Medien & Digitale Technologien



UNIVERSITY OF APPLIED SCIENCES



Bachelor Creative Computing

Curriculum Version 4.0

St. Pölten, 10/04/2025



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1 Graphic view of the curriculum





Farben der Modulbereiche (subareas):

Programming
User Interface Design
Human-Computer Interaction
Foundations
Projects
Elective Modules
Scientific Work
Internship

Akronyme der Modulnamen:

FD ... Frontend Development VDGG ... Visual Design and Game Graphics FCC ... Foundations of Creative Computing CCL: GPF ... Creative Code Lab 1: Games and Playful Frontends WP ... Web Programming DOH ... Design-oriented HCI WD ... Web Design FCC2 ... Foundations of Creative Computing 2 CCL2: CW ... Creative Code Lab 2: Connected World MP ... Mobile Programming EMH ... Empirical Methods in HCI MTUID ... Mobile and Tangible User Interface Design PCA ... Physical Computing and Algorithms EM ... Elective Module: Mobile Applications CCL3: MA ... Creative Code Lab 3: 3DD ... 3D Design XRC ... Extended Reality Coding SW ... Scientific Writing CCL4: ER ... Creative Code Lab 4: Extending Realities BT ... Bachelor Thesis CCL5: ACC ... Creative Code Lab 5: Applications in **Creative Computing** WOOP ... Window of Opportunity IS ... Internship

2 Curriculum matrix

Modul	I V-Bezeichnung	I V-Tvp	SWS	Anzahl Gruppe	ASWS	ALVS	FCTS
ED	Introduction to Web Technologies		2	2	4.7	70	2
		1∟v	2	5	4.7	10	5
FD	Client-Side Coding	ILV	3	3	7	105	4
FD	2D Browser Game Coding	UE	2	3	6	90	3
VDGG	Graphics Design	ILV	2	3	4	60	3
VDGG	2D Game Graphics	UE	1	3	3	45	2
FCC	Data Ethics	UE	1	3	3	45	1
FCC	Game Design and Digital Storytelling	ILV	2	3	4	60	3
FCC	Design Thinking	ILV	1	3	2.3	35	1.5
FCC	Selected Legal Topics for Developers and Designers	VO	1	1	1	15	1.5
FCC	Mathematical Foundations for Computing	UE	2	3	6	90	3
CCL1: GPF	Creative Code Lab 1: Games and Playful Frontends	PR	3	3	9	135	5
Summenzeile			20		50	750	30
LVS = Summe SWS*LV-Wochen			300				

2. Semester

Modul	LV-Bezeichnung	LV- Typ	sws	Anzahl Gruppen	ASWS	ALVS	ECTS
WP	Server-Side Coding	ILV	3	3	7.7	115	5
DOH	Introduction to human-centered design	VO	1	1	1	15	2
DOH	User Research	ILV	2	3	4	60	3
WD	User Interface Design	UE	2	3	6	90	3
WD	Inclusive Design and Accessibility	UE	2	3	6	90	2
FCC2	Networks, Cloud & Communication Security	ILV	2	3	4.7	70	3
FCC2	Applied Artificial Intelligence (AI)	UE	2	3	6	90	3
FCC2	Framework-oriented Coding	UE	2	3	6	90	4
CCL2: CW	Creative Code Lab 2: Connected World	PR	3	3 3 9 135		135	5
Summenzeile			19		50.3	755	30
LVS = Summe SWS*LV-Wochen			285				

Modul	LV-Bezeichnung	LV- Typ	sws	Anzahl Gruppen	ASWS	ALVS	ECTS
MP	Mobile Coding	UE	3	3	9	135	5
EMH	Usability and Experience Evaluation	ILV	3	3 3 7 105		105	5
MTUID	User Interface Design for Mobile Devices	UE	2	2 3 6 90		3	
MTUID	Tangible User Interfaces	UE	2	3	6	90	2
PCA	Physical Computing and Connectivity	UE	2	3	6	90	2
PCA	Data Structures and Algorithms	UE	2	3	6	90	3
EM	Elective Module	ILV	3	3 9 135		135	5
CCL3: MA	Creative Code Lab 3: Mobile Applications	PR	3	3 3 9 135		5	
Summenzeile			20		58	870	30
LVS = Summe SWS*LV-Wochen			300				

4. Semester

Modul	LV-Bezeichnung	LV- Typ	SWS	Anzahl Gruppen	ASWS	ALVS	ECTS
3DD Interface and Interaction Design for Extended Realities		UE	1.5	3	4.5	69	2
3DD 3D Modelling and Animation		UE	3	3	9	135	3
XRC	Practical Software Design Principles	n Principles UE 2 3 6 90		90	3		
XRC	Engine-based Extended Reality Development	UE	3	3 3 9 135		135	5
XRC	Audio for 3D Engines	ILV 2 3 6 70		70	2		
SW	Scientific Writing	SE	3	3 3 9 90		90	5
EM	Elective Module	ILV	3	3	9	135	5
CCL4: ER	Creative Code Lab 4: Extending Realities	PR	3	3 9 135		5	
Summenzeile			19.5		58.5	859	30
LVS = Summe SWS*LV-Wochen			293				

Modul	LV-Bezeichnung	LV- Typ	sws	Anzahl Gruppen	ASWS	ALVS	ECTS
BT	Bachelor Thesis: Plan and Research	SE	1.5	6	9	138	5
CCL5: ACC Team Development		WS	2	6	12	180	3
CCL5: ACC	Scrum Coaching	ILV	2	6	12	180	2
CCL5: ACC	Software Testing	UE	1	3	3	45	1
CCL5: ACC	Project Work	PR	3	12	36	540	19
Summenzeile			9.5		72	1083	30
LVS = Summe SWS*LV-Wochen			143				

Modul	LV-Bezeichnung	LV-Typ	SWS	Anzahl Gruppen	ASWS	ALVS	ECTS
WOOP	Window of Opportunity (WoOp)	ILV	2	3	4	60	5
IS	Internship	BP	1	6	6	90	18
BT	Bachelor Thesis: Implementation and Evaluation	SE	1.5	6	9	135	5
BT Bachelor Exam		SE	0.05	75	3.75	56.3	2
Summenzeile			4.6		22.75	341	30
LVS = Summe SWS*LV-Wochen			69				

3 Module and Course descriptions

3.1 Frontend Development

FD	Frontend Development 10 ECTS		
Unit number	Unit title	Workload	
Course of studies	Bachelor Degree Programme Creative Computing		
Position in curriculum	1st semester		
Language	English		
Assignment to subarea	Programming		
Prior knowledge	Mathematical Foundations for Computing (Unit FCC) ne	eded for	
	Course "2D Browser Game Coding"		
	None for the other courses		
Blocked	Partially		
Participants	Beginners		
Learning outcomes	The students are able to		
	 explain web-based client-server communicatio independently design a simple website and im browser-compatible with client-side technologic CSS). (L3) explain fundamentals of programming. (L2) independently implement a simple application (L3) implement accessible web interfaces. (L3) independently implement a simple 2D Browser based on predefined requirements. (L3) 	n. (L2) plement it es (HTML, with JavaScript. ⁻ Game Engine	
Unit examinations	None		
Contribution to following units	Creative Code Lab 1: Games and Playful Frontends Web Programming Mobile Programming		
Literature	Anquetil, R. (2019). Fundamental Concepts for Web De HTML5, CSS3, JavaScript and much more! For comple Independently published. Coyier, C. (o. J.). CSS Flexbox Layout Guide CSS-Tric 7. Januar 2025, von https://css-tricks.com/snippets/css/	velopment: te beginners! cks. Abgerufen a-guide-to-	
	flexbox/		

Graeme, S. (2017). Introducing Javascript game development: Build a 2d game from the ground up. Springer Science+Business Media.
JavaScript With Syntax For Types. (o. J.). Abgerufen 10. Januar 2025, von https://www.typescriptlang.org/index.html
Myers, M. (2013). A smarter way to learn Javascript. CreateSpace.
Online Courses and Digital Marketing Training—Google- Grow with Google. (o. J.). Abgerufen 10. Januar 2025, von <u>https://grow.google/intl/uk/courses-and-tools/</u>
Simpson, K. (2020a). Get started (Second edition). GetiPub & Leanpub.
Simpson, K. (2020b). Scope and closures (Second edition). GetiPub & Leanpub.
Sung, K. (Hrsg.). (2015). Build your own 2D game engine and create great web games using HTML5, JavaScript, and WebGL. Apress : Distributed to the Book trade worldwide by Springer Science+Business Media.
TypeScript Tutorial. (o. J.). Abgerufen 10. Januar 2025, von https://www.tutorialspoint.com/typescript/index.htm
W3C Web Accessibility Initiative. (o. J.). Web Standards. W3C. Abgerufen 10. Januar 2025, von <u>https://www.w3.org/standards/</u>
Web technology for developers MDN. (o. J.). Abgerufen 7. Januar 2025, von <u>https://developer.mozilla.org/en-US/docs/Web</u>
West, M. (2013). HTML5 foundations. John Wiley & Sons.

