Probabilistic Inverse theory – COURSE SYLLABUS

1.	**Course title:**	
	Probabilistic Inverse theory	
2.	**Lecturer:**	
	Prof. dr hab. Wojciech Dębski	
3.	**Field, type and level of studies, year of study:**	
	geophysics, experimental physics, year 2-4	
4.	**Course character:**	
	monographic lecture	
5.	**Teaching method:**	
	traditional, eventually on-line if convenient for participants	
6.	**Language:**	*English*
7.	**Course type and number of hours:**	
	lecture, 22h	
8.	**Estimated load of student's independent work:**	*eg., 4-10h*
9.	**Total workload and number of ECTS points:**	*eg., 26-30 h, 3 ECTS*
10.	**Short description and main focus of the course:**	
	I I am going to give a lecture on the Bayesian Inverse Theory and its application to physical/geophysical problems. The lecture will consists essentially of a two basic two parts. The first one is intended to be an introduction to the Bayesian theory with examples of its application. The second part will be devoted to the Monte Carlo techniques used in the framework of the discussed theory. I plan to present global optimizations techniques like Metropolis algorithm, Simulating Annealing, and Genetic Algorithm as well as MC sampling techniques like Random Walk algorithms or Importance Sampling. The more detailed plan provides the list on the next page. *The first part of the lecture will provide a general introduction to the Bayesian inverse theory and will be illustrated with real, seismological applications. To understand this part neither knowledge of inverse problems nor any advanced mathematics is necessary.I n the second part I will talk about the advanced numerical method used in the framework of the Bayesian inverse theory. The exact form of this part will be adopted to the need of participants. Basically, I will try again to present listed above techniques as simply as possible. However, please keep in mind that application of the Monte Carlo method in*	

	the Inverse Theory is a hot topic research subject developing very quickly. For this reason the second part of the lecture will be in fact a presentation of currently used methods and is supposed to give a rather general idea than a deeper knowledge of a particular MC method.	
11.	**References:**	
	W. Dębski, Probabilistic Inverse Theory, Advances in Geophys. Vol. 52, pp. 1-102 doi:10.1016/S0065-2687(10)52001-6 *W. Dębski, (1997), The Probabilistic Formulation of the Inverse Theory with Application to the Selected Seismological Problems Publs. Inst. Geophys. Pol. Acad. Sc. Vol. B19 pp. 1-173*	
12.	**Prerequisites:**	
	basic knowledge of probability methods and linear algebra	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	***Knowledge:** Students will know and understand the world's achievements relating to: theoretical foundations of the probabilistic inverse theory, general and selected specific issues of the issue at a level enabling the revision of existing paradigms. They will also know the main scientific developments in the disciplines essential to the study programme. They will understand the methodology of scientific research in inverse theory.*	*P8S_WG*
	***Practical Skills:** The students will be able to communicate on probabilistic inverse theory to a degree that enables active participation in an international scientific environment, disseminate research results, also to the general public and initiate debates in this field of knowledge. They will be also able to participate in academic discourse concerning the inverse theory.*	*P8S_UK*
	***Social Skills:** The students will be ready to recognize the value of knowledge in solving cognitive and practical problems in the firld of probabilistic inverse theory*	*P8S_KK*
14.	**Evaluation of the educational outcomes:**	
	final report	
15.	**Criteria to complete the course:**	
	preparing the final report. the grade depends on the evaluation of the report	
16.	**Contact with the lecturer:**	
	debski@igf.edu.pl	