COURSE/MODULE DESCRIPTION (SYLLABUS)

1.	Course/module Neutrino physics	
2.	University department Department of Physics and Astronomy	
3.	Course/module code 24-FZ-S2-E2-Wsp.FN	
4.	Course/module type – mandatory (compulsory) or elective (optional) optional	
5.	University subject (programme/major) Physics	
6.	Degree: *(master, bachelor)* master, phd	
7.	Year 1, 2	
8.	Semester *(autumn, spring)* Spring	
9.	Form of tuition and number of hours Lecture 30h, Classes 30h	
10.	Name, Surname, academic title Prof. dr hab. Jan Sobczyk	
11.	Initial requirements (knowledge, skills, social competences) regarding the course/module and its completion It is expected that students have basic knowledge about relativity, quantum mechanics, particle physics and quantum field theory.	
12.	Objectives The aim of this 30h course is to introduce students to the area of neutrino physics.	
13.	Learning outcomes A. Understanding of a significance of neutrino physics in general B. Understanding of a phenomenon of neutrino oscillations C. Understanding of a role of matter effects in measurements of solar neutrinos. D. Understanding of differences between Dirac and Majorana neutrinos on theoretical and experimental level. E. Understanding of CP violation in neutrino oscillation studies.	Outcome symbols, *e.g.: K_W01*, K_U05, K_K03*

	F. Ability to perform cross section computations for selected neutrino processes.	
14.	Content I) neutrino as a Dirac field ii) neutrinos in the Standard Model iii) three families, CP violation iv) neutrino mass terms, Majorana neutrino v) neutrino oscillations vi) MSW matter effects vii) neutrino sources (Sun, supernovae, atmospheric neutrinos) viii) experimental evidence for neutrino oscillations ix) neutrino interactions x) perspectives.	
15.	Recommended literature: F. Close, "Neutrino", Oxford University Press 2010 C. Giunti, Ch. Kim, "Fundamentals of neutrino physics and astrophysics" Oxford Press A. Strumia, F. Vissani, "Neutrino masses and mixings and...", arXiv: hep-ph/06060543 K. Zuber, "Neutrino physics" CRS Press 2011 P. Lipari, "Introduction to neutrino physics" https://cds.cern.ch/record/677618/files/p115.pdf S. Bilenky, S. Petcov, "Massive neutrinos and neutrino oscillations", Rev. Mod. Phys 59 (1987) 571. S. Bilenky, "Neutrino", Rev. Part. Nucl. 44 (2013) 1. Proceedings of 52 Winter School in Lądek Zdrój published as a volume in Acta Physica Polonica.	
16.	Ways of earning credits for the completion of a course /particular component, methods of assessing academic progress: lecture: examination – written and/or oral parts class: activity during classes + seminar on a selected topic related with the course laboratory: seminar: other:	
17.	Language of instruction English	

18.	Student’s workload
	Activity
	Hours of instruction (as stipulated in study programme) : - lecture: 30h - classes: 30h - laboratory: - other:
	student’s own work, e.g.: - preparation before lectures 15h - preparing a seminar 15 h - solving problems for classes: 20h - writing course report: - preparing for exam: 20h
	Hours
	Number of ECTS

* Key to symbols:

K (before underscore) - learning outcomes for the programme
W - knowledge
U - skills
K (after underscore) - social competences
01, 02, 03 and subsequent - consecutive number of learning outcome