	Introduction to Web Technologies			
Course number	Course title			
Course type	Integrated course (ILV)			
Teaching and learning	Lectures interwoven with exercises			
methods	Exercises			
Workload	3 ECTS & 2 SWS			
Position in curriculum	1st semester			
Language	English			
Prior knowledge	None			
Learning outcomes	The students are able to			
	• explain web-based client-server communication. (L2)			
	 independently design a simple website and implement it 			
	browser-compatible with client-side technologies (HTML,			
	CSS). (L3)			
	implement accessible web interfaces. (L3)			
Contents	Introduction to the fundamentals of web development:			
	• internet and its services,			
	 history of HTML and CSS, 			
	client-server communication			
	HTTP methods,			

	browser compatibility
	requirements for barrier-free access to information for people
	with disabilities
	Introduction to the development with HTML and CSS as client-side technologies
Exam modalities	Course-immanent exam
Literature	Anquetil, R. (2019). Fundamental Concepts for Web Development: HTML5, CSS3, JavaScript and much more! For complete beginners! Independently published.
	Coyier, C. (o. J.). CSS Flexbox Layout Guide CSS-Tricks. Abgerufen 7. Januar 2025, von <u>https://css-tricks.com/snippets/css/a-guide-to-flexbox/</u>
	Web technology for developers MDN. (o. J.). Abgerufen 7. Januar 2025, von <u>https://developer.mozilla.org/en-US/docs/Web</u>

	Client-Side Coding
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lectures interwoven with exercises Exercises Inverted Classroom
Workload	4 ECTS & 3 SWS
Position in curriculum	1st semester
Language	English
Prior knowledge	Introduction to Web Technologies
Learning outcomes	The students are able to
	 explain fundamentals of programming. (L2) independently implement a simple application with JavaScript. (L3) create a GIT repository and upload the code (L3)
Contents	 Fundamentals of programming based on JavaScript / Typescript: variables, Data types and operators, arrays conditions and loops (if, while, for) functions and scope Debugging Using JavaScript libraries (e.g., Math) Objects & Classes DOM Manipulation Basics of GIT
Exam modalities	Course-immanent exam
Literature	JavaScript With Syntax For Types. (o. J.). Abgerufen 10. Januar 2025, von <u>https://www.typescriptlang.org/index.html</u>

Myers, M. (2013). A smarter way to learn Javascript. CreateSpace.
Online Courses and Digital Marketing Training—Google- Grow with Google. (o. J.). Abgerufen 10. Januar 2025, von <u>https://grow.google/intl/uk/courses-and-tools/</u>
Simpson, K. (2020a). Get started (Second edition). GetiPub & Leanpub.
Simpson, K. (2020b). Scope and closures (Second edition). GetiPub & Leanpub.
TypeScript Tutorial. (o. J.). Abgerufen 10. Januar 2025, von https://www.tutorialspoint.com/typescript/index.htm
W3C Web Accessibility Initiative. (o. J.). Web Standards. W3C. Abgerufen 10. Januar 2025, von <u>https://www.w3.org/standards/</u>
Web technology for developers. (o. J.). <u>https://developer.mozilla.org/en-US/docs/Web</u>

	2D Browser Game Coding	
Course number	Course title	
Course type	Exercise (UE)	
Teaching and learning methods	Lectures Live-coding Exercises Hands-on coding	
Workload	3 ECTS & 2 SWS	
Position in curriculum	1st semester	
Language	English	
Prior knowledge	Client-side coding	
Learning outcomes	The students are able to independently implement a simple 2D Browser Game Engine based on predefined requirements (L3).	
Contents	 Fundamentals of programming a 2D browser game engine: working with HTML canvas moving, rotating and translating elements implementing physics local data storage manage user input (mouse, keyboard) implementing a gameloop with all nessecary parts manage reusable code in modules & practically use OOP learn about collision detection and implement AABBs handling sprite sheets and animation 	
Exam modalities	Course-immanent exam	
Literature	Graeme, S. (2017). Introducing Javascript game development: Build a 2d game from the ground up. Springer Science+Business Media. Sung, K. (Hrsg.). (2015). Build your own 2D game engine and create great web games using HTML5, JavaScript, and WebGL. Apress : Distributed to the Book trade worldwide by Springer Science+Business Media. West M. (2013). HTML5 foundations. John Wiley & Sons	

3.2 Visual Design and Game Graphics

VDGG	Visual Design and Game Graphics	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	1st semester	
Language	English	
Assignment to subarea	User Interface Design	
Prior knowledge	None	
Blocked	No	
Participants	All Students	
Learning outcomes	 nts are able to explain the essential design principles and ele explain the gestalt laws (L2). Critique and evaluate graphical work based of and gestalt laws (L5). develop a design independently according to briefing with a graphic software (L3). create their own graphics or modify existing genes (L2). optimize graphics for game efficiency (L3). explain the differences between frame-by-frating ged/puppet, and stop-motion animation (L2). create or edit simple animations in dedicated export them as sprite sheets (L3) understand grids and ratios in pixel art and pigames (L2). 	ements (L2). on principles a client graphics (L3). d raster me, 2) software and ixel-based
Unit examinations	None	
Contribution to following units	Creative Code Lab 1: Games and Playful Frontends Web Design Mobile User Interface Design 3D Design	
Literature	 Aleksander, N., & Tilbury, R. (2014). Beginner's guide painting in photoshop (Reprint). 3dtotal Publ. Anderson, K., Cady-Lee, D., Carre, C., & Mengert, H. J.). (2019). Creating characters for the entertainment in Character design for animation, illustration & video gar Publishing. Azzi, M. (o. J.). Pixel Logic. <u>https://pixellogicbook.com</u> Cording, D., & Morse, S. (Hrsg.). (2016). Master the a painting: Digital painting techniques. 3dtotal Publishing. 	to digital (with Woods, industry: mes. 3dTotal <u>/</u> rt of speed

Heller, S., & Ilić, M. (Hrsg.). (2007). The anatomy of design: Uncovering the influences and inspirations in modern graphic design. Rockport.

Johnson, J. (2014). Designing with the mind in mind: Simple guide to understanding user interface design guidelines (2nd edition). Elsevier, Morgan Kaufmann is an imprint of Elsevier.

Lewis, M., Cartwright, J., & Lewis, M. (Hrsg.). (2018). Creating stylized characters. 3dtotalPublishing.

Lupton, E. (2010). Thinking with type: A critical guide for designers, writers, editors, & students (2nd rev. and expanded ed). Princeton Architectural Press.

Lupton, E., & Phillips, J. C. (2015). Graphic design: The new basics (2nd edition, revised and expanded). Princeton Architectural Press [u.a.].

Meggs, P. B., Purvis, A. W., & Meggs, P. B. (2016). Meggs' history of graphic design (Sixth edition). Wiley.

Müller-Brockmann, J. (2021). Grid systems in graphic design: A visual communication manual for graphic designers, typographers and three dimensional designers = Raster Systeme für die visuelle Gestaltung: ein Handbuch für Grafiker, Typografen und Ausstellungsgestalter (18th edition). Niggli.

Samara, T. (2023). Making and Breaking the Grid, Third Edition: A Graphic Design Layout Workshop. Quarto Publishing Group USA.

Sherin, A. (2021). Introduction to graphic design: A guide to thinking, process and style. Bloomsbury Visual Arts.

White, A. W. (2011). The elements of graphic design: Space, Unity, Page Architecture, and Type (Second edition). Allworth Press.

Williams, R. (2009). The animator's survival kit: A manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators (expanded edition). Faber and Faber.

	Graphics Design
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning methods	Lectures interwoven with exercises Exercises
Workload	3 ECTS & 2 SWS
Position in curriculum	1st semester
Language	English
Prior knowledge	none
Learning outcomes	 explain the essential design principles and elements (L2). explain the gestalt laws (L2). Critique and evaluate graphical work based on principles and gestalt laws (L5). develop a design independently according to a client briefing with a graphic software (L3).

Contents	 Introduction to the basic design principles and elements (shapes, colors, typography, visual hierarchy, white space, etc.) Introduction to the gestalt laws Introduction to layout and positioning Introduction to project briefing and process Design analysis and development Software Training
Exam modalities	Course-immanent exam
Literature	Heller, S., & Ilić, M. (Hrsg.). (2007). The anatomy of design: Uncovering the influences and inspirations in modern graphic design. Rockport.
	Johnson, J. (2014). Designing with the mind in mind: Simple guide to understanding user interface design guidelines (2nd edition). Elsevier, Morgan Kaufmann is an imprint of Elsevier.
	Lupton, E. (2010). Thinking with type: A critical guide for designers, writers, editors, & students (2nd rev. and expanded ed). Princeton Architectural Press.
	Lupton, E., & Phillips, J. C. (2015). Graphic design: The new basics (2nd edition, revised and expanded). Princeton Architectural Press [u.a.].
	Meggs, P. B., Purvis, A. W., & Meggs, P. B. (2016). Meggs' history of graphic design (Sixth edition). Wiley.
	Müller-Brockmann, J. (2021). Grid systems in graphic design: A visual communication manual for graphic designers, typographers and three dimensional designers = Raster Systeme für die visuelle Gestaltung: ein Handbuch für Grafiker, Typografen und Ausstellungsgestalter (18th edition). Niggli.
	Samara, T. (2023). Making and Breaking the Grid, Third Edition: A Graphic Design Layout Workshop. Quarto Publishing Group USA.
	Sherin, A. (2021). Introduction to graphic design: A guide to thinking, process and style. Bloomsbury Visual Arts.
	White, A. W. (2011). The elements of graphic design: Space, Unity, Page Architecture, and Type (Second edition). Allworth Press.

