STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Diploma project		**1010322331010323898**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**(brak)**	**2 / 3**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Electrical Systems in Mechatronics	**Polish**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours				No. of credits
Lecture: **-**	Classes: **-**	Laboratory: **-**	Project/seminars: **15**	**1**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
(brak)	**(brak)**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**1 100%**
Technical sciences	**1 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledges of electrical engineering, electrical machinery, electrical metrology, electrical circuit theory, power controls, power electronics, and operating system support. Fundamentals of construction and design of electrical machines. Knowledges of computer science and numerical methods. Knowledges from the construction, analysis and synthesis of electromechanical transducers and measurement methods used in mechatronics.
2	**Skills**	Fundamentals of construction and operation of electrical systems and mechatronics with the use of tools.
3	**Social competencies**	Student is aware of the need to broaden their competence, willingness to work together as a team

Assumptions and objectives of the course:

Acquiring modern methods of design, testing and analysis of mechatronics and actuators electromagnetic and electromechanical devices. The acquisition of skills in computing package selected.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Student has an extended knowledge of advanced numerical methods used to solve complex technical problems in electrical engineering - [K_W02 ++]
2. Student has knowledge of the development trends and the most important new developments in the field of electrical engineering and - to a lesser extent - in electronics, information technology and power energy - [K_W04 ++]
3. Student has knowledge about the formulation of equations describing of simple propulsion systems, application of the principles of identification, using the software to analyze the results of computer simulations, and has expertise in designing simple drive systems - [K_W10+]

Skills:

1. Student can obtain information from literature, databases and other sources, it can integrate the information, make their interpretation and critical evaluation, as well as draw conclusions and formulate and fully justify opinions - [K_U01 +++]
2. Student is able to work independently and in a team, it is able to assess the time-consuming task, it can lead a small team to ensure execution of tasks in a given period - [K_U02 ++]
3. Student is able prepare and give a presentation on the implementation of the project or research task, and lead a discussion about the presentation shown - [K_U04 +]

Social competencies:
1. Student is able think and act in a creative and enterprising - [K_K01++]
2. Student understands the need for the formulation and communication of information and opinions on the developments in the field of electrical engineering and other aspects of the electrical engineer, shall endeavor to provide such information in a manner commonly opinions clear - [K_K02+]

Assessment methods of study outcomes
Project lectures
-Evaluation based on the current progress of the projects and thesis.
Get extra points for the activity in the classroom, and in particular for:
- propose to discuss further aspects of the subject;
- the effectiveness of the application of the knowledge gained during solving the given problem.

Course description
Simulation of operation of electrical machines and DC permanent magnet machines in Matlab. Using Maxwell to analyze of magnetic field in the selected systems with magnetic field. Using LabVIEW to create virtual instruments supporting electromagnetic and thermal measurements of electromechanical transducers. Measuring systems for the study of phenomena in transformers. Legislation allowing for the operation of power systems (Polish Standard, EU directives). Methods for measuring force, mechanical stress, torque, moment of inertia, speed and slip in electrical machines.
Update 2017: The project is closely linked to the topic of the thesis, which in turn affects the resolution of new problems every year.
Applied methods of education: project - analysis / discussion of various methods (including nonconventional) problem solving, multimedia demonstration, teamwork.

Basic bibliography:

1. Control of Electrical Drives, Leonhard W., Springer-Verlag, Berlin-Heidelberg-NewYork-Tokyo, 1985
2. AUTOCAD helpdesk
3. Handbook of small electric motors, Yeadon W.H., Yeadon A.W., Mc Graw Hill, 2001
4. LabVIEW Graphical Programming, Jennings Richard, Johnson Gary W., McGraw-Hill Professional Publishing, 2006
5. Analysis of Electric Machinery, P. Krauze, McGraw Hill Book Company, New York , 1986
6. Numerical Analysis, R. Burden, J.D. Faires, PWS Publishers, Prindle, Weber&Schmidt, 1985
7. Metody Numeryczne w Turbo Pascalu, B. Baron, Wyd. Helion, Gliwice, 1995
8. Układy napędowe z silnikami synchronicznymi , Kaczmarek T., Zawirski K., Wyd. PP, Poznań, 2000
9. Environment LabVIEW w eksperymencie wspomaganym komputerowo, Tłaczała W., WNT, Warszawa, 2002
10. LabVIEW w praktyce, Chruściel M., Wydawnictwo BTC, Legionowo, 2008
11. http://www.ansys.com/products/academic
12. AC micro-machinery, Simst J., Clarendon Press, New York, 1994
13. https://www.infolytica.com/en?category=Motors%20Generators%20Brushless&page=1
14. Silniki krokowe, Wróbel T., WNT, Warszawa, 1993
15. https://www.comsol.com/videos?&sortOrder=&s

Additional bibliography:

1. Barański. M., FE analysis of current displacement phenomena in a squirrel cage motor working at cryogenic temperature, Archives of Electrical Engineering, Volume 63, Issue 2 ,pp.139-147, 2014
2. Barański M., Idziak P., Łyskawiński W., Analiza powównawcza stanów pracy silników indukcyjnego i synchronicznego z magnesami trwałymi i klatka rozruchowa, Poznan University of Technology Academic Journals, Electrical Engineering, Issue 77, pp. 155-163, 2014
3. Barański M.,, Jędryczka C., Knypiński Ł., Stachowiak D., Szeląg W., Analiza wpływu niesymetrii obwodu magnetycznego wirnika na parametry rozruchowe 6-biegunowego silnika magnetoelektrycznego synchronicznego, Zeszyty Problemowe - Maszyny Elektryczne, BOBRME - KOMEL, Nr 4/2015 (108), s. 43-48, 2015
4. Barański M., Field-circuit analysis of LSPMS motor supplied with distorted voltage, Computer Applications in Electrical Engineering, Poznań 2017, Vol. 91, pp. 287-297.
5. Wojciechowski R. M., Jędryczka C., Łukaszewicz P., Kapelski D., Analysis of high speed permanent magnet motor with powder core material, The International Journal for Computation and Mathematics in Electrical and Electronic Engineering, 2012, Vol. 31, No. 5, pp. 1528 ? 1540,
6. Wojciechowski R. M., Jedryczka C., Demenko A., Sykulski J. K., Strategies for two-dimensional and three-dimensional field computation in the design of permanent magnet motors, IET Sci. Meas. Techn. Vol. 9, No. 2, 2015, pp. 224-233.

Result of average student's workload

Activity	**Time (working hours)**

1. Participation in project activities	15
2. Participation in consultation	12
3. Participation in the exam	2
4. Participation in the thesis	10

Student's workload

Source of workload	hours	ECTS
Total workload	39	1
Contact hours	29	1
Practical activities	10	1