AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Mathematics In Geophysics

Academic year: 2015/2016 Code: BGF-2-107-AG-s ECTS credits: 6

Faculty of: Geology, Geophysics and Environmental Protection

Field of study: Geophysics Specialty: Applied Geophysics

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 1

Course homepage: http://wms.mat.agh.edu.pl/~korbel

Responsible teacher: dr Czyżewska Katarzyna (kasia@agh.edu.pl)

Academic teachers: dr Czyżewska Katarzyna (kasia@agh.edu.pl)
dr hab. inż. Tomecka-Suchoń Sylwia (tomecka@agh.edu.pl)

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	he/she will be able to work in a group and find the solution to any given problem in the field of Engineering	GF2A_W02, GF2A_U02, GF2A_K02, GF2A_K03, GF2A_K04, GF2A_U04	Activity during classes, Project, Scientific paper
Skills			
M_U001	he/she will acquired a deep knowledge of Mathematics that will enable him/her to properly analyse the parameters of Geophysics (used) in the context of the physical properties of rock formations and in the context of various geophysical processes	GF2A_W02, GF2A_K05, GF2A_U02, GF2A_W05, GF2A_K07, GF2A_U04	Examination, Test
M_U002	he/she will be familiar with those methodologies used in Mathematics which are also used to solve the problems in the field of Geophysics	GF2A_W02, GF2A_U11, GF2A_W01, GF2A_K07, GF2A_U04, GF2A_W07	Activity during classes, Examination, Test

M_U003	he/she will be familiar with the advanced methodologies of Mathematics and he/she will be able to apply them when analysing the experimental data	GF2A_W02, GF2A_U03, GF2A_U02, GF2A_W05, GF2A_W01, GF2A_K02, GF2A_K07, GF2A_U04	Examination, Test
M_U004	he/she will be able to carry out further independent research that will involve finding and reading literature in both Polish and English languages	GF2A_W02, GF2A_K05, GF2A_K01, GF2A_U01, GF2A_K07, GF2A_U17, GF2A_U16	Activity during classes, Examination, Test
Knowledge			
M_W001	He/she will be familiar with and will understand the advanced phenomena of physics and various and diverse geophysical processes	GF2A_U02, GF2A_K01, GF2A_W01, GF2A_U01, GF2A_K02, GF2A_K07, GF2A_U04	Examination, Test
M_W002	He/she will know and understand those advanced methodologies used in the field of Mathematics which are vital in describing and explaining the complex problems in the field of Geophysics	GF2A_W02, GF2A_K08, GF2A_U02, GF2A_U01, GF2A_K02, GF2A_K03, GF2A_U04	Activity during classes, Examination, Test
M_W003	He/she will acquired a deep knowledge of the various methodologies used in Mathematics and their application in general and applied Geophysics	GF2A_U18, GF2A_U01, GF2A_K02, GF2A_K07, GF2A_W04, GF2A_U09	Examination, Test

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Others	E-learning
Social competence												
M_K001	he/she will be able to work in a group and find the solution to any given problem in the field of Engineering	-	-	-	+	-	-	-	-	-	-	-
Skills												
M_U001	he/she will acquired a deep knowledge of Mathematics that will enable him/her to properly analyse the parameters of Geophysics (used) in the context of the physical properties of rock formations and in the context of various geophysical processes	-	-	-	+	-	-	-	-	-	-	-

M_U002	he/she will be familiar with those methodologies used in Mathematics which are also used to solve the problems in the field of Geophysics	+	-	-	+	-	-	-	-	-	-	-
M_U003	he/she will be familiar with the advanced methodologies of Mathematics and he/she will be able to apply them when analysing the experimental data	-	-	-	+	-	-	-	-	-	-	-
M_U004	he/she will be able to carry out further independent research that will involve finding and reading literature in both Polish and English languages	-	-	-	+	-	-	-	-	-	-	-
Knowledge												
M_W001	He/she will be familiar with and will understand the advanced phenomena of physics and various and diverse geophysical processes	+	-	-	-	-	-	-	-	-	-	-
M_W002	He/she will know and understand those advanced methodologies used in the field of Mathematics which are vital in describing and explaining the complex problems in the field of Geophysics	+	-	-	+	-	-	-	-	-	-	-
M_W003	He/she will acquired a deep knowledge of the various methodologies used in Mathematics and their application in general and applied Geophysics	+	-	-	+	-	-	-	-	-	-	-

Module content

Lectures

Complex function: complex derivative, Cauchy-Riemann equations, holomorfic function, harmonic function, conformal mapping, singular points of complex function, Taylor and Laurent series, complex integral, Cauchy theorem, residuum theorem with applications, Gamma and Beta functions
Integral transforms: Fourier and Laplace transform with applications
Special ordinary differential equations: Fuchs class equations, Frobenius method, Lagrange, Bessel, confluent, Legendre equations, Sturm-Liouville problem, orthogonal polynomials, generating function, Rodriguez formula
Mathematical physics equations: initial and boundary conditions, Laplace, heat and wave equations, separation of variables for partial differential equation, boundary value problems in various symmetries: rectangular, cylindrical and spherical

Project classes

Complex function: complex derivative, Cauchy-Riemann equations, holomorfic function, harmonic function, conformal mapping, singular points of complex function, Taylor and Laurent series, complex integral, Cauchy theorem, residuum theorem with applications, Gamma and Beta functions
Integral transforms: Fourier and Laplace transform with applications
Special ordinary differential equations: Fuchs class equations, Frobenius method, Lagrange, Bessel, confluent, Legendre equations, Sturm-Liouville problem, orthogonal polynomials, generating function, Rodriguez formula
Mathematical physics equations: initial and boundary conditions, Laplace, heat and wave equations, separation of variables for partial differential equation, boundary value problems in various symmetries: rectangular, cylindrical and spherical

Method of calculating the final grade
Evaluation: 50% seminars and 50% final exam

Prerequisites and additional requirements
the student should obtain a ‘pass’ grade in the course in Mathematics (3 terms) and the course in Physics (2 terms)

Recommended literature and teaching resources
1. Arfken, G.; Mathematical Methods for Physicists, New York andLondon, Academic Press 1985
2. Conway, J.B.: Functions of One Complex Variable, Springer-Verlag Berlin and Heidelberg, Co. 2001
3. Hildebrand, F.B.: Advanced Calculus for Applications, Englewood Cliffs and New Jersey, Prentice-Hall, Inc. 1964
4. Boyce, DiPrima: Elementary Differential Equations and Boundary Value Problems, John Wiley and Sons, Inc. 2009
5. Titchmarsch, E.C.: Eigenfunction Expansions Associated with Second Order Differential Equations, London, Oxford University Press 1962
6. Farrel, O.J., Ross, B.: Solved Problems: Gamma and Beta Functions, Legendre Polynomials, Bessel Functions, New Yorn, The Macmillan Co. 1963
7. Watson, G.N.: A Treatise on the Theory of Bessel Fuctions, Cambridge, Cambridge University Press 1952

Scientific publications of module course instructors related to the topic of the module
Additional scientific publications not specified

Additional information
None

Student workload (ECTS credits balance)

Student activity form	Student workload
Examination or Final test	12 h
Participation in lectures	28 h
Participation in auditorium classes	28 h
Preparation for classes	30 h
Realization of independently performed tasks	75 h
Summary student workload	173 h
Module ECTS credits	6 ECTS