2">Forms and number of hours of tuition</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>FW</td><td>S</td><td>Semester</td><td>summer</td></tr>
<tr><td>30</td><td></td><td></td><td></td><td>15</td><td></td><td></td><td>No. of ECTS credits</td><td>4</td></tr>
<tr><td>Entry requirements</td><td colspan="9">High Frequency Techniques or equivalent</td></tr>
<tr><td>Course objectives</td><td colspan="9">The aim of the course is to acquaint the students with radiation, transmission and reception of electromagnetic waves, with particular emphasis on the different antenna designs and applications of antennas in wireless communication systems. Training skills for using of software for computer-aided analysis and design of consumer antennas, taking graphical environment 4NEC2 as an example.</td></tr>
<tr><td>Course content</td><td colspan="9">Classification and properties of antennas. Basics of radiation theory. Radiation pattern, antenna parameters. Range equation. Electromagnetic field radiated by elementary antennas: Hertz dipole and magnetic dipole. Radiation field of a symmetric thin-wire antenna. Features of a short dipole. Antennas over a ground plane. Feeding of wire antennas, impedance matching, baluns. Antenna arrays, phased arrays. Wire reflectors and directors, Yagi-Uda antennas. Travelling-wave antennas. Frequency-independent and log-periodic antennas. Aperture antennas. Radiation patterns of nonuniform feeded arrays and aperture antennas. Horn antennas, parabolic-reflector antennas, lens antennas. Radiation from microstrips and slots. Antennas in consumer appliances. Propagation of electromagnetic waves in the Earth’s atmosphere, urban and country areas. Wave propagation in different frequency bands.</td></tr>
<tr><td>Teaching methods</td><td colspan="9">lecture, specialization workshop.</td></tr>
<tr><td>Assessment method</td><td colspan="9">lecture: oral exam;
specialization workshop: verification of preparation for workshop, evaluation of reports, completion, presentation and discussion of a final project.</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="7">Learning outcomes
Student:</td><td colspan="2">Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="7">has detailed knowledge on basic structures of antennas, applied, among others, in wireless communication systems;</td><td colspan="2"></td></tr>
<tr><td>LO2</td><td colspan="7">has knowledge on transmission of electromagnetic waves in wireless systems and networks;</td><td colspan="2"></td></tr>
<tr><td>LO3</td><td colspan="7">has knowledge on developments in the field of antenna design;</td><td colspan="2"></td></tr>
<tr><td>LO4</td><td colspan="7">can obtain information from the literature and other sources, also in a foreign language, can interpret the information and draw conclusions;</td><td colspan="2"></td></tr>
<tr><td>LO5</td><td colspan="7">can work individually and in a small team;</td><td colspan="2"></td></tr>
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LO6	can develop documentation on a project task;	
LO7	can prepare and give a presentation on the results of a project task.	
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**
LO1	exam, evaluation of the student's performance during workshops	**L, SW**
LO2	exam, evaluation of the student's performance during workshops	**L, SW**
LO3	exam, evaluation of the student's performance during workshops	**L, SW**
LO4	exam, evaluation of the student's performance during workshops	**L, SW**
LO5	evaluation of the student's performance during workshops	**SW**
LO6	evaluating the student's project and reports	**SW**
LO7	evaluating a presentation on the results of a project task	**SW**
Student workload (in hours)		**No. of hours**
Calculation	attending the class sessions	**30**
	preparation for specialization worshop	**15**
	work on presentations	**15**
	preparation for and participation in exams/tests	**5**
	work on reports from workshop classes and/or work on home assignments	**20**
	participation in student-teacher sessions related to lectures and workshops:	**5**
	preparation for and attendance at the final test from lectures:	**10**
	TOTAL:	**100**

Quantitative indicators	**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation	**50**	**2**
Student workload – practical activities	**60**	**2,5**

Basic references	1. Milligan T. A.: Modern antenna design. IEEE Press, J. Wiley Interscience, 2005. 2. White J. F.: High frequency techniques - an introduction to RF and microwave engineering. J. Wiley Interscience, 2004. 3. Collin R. E.: Antennas and radiowave propagation. McGraw-Hill, 1985.
Supplementary references	1. Hickman I.: Practical radio frequency handbook. Newnes, 2002. 2. IEEE Antennas and Propagation Magazine. 3. IEEE Microwave Magazine. 4. K. Aniserowicz: Lecture notes.

Organisational unit conducting the course	**Department of Photonics, Electronics and Lighting Technology**	**Date of issuing the programme**
Author of the programme	**Prof. Karol Aniserowicz**	**26.01.2020**

L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, FW - field work, S – seminar