	2D Game Graphics
Course number	Course title
Course type	Exercise (UE)
Teaching and learning	Lectures interwoven with exercises
methods	Exercises
	Development of a pitch bible
Workload	2 ECTS & 1 SWS
Position in curriculum	1st semester
Language	English
Prior knowledge	none
Learning outcomes	The students

	 create their own graphics or modify existing graphics (L3).
	understand the difference between vector and raster
	graphics (L2).
	 optimize graphics for game efficiency (L3).
	• explain the differences between frame-by-frame,
	rigged/puppet, and stop-motion animation (L2)
	create or edit simple animations in dedicated software and
	export them as sprite sheets (L6)
	 understand grids and ratios in pixel art and pixel-based
	games (L2)
Contents	The students
	• Learn the basics of graphics editing with dedicated software.
	Differences between vector and raster graphics
	Concepts of 2D animation for games (Sprite Sheets)
	Apply simple effects
Exam modalities	Course-immanent exam
Literature	Aleksander, N., & Tilbury, R. (2014). Beginner's guide to digital painting in photoshop (Reprint). 3dtotal Publ.
	Anderson, K., Cady-Lee, D., Carre, C., & Mengert, H. (with Woods, J.). (2019). Creating characters for the entertainment industry: Character design for animation, illustration & video games. 3dTotal Publishing.
	Azzi, M. (o. J.). Pixel Logic. https://pixellogicbook.com/
	Cording, D., & Morse, S. (Hrsg.). (2016). Master the art of speed painting: Digital painting techniques. 3dtotal Publishing.
	Lewis, M., Cartwright, J., & Lewis, M. (Hrsg.). (2018). Creating stylized characters. 3dtotalPublishing.
	Williams, R. (2009). The animator's survival kit: A manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators (expanded edition). Faber and Faber.

3.3 Foundations of Creative Computing

FCC	Foundations of Creative Computing 1	10 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	1st semester	
Language	English	
Assignment to subarea	Foundations	
Prior knowledge	None	
Blocked	No	
Participants	Beginners	
Learning outcomes	The students	
	 have a basic understanding of data usage in data a machine learning (L2). understand the principles of generative AI models (understand the limitations of generative AI models (understand the ethical implications of data usage for (generative) AI models (L2). understand the basics of game design and the differems of graphics, story and audio (L2). can explain different game styles and implement the (L3). are able to analyze games on the basis of genre, the characters acting and describe their storyline (L4). understand the different concepts of storytelling in r and can create their own game stories (L3). have the ability to create story boards and mood bo graphics to reflect the storylines and the story of the (L3). can independently design and present pitching pade (L3). understand the implications of using other componentibraries, media, etc.) as part of their own services (can select an appropriate existing license for their or (especially for Open Source) (L3). know the necessary steps to protect the rights on the content (L1). know the existing accessibility legislation (L1). 	analytics and L2). (L2). (L2). or the training of erent game genres in em in the design he style, identify the relation to games bards for audio and e underlying game s for your own game ents (software L3). issues with regards own software heir own created 3).

	 understand the fundamentals of logic for computing purposes (L3).
	 are able to set up functions themselves (L3).
	 understand the foundation of proof methods (L2).
	• master the basics of trigonometry (L3).
	 can calculate with complex numbers, vectors and matrices (L3).
	• master the basics of integral and differential calculus and equation (L2).
	 understand the basics of statistics (L2)
	can calculate using basic concept of vectors and matrices (L2).
Unit examinations	None
Contribution to following	User Interface Design and Game Graphics
units	Creative Code Lab 1: Games and Playful Front Ends
	Design-oriented HCI
	3D Design
	Foundations of Creative Computing 2
Literature	Ben-Ari, M. (2012). Mathematical logic for computer science (Third edition). Springer.
	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders.
	Dell'Acqua, F., McFowland, E., Mollick, E. R., Lifshitz-Assaf, H., Kellogg, K., Rajendran, S., Krayer, L., Candelon, F., & Lakhani, K. R. (2023). Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of Al on Knowledge Worker Productivity and Quality. SSRN Electronic Journal. <u>https://doi.org/10.2139/ssrn.4573321</u>
	Devlin, K. J. (2012). Introduction to mathematical thinking. Devlin.
	European Union. (o. J.). Al Act. European Commission. <u>https://digital-</u> strategy.ec.europa.eu/en/policies/regulatory-framework-ai
	Howell, C., & Farrand, B. (2018). Law Express: Intellectual Property Law (6th ed). Pearson Education Limited.
	Jain, R., & Jain, A. (2023). Generative AI in Writing Research Papers: A New Type of Algorithmic Bias and Uncertainty in Scholarly Work (Version 1). arXiv. https://doi.org/10.48550/ARXIV.2312.10057
	Lewrick, M., Link, P., & Leifer, L. J. (2018). The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems. Wiley.
	Möller, M., Nirmal, G., Fabietti, D., Stierstorfer, Q., Zakhvatkin, M., Sommerfeld, H., & Schütt, S. (2024). Revolutionising Distance Learning: A Comparative Study of Learning Progress with AI-Driven Tutoring (Version 1). arXiv. <u>https://doi.org/10.48550/ARXIV.2403.14642</u>
	Oscar Levin. (2021). Discrete Mathematics: An Open Introduction (3rd Aufl.).
	Råde, L., & Westergren, B. (2004). Mathematics handbook for science and engineering (5th ed). Springer.
	Sellers, M. (2018). Advanced game design: A systems approach. Addison- Wesley.
	Serjent-Tipping, J. (Hrsg.). (2015). Beginner's guide to sketching: Characters, creatures & concepts. 3dtotal Publishing.
	Sherin, A. (2018). Introduction to graphic design: A guide to thinking, process & style. Bloomsbury Visual Arts.
	Singal, R. K, Singal, R., & Singal, M. (2017). Basics of Mechanical Engineering. I.K.International Publishing House PVT Ltd.

Skolnick, E. (2014). Video game storytelling: What every developer needs to know about narrative techniques. Watson-Guptill.

Stickdorn, M., Hormess, M., Lawrence, A., & Schneider, J. (Hrsg.). (2021). This is service design doing: Applying service design thinking in the real world; a practitioners' handbook (10. Nachdr). O'Reilly Media.

Stickdorn, M., Lawrence, A., Hormess, M., & Schneider, J. (Hrsg.). (2018). This is service design methods: A companion to this is service design doing (First edition, second release). O'Reilly.

Tollen, D. W. (with American Bar Association). (2015). The tech contracts handbook: Cloud computing agreements, software licenses, and other IT contracts for lawyers and businesspeople (Second Edition). American Bar Association, Section of Intellectual Property Law.

UNESCO. (2023). UNESCO's Recommendation on the Ethics of Artificial Intelligence: Key facts (0000385082). UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385082

Voigt, P., & Bussche, A. von dem. (2017). The EU general data protection regulation (GDPR). Springer Berlin Heidelberg.

Weisz, J. D., Muller, M., He, J., & Houde, S. (2023). Toward General Design Principles for Generative AI Applications (Version 1). arXiv. <u>https://doi.org/10.48550/ARXIV.2301.05578</u>

Zichermann, G., & Cunningham, C. (2011). Gamification by design: Implementing game mechanics in web and mobile apps. O'Reilly.

Zimmerman, D. L., Tanis, E., & Hogg, R. V. (2019). Proability and Statistical Inference. Person India.

	Data Ethics
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lecture Hands-on examples
Workload	1 ECTS & 1 SWS
Position in curriculum	1st semester
Language	English
Prior knowledge	None
Learning outcomes	 The students have a basic understanding of data usage in data analytics and machine learning (L2). understand the principles of generative AI models (L2). understand the limitations of generative AI models (L2). understand the ethical implications of data usage for the training of generative AI models (L2). know how to use applied GenAI tools ethically and responsibly (L3) can apply the current university regulations of AI usage (L3)
Contents	 Data ethics Basics of data analytics and machine learning Basics of generative AI models

