

**AGH**AGH UNIVERSITY OF SCIENCE
AND TECHNOLOGY

Module name: Internet of things, smart grid, and modern communication technologies

Academic year: 2019/2020 Code: ZSDA-3-0177-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. Miśkowicz Marek (miskow@agh.edu.pl)

Module summary

The course programme is focused on emerging trends in information and communication technologies including Internet of Things (IoT), and smart grid as one of the largest applications of the IoT.

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	is able to cooperate in the research team	SDA3A_K02	Participation in a discussion
Knowledge: he knows and understands			
M_W001	knows major trends of evolution of modern communication technologies	SDA3A_W02	Activity during classes, Presentation
M_W002	knows fundamental concepts of Internet of Things	SDA3A_W02	Presentation, Activity during classes
M_W003	knows fundamental concepts of smart grid	SDA3A_W02	Presentation, Activity during classes

Number of hours for each form of classes

Suma	Form of classes										
	Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Prace kontrolne i przejściowe	Lektorat
20	10	0	0	0	0	10	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	is able to cooperate in the research team	-	-	-	-	-	-	-	-	-	-	-
Knowledge: he knows and understands												
M_W001	knows major trends of evolution of modern communication technologies	+	-	-	-	-	+	-	-	-	-	-
M_W002	knows fundamental concepts of Internet of Things	-	-	-	-	-	-	-	-	-	-	-
M_W003	knows fundamental concepts of smart grid	-	-	-	-	-	-	-	-	-	-	-

Student workload (ECTS credits balance)

Student activity form	Student workload
Udział w zajęciach dydaktycznych/praktyka	20 h
Preparation for classes	10 h
przygotowanie projektu, prezentacji, pracy pisemnej, sprawozdania	30 h
Realization of independently performed tasks	25 h
Summary student workload	85 h
Module ECTS credits	3 ECTS

Additional information

Module content

Lectures

The technical content of the course includes overview, principles, vision, applications, challenges and architectures of the IoT. The perspective of convergence of the smart grid with IoT, and technical aspects of IoT-aided smart grid systems will be addressed. The course objective is to outline the state of the art, and to identify extensive open issues as well as future research directions in modern communication technologies.

Seminar classes

The seminar classes are focused on discussion selected topics of modern communication technologies.

Teaching methods and techniques:

Lectures: The lecture is based on classical presentation.

Seminar classes: The seminar classes are based on discussions of presentation by students of selected modern communication technologies.

Warunki i sposób zaliczenia poszczególnych form zajęć, w tym zasady zaliczeń poprawkowych, a także warunki dopuszczenia do egzaminu:

The attendance of the classes (at least 60%) and the presentation by students of selected problems of modern communication technologies are required to pass the course.

Zasady udziału w poszczególnych zajęciach, ze wskazaniem, czy obecność studenta na zajęciach jest obowiązkowa:

Lectures:

- Attendance is mandatory: No
- Participation rules in classes: The lecture is an introduction to the emerging trends in information and communication technologies including Internet of Things and smart grid.

Seminar classes:

- Attendance is mandatory: Yes
- Participation rules in classes: The seminar classes are aimed to discuss in depth selected topics of modern communication technologies.

Method of calculating the final grade

The final score will be evaluated on the quality of presentation, and the student's contribution to discussions during the class.

Sposób i tryb wyrównywania zaległości powstałych wskutek nieobecności studenta na zajęciach:

In case of absence in the class, an extra presentation on a selected topic of modern communication technologies will be required to pass the course.

Prerequisites and additional requirements

Prerequisites and additional requirements not specified

Recommended literature and teaching resources

1. A. Al-Fuqaha, M. Guizani, M. Mohammadi, M. Aledhari, M. Ayyash, "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications", IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347-2376, 2015

2. M. Emmanuel, R. Rayudu, "Communication technologies for smart grid applications: A survey", *Journal of Network and Computer Applications*, vol. 74, pp. 133-148, 2016
3. E. Ahmed, I. Yaqoob, A. Gani, M. Imran, M. Guizani, "Internet-of-things-based smart environments: state of the art, taxonomy, and open research challenges", *IEEE Wireless Communications*, vol. 23, no. 5, pp. 10-16, 2016
4. S. E. Collier, "The Emerging Enernet: Convergence of the Smart Grid with the Internet of Things", *IEEE Industry Applications Magazine*, vol. 23, no. 2, pp. 12-16, 2017
5. Y. Saleem, N. Crespi, M. H. Rehmani, R. Copeland, "Internet of Things-aided Smart Grid: Technologies, Architectures, Applications, Prototypes, and Future Research Directions", *IEEE Access*, vol. 7, pp. 62962 - 63003, 2019

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

1. M. Miśkiewicz, „Average channel utilization of CSMA with geometric distribution under varying workload”, *IEEE Transactions on Industrial Informatics*, vol. 5, no. 2, pp. 123-131, 2009
2. M. Miśkiewicz, "Access delay in LonTalk MAC protocol", *Computer Standards & Interfaces*, vol. 31, no. 3, pp. 548-556, 2009
3. M. Miśkiewicz R. Golański, "LON technology in wireless sensor networking applications", *Sensors*, vol. 6, no. 1, pp. 30-48, 2006
4. D. Kościelnik, M. Miśkiewicz, „Analytical approach to multiple memoryless backoff contention analysis”, *Proceedings of IEEE World Conference on Factory Communication Systems WFCS 2015*, pp. 1-4, 2015
5. D. Kościelnik, M. Miśkiewicz, J. Szyduczyński, „Upper bounds on unsuccessful transmission rate in persistent and non-persistent CSMA protocols”, *Proceedings of 22nd IEEE International Conference on Computer Communications and Networks ICCCN 2013*, pp. 1-5, 2013

Additional information

None