

CALCULUS

Faculty of Computer Science			
Study programme:	Computer Science		Degree level: Engineer's degree full-time programme
Specialization	---		Diploma path: 2026/2027W - 2026/2027S
Module name:	Calculus (Analiza matematyczna)		
Module type:	obligatory	Semester: 1	ECTS:5 Module ID:FCS-00002
No. of hrs in semester:	Lecture (L) - 30 Classes(C) - 20 Specialization workshop (SW) - 15 Project (P) - 0 Laboratory classes (LC) - 0 Seminar (S) - 0		
Prerequisites	-		
Aims and objectives:	The course will introduce the concepts of limit of a sequence, convergence of number series, continuity and derivatives of real functions of one variable and n-variables, indefinite and definite integrals of functions of one variable. An emphasis will be put on applications of definite integrals and differential calculus of real functions of one variable and n-variables.		
Forms of teaching activities:	lecture, classes, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes:
		Lectures - written exam, exercises - written test.	
Module content:	<p>Lecture:</p> <ol style="list-style-type: none"> Review of elementary functions and discussion of their properties Sets and functions Functions and sequences Sequences (limits) Limits, continuity, and derivatives of functions Properties of derivatives. Higher-order derivatives Applications of derivatives (extrema, convexity, concavity, inflection points) Indefinite integrals Definite integrals and their applications Numerical series Fourier series and Fourier transform Differential calculus of functions of several variables Local extrema of functions of several variables Global extrema of functions of several variables Constrained extrema of functions of several variables <p>Practical classes:</p> <ol style="list-style-type: none"> Limits of sequences and functions Derivatives and their properties. Higher-order derivatives Applications of derivatives (monotonicity, extrema, convexity, concavity, inflection points) Indefinite integrals (integration by parts and substitution methods) Definite integrals and their applications Series - convergence Fourier series Differential calculus of functions of several variables Extrema of functions of several variables Assessment <p>Specialized laboratory</p> <ol style="list-style-type: none"> Review of elementary functions Properties of sequences and functions (monotonicity, evenness/oddness, periodicity, etc.) Limits of sequences 		

	<p>4. Asymptotes of functions</p> <p>5. Derivatives of functions</p> <p>6. Extrema of functions</p> <p>7. Convexity, concavity, and inflection points</p> <p>8. Indefinite integrals</p> <p>9. Definite integrals and applications</p> <p>10. Series - convergence</p> <p>11. Fourier series</p> <p>12. Fourier transform</p> <p>13. Local extrema of functions of several variables</p> <p>14. Global and constrained extrema of functions of several variables</p> <p>15. Course completion</p>		
Teaching methods: subject exercises, classic problem method, lecture problem, informative lecture,			
Learning outcomes			
Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge - skills - competence. Each learning outcome must be verifiable	Reference to the programme learning outcomes of education	
L01	knows how to use in different context the concept of a limit of a sequence, convergence of number series, continuity of real functions of one variable and n-variables.		
L02	calculates derivatives of a function of one variable and partial derivatives of a function of n-variables.		
L03	calculates indefinite and definite integrals of functions of one variable applying basic methods of integration.		
L04	solves problems of optimization using tools of differential calculus of real functions of one variable and n-variables.		
L05	applies elements of integral calculus of real functions of one variable and n-variables to geometric calculations.		
No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed	
L01	written tests, written exam	L, C	
L02	written tests, written exam	L, C	
L03	written tests, written exam	L, C	
L04	written tests, written exam	L, C	
L05	written tests, written exam	L, C	
Student's workload (in hours)	1 - Participation in lectures	2x15h	30
	2 - Participation in other forms of classes	20h+15h	35
	3 - individual academic support in the learning process and participation in assessments conducted outside the scheduled classes	None	4
	4 - Preparation to the exam	None	15
	5 - Participation for practical classes preparation assessment	None	15
	6 - Preparation for the specialized laboratory assessment	None	11
	7 - Preparation for ongoing classes	None	15
		TOTAL:	
Quantitative indicators	Student's workload - activities that require direct teacher participation: (1)+(2)+(3)+(7)	84	ECTS 3.4
	Student's workload connected with practical classes (2)+(5)+(6)+(7)	76	3.0
Basic references:	<p>1. Marsden, Jerrold., and Alan. Weinstein. Calculus I. 2nd ed. New York: Springer-Verlag, 1985. Print. Undergraduate Texts in Mathematics.</p> <p>2. Weir, Maurice D., Joel. Hass, Frank R. Giordano, and George B. Thomas. Thomas' Calculus. 11th Ed., Media Upgrade. ed. Boston: Pearson Addison Wesley, 2008. Print.</p> <p>3. Stewart, James. Single Variable Calculus : Early Transcendentals. 7th Ed. Hybrid. ed. Belmont: Brooks/Cole : Cengage Learning, 2012. Print.</p>		
Further reading	<p>1. Auvil, Daniel L. Calculus with Applications. Reading: Addison-Wesley Publ., 1993. Print.</p> <p>2. Adams, Robert Alexander. Single-variable Calculus. Don Mills: Addison-Wesley Publ., 1983. Print.</p>		
Unit:	Department of Mathematics	Lecturer/ instructor	dr hab. Ewa Girejko
Date of issuing the programme:	18th Feb. 2022	Author of the programme:	dr hab. Ewa Girejko

L - lecture, C - classes, LC - laboratory classes, P-project, SW
- specialization workshop, S - seminar