	Data usage for training of (generative) AI models
	Applied AI tools to support students work
	Al regulations and best practices in the academic setting at our
	university
Exam modalities	Course-immanent exam
Literature	Dell'Acqua, F., McFowland, E., Mollick, E. R., Lifshitz-Assaf, H., Kellogg, K., Rajendran, S., Krayer, L., Candelon, F., & Lakhani, K. R. (2023). Navigating the Jagged Technological Frontier: Field Experimental Evidence of the Effects of AI on Knowledge Worker Productivity and Quality. SSRN Electronic Journal. <u>https://doi.org/10.2139/ssrn.4573321</u>
	European Union. (o. J.). Al Act. European Commission. <u>https://digital-</u> <u>strategy.ec.europa.eu/en/policies/regulatory-framework-ai</u>
	Jain, R., & Jain, A. (2023). Generative AI in Writing Research Papers: A New Type of Algorithmic Bias and Uncertainty in Scholarly Work (Version 1). arXiv. <u>https://doi.org/10.48550/ARXIV.2312.10057</u>
	Möller, M., Nirmal, G., Fabietti, D., Stierstorfer, Q., Zakhvatkin, M., Sommerfeld, H., & Schütt, S. (2024). Revolutionising Distance Learning: A Comparative Study of Learning Progress with AI-Driven Tutoring (Version 1). arXiv. <u>https://doi.org/10.48550/ARXIV.2403.14642</u>
	UNESCO. (2023). UNESCO's Recommendation on the Ethics of Artificial Intelligence: Key facts (0000385082). UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385082
	Weisz, J. D., Muller, M., He, J., & Houde, S. (2023). Toward General Design Principles for Generative AI Applications (Version 1). arXiv. <u>https://doi.org/10.48550/ARXIV.2301.05578</u>

	Game Design and Digital Storytelling		
Course number	Course title		
Course type	Integrated course (ILV)		
Teaching and learning methods	Lecture Hands-on examples		
Workload	3 ECTS & 2 SWS		
Position in curriculum	1st semester		
Language	English		
Prior knowledge	None		
Learning outcomes	 The students understand the basics of game design and the different game genres in terms of graphics and story (L2). can explain different game styles and implement them in the design (L3). are able to analyze games on the basis of genre, the style, identify the characters acting and describe their storyline (L4). understand the different concepts of storytelling in relation to games and can create their own game stories (L3). 		

	 have the ability to create story boards and mood boards for graphics to reflect the storylines and the story of the underlying game (L3). can independently design and present pitching pads for their own game (L3).
Contents	Basic knowledge and practical exercises on
	Game Design
	 Story Telling with focus on games
	 Concepts of story development for games
	 Creating storyboards and moodboards for graphics
	Creation of pitching documents
Exam modalities	Course-immanent exam
Literature	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders.
Literature	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders. Sellers, M. (2018). Advanced game design: A systems approach. Addison-Wesley.
Literature	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders. Sellers, M. (2018). Advanced game design: A systems approach. Addison-Wesley. Serjent-Tipping, J. (Hrsg.). (2015). Beginner's guide to sketching: Characters, creatures & concepts. 3dtotal Publishing.
Literature	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders. Sellers, M. (2018). Advanced game design: A systems approach. Addison-Wesley. Serjent-Tipping, J. (Hrsg.). (2015). Beginner's guide to sketching: Characters, creatures & concepts. 3dtotal Publishing. Sherin, A. (2018). Introduction to graphic design: A guide to thinking, process & style. Bloomsbury Visual Arts.
Literature	Crawford, C. (2013). Chris Crawford on interactive storytelling (Second edition). New Riders. Sellers, M. (2018). Advanced game design: A systems approach. Addison-Wesley. Serjent-Tipping, J. (Hrsg.). (2015). Beginner's guide to sketching: Characters, creatures & concepts. 3dtotal Publishing. Sherin, A. (2018). Introduction to graphic design: A guide to thinking, process & style. Bloomsbury Visual Arts. Skolnick, E. (2014). Video game storytelling: What every developer needs to know about narrative techniques. Watson-Guptill.

	Design Thinking		
Course number	Course title		
Course type	Integrated course (ILV)		
Teaching and learning	Lecture		
methods	Practical examples		
Workload	1,5 ECTS & 1 SWS		
Position in curriculum	1st semester		
Language	English		
Prior knowledge	None		
Learning outcomes	The students are able to		
	• describe design thinking. (L2)		
	 describe the design process with its phases. (L2) 		
	 identify and apply two different design or creativity methods 		
	for each phase of the design process. (L3)		
Contents	Introduction to Design Thinking		
	Introduction to the design process with its phases		

	 Introduction to various design and creativity methods
Exam modalities	Course-immanent exam
Literature	Lewrick, M., Link, P., & Leifer, L. J. (2018). The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems. Wiley.
	Stickdorn, M., Hormess, M., Lawrence, A., & Schneider, J. (Hrsg.). (2021). This is service design doing: Applying service design thinking in the real world; a practitioners' handbook (10. Nachdr). O'Reilly Media.
	Stickdorn, M., Lawrence, A., Hormess, M., & Schneider, J. (Hrsg.). (2018). This is service design methods: A companion to this is service design doing (First edition, second release). O'Reilly.

	Selected Legal Topics for Developers and Designers	
Course number	Course title	
Course type	Vorlesung (VO)	
Teaching and learning methods	Lecture	
Workload	1,5 ECTS & 1 SWS	
Position in curriculum	1st semester	
Language	English	
Prior knowledge	None	
Learning outcomes	The students	
	 understand the implications of using other components (software libraries, media, AI generated contents, etc.) as part of their own services (L3). can analyze their own web site / services for major issues with regards to privacy & data protection (L4). can select an appropriate existing license for their own software (especially for Open Source) (L3). know the necessary steps to protect the rights on their own created content (L1). 	
Contents	 Relevant legal topics: Intellectual property rights (IPR). Copyright, copyleft & open source. Software licensing, and IPR contractual clauses. Software licensing models and software warranties/support. Remedies for breach. Privacy & data protection (GDPR). Taxation of software licences fees/royalties. 	

	• Media law
Exam modalities	Final exam
Literature	Howell, C., & Farrand, B. (2018). Law Express: Intellectual Property Law (6th ed). Pearson Education Limited.
	Tollen, D. W. (with American Bar Association). (2015). The tech contracts handbook: Cloud computing agreements, software licenses, and other IT contracts for lawyers and businesspeople (Second Edition). American Bar Association, Section of Intellectual Property Law.
	Voigt, P., & Bussche, A. von dem. (2017). The EU general data protection regulation (GDPR). Springer Berlin Heidelberg.

	Mathematical Foundations for Computing	
Course number	Course title	
Course type	Exercise (UE)	
Teaching and learning methods	Lectures interwoven with exercises	
Workload	3 ECTS & 2 SWS	
Position in curriculum	1st semester	
Language	English	
Prior knowledge	None	
Learning outcomes	The students	
	 set up the right mindset of mathematical thinking (L3). understand the fundamentals of logic for computing purposes (L3). are able to set up functions themselves (L3). understand the foundation of proof methods (L2). master the basics of trigonometry (L3). master the basics of integral and differential calculus and equations (L2). understand the basics of statistics (L2). can calculate using basic concept of vectors and matrices (L2). 	
Contents	 Mathematical thinking Introduction of mathematics and physics (mainly on 2D, but similar concept for 3D will be mentioned) Elementary Logic Functions, basics of trigonometry Vectors and matrices calculations, and their generalization Integral and differential calculus and equation Statistics basics 	

Exam modalities	Course-immanent exam
Literature	Ben-Ari, M. (2012). Mathematical logic for computer science (Third edition). Springer.
	Devlin, K. J. (2012). Introduction to mathematical thinking. Devlin.
	Oscar Levin. (2021). Discrete Mathematics: An Open Introduction (3rd Aufl.).
	Råde, L., & Westergren, B. (2004). Mathematics handbook for science and engineering (5th ed). Springer.
	Singal, R. K, Singal, R., & Singal, M. (2017). Basics of Mechanical Engineering. I.K.International Publishing House PVT Ltd.
	Zimmerman, D. L., Tanis, E., & Hogg, R. V. (2019). Proability and Statistical Inference. Person India.

3.4 Creative Code Lab 1: Games and Playful Frontends

CCL1: GPF	Creative Code Lab 1: Games and Playful Frontends 5 ECTS		
Unit number	Unit title Workload		
Course of studies	Bachelor Degree Programme Creative Computing		
Position in curriculum	1st semester		
Language	English		
Assignment to subarea	Projects		
Prior knowledge	All courses of the first semester		
Blocked	Yes		
Participants	All students		
Learning outcomes	The students are able to		
	 plan a project that can be completed by an individual within two intense weeks. (L4) create game characters and visually design them based on the knowledge of the design lectures of the first semester. (L3) integrate the knowledge acquired in the technical lectures of the first semester into a simple jump-and-run web browser game using HTML, CSS and JavaScript. (L3) present their work suitably on-site at a small fair. (L3) Present their work on-line in their ePortfolios including a written description of the game setting. (L3) use GIT to keep their source code throughout the code lab 		
Unit examinations	None		
Contribution to following units	Creative Code Lab 2 Creative Code Lab 5		
Literature	Complete literature of the first semester		

