Hydromagnetic dynamo theory in geo- and astrophysics 2

- ***COURSE SYLLABUS***

1.	**Course title:**	
	Hydromagnetic dynamo theory in geo- and astrophysics 2	
2.	**Lecturer:**	
	Krzysztof Mizerski	
3.	**Field, type and level of studies, year of study:**	
	Electromagnetism and fluid dynamics, All years	
4.	**Course character:**	
	monographic lecture	
5.	**Teaching method:**	
	traditional	
6.	**Language:**	*English (or Polish, depending on the audience)*
7.	**Course type and number of hours:**	
	Lecture 30h, exercise class 30h	
8.	**Estimated load of student's independent work:**	*70h*
9.	**Total workload and number of ECTS points:**	*6 ECTS*
10.	**Short description and main focus of the course:**	
	1. Theoretical description of Convection in natural systems *a. Boussinesq approximation* *b. Anelastic approximation* *2. Waves in the Earth's core – dispertion relations and physical properties. Observed geomagnetic oscillations.* *a. Methods used in the study of geomagnetic variations.* *b. MAC waves* *c. Torsional waves* *d. Rossby waves* *e. Inertial waves* *3. Comparison of observations and theory. What has been explained and examples of important problems still waiting be resolved.*	
11.	**References:**	
	Literature: The lecture will not be fully based on any particular book and its aim will be to	

	present complex issues related to the hydromagnetic dynamo in an accessible form. Therefore, there is no single textbook, but the recommended literature includes (will be sent to students in electronic form): *[1] P. Roberts 1967, An introduction to magnetohydrodynamics, American Elsevier Pub. What.* *[2] H.K. Moffatt and E. Dormy 2019, Self-exciting fluid dynamos, Cambridge University Press,* *[3] K.A. Mizerski 2021, Foundations of Convection with density stratification, Springer* *[4] IUGG, 2020, Geomagnetism, Aeronomy and Space Weather, Eds. M. Mandea, M. Korte, A. Yau, E. Petrovsky, Cambridge University Press.*	
12.	**Prerequisites:** *1. Knowledge of algebra and mathematical analysis.* *2. Ability to solve differential equations.* *3. Basic knowledge of electromagnetism* *4. Knowledge of vector calculus.*	
13.	**Educational outcomes:**	**PQF level 8 codes:**
	Knowledge: *Students know and understand the world's achievements in geomagnetism and the resulting implications of this for practical solutions.*	*P8U_W*
	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 geomagnetism, assume professional and public challenges concerning this field of knowledge.*	*P8U_K*
14.	**Evaluation of the educational outcomes:** *oral exam and essay.*	
15.	**Criteria to complete the course:** *Completeing the essay and at least grade 3 on the final exam.*	
16.	**Contact with the lecturer:** *kamiz@igf.edu.pl*	