COMPUTER GRAPHICS

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:	**Computer Graphics** (Grafika komputerowa)			
Module type:	**obligatory**	**Semester: 1**	ECTS:**3**	Module ID:**FCS-00010**
No. of hrs in semester:	Lecture (L) - **15** Classes(C) - **0** Specialization workshop (SW) - **30** Project (P) - **0** Laboratory classes (LC) - **0** Seminar (S) - **0**			
Prerequisites	Linear Algebra (FCS-00030), Object Oriented Programming (FCS-00012),			

Aims and objectives:	Creating images using a standard API to implement basic operations affine vector objects and raster image, creating and conducting usability of text on an existing application; the use of tools to support the creation of a graphical user interface		
Forms of teching activities::	lecture, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes: Lecture - written exam Laboratory - exercise reports
Module content:	Lecture: 1. Basic concepts of computer graphics. 2. Applications of computer graphics. 3. Color space models: RGB, CMYK, HSV. 4. RGB cube, HSV cone, and the problem of color mapping. 5. Digital image representation. Image processing. Methods of image quality enhancement. Point operations. Histogram. 6. Image filtering. Median, smoothing, sharpening, high-pass, and low-pass filters. Thresholding and algorithms for automatic threshold selection. 7. Geometric modeling. Representation and main types of curves. 8. Bézier curves. 9. Geometric transformations in the plane: translation, rotation, scaling. Transformations in homogeneous coordinates. 10. Composition of elementary transformations. 11. Mathematical morphology in image processing. 12. Structuring element, hit-or-miss, dilation, erosion, opening, closing. 13. Compression of static images. 14. JPEG image encoding algorithm. Transformations and quality of lossy compression. 15. Final assessment. Specialized Laboratory: 1. Preparation of environments and graphic libraries. 2. Drawing graphic primitives using libraries and the concept of a canvas. 3. Implementation of loading a simple graphic file format. 4. Color spaces. Color space conversion. 5. Visualization of the RGB cube and HSV cone. 6. Point transformations on a raster image. Methods of image enhancement. Implementation of selected filtering algorithms. 7. Mathematical morphology in image processing. 8. Histogram. Implementation and demonstration of image normalization through histogram operations. 9. Implementation and demonstration of image binarization with adjustable thresholds. 10. Bézier curve. Implementation of a simple Bézier curve editor. 11. 2D transformations. Implementation of a simple tool to demonstrate 2D transformations. 12. Morphological operators. Implementation of selected morphological filters and demonstration of their effect on a loaded image. 13. Implementation of a selected image processing method, e.g., segmentation, object detection, or pattern recognition. 14. Image analysis and recognition. 15. Final assessment.		
Teaching methods:	programming, lecture problem,		

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
LO1	is familiar with the basic concepts of computer graphics and computer graphics subsystem building	
LO2	knows the methods of representation and processing of digital images	
LO3	knows the technologies and methods used in the creation of graphical applications	
LO4	is able to use the known methods, algorithms and graphical libraries to build information systems	
LO5	is able to present the results of experiments in graphic form	
LO6	is able to identify the technical and scientific use of computer graphics	

No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed
LO1	Written exam	L
LO2	Written exam	L
LO3	Projects	Sw
LO4	Projects	Sw
LO5	Projects	Sw
LO6	Written exam, projects	L, Sw

Student's workload (in hours)	**1** - Attendance at lectures	None	15
	2 - Attendance at laboratories	None	30
	3 - Homeworks	None	10
	4 - Preparation of reports	None	10
	5 - Preparation for the exam	None	10
		TOTAL:	**75**
Quantitative indicators	Student's workload - activities that require direct teacher participation: (2)+(1)	45	**ECTS** 1.8
	Student's workload connected with practical classes (2)+(3)+(4)	50	2.0
Basic references:	1. P.Shirley ,Fundamentals of Computer Graphics , A.K.Peters, Natick Massachusetts 2002		
Further reading	1. A.Glassner, Principles of Digital Imagne Synthesis , Morgan Kaufmann Publ. San Francisco 1995		

Unit:	Department of Digital Media and Computer Graphics	Lecturer/ instructor	
Date of issuing the programme:	31st March 2026	Author of the programme:	dr inż. Marcin Skoczylas

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