	Creative Code Lab 1: Games and Playful Frontends	
Course number	Course title	
Course type	Project (PR)	
Teaching and learning methods	In two weeks at the end of the semester, the students will use all knowledge and competences that they acquired during the semester for small projects. Within the two weeks, they will conceive, design and implement a project, which will be demonstrated in different formats at the end. The documentation of the Making-of and the finished project will be an essential part of the students' ePortfolios. In the first semester, the projects are individual projects dealing with	
	front-end web design and programming, game design, game graphics	

	and presentation skills. The presentation of the projects will happen in a fair at the end of the two weeks.		
Workload	5 ECTS & 3 SWS		
Position in curriculum	1st semester		
Language	English		
Prior knowledge	All courses of the first semester		
Learning outcomes	The students are able to		
	 plan a project that can be completed by an individual within two intense weeks. (L4) create game characters and visually design them based on the knowledge of the design lectures of the first semester. (L3) integrate the knowledge acquired in the technical lectures of the first semester into a simple jump-and-run web browser game using HTML, CSS and JavaScript. (L3) present their work suitably on-site at a small fair. (L3) present their work on-line in their ePortfolios including a written description of the game setting. (L3) 		
Contents	use GTT to keep their source code throughout the code lab		
Contents	 In addition to the contents of the lectures of the first semester, the students are coached regarding the planning of their projects, time-efficient presentation for a booth presentation at a small fair, writing a description of the game setting, creating an entry about the project results in their ePortfolio. uploading their source code to GIT Throughout the two blocked weeks, tutors are available to support the students. 		
Exam modalities	Course-immanent exam		
Literature	Complete literature of the first semester		

3.5 Web Programming

WP	Web Programming	5 ECTS	
Unit number	Unit title Workload		
Course of studies	Bachelor Degree Programme Creative Computing		
Position in curriculum	2nd semester		
Language	English		
Assignment to subarea	Programming		
Prior knowledge	Frontend Development		
Blocked	No		
Participants	Beginners		
Learning outcomes	 Students can explain the necessary steps and tools to user web apps (L2). can create an architecture for a service that responsive client-facing user interface, as w necessary server-side backend (L3). can implement and deploy a multi-user web based on a given software architecture, usin development tools and frameworks (L3). are able to differentiate between various typ storage systems and analyze their propertie (L2). can design and create various data storage access them from an application (L3). 	create multi- contains both a ell as the application og appropriate es of data s and use cases types and	
	 know how to use verison control systems an there used is a list in the system. 	d work with	
	them while developing in distributed teams.	(L3)	
	 Know pasies of CI/CD and understand how t server-side development (12) 	o use it tor	
I Init examinations	None		
Contribution to following units	Creative Code Lab 2: Connected World Mobile Programming		
Literature	Brown, E. (2014). Web development with Node and E Leveraging the JavaScript stack (1st ed). O'Reilly. Casciaro, M., & Mammino, L. (2016). Node.js design	Express: patterns: Get	
	the best out of Node.js by mastering its most powerful and patterns to create modular and scalable applicati second edition (2nd ed). Packt Publishing.	I components ons with ease,	
	Cervantes, H., & Kazman, R. (2016). Designing softwarchitectures: A practical approach. Addison-Wesley. Crockford, D. (2008). JavaScript. Yahoo Press.	rare	

Haverbeke, M. (2019). Eloquent JavaScript: A modern introduction to programming (Third edition). No Starch Press. Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilly Media.

	Server-Side Coding
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning methods	Integrated course / Hands-on Programming / Group Work
Workload	5 ECTS & 3 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Frontend Development
Learning outcomes	Students
	 can explain the necessary steps and tools to create multi- user web apps (L2).
	 can create an architecture for a service that contains both a responsive client-facing user interface, as well as the necessary server-side backend (L3).
	 will implement and deploy a multi-user web application based on a given software architecture, using appropriate development tools and frameworks (L3).
	 will be able to differentiate between various types of data storage systems and analyze their properties and use cases (L2).
	 can design and create various data storage types and access them from an application (L3).
	 know how to use verison control systems and work with them while developing in distributed teams. (L3)
	 know basics of CI/CD and understand how to use it for server-side development. (L2)
Contents	Introduction to concepts and tools:
	 Software development languages & tools for server-side development Essential concepts related to server-side web development (HTTP, statelessness, REST, server-side rendering, client-side

	rendering, WebSockets, etc.).Industry-standard web
	frameworks with a focus on multi-platform development
	Architecture considerations and advice for creating reliable
	multi-user apps (e.g., asynchronous execution, design
	patterns)
	User authentication and managing logins
	Database system overview: file storage, HTML5 web storage,
	SQL, NoSQL, Cloud databases
	Database design for selected systems (e.g. tables,
	relationships, entities, JSON storage)
	Accessing and manipulating databases through web services
	Database security & safety basics (SQL injection, automated
	backups, replication)
Exam modalities	Course-immanent exam
Literature	Brown, E. (2014). Web development with Node and Express:
	Leveraging the bavaochpt stack (1st ed). O Keiny.
	Casciaro, M., & Mammino, L. (2016). Node.js design patterns: Get the best out of Node.js by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing.
	 Casciaro, M., & Mammino, L. (2016). Node is design patterns: Get the best out of Node is by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing. Cervantes, H., & Kazman, R. (2016). Designing software architectures: A practical approach. Addison-Wesley.
	 Casciaro, M., & Mammino, L. (2016). Node.js design patterns: Get the best out of Node.js by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing. Cervantes, H., & Kazman, R. (2016). Designing software architectures: A practical approach. Addison-Wesley. Crockford, D. (2008). JavaScript. Yahoo Press.
	 Casciaro, M., & Mammino, L. (2016). Node.js design patterns: Get the best out of Node.js by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing. Cervantes, H., & Kazman, R. (2016). Designing software architectures: A practical approach. Addison-Wesley. Crockford, D. (2008). JavaScript. Yahoo Press. Haverbeke, M. (2019). Eloquent JavaScript: A modern introduction to programming (Third edition). No Starch Press.
	 Casciaro, M., & Mammino, L. (2016). Node.js design patterns: Get the best out of Node.js by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing. Cervantes, H., & Kazman, R. (2016). Designing software architectures: A practical approach. Addison-Wesley. Crockford, D. (2008). JavaScript. Yahoo Press. Haverbeke, M. (2019). Eloquent JavaScript: A modern introduction to programming (Third edition). No Starch Press. Kleppmann, M. (2017). Designing data-intensive applications: The b ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilly Media.

3.6 Design-Oriented HCI

DOH	Design-oriented HCI	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	2nd semester	
Language	English	
Assignment to subarea	Human-Computer Interaction	
Prior knowledge	Foundations of Creative Computing	
Blocked	No	
Participants	All Students	
Learning outcomes	 Students are able to define human-centered design. (L1) describe the design process with its phases. understand the basics of perception, cognitive communication psychology. (L2) understand the basics of the sociology of tech know about the cultural and social characterist user groups. (L1) define user experience, usability, and access know norms, standards, and guidelines for the of user experience and accessibility. (L1) name all required user- and environment and planned interactive product. (L2) carry out competitive analyses. (L3) carry out quantitative and qualitative methods research and to interpret their results through statistics. (L3) create personas and scenarios. (L3) 	(L2) e and hnology. (L2) stics of different ibility. (L1) le assessment ilyses for a s of user n descriptive
Unit examinations	None	
Contribution to following units	Creative Code Lab 2: Connected World Empirical Methods of HCI Physical Computing and Internet of Things	toraction
Literature	 Cooper, A. (2003). About face 2.0: The essentials of Ir design. Wiley. Denzin, N. K., & Lincoln, Y. S. (Hrsg.). (2018). The SA of qualitative research (Fifth edition). SAGE. Häußling, R. (2019). Techniksoziologie: Eine Einführu überarbeitete und aktualisierte Auflage). Verlag Barba <u>https://doi.org/10.36198/9783838550794</u> Lazar, J. (2017). Research methods in human comput (2nd edition). Elsevier. Nielsen, J. (1993a). Usability engineering (1. [print.]). A 	GE handbook ng (2., ra Budrich. er interaction Academic Pr.

Nielsen, J. (1993b). Usability engineering (1. [print.]). Academic Pr. Norman, D. A. (2013a). The design of everyday things (Rev. and expanded edition). MIT press.

Norman, D. A. (2013b). The design of everyday things (Rev. and expanded edition). MIT press.

Nunnally, B., & Farkas, D. (2017a). UX research: Practical techniques for designing better products. O'Reilly.

Nunnally, B., & Farkas, D. (2017b). UX research: Practical techniques for designing better products. O'Reilly.

Shneiderman, B., & Plaisant, C. (2010a). Designing the user interface: Strategies for effective human-computer interaction (5th ed). Addison-Wesley.

Shneiderman, B., & Plaisant, C. (2010b). Designing the user interface: Strategies for effective human-computer interaction (5th ed). Addison-Wesley.

Stickdorn, M., Hormess, M., Lawrence, A., & Schneider, J. (Hrsg.). (2021). This is service design doing: Applying service design thinking in the real world; a practitioners' handbook (10. Nachdr). O'Reilly Media.

Ware, C. (2021). Information visualization: Perception for design (4th ed). Elsevier.

Wright, P. (with McCarthy, J., & Carroll, J. M.). (2010). Experience-Centered Design: Designers, Users, and Communities in Dialogue. Morgan & Claypool Publishers.

