AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Power electronics

Academic year: 2019/2020 Code: ZSDA-3-0104-s ECTS credits: 3

Faculty of: Szkoła Doktorska AGH

Field of study: Szkoła Doktorska AGH Specialty: —

Study level: Third-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 0

Course homepage: —

Responsible teacher: dr hab. inż. Stala Robert (stala@agh.edu.pl)

Module summary

Selected issues of modern power electronic energy conversion. Semiconductor switches, converter topologies and control methods.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence: is able to			
M_K001	Ability of analysis of research works for power electronic systems development	SDA3A_K01	Presentation
Skills: he can			
M_U001	Ability of research analysis of operation of selected power electronic converters and systems	SDA3A_U01	Presentation
Knowledge: he knows and understands			
M_W001	Knowledge of selected research issues of modern power electronic technology	SDA3A_W02	Presentation
M_W002	Research methodology in power electronic field applcable for doctoral thesis implementation.	SDA3A_W01	Presentation

Number of hours for each form of classes

	Form of classes										
Suma	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
20	0	0	0	0	0	20	0	0	0	0	0

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
Social competence: is able to												
M_K001	Ability of analysis of research works for power electronic systems development	-	-	-	-	-	+	-	-	-	-	-
Skills: he can												
M_U001	Ability of research analysis of operation of selected power electronic converters and systems	-	-	-	-	-	+	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	Knowledge of selected research issues of modern power electronic technology	-	-	-	-	-	+	-	-	-	-	-
M_W002	Research methodology in power electronic field applcable for doctoral thesis implementation.	-	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	20 h
Preparation for classes	20 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	20 h
Realization of independently performed tasks	20 h
Summary student workload	80 h
Module ECTS credits	3 ECTS

Additional information

Module content

Seminar classes

-

Teaching methods and techniques:
Seminar classes: Classes includes presentations discussions and problems analysis.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:
Presence on classes is obligatory according to the general study regulation. If the requirement is not met the chief lecturer may specify additional conditions for the positive final grade or issue the negative grade (negative assessment).
Marks are issued on the basis of presentation delivered by students as well as activity during classes.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:
Seminar classes:
– Attendance is mandatory: Yes
– Participation rules in classes: Attendance is mandatory.

Method of calculating the final grade
The final grade is calculation from marks achieved from presentation as well as activity during classes. The teacher holds the right to lower the final grade due to lack of presence on classes.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:
Attendance is obligatory according to the general study regulation. Failure to meet the requirement may result in negative assessment.
For a student who was absent (due to any reason) other term may be also agreed depending on both the room and the teacher availability.

Prerequisites and additional requirements
Prerequisites and additional requirements not specified

Recommended literature and teaching resources
1. Mohan N.: Power Electronics: Converters, Applications, and Design, John Wiley & Sons Inc.
2. Rashid M.H. (editor-in-chief): Power Electronics Handbook, Academic Press 2001.
3. Piróg S.: Energoelektronika. Układy o komutacji sieciowej i komutacji twardej, Wydawnictwa, AGH Kraków 2006.
4. Strzelecki R., Supronowicz H.: „Współczynnik mocy w systemach zasilania prądu przemiennego i metody jego poprawy”, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2000.
5. Singh B., Al–Haddad K., Chandra A.: „A review of active filters for power quality improvement”, IEEE Trans. on Industrial Electronics, Vol. 46, No. 5, October 1999.
6. Akagi H.: „The state-of-the-art of active filters for power conditioning”, Proc. of the EPE ’05, Dresden, 2005
7. Citko, T.: „Energoelektronika: układy wysokiej częstotliwości”, Wydawnictwo Politechniki Białostockiej, 2007.

Scientific publications of module course instructors related to the topic of the module

1. R. Stala, S. Pirog, M. Baszynski, A. Mondzik, A. Penczek, J. Czekonski, S. Gasiorek: „Results of Investigation of Multicell Converters With Balancing Circuit—Part I”, IEEE Transaction on Industrial Electronics, Vol. 56, July 2009, pp. 2610-2619.
2. R. Stala, S. Pirog, A. Mondzik, M. Baszynski, A. Penczek, J. Czekonski, S. Gasiorek: „Results of Investigation of Multicell Converters With Balancing Circuit—Part II”, IEEE Transaction on Industrial Electronics, Vol. 56, July 2009, pp. 2620-2628 .
3. R Stala: “The Switch-Mode Flying Capacitor DC/DC Converters With Improved Natural Balancing”, IEEE Transaction on Industrial Electronics, Vol. 57, April 2010, pp. 1369-1382.
4. R. Stala: “Application of Balancing Circuit for DC-Link Voltages Balance in a Single-Phase Diode-Clamped Inverter With Two Three-Level Legs”, IEEE Transactions on Industrial Electronics, vol. 58, no. 9, pp. 4185-4195, Sept. 2011.
5. R. Stala, “A Natural DC-Link Voltage Balancing of Diode-Clamped Inverters in Parallel Systems”, IEEE Transactions on Industrial Electronics, vol. 60, no. 11, pp. 5008-5018, Nov. 2013.
6. A. Mondzik, Z. Waradzyn, R. Stala and A. Penczek, “High efficiency switched capacitor voltage doubler with planar core-based resonant choke,” 2016 10th International Conference on Compatibility, Power Electronics and Power Engineering (CPE-POWERENG), Bydgoszcz, 2016, pp. 402-409.
7. R. Stala, “Natural capacitor voltage balance in multilevel flying capacitor converters. A review of research achievements”, Power Electronics and Drives (PE&D), ISSN 2451-0262, Vol. 1, No. 2, pp. 5–33, 2016. DOI: 10.5277/PED160201.
8. R. Stala, Z. Waradzyn, A. Penczek, A. Mondzik and A. Skala, “A Switched-Capacitor DC-DC Converter with Variable Number of Voltage Gains and Fault-tolerant Operation,” in IEEE Transactions on Industrial Electronics. doi: 10.1109/TIE.2018.2851962
9. Stala, R., Piróg, S., Penczek, A., et al., “A family of high-power multilevel switched capacitor-based resonant DC-DC converters – operational parameters and novel concepts of topologies”, Bulletin of the Polish Academy of Sciences Technical Sciences, 65(5), pp. 639-651, Oct. 2017. doi: 10.1515/bpasts-2017-0069.
10. A. Penczek, A. Mondzik, Z. Waradzyn, R. Stala, A. Skała and S. Pirog, “Switching strategies of a resonant switched-capacitor voltage multiplier,” 2017 19th European Conference on Power Electronics and Applications (EPE’17 ECCE Europe), Warsaw, Poland, 2017, pp. P.1-P.10.
11. A. Kawa and R. Stala, “Bidirectional multilevel switched-capacitor resonant converter based on SiC MOSFET switches,” 2017 19th European Conference on Power Electronics and Applications (EPE’17 ECCE Europe), Warsaw, Poland, 2017, pp. P.1-P.10.
12. Z. Waradzyn, R. Stala, A. Mondzik, A. Penczek, A. Skala and S. Pirog, “Efficiency Analysis of MOSFET-Based Air-Choke Resonant DC–DC Step-Up Switched-Capacitor Voltage Multipliers,” in IEEE Transactions on Industrial Electronics, vol. 64, no. 11, pp. 8728-8738, Nov. 2017. doi: 10.1109/TIE.2017.2698368

Additional information

None