Selected topics of theoretical physics: Introduction to Electrodynamics and Theory of Relativity

- ***COURSE SYLLABUS***

1.	**Course title:**	
	Selected topics of theoretical physics: Introduction to Electrodynamics and Theory of Relativity	
2.	**Lecturer:**	
	Prof. Jerzy Kijowski, CFT PAN	
3.	**Field, type and level of studies, year of study:**	
	physics, electrodynamics & relativity, all years of study	
4.	**Course character:**	
	monographic lecture	
5.	**Teaching method:**	
	traditional	
6.	**Language:**	*English*
7.	**Course type and number of hours:**	
	lecture	
8.	**Estimated load of student's independent work:**	*15 h*
9.	**Total workload and number of ECTS points:**	*30 h, 3 ECTS*
10.	**Short description and main focus of the course:**	
	Content: 1. Time and space according to Aristotle. 2. What is Euclidean space: its metric and affine properties in modern terms. 3. Examples of non-Euclidean geometries. 4. Space-time according to Galileo and Newton. 5. String equation and its symmetries. Lorenz transformation. Initial problem and boundary-initial problem. 6. Fourier transform: the basic tool of the physicist and engineer to study the properties of differential equations. 7. Sound propagation equation. Green's function and strong Huygens' principle. 8. Fundamentals of electrodynamics in Maxwell's formulation. The discovery of electromagnetic waves. 9. Contradictions between electrodynamics and Galileo's principle of relativity. The Michelson-Morley experiment. 10. What does it mean that two distant events occur simultaneously. Analysis of the concept	

	of "simultaneity". *11. Discovery of pseudo-Euclidean geometry by Einstein and Minkowski.* *12. The so-called "paradoxes" of relativity: the Lorenz contraction, the twin paradox, etc.* *13. Relativistic equation of motion of a particle carrying an electric charge. The dependence of inertia on speed.* *14. Equivalence of mass and energy.* *15. Do we "know everything"? What difficulties remain. Particles and fields and their interaction. Local and global inertial frames. A glimpse into the theory of gravity.*	
11.	**References:**	
12.	**Prerequisites:**	
	Mathematical education required in the field of mathematical analysis, linear algebra and analytical geometry corresponding to bachelor's studies at the faculties of exact sciences (mathematics, physics, chemistry) or engineering.	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	Knowledge: *Knowledge about basics of electrodynamics & relativity, their foundations and mathematical aspects.*	*P8S_WG*
	Practical Skills: *Students are able to analyse and creatively synthesise scientific and creative achievements to identify and solve research problems as well as those related to innovative and creative activities. Also they are able to contribute new elements to these achievements, independently plan their own development as well as inspire the development of others. Additionally they participate in the exchange of experiences and ideas, also in the international community.*	*P8U_U*
	Social Skills: *Students are ready to conduct independent research which contributes to existing scientific and creative achievements in electrodynamics and relativity, assume professional and public challenges concerning this field of knowledge.*	*P8U_K*
14.	**Evaluation of the educational outcomes:**	
	written exam, grade	
15.	**Criteria to complete the course:**	
	at least 80% attendance and grade at least 3 at the exam	
16.	**Contact with the lecturer:**	
	kijowski@cft.edu.pl, office: CFT PAN, Warszawa, al. Lotników 32/46, room 305	