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

COURSE DESCRIPTION CARD

<table>
<tr><th colspan="11">Faculty of Electrical Engineering</th></tr>
<tr><td>Field of study</td><td colspan="7">Electrical and Electronics Engineering</td><td>Degree level and programme type</td><td colspan="2">Bachelor's degree</td></tr>
<tr><td>Specialization/ diploma path</td><td colspan="7">-</td><td>Study profile</td><td colspan="2">-</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="7" rowspan="2">Computational Electromagnetics</td><td>Course code</td><td colspan="2">IS-FEE-10045S</td></tr>
<tr><td>Course type</td><td colspan="2">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 colspan="2">summer</td></tr>
<tr><td>10</td><td></td><td></td><td></td><td>20</td><td></td><td></td><td>No. of ECTS credits</td><td colspan="2">2</td></tr>
<tr><td>Entry requirements</td><td colspan="10">-</td></tr>
<tr><td>Course objectives</td><td colspan="10">Description of widely used CAD methods for engineering problems dealing with the electromagnetic field: finite element method and finite difference method. Applications of these methods to electromagnetic issues (static models, low and high frequency).</td></tr>
<tr><td>Course content</td><td colspan="10">Lecture: Partial differencial equations: classification, method of solution. Physical model vs. mathematical model. Analytical solution vs. simulation. Modeling and Simulation Cycle, modeling methodology. 1D, 2D, 3D modeling. Time domain vs. time harmonic analysis. Narrowband vs. wideband analysis. 2D Mixed-Mode Modeling. Explicit vs. implicite methods. Models of materials in computational electromagnetics. Finite element method: weak form, classification of the elements, test functions. Local and global formulation. Declaration and physical interpretation of the boundary conditions. Perfectly Matched Layer conditions. Methods of adaptive meshing. Parametrization of the models. Coupled analysis of the phenomena. Finite difference calculus: differentia quotiens, differencing, discretization of the domain, spatial difference operators, implicit formulas.
Specialization workshop: Solution and analysis of some EM phenomena issues using FEM and FDM methods. The specialized software will be implemented.</td></tr>
<tr><td>Teaching methods</td><td colspan="10">understands and explains the principles of computer aided modelling usind FEM and FD schmes</td></tr>
<tr><td>Assessment method</td><td colspan="10">Lecture - final written test (at least 50% of points are necessary to pass).
Workshop - written reports and tests.</td></tr>
<tr><td>Symbol of learning outcome</td><td colspan="9">Learning outcomes</td><td>Reference to the learning outcomes for the field of study</td></tr>
<tr><td>LO1</td><td colspan="9">understands and explains the principles of computer aided modelling usind FEM and FD schmes</td><td></td></tr>
<tr><td>LO2</td><td colspan="9">is able to construct the proper model of EM phenomena using FEM and FD methods</td><td></td></tr>
<tr><td>LO3</td><td colspan="9">is able to interpret and assess the results of computations</td><td></td></tr>
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LO4	can prepare an advanced numerical model of the EM problem		
Symbol of learning outcome	**Methods of assessing the learning outcomes**	**Type of tuition during which the outcome is assessed**	
LO1	evaluation of students' reports and written tests	**L, SW**	
LO2	evaluation of students' reports and written tests	**L, SW**	
LO3	evaluation of students' reports and written tests	**L, SW**	
LO4	evaluation of students' reports and written tests	**L, SW**	
Student workload (in hours)		**No. of hours**	
Calculation	Lecture attendance:	**10**	
	Preparation for workshops:	**12**	
	Participation in workshops:	**20**	
	Work on reports from workshop classes and/or work on home assignments	**12**	
	Participation in student-teacher sessions related to lectures and workshops:	**4**	
	Preparation for and attendance at the final test from lectures:	**2**	
	TOTAL:	**60**	
Quantitative indicators		**HOURS**	**No. of ECTS credits**
Student workload – activities that require direct teacher participation		**30**	**1**
Student workload – practical activities		**46**	**1,5**
Basic references	Bhatti A. M.: Fundamental finite element analysis and applications : with Mathematica and Matlab computations. J. Wiley & Sons, Hoboken, 2005. Manassah J. T.: Elementary mathematical and computational tools for eletrical and computer engineers using Matlab. CRC Press, Boca Raton, 2001. Elsherbeni A. Z., Demir V.: The finite-difference time-domain method for electromagnetics with MATLAB simulations. SciTech Publishing, Raleigh, 2009. Crow M.: Computational methods for electric power systems. CRC Press, Boca Raton, 2003.		
Supplementary references	Hager G., Wellein G.: Introduction to high performance computing for scientists and engineers. CRC/Taylor & Francis, Boca Raton, 2011. Schafer M.: Computational engineering : introduction to numerical methods. Springer-Verlag, Berlin, 2006. Zienkiewicz O. C., Taylor R.L., Zhu J.Z.: The finite element method: its basis and fundamentals. Elsevier, Amsterdam, 2005. Taflove A.: Advances in computational electrodynamics : the finite-difference time-domain method. Artech House, London, 1998.		
Organisational unit conducting the course	**Department of Electrotechnics, Power Electronics and Power Engineering**	**Date of issuing the programme**	
Author of the programme	**Boguslaw Butrylo, D.Sc., Ph.D., Assoc. Prof.**	**2019-12-13**	