Załącznik nr 9
do Zarządzenia Rektora PŚk Nr 35/19
w brzmieniu ustalonym Zarządzeniem Nr 12/22

COURSE DESCRIPTION

Course code	full-time studies	**X**
	part-time-studies	**X**
Course name	**Radiokomunikacja satelitarna**	
Course name in English	**Satellite Radio Communication**	
Valid from academic year	**2022/23**	

PLACEMENT IN THE TEACHING PROGRAM

Field of study	**Computer Science**
Level of education	**1st degree**
Studies profile	**General**
Form and method of teaching classes	**Full-time and part-time studies**
Specialization	**All specializations**
Organizational unit responsible for the course	**Department of Information Systems**
Course coordinator	**Jacek Wilk-Jakubowski**
Approved by	**Dean of the Faculty of Electrical Engineering, Automatic Control and Computer Science Roman Deniziak, KUT prof., DSc, PhD**

GENERAL CHARACTERISTIC OF THE COURSE

Course affiliation		**Directional course**
Course status		**Elective**
Language		**English**
Semester	full-time studies	**Semester VII**
	part-time-studies	**Semester VIII**
Requirements		**Fundamentals of Electronics Digital measurements Probabilistic methods and statistics**
Exam (YES/NO)		**NO**
ECTS		**6**

Course form		**lecture**	**classes**	**laboratory**	**project**	**other**
Hours per semester	full-time studies	**30**		**15**	**30**	
	part-time-studies	**18**		**9**	**18**	

LEARNING RESULTS

Category	Result Symbol	Learning Results	References to the field of study results
Knowledge	W01	Student knows and understands the selected problems of mathematical analysis and linear algebra, selected probabilistic methods and basics of mathematical statistics, selected problems of discrete mathematics.	INF_W03
	W02	Student knows and understands the methods of design, management and administration as well as virtualization of the complex data communication systems functioning in different spaces of the hypercommunicated world, methods of communication and object location including real-time requirements.	INF_W30
Skills	U01	Student is able to use the apparatus of mathematical analysis, calculate probabilities of events, interpret concepts from the field of computer science in terms of functions and relations, apply the apparatus of logic, techniques of proving theorems, graph theory and recursion to solve problems of computer science.	INF_U03
	U02	Student is able to design, implement, configure and test complex data communications systems together with the preparation of dedicated virtual environments and selected hardware components.	INF_U30
Social competence	K01	Student is ready to recognize the significance of knowledge in solving engineering problems and the need for its continuous expansion to improve professional, personal and social competences.	INF_K1
	K02	Student is ready to critically evaluate his/her qualifications and understands the potential consequences of decisions/actions taken on the basis of incomplete knowledge/poor skills.	INF_K2

COURSE CONTENT

Course Form	Content
lecture	1, 2. Introduction to satellite radio communications. Basic terms. Classification of systems. Reliability classes of systems. 3. Traditional radio wave and decade division according to the ITU-R. Application of radio waves depending on the frequency. 4, 5. Broadband satellite data networks. Network topologies. Characteristics of satellite systems. 6. Satellite link budget. 7. Radio wave propagation in free space. 8, 9. The real propagation environment of microwave waves. 10-12. Propagation conditions of microwave waves in the Earth's atmosphere. Sources of signal degradation. 13. The use of regression method for the study of radio wave propagation. 14-15. Modeling satellite links for varied atmospheric conditions.
laboratory	1. Analysis of technical parameters, availability classes and dependencies in the satellite communication systems. 2. Analysis of radio wave propagation in free space. 3-5. Computer simulation of the effects of real propagation environment on microwave waves including selected measurement- and experimental-based data models for different input parameters. 6-7. Calculating the link budgets for the satellite links (in some examples).

project	To assign a project task to be completed in groups of 3-5 (each person on the project group has an assigned role) and its implementation with the use of computer tools (simulation). As part of the project students should: - calculate the satellite link budget and present the influence of selected factors, interferences and technical parameters on the satellite signals, - create technical documentation, - present the finished project and its technical documentation for the defense.

LEARNING RESULTS VERIFICATION METHODS

Result Symbol	Learning results verification methods					
	Oral Exam	Written Exam	Midterm	Project	Report	Other
W01			X			
W02			X			
U01				X	X	
U02				X	X	
K01				X	X	
K02				X	X	

ASSESSMENT FORMS AND CRITERIA

Course Form	Assessment Form	Assessment Criteria
lecture	Passing grade	Obtain min. 50% of the points in the final written/oral colloquium.
laboratory	Passing grade	Completion of all exercises and reports for a positive grade.
project	Passing grade	Defense of the project (personal demonstration of the project with the ability to explain it and presentation of technical documentation) for a positive grade.

STUDENT'S VOLUME OF WORK

ECTS Balance												
No.	Activity Type	Student Involvement										Unit
		full-time studies					part-time-studies					
1.	Participation in classes according to the schedule	Lec	C	Lab	P	S	Lec	C	Lab	P	S	h
		30	-	15	30	-	18	-	9	18	-	
2.	Other (consultations, exams)	2	-	2	2		2	-	2	2	-	h
3.	**Total with the direct assist of an academic teacher**	**81**					**51**					h
4.	**Number of ECTS, that students obtains with the direct assist of an academic teacher**	**3,24**					**2,04**					ECTS
5.	**Hours of unassisted student work**	**69**					**99**					h
6.	**Number of ECTS that student obtains working unassisted**	**2,76**					**3,96**					ECTS

7.	**Practical classes volume of work**	**45**	**27**	h
8.	**Number of ECTS obtained by student at practical classes**	**3,33**	**3,18**	ECTS
9.	**Total student's volume of work expressed in hours**	**150**	**150**	h
10.	**ECTS**	**6**		ECTS

BIBLIOGRAPHY

1. Dobosz M. Wspomagana komputerowo statystyczna analiza wyników badań, Akademicka Oficyna Wydawnicza Exit, Warszawa 2001.
2. Elbert B. R. Satellite communication applications handbook, Artech House, Norwood 2004.
3. Ippolito L. J. Satellite communications. Systems engineering. Atmospheric effects, satellite link design and system performance, JohnWiley & Sons, Chichester 2008.
4. Jo Kenneth Y. Satellite communications network design and analysis, Artech House, Norwood 2011.
5. Kolawole M. O. Satellite communication engineering, Marcel Dekker, Inc., New York 2002.
6. Szóstka J. Mikrofale, Wydawnictwa Komunikacji i Łączności, Warszawa 2006.
7. Wilk-Jakubowski J. Ł. Propagacja fal radiowych w łączności satelitarnej. Radiowaves Propagation in Satellite Communications Systems, Wydawnictwo PŚk, Kielce 2018.
8. Zieliński R. J. Satelitarne sieci teleinformatyczne, Wydawnictwa Naukowo-Techniczne, Warszawa 2009.