STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Diploma project	**1010324391010323898**

Field of study	Profile of study (general academic, practical)	Year /Semester
Electrical Engineering	**(brak)**	**5 / 9**
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)
First-cycle studies	**part-time**

No. of hours	No. of credits
Lecture: **-** Classes: **-** Laboratory: **-** Project/seminars: **9**	**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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Electrical
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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basic knowledge of electrical engineering, electrical machinery, electrical metrology, electrical circuit theory, power controls, power electronics, and operating system support. Basic knowledge of construction and design of electrical machines. Basic knowledge 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 a basic knowledge of numerical methods allow to solve simple tasks in the field of electrical engineering, it is well versed in tools used to perform numerical computations and analysis and design of selected technical systems - [K_W02 ++]

2. Student knows the typical engineering technologies in Electrical Engineering and it is versed in the latest trends and development in the field of direction being studied Electrical Engineering - [K_W18 ++]

Skills:

1. Student can formulate an algorithm, he uses a programming language and related software tools used in electrical engineering - [K_U04 ++]

2. Student can use the known methods, mathematical models and computer simulations to analyze and evaluate the performance of electrical components and systems - [K_U10 ++]

3. Student can use to compare different design solutions in the field of basic electrical engineering issues, due to selected usable and economical criteria. - [K_U12 ++]

Social competencies:

1. Student is aware of validity for his own work and willingness to follow the rules of teamwork and responsibility for jointly accomplished tasks - [K_K03 +]

2. Student is aware of the role of a social college graduate, and especially understands the need for formulation and communication to the public, in particular through the mass media, information and opinion on the achievements of technology and other aspects of electrical engineering - [K_K05 +++]

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. LabVIEW Graphical Programming, Jennings Richard, Johnson Gary W., McGraw-Hill Professional Publishing, 2006

2. Control of Electrical Drives, Leonhard W., Springer-Verlag, Berlin-Heidelberg-NewYork-Tokyo, 1985

3. AUTOCAD helpdesk

4. Handbook of small electric motors, Yeadon W.H., Yeadon A.W., Mc Graw Hill, 2001

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. AC micro-machinery, Simst J., Clarendon Press, New York, 1994

12. Silniki krokowe, Wróbel T., WNT, Warszawa, 1993

13. http://www.ansys.com/products/academic

14. https://www.infolytica.com/en?category=Motors%20Generators%20Brushless&page=1

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	9
2. Participation in consultation	12
3. Participation in the exam	2
4. Participation in the thesis	15

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	38	1
Contact hours	23	1
Practical activities	15	1