	Introduction to Human-Centered Design
Course number	Course title
Course type	Lecture (VO)
Teaching and learning methods	Lecture units with theory Group Work during lecture Group Discussions
Workload	2 ECTS & 1 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Foundations of Creative Computing
Learning outcomes	 Students are able to: define Human-Centered Design. (L1) describe the design process with its phases. (L2) understand the basics of perception, cognitive and communication psychology. (L2) understand the basics of the sociology of technology. (L2) know about the cultural and social characteristics of different user groups. (L1) define user experience, usability, and accessibility. (L1) know norms, standards, and guidelines for the assessment of user experience and accessibility. (L1)

Contents	 Introduce Human-Centered design cycle, including the Design Thinking process and its phases. The significance, development and use of artefacts in society will be presented in relation to the Human-Centered design cycle. The social effects of media and technology use will be discussed with current social trends and controversies. The tension between technology and society will be pointed out. Furthermore, an overview of theories of perception, cognitive and communication psychology, as well as pedagogy, media science and sociology of technology with a focus on
	interactive media is given.
	Finally, there is an introduction to user experience with a
	focus on the field of interactive media. Finally, we clarify what
	user experience and usability mean and which standards or
	guidelines can be used to check them.
Exam modalities	Final exam
Literature	Häußling, R. (2019). Techniksoziologie: Eine Einführung (2., überarbeitete und aktualisierte Auflage). Verlag Barbara Budrich. https://doi.org/10.36198/9783838550794
	Nielsen, J. (1993). Usability engineering (1. [print.]). Academic Pr.
	Norman, D. A. (2013). The design of everyday things (Rev. and expanded edition). MIT press.
	Nunnally, B., & Farkas, D. (2017). UX research: Practical techniques for designing better products. O'Reilly.
	Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: Strategies for effective human-computer interaction (5th ed). Addison- Wesley.
	Ware, C. (2021). Information visualization: Perception for design (4th ed). Elsevier.
	Wright, P. (with McCarthy, J., & Carroll, J. M.). (2010). Experience- Centered Design: Designers, Users, and Communities in Dialogue. Morgan & Claypool Publishers.

	User Research
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning	Lectures interwoven with exercises
methods	Research Project
Workload	3 ECTS & 2 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Foundations of Creative Computing
Learning outcomes	Students are able to:

	 name all required user- and environment analyses for a
	planned interactive product. (L2)
	 carry out competitive analyses. (L3)
	carry out quantitative and qualitative methods of user
	research and interpret their results through descriptive
	statistics. (L3)
	create personas and scenarios. (L3)
Contents	The course conveys methods for obtaining the essential
	user- and environment information required for creating an
	interactive product.
	The analyses covered include competitor analysis,
	quantitative and qualitative methods of user research, usage
	analysis, and trend and market analysis. Furthermore, the
	course contains an introduction to basic statistics for the
	preparation and interpretation of the collected data.
	• The taught methods for describing the target group within an
	interactive application include personas and scenarios.
Exam modalities	Course-immanent exam
Literature	Cooper, A. (2003). About face 2.0: The essentials of interaction design. Wiley.
	Denzin, N. K., & Lincoln, Y. S. (Hrsg.). (2018). The SAGE handbook of qualitative research (Fifth edition). SAGE.
	Lazar, J. (2017). Research methods in human computer interaction (2nd edition). Elsevier.
	Nielsen, J. (1993). Usability engineering (1. [print.]). Academic Pr.
	Norman, D. A. (2013). The design of everyday things (Rev. and expanded edition). MIT press.
	Nunnally, B., & Farkas, D. (2017). UX research: Practical techniques for designing better products. O'Reilly.
	Shneiderman, B., & Plaisant, C. (2010). Designing the user interface: Strategies for effective human-computer interaction (5th ed). Addison-Wesley.
	Stickdorn, M., Hormess, M., Lawrence, A., & Schneider, J. (Hrsg.). (2021). This is service design doing: Applying service design thinking in the real world; a practitioners' handbook (10. Nachdr). O'Reilly Media

3.7 Web Design

WD	Web Design	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	2nd semester	
Language	English	
Assignment to subarea	User Interface Design	
Prior knowledge	Visual Design and Game Graphics Frontend Development	
Blocked	No	
Participants	All Students	
Learning outcomes	Students can	
Unit examinations	 describe the elements and principles of interf explain essential navigation concepts. (L2) describe and analyze essential concepts of p design. (L3) apply web typography and variable fonts in a (L3) present appropriate visual elements and inter and apply them in a visual interface. (L3) explain and analyze visual hierarchy in interfa independently design and implement an inter graphics program. (L3) explain and apply common Lo-Fi and Hi-Fi pr and/or techniques. (L3) use software to develop a clickable hi-fi proto know about the cultural and social characteris user groups. (L1) can define accessibility and inclusive design. know which standards form the basis for corr implementation. (L2) understand how to adjust the source code to implementation compliant with accessibility s use assistive devices and automatic testing to carry out the assessment of a website based standards (L3) implement accessible web interfaces. (L3) 	Face design. (L1) Perception in Visual interface. Inface patterns ace design. (L3) face using a Prototyping tools Prototyping tools Prototype. (L3) stics of different (L1) rect accessible make the tandards. (L2) ools. (L3) on accessibility
Contribution to following units	Creative Code Lab 2: Connected World 3D Design	

Literature	Chisholm, W., & May, M. (2009). Universal Design for Web Applications: Building web applications for everyone (1. ed). O'Reilly.
	Coleman, B. (with Goodwin, D. J.). (2017). Designing UX: Because Modern Design Is Never Static (1st ed). SitePoint Pty, Limited.
	Cooper, A., Reimann, R., Cronin, D., & Cooper, A. (2014). About face: The essentials of interaction design (Fourth edition). John Wiley and Sons.
	Cunningham, K. (2012a). Accessibility handbook: Making 508 websites for everyone. O'Reilly.
	Cunningham, K. (2012b). Accessibility handbook: Making 508 websites for everyone. O'Reilly.
	European Commission. (o. J.). European accessibility act. <u>https://ec.europa.eu/social/main.jsp?catId=1202</u>
	Firth, A. (2020). Practical web inclusion and accessibility: A comprehensive guide to access needs. Apress.
	Gilbert, R. M., & Rateau, R. (2019). Inclusive design for a digital world: Designing with accessibility in mind. Apress.
	Horton, S., & Quesenbery, W. (2015). A web for everyone: Designing accessible user experiences. Rosenfeld Media.
	Jean-Baptiste, A. (with Safari, an O'Reilly Media Company). (2020). Building For Everyone (1st edition). Wiley.
	Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web [and mobile] usability (third edition). New Riders.
	McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann.
	Microsoft. (o. J.). Microsoft Inclusive Design. https://inclusive.microsoft.design/
	Monteiro, M. (2012). Design is a job. A Book Apart.
	Pereyra, I. (2023). Universal principles of UX: 100 timeless strategies to create positive interactions between people and technology. Rockport Publishers, an imprint of The Quarto Group.
	Peterson, C. (2014). Learning responsive web design: A beginner's guide (1. ed). O'Reilly.
	Spies, M., & Wenger, K. (2020). Branded interactions: Marketing through design in the digital age (Revised and updated edition). Thames & Hudson Ltd.
	Tidwell, J., Brewer, C., & Valencia, A. (2020a). Designing interfaces: Patterns for effective interaction design (Third edition). O'Reilly.
	Tidwell, J., Brewer, C., & Valencia, A. (2020b). Designing interfaces: Patterns for effective interaction design (Third edition). O'Reilly.
	W3C Web Accessibility Initiative. (o. J.). Web Accessibility Laws & Policies. <u>https://www.w3.org/WAI/policies/</u>
	Yablonski, J. (2024). Laws of UX: Using psychology to design better products & services (Second edition). O'Reilly Media, Inc.

	User Interface Design
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lecture units with exercises Projects Virtual Field Trip

Workload	3 ECTS & 2 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Visual Design and Game Graphics
Learning outcomes	 Students can describe the elements and principles of interface design. (L1) explain essential navigation concepts. (L2) describe and analyze essential concepts of perception in design. (L3) apply web typography and variable fonts in a visual interface. (L3) present appropriate visual elements and interface patterns and apply them in a visual interface. (L3) explain and analyze visual hierarchy in interface design. (L3) independently design and implement an interface using a graphics program. (L3) explain and apply common Lo-Fi and Hi-Fi prototyping tools and/or techniques. (L3)
Contents	 use software to develop a clickable hi-fi prototype. (L3) Elements and principles of interface design Navigation concepts and orientation Visual elements and interface patterns Perception of design Design and concept for accessible offers Introduction to Visual Hierarchy in Interface Design Wireframing and Prototyping Tools and Techniques Training an industry standard activate
Exam modalities	I raining on Industry standard software Course-immanent exam
Literature	 Coleman, B. (with Goodwin, D. J.). (2017). Designing UX: Because Modern Design Is Never Static (1st ed). SitePoint Pty, Limited. Cooper, A., Reimann, R., Cronin, D., & Cooper, A. (2014). About face: The essentials of interaction design (Fourth edition). John Wiley and Sons. Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web [and mobile] usability (third edition). New Riders. McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann. Monteiro, M. (2012). Design is a job. A Book Apart. Pereyra, I. (2023). Universal principles of UX: 100 timeless strategies to create positive interactions between people and technology. Rockport Publishers, an imprint of The Quarto Group.
	Peterson, C. (2014). Learning responsive web design: A beginner's guide (1. ed). O'Reilly.

