

| <b>STUDY MODULE DESCRIPTION FORM</b>   |  |  |
|--|--|--|
| Name of the module/subject<br><b>(-)</b>   |  | Code<br><b>1010803141010834611</b>   |
| Field of study<br><b>Communications Technologies</b>   | Profile of study<br>(general academic, practical)<br><b>general academic</b> | Year /Semester<br><b>2 / 4</b>   |
| Elective path/specialty<br><b>-</b>  | Subject offered in:<br><b>Polish</b>   | Course (compulsory, elective)<br><b>elective</b>   |
| Cycle of study:<br><b>Doctoral studies</b>   | Form of study (full-time, part-time)<br><b>full-time</b>                     |  |
| No. of hours<br>Lecture: <b>15</b> Classes: <b>-</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>   |  | No. of credits<br><b>2</b>   |
| Status of the course in the study program (Basic, major, other)<br><b>other</b>  |  | (university-wide, from another field)<br><b>university-wide</b>  |
| Education areas and fields of science and art<br><b>technical sciences</b>   |  | ECTS distribution (number and %)<br><b>2 100%</b>  |
| <b>Responsible for subject / lecturer:</b><br>dr inż. Jan Lamperski<br>email: jlamper@et.put.poznan.pl<br>tel. +48 61 665 3809<br>Faculty of Electronics and Telecommunications<br>ul. Piotrowo 3A 60-965 Poznań             |  |  |
| <b>Prerequisites in terms of knowledge, skills and social competencies:</b>  |  |  |
| 1  | <b>Knowledge</b>   | Has a systematic knowledge, together with theoretical background, of optoelectronics and opto-telecommunication.   |
| 2  | <b>Skills</b>  | Is able to formulate a design specification, analyze the operation of, evaluate and compare design solutions for fiber optics communication systems. Is also able to propose the configuration and implementation of such systems. |
| 3  | <b>Social competencies</b>   | Is aware of the main problems and challenges facing photonics and optical telecommunication in the 21st century.   |
| <b>Assumptions and objectives of the course:</b><br>Understanding of theoretical foundations and operations of all optical processing and transmission techniques. Understanding current limitations and development trends. |  |  |
| <b>Study outcomes and reference to the educational results for a field of study</b>  |  |  |
| <b>Knowledge:</b><br>1. He has in-depth knowledge in the field of all optical signal processing and transmission - [SD_W02]  |  |  |
| <b>Skills:</b><br>1. Able to independently formulate and verify research hypotheses - [SD_U02]   |  |  |
| <b>Social competencies:</b><br>1. Can in an understandable way to disseminate knowledge of the achievements of science and technology - [UD_K03]   |  |  |
| <b>Assessment methods of study outcomes</b>  |  |  |
| Oral examination   |  |  |
| <b>Course description</b>  |  |  |

Optical nonlinearity  
 Major nonlinear effects in optical fibers  
 Self-Phase Modulation (SPM)  
 Cross-Phase Modulation (XPM).  
 Four-Wave Mixing (FWM), parametric gain  
 Nonlinear Optical-Loop Mirrors (NOLM), Sagnac type interferometers  
 Mach-Zehnder configuration  
 Semiconductor optical amplifiers - nonlinear properties  
     Cross Gain Modulation (XGM)  
 EDFA based optically controlled switches and gates  
 Ultrafast optical switching techniques  
 Wavelength conversion of WDM channels  
 All optical multiplexing  
 High-speed optical signal processing  
 All-optical regeneration schemes  
 SAW based optical signal processors

Advanced optical data modulation formats  
 Light modulation devices: PM, IM, EAM and MZM  
 Amplitude Shift Keying transmitters and receivers  
 Phase Shift Keying transmitters and receivers  
 DQPSK system advantages and limitations  
 100G PolMux 16QAM optical system: Bandwidth limitation, Chromatic dispersion, Polarization crosstalk, LDs phase noise problems

**Basic bibliography:**

1. G. P. Agrawal, Nonlinear Fiber Optics, Academic Press, Londyn
2. IEEE Photonics Technology Letters, A publication of the IEEE Photonics Society
3. IEEE Journal of Lightwave Technology, A joint IEEE / OSA publication

**Additional bibliography:**

1. J. M. Senior, Optical Fiber Communications: Principles and Practice, Prentice Hall, N. York, 2009
2. E. Desurvire, Erbium Doped Fiber Amplifiers, John Wiley & Sons Ltd.

| <b>Result of average student's workload</b> |                             |             |
|---|-----------------------------|-------------|
| <b>Activity</b>                             | <b>Time (working hours)</b> |             |
| 1. Participation in lectures                | 15                          |             |
| 2. Selfstudy                                | 45                          |             |
| <b>Student's workload</b>                   |                             |             |
| <b>Source of workload</b>                   | <b>hours</b>                | <b>ECTS</b> |
| Total workload                              | 60                          | 2           |
| Contact hours                               | 17                          | 1           |
| Practical activities                        | 0                           | 0           |