Specification for the book of courses

Study program	Electrical Engineering and Computer Science		
Module	Electronics - Electronic Circuits and Embedded Systems		
Type and level of studies	Undergraduate Academic Studies		
The name of the course	Solar Devices and Systems		
Lecturer (for lectures)	Mančić D. Dragan, Pantić S. Dragan, Aleksić M. Sanja		
Lecturer/associate (for exercises)	Jovanović D. Igor		
Lecturer/associate (for OFE)	Jovanović D. Igor		
Number of ECTS	5	**Course status (obligatory/elective)**	Elective
Prerequisites			
Course objectives	Introduction to the principle of operation, types and basic electrical characteristics of solar cells. Also, the goal is for students to acquire knowledge about the types of photovoltaic systems, their basic characteristics, as well as the procedures for their dimensioning, design, implementation, monitoring and maintenance.		
Course outcomes	The course is organized in such a way that, thanks to the combination of acquired theoretical and practical knowledge and skills, students are able to perform the proper selection of components of photovoltaic systems (solar modules, inverters, batteries, etc.) at the end of the course, and then to configure, design, optimize and realize independent, hybrid and network-linked photovoltaic systems.		
Course outline			
Theoretical teaching	Getting acquainted with the contents of the course, teachers, associates, the necessary literature and the way of passing the exam. Historical overview of the development of solar technology. Solar energy. Characteristics of solar radiation, spectrum of solar radiation. Photovoltaic effect. Absorption of light and generation of carriers. Photovoltaic conversion mechanisms. Solar cell. Principle of operation, electrical characteristics, electrical and optical losses, models of solar cells. Technologies for the production of solar cells, types of solar cells. New Materials and Trends in Solar Cell Development. Solar cells based on monocrystalline silicon. Highly efficient solar cell. Thin-layer solar cells on amorphous Si, Ga-As, Cu-In-Se2. Characterization of solar cells. Modeling and simulation of the technological array for the production and electrical characteristics of solar cells using TCAD software packages. Photovoltaic systems. System components, system types. Independent, hybrid and network-connected photovoltaic systems. Efficiency and basic characteristics of photovoltaic systems. PVSyst - a program for dimensioning, designing and optimizing photovoltaic systems. Design of autonomous photovoltaic systems using the PVSyst program. Designing hybrid and network-connected photovoltaic systems using the PVSyst program. Realization, monitoring and maintenance of photovoltaic systems. Techno-economic analysis of solar technologies and their application. Legislation.		
Practical teaching (exercises, OFE, study and research work)	Modeling of Sun-tracking systems. Modeling of extraterrestrial radiation. Modeling of global solar radiation. Modeling of electrical characteristics of solar cells under standard test conditions. Measurement of current and voltage characteristics of illuminated and unluminated solar cells. Simulation of technological process for production and electrical characteristics of high efficiency Si solar cell. Simulation of the technological process for the production and electrical characteristics of IBC-SHJ solar cells. Determination of the maximum power point (MPPT) for different values of the intensity of solar iradiation. Design, optimization and techno-economic analysis of the independent (stand-alone) photovoltaic system. Configuration of a stand-alone photovoltaic system and measurement using I/V photovoltaic PVCHECK tester. Design, optimization and techno-economic analysis of the PV/wind photovoltaic system. Measurement of the characteristics of the network-connected (grid-on) photovoltaic system using I/V photovoltaic PVCHECK tester. Design, optimization and techno-economic analysis of grid-on photovoltaic system.		
Textbooks/references			
1	Photovoltaic Devices, Systems and Applications CD-ROM, C. Honsberg and S. Bowden, (free online resource)		
2	Planning and Instaling Photovoltaic Systems, Eartscan UK&USA, 2008.		
3	Photovoltaic Science and Engineering Handbook, Second Edition, Antonio Luque and Steven Hegedus, John Wiley and Sons, 2012.		
4	Applied Photovoltaic 2nd ed., S. Wenham, M. Green, et. al., ARC Centre for Advance Silicon Photovoltaics and Photons, 2007.		
5	Lectures and Exercises (http://mikro.elfak.ni.ac.rs/predmeti/solarne-komponente-i-sistemi/)		
Number of classes of active education per week during semester/trimester/year			

Lectures	Exercises	OFE	Study and research work	Other classes
2	1	2	0	0
Teaching methods	Lectures, independent studio research work, computational exercises, laboratory exercises, consultations. The lectures present the theoretical part of the material, supported by characteristic examples for easier understanding of matter. Through student research work, a student studying available literature, doing a seminar work or a team project. Practical examples of calculation and design of concrete photovoltaic systems are used in calculation exercises. Practical knowledge is acquired in laboratory exercises.			
Grade (maximum number of points 100)				
Pre-exam duties		Points	Final exam	Points
Activity during lectures		5	Written exam	25
Exercises		15	Oral exam	25
Colloquia				
Projects		30		