MODULE/ COURSE FORM

A. general information

To be completed by Course Team							
	Module name : **MATHEMATICAL ANALYSIS**					Module code:	
	Course name: **Mathematical analysis**					Course code:	
	Faculty: **INSTITUTE OF APPLIED INFORMATICS**						
	Field of study: **INFORMATICS**		Level of education: **first**				
	Mode of study : **Full-time**	Learning profile: **Practical**	Speciality::				
	Year/ semester: **1/2**	Module/ course status:: **mandatory**		Module/ course language: **Polish/English**			
	Type of classes	lecture	lessons	lab	project	Tuto rial	other (please specify)
	Course load	**30**	**30**				

Module/ course objectives	to acquaint the student with the basic notions of the mathematical analysis necessary in the work of enginineers when solving problems requiring the differential and integral calculus and methods of approximate calculations
Entry requirements	High school mathematics

LEARNING OUTCOME

Nr	LEARNING OUTCOME DESCRIPTION	Learning outcome reference
	Knowledge: the student...	
01	...knows the mathematical analysis of the differential and integral calculus, its interpretations with respect to some real phenomena, in particular related to informatics	K_W01
02	...knows basic algorithms of approximate calculations and their range of validity	K_W01
	Abilities and skills: the student...	
03	...solves problems of determining properties of sequences and functions of a single and many variables in the range described by the syllabus, especially those useful in mathematical modelling of objects and phenomena appearing in informatics' systems	K_U07
	Social competences: the student...	
04	recognizes cases of lack of complete information and more carefully formulates his/her opinions in such situations, seeks and looks for better sources of the knowledge	K-K01

Assessment method	Learning outcome number
5 short tests at the end of lessons related to simple applications of the currently considered mathematical methods	01, 03
3 individually assigned series of problems to be solved as a homework related to more complex applications of the mathematical analysis to real objects	01, 03, 04

2 midterms during classes, related to theoretical problems of the analysis (formulas, theorems, calculations of limits, derivatives, integrals, infinite sums, evolution equations, properties of sequences and functions)	01, 02, 03
1 final exam (written and oral) verifying mainly the parts not covered by the midterms, but not excluding some problems of the midterms)	01, 02, 03, 04

STUDENT WORKLOAD

	Number of hours	
	In all	including practical
Participation in lectures	30	4
Independent study of lecture topics	30	
Participation in tutorials, labs, projects and seminars	30	9
Independent preparation for tutorials*	20	
Preparation of projects/essays/etc. *	10	
Preparation/ independent study for exams	25	
Participation during consultation hours	5	
Other	3	
TOTAL student workload in hours	153	14
Number of ECTS credit per course unit	**6 ECTS**	
Number of ECTS credit associated with practical classes	**0.5 ECTS**	
Number of ECTS for classes that require direct participation of professors	**2.7 ECTS**	

B. details information

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Module/ course coordinator	**dr hab. inż. Joachim Domsta**
Lecturer	**dr hab. inż. Joachim Domsta, mgr inż. Dorota Żarek**

CURRICULUM CONTENTS

Lecture

1. numbers: natural numbers - mathematical induction; field of real numbers
2. the Newton binomial formula, the Bernoulli inequality
3.sequences of numbers: definition, classes of sequences - bounded, monotone, etc.
4. parameters of sequences: upper and lowr limits, the limit, calculation of lmits, numbers e and π
5. operations on sequences: limits of sums, products, etc; subsequences - the Bolzano-Weierstrass theorem, divergencs to infinity
6. number series: convergence, theorems on the convergence: the Cauchy and the d'Alembert criteria; absolutely convergent series
7. functions: classes of functions: monotone, epimorphic, injective, bijective, etc; invertible functions; elementary functions; operations on functions: sumation, product, composition, etc
8. limits and continuity of functions - the Cauchy and the Heine definitions; properties of continuous functions
9. the derivative of functions - differentiating elementary functions,.composition of functions, inverse functions
10. the Rolle and Lagrange thoerems; geometrical and other interpretations of the derivative, extremals of functions,
11. asymptots of functions, undetremined limits of functions, application of the de l'Hospital theorem
12. higher order derivatives: definitions, examples, interpretations; the Taylor and Maclaurin formulas; power series expansions
13. multivariate analysis - partial derivatives, necessary conditions for local extrema
14. undefinite integrals (anti-derivative): definition, integration formulas, existence of integrals of continuous functions
15. integrating exponential, trigonometric, hyperbolic functions and their inverses, examples of rational functions, and some irrational functions of second degree
16. definite (Riemann) integral: definition, examples, applications to length of curves, side-area and volume of rotational bodies
17. singular (improper) integrals, relation of their convergence to the series convergence
18. functional sequences and series - criteria of their convergence, power series convergence and derivatives, Taylor

series expansion - part 2
19. the Fourier series: definition, formulas for coefficients, examples of applications
20. elementary introduction to differential equations

Participation of practical problems: 15% (mathematical description of real phenomenain the form of functional dependence, mathematical formulation of problems of optimization - their solutions, calculating cumulated values with the use of integral calculus, determining the spectrum of periodic signals).

Lessons

content - same as in lectures.

Participation of practical problems: 30% (mathematical description of real phenomenain the form of functional dependence, mathematical formulation of problems of optimization - their solutions, calculating cumulated values with the use of integral calculus, determining the spectrum of periodic signals, dynamics of simple autonom systems, presentation of the analysis and solutions of chosen problems).

Project (other)

Basic literature	"Calculus" James Stewart, McMASTER UNIVERSITY AND UNIVERSITYOF TORONTO. BROOKS/COLE CENGAGE Learning
Additional literature	
Teaching methods	**lectures** - presentation of the content written on the boars, displayed in a form of slides, each lecture available via internet few days in advance **instructions** - solving problems directly related to the content of the lectures during lessons; the solutions are obtained by joint analysis of the problems with all students in the class, supported by the instructor suggestions with respect to the merital content of lectures (lectures' material precedes the problems due to particular lessons) **individual advices (consultations)** - students can ask help and advices in solving their problems during office hours of the lecturer and instructor.
Form and terms of final grade	evaluation of the short tests during lessons: 5 × 3% = 15% evaluation of the individual home work presentation 3 × 5 = 15% evaluation of two midterms 2 × 15% evaluation of the final exam 40% final grade depends on the obtained total scoring: 0-50%: 2; 51-60%: 3; 61-70%: 3.5; 71-80%: 4; 81-90%: 4.5; 91-100%: 5