



## Subject card

Subject name and code	Image Synthesis and Processing, PG_00048332						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Multimedia Systems -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Grzegorz Szwoch				
	Teachers		dr hab. inż. Grzegorz Szwoch				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	30		3.0		42.0	75
Subject objectives	Students learn the basics of 3D computer graphics and animation. Specific topics include real-time rendering of 3D images (e.g. in computer games) and off-line rendering (in ray tracers), as well as creating computer animations (such as in computer games and animated movies). Additional topics are creation of stereoscopic images and images with increased dynamics range (HDR). During the laboratory classes, students learn how to operate basic computer graphics software such as Blender.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U04] can apply knowledge of programming methods and techniques as well as select and apply appropriate programming methods and tools in computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, making assessment and critical analysis of the prepared software as well as a synthesis and creative interpretation of information presented with it	The student knows how to perform basic procedures related to computer graphic and animation, such as: 3D scene modelling, scene transformations, shading, texturing, rendering, skeletal animation.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
	[K7_W03] Knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum.	The student knows and understands algorithms and methods related to computer graphic and animation, such as: 3D modelling, scene building, rendering, computer animation methods.	[SW1] Assessment of factual knowledge
	[K7_W04] Knows and understands, to an advanced extent, the principles, methods and techniques of programming and the principles of computer software development or programming devices or controllers using microprocessors or programmable elements or systems specific to the field of study, and organisation of systems using computers or such devices	The student knows software and hardware used in computer graphic and animation, such as graphic programming systems (DirectX, OpenGL) and graphic hardware (GPU).	[SW1] Assessment of factual knowledge

Subject contents	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Image synthesis - basic terms</li> <li>3. Applications of image synthesis. History of development of image synthesis methods.</li> <li>4. Modeling of 3D objects.</li> <li>5. Transformations of 3D objects.</li> <li>6. Lighting and shading.</li> <li>7. Textures, MIP mapping, texture filtering. Bump mapping.</li> <li>8. Shadow mapping.</li> <li>9. Advanced effects: fog, occlusion, particle systems.</li> <li>10. Global illumination algorithms. Ray tracing and radiosity.</li> <li>11. Rasterization of the 3D image. Z-buffer algorithm.</li> <li>12. Introduction to computer animation. Applications of animation.</li> <li>13. Kinematic and physic animation. Physical model of the animation. Procedural animation.</li> <li>14. Realistic character animation. Behavioral animation. Skeleton model.</li> <li>15. Development of computer animated movies.</li> <li>16. Hardware and software solutions for image synthesis. Graphic Processing Units. DirectX and OpenGL. Shaders.</li> <li>17. High dynamic range (HDR) images and dynamic range increase (DRI) algorithms.</li> <li>18. Advanced image synthesis: stereographs, anaglyphs, fractals.</li> <li>19. Conclusion. Perspectives of image synthesis.</li> </ol>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 40%;">Subject passing criteria</th> <th style="width: 30%;">Passing threshold</th> <th style="width: 30%;">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td>Written exam</td> <td>51.0%</td> <td>50.0%</td> </tr> <tr> <td>Practical exercises</td> <td>51.0%</td> <td>50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	Written exam	51.0%	50.0%	Practical exercises	51.0%	50.0%
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Written exam	51.0%	50.0%										
Practical exercises	51.0%	50.0%										
Recommended reading	Basic literature	Lecture presentations and other supplementary materials available at: <a href="https://multimed.org/student/materialy.html#so">https://multimed.org/student/materialy.html#so</a>  Instrukcje laboratoryjne: <a href="https://multimed.org/student/laboratoria.html#so">https://multimed.org/student/laboratoria.html#so</a>										

	Supplementary literature	<p>Kamil Kuklo, Jarosław Kolmaga: Blender. Kompendium. Helion 2007, ISBN: 83-246-0824-9</p> <p>Bogdan Bociek: Blender. Podstawy modelowania.. Helion 2007, ISBN: 978-83-246-0630-6</p> <p>George Maestri: Animacja cyfrowych postaci. Helion 2000, ISBN: 83-7197-177-X</p> <p>Frank Luna: Introduction to 3D Game Programming with DirectX 9.0c: A Shader Approach. Jones &amp; Bartlett Publishers, 2006, ISBN: 1598220160</p> <p>J. Foley, A. van Dam, S. Feiner, J. Hughes, R. Phillips: Wprowadzenie do grafiki komputerowej. WNT, Warszawa 2001.</p>
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	