Spies, M., & Wenger, K. (2020). Branded interactions: Marketing through design in the digital age (Revised and updated edition). Thames & Hudson Ltd.
Tidwell, J., Brewer, C., & Valencia, A. (2020). Designing interfaces: Patterns for effective interaction design (Third edition). O'Reilly.
Yablonski, J. (2024). Laws of UX: Using psychology to design better products & services (Second edition). O'Reilly Media, Inc.

	Inclusive Design and Accessibility
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lectures interwoven with exercises
	Group Discussions
	Inverted Classroom
Workload	2 ECTS & 2 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Visual Design and Game Graphics
	Frontend Development
Learning outcomes	Students can:
	 know about the cultural and social characteristics of different
	user groups. (L1)
	 define accessibility and inclusive design. (L1)
	know which standards form the basis for correct accessible
	implementation. (L2)
	 understand how to adjust the source code to make the
	implementation compliant with accessibility standards. (L2)
	 use assistive devices and automatic testing tools. (L3)
	carry out the assessment of a website based on accessibility
	standards (L3)
	 implement accessible web interfaces. (L3)
	 know the existing accessibility legislation. (L1)
Contents	Requirements for barrier-free access to information for people
	with disabilities
	Cultural and social characteristics of different user groups
	Accessibility standards
	Legal framework
	Design and concept for accessible offers
	Content preparation for accessible offers
Exam modalities	Course-immanent exam
Literature	Chisholm, W., & May, M. (2009). Universal Design for Web Applications: Building web applications for everyone (1. ed). O'Reilly.
Cunningham, K. (2012). Accessibility handbook: Making 508 websites for everyone. O'Reilly. European Commission. (o. J.). European accessibility act. https://ec.europa.eu/social/main.jsp?catId=1202 Firth, A. (2020). Practical web inclusion and accessibility: A comprehensive guide to access needs. Apress. Gilbert, R. M., & Rateau, R. (2019). Inclusive design for a digital world: Designing with accessibility in mind. Apress. Horton, S., & Quesenbery, W. (2015). A web for everyone: Designing accessible user experiences. Rosenfeld Media. Jean-Baptiste, A. (with Safari, an O'Reilly Media Company). (2020). Building For Everyone (1st edition). Wiley. Microsoft. (o. J.). Microsoft Inclusive Design. https://inclusive.microsoft.design/ W3C Web Accessibility Initiative. (o. J.). Web Accessibility Laws & Policies. https://www.w3.org/WAI/policies/

3.8 Foundations of Creative Computing 2

FCC2	Foundations of Creative Computing 2 1	0 ECTS
Unit number	Unit title W	orkload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	2nd semester	
Language	English	
Assignment to subarea	Foundations	
Prior knowledge	Frontend Development	
	Visual Design and Game Graphics	
	Foundations of Creative Computing	
	Web Programming	
	web Design	
Biocked		
Participants		
	 understand the fundamentals of network technology protocols and formats (HTTPS, REST, JSON) (L know how to design a connected application with 	ogy, 2). real-time
	 know how to design a connected application with communication between different nodes (L3). can set up servers / services and administrate the on-premise and in the cloud (L2). apply important security concepts to their service (L3). understand the implications of using other compore (software libraries, media, etc.) as part of their ow (L3). are able to understand the use of AI technologies methodically and to solve simple tasks themselve. are familiar with market-ready implementations of technologies and can use them or commission the sound knowledge. (L3) will be able to describe key design patterns (e.g., View-Controller) and apply them to build modular maintainable code. (L3) will be able to compare different frontend frameworuse one to develop a responsive user interface. (In know how to use version control systems and worthem while developing. (L3) know basics of CI/CD and understand how to use davelopment (L2) 	real-time ese, both landscape onents on services s. (L3) f the eir use with Model- and orks and L3) rk with e it during

	will create and execute simple unit tests to validate	
	application functionality using a testing framework. (L3)	
Unit examinations	None	
Contribution to following units	Creative Code Lab 2: Connected World Mobile Programming	
Literature	Bishop, C. M. (2006). Pattern recognition and machine learning. Springer.	
	Brown, E. (2014). Web development with Node and Express: Leveraging the JavaScript stack (1st ed). O'Reilly.	
	Casciaro, M., & Mammino, L. (2016). Node.js design patterns: Get the best out of Node.js by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing.	
	Cervantes, H., & Kazman, R. (2016a). Designing Software Architectures. Pearson Education.	
	Cervantes, H., & Kazman, R. (2016b). Designing Software Architectures. Pearson Education.	
	Chisholm, W., & May, M. (2009). Universal Design for Web Applications: Building web applications for everyone (1. ed). O'Reilly.	
	Crockford, D. (2008). JavaScript: The Good Parts. Yahoo Press.	
	Géron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (Second edition). O'Reilly.	
	Gilbert, R. M., & Rateau, R. (2019). Inclusive design for a digital world: Designing with accessibility in mind. Apress.	
	Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. The MIT press.	
	Haverbeke, M. (2019). Eloquent JavaScript: A modern introduction to programming (Third edition). No Starch Press.	
	Hofmann, M., & Klinkenberg, R. (Hrsg.). (2014). RapidMiner: Data mining use cases and business analytics applications. CRC Press.	
	Kelleher, J. D., MacNamee, B., & D'Arcy, A. (2015). Fundamentals of machine learning for predictive data analytics: Algorithms, worked examples, and case studies. The MIT Press.	
	Kleppmann, M. (2017a). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilley.	
	Kleppmann, M. (2017b). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilly Media.	
	Patterson, J., & Gibson, A. (2017). Deep learning: A practitioner's approach (First Edition). O'Reilly.	
	Shron, M. (2014). Thinking with data: How to turn information into insights (1. ed). O'Reilly.	
	Tanenbaum, A. S., & Steen, M. van. (2016). Distributed systems: Principles and paradigms (Second edition, adjusted for digital publishing). Maarten van Steen.	
	Tanenbaum, A. S., & Wetherall, D. (2018). Computer networks (Fifth edition, Pearson new international edition). Pearson India Education Services Pvt, Limited.	
	Tollen, D. W. (2016). The Tech Contracts Handbook: Software Licenses, Cloud ComputingAgreements, and Other It Contracts for Lawyers and Businesspeople. American Bar Association.	

Voigt, P., & Bussche, A. von dem. (2017). The EU general data protection regulation (GDPR). Springer Berlin Heidelberg. Witten, I. H., Frank, E., & Hall, M. A. (2011). Data mining: Practical machine learning tools and techniques (3rd ed). Morgan Kaufmann.

NCCS	Networks, Cloud & Communication Security	
Course number	Course title	
Course type	Integrated course (ILV)	
Teaching and learning methods	Integrated course	
Workload	3 ECTS & 2 SWS	
Position in curriculum	2nd semester	
Language	English	
Prior knowledge	None	
Learning outcomes	Students	
	 be able to explain the fundamentals of network technology, protocols and formats (HTTPS, REST, JSON) (L2). know how to design a connected application with real-time communication between different nodes (L2). will be able to configure and manage servers and services, both on-premise and in cloud environments, using appropriate tools and technologies. (L2). apply important security concepts to their service landscape (L2). 	
Contents	 Introduction to concepts and tools: Fundamentals of network technology, protocols & formats (HTTPS, REST, JSON) Real-time communication Server administration & cloud services (IAAS, PAAS) Web security, certificates and encryption 	
Exam modalities	Course-immanent exam	
Literature	 Tanenbaum, A. S., & Steen, M. van. (2016). Distributed systems: Principles and paradigms (Second edition, adjusted for digital publishing). Maarten van Steen. Tanenbaum, A. S., & Wetherall, D. (2018). Computer networks (Fifth edition, Pearson new international edition). Pearson India Education Services Pvt, Limited. Tollen, D. W. (2016). The Tech Contracts Handbook: Software Licenses, Cloud ComputingAgreements, and Other It Contracts for Lawyers and Businesspeople. American Bar Association. Voigt, P., & Bussche, A. von dem. (2017). The EU general data 	
	Lawyers and Businesspeople. American Bar Association. Voigt, P., & Bussche, A. von dem. (2017). The EU general data protection regulation (GDPR). Springer Berlin Heidelberg.	

AAI	Applied Artificial Intelligence (AI)
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Brief lectures inputs interwoven with exercises
Workload	3 ECTS & 2 SWS
Position in curriculum	2nd semester
Language	English
Prior knowledge	Mathematical Foundations of Creative Computing
Learning outcomes	 Students are able to understand the use of AI technologies methodically and to solve simple tasks themselves. (L2) are familiar with market-ready implementations of the technologies and can use them or commission their use with sound knowledge. (L3)
Contents	 Introduction to Data Analysis, image processing, computer vision, text retrieval Supervised & un-supervised machine learning Clustering Classification Regression Deep learning Exercises with Cloud-based AI services and Concept detectors
Exam modalities	Course-immanent exam
Literature	 Bishop, C. M. (2006). Pattern recognition and machine learning. Springer. Cervantes, H., & Kazman, R. (2016). Designing Software Architectures. Pearson Education. Chisholm, W., & May, M. (2009). Universal Design for Web Applications: Building web applications for everyone (1. ed). O'Reilly. Géron, A. (2019). Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems (Second edition). O'Reilly. Gilbert, R. M., & Rateau, R. (2019). Inclusive design for a digital world: Designing with accessibility in mind. Apress. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. The MIT press. Hofmann, M., & Klinkenberg, R. (Hrsg.). (2014). RapidMiner: Data mining use cases and business analytics applications. CRC Press. Kelleher, J. D., MacNamee, B., & D'Arcy, A. (2015). Fundamentals of machine learning for predictive data analytics: Algorithms, worked examples, and case studies. The MIT Press.

Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilley.
Patterson, J., & Gibson, A. (2017). Deep learning: A practitioner's approach (First Edition). O'Reilly.
Shron, M. (2014). Thinking with data: How to turn information into insights (1. ed). O'Reilly.

FwOC	Framework-oriented Coding	
Course number	Course title	
Course type	Exercise (UE)	
Teaching and learning methods	Exercise / Hands-on programming course	
Workload	4 ECTS & 2 SWS	
Position in curriculum	2nd semester	
Language	English	
Prior knowledge	Frontend Development Visual Design and Game Graphics Foundations of Creative Computing Web Programming Web Design	
Learning outcomes	 Students will be able to describe key design patterns (e.g., Model-View-Controller) and apply them to build modular and maintainable code. (L3) will be able to compare different frontend frameworks and use one to develop a responsive user interface. (L3) know module bundlers and can use them. (L3) know how to use version control systems and work with them while developing. (L3) know basics of CI/CD and understand how to use it during development. (L2) will create and execute simple unit tests to validate application functionality using a testing framework. (L3) 	
Contents	 Design Patterns (e.g.: Model-View-Controller Concept) Module Bundlers JavaScript Frontend Frameworks Requirements for barrier-free access to information for people with disabilities JavaScript Unit Tests 	
Exam modalities	Course-immanent exam	
Literature	Brown, E. (2014). Web development with Node and Express: Leveraging the JavaScript stack (1st ed). O'Reilly.	

Casciaro, M., & Mammino, L. (2016). Node is design patterns: Get the best out of Node is by mastering its most powerful components and patterns to create modular and scalable applications with ease, second edition (2nd ed). Packt Publishing.

Cervantes, H., & Kazman, R. (2016). Designing Software Architectures. Pearson Education.

Crockford, D. (2008). JavaScript: The Good Parts. Yahoo Press.

Haverbeke, M. (2019). Eloquent JavaScript: A modern introduction to programming (Third edition). No Starch Press.

Kleppmann, M. (2017). Designing data-intensive applications: The big ideas behind reliable, scalable, and maintainable systems (First edition). O'Reilly Media.

3.9 Creative Code Lab 2: Connected World

CCL2: CW	Creative Code Lab 2: Connected World	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	2nd semester	
Language	English	
Assignment to subarea	Projects	
Prior knowledge	Creative Code Lab 1 All courses of the second semester	
Blocked	Yes	
Participants	All students	
Learning outcomes	 The students are able to analyze and plan the structure and functionality dynamic multi-user, multi-screen website, inclusiflow and interactivity. (L4) design and prototype the interactions for a multiwebsite, ensuring usability and responsiveness define the technical stack (e.g. server sided techdatabases, client side technologies) for individu (L3) define and design the technical architecture of is solution. (L4) debug and solve technical issues during the improcess. (L3) demonstrate barrier-free design with an access statement. (L3) design the visual elements of a multi-user webs develop and deploy a fully functional multi-user using a web frontend framework with client-servintegration. (L3) create and deliver an engaging online presentation work, including a video tailored for potential clies Present their work including the most essential planning documents (wireframe, interaction design, visual design elements) in their ePortfore 	of a ding its user i-user (L3) chnologies, ual projects. the planned plementation ibility site. (L3) website ver tion of their ents. (L3) design and sign, logo lios. (L3)
Unit examinations	Course-immanent exam	
Contribution to following	Creative Code Lab 2	
Literature	Creative Code Lab 5 All literature of the second semester	

CCL2	Creative Code Lab 2: Connected World	
Course number	Course title	
Course type	Project (PR)	
Teaching and learning methods	Project work & Coaching	
Workload	5 ECTS & 3 SWS	
Position in curriculum	2nd semester	
Language	English	
Prior knowledge	The whole second semester	
Learning outcomes	 The students are able to analyze and plan the structure and functionality of a dynamic multi-user, multi-screen website, including its user flow and interactivity. (L4) design and prototype the interactions for a multi-user website, ensuring usability and responsiveness. (L3) define the technical stack (e.g. server sided technologies, databases, client side technologies) for individual projects. (L3) define and design the technical architecture of the planned solution. (L4) debug and solve technical issues during the implementation process. (L3) deronstrate barrier-free design with an accessibility statement. (L3) develop and deploy a fully functional multi-user website using a web frontend framework with client-server integration. (L3) create and deliver an engaging online presentation of their work, including a video tailored for potential clients. (L3) Present their work including the most essential design and planning documents (wireframe, interaction design, logo design, visual design elements) in their ePortfolios. (L3) 	
Contents	In addition to the contents of the lectures of the second semester, the	
	students are coached regarding	
	the planning of their projects.	
	 time-efficient presentation in a short video clip. creating an entry about the preject regults and the making of 	
	in their portfolio.	

	Throughout the two blocked weeks, tutors are available to support the students.
Exam modalities	Course-immanent exam
Literature	All literature of the second semester

3.10 Mobile Programming

MP	Mobile Programming	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd semester	
Language	English	
Assignment to subarea	Programming	
Prior knowledge	Frontend Development Web Programming	
Blocked	No	
Participants	All Students	
Learning outcomes	 Students: can explain the differences in development a mobile applications. (L2) can explain the peculiarities of software archimobile applications. (L2) can compare development approaches for mapplications. (L2) can explain the peculiarities of software archimobile applications. (L2) can explain the peculiarities of software archimobile applications. (L2) can independently implement a mobile application ative programming. (L3) can implement modern and accessible mobile (L3) can plan and execute unit and UI tests on moapplications. (L3) 	pproaches for tecture for obile tecture for ation using e interfaces.
Unit examinations	None	
Contribution to following units	Creative Code Lab 3: Mobile Applications Extended Reality Coding	
Literature	 Android. (o. J.). Develop for Android. <u>https://developer.android.com/docs</u> Beizer, B. (1990). Software testing techniques (2. ed). Thomson Computer Press. Burnstein, I. (2010). Practical software testing—A prod approach. Springer-verlag New York Inc. Copeland, L. (2004). A practitioner's guide to software Artech House. Griffiths, D., & Griffiths, D. (2021). Head First Android (Third edition). O'Reilly Media, Incorporated. Palmieri, M., Singh, I., & Cicchetti, A. (2012). Compari platform mobile development tools. 2012 16th Internat Conference on Intelligence in Next Generation Networ https://doi.org/10.1109/ICIN.2012.6376023 	Intern. cess-oriented test design. Development son of cross- ional tks, 179–186.

Wasserman, A. I. (2010). Software engineering issues for mobile application development. Proceedings of the FSE/SDP Workshop on Future of Software Engineering Research, 397–400. https://doi.org/10.1145/1882362.1882443

	Mobile Coding	
Course number	Course title	
Course type	Exercise (UE)	
Teaching and learning methods	Lecture units with exercises Inverted Classroom Individual projects	
Workload	5 ECTS & 3 SWS	
Position in curriculum	3rd semester	
Language	English	
Prior knowledge	Frontend Development Web Programming	
Learning outcomes Contents	 Students: can compare development approaches for mobile applications. (L2) can explain the peculiarities of software architecture for mobile applications. (L2) can independently implement a mobile application using native programming. (L3) can implement modern and accessible mobile interfaces. (L3) can plan and execute unit and UI tests on mobile applications. (L3) Development of different approaches in the field of mobile application development (web vs. hybrid vs. cross-compiled vs. native) Development of native applications using a modern high-level programming language (e.g., Kotlin) Software architecture of mobile applications and fundamentals in programming mobile native applications (e.g., Android): MVVM, Application lifecycle, Compose, App Localization, Camera and Sensors, SQLite and ROOM, Coroutines. Testing Android apps (e.g., functional, performance, accessibility, and compatibility testing) 	
Exam modalities Literature	Course-immanent exam Android. (o. J.). Develop for Android. <u>https://developer.android.com/docs</u> Beizer, B. (1990). Software testing techniques (2. ed). Intern. Thomson Computer Press.	

Burnstein, I. (2010). Practical software testing—A process-oriented approach. Springer-verlag New York Inc.

Copeland, L. (2004). A practitioner's guide to software test design. Artech House.

Griffiths, D., & Griffiths, D. (2021). Head First Android Development (Third edition). O'Reilly Media, Incorporated.

Palmieri, M., Singh, I., & Cicchetti, A. (2012). Comparison of crossplatform mobile development tools. 2012 16th International Conference on Intelligence in Next Generation Networks, 179–186. <u>https://doi.org/10.1109/ICIN.2012.6376023</u>

Wasserman, A. I. (2010). Software engineering issues for mobile application development. Proceedings of the FSE/SDP Workshop on Future of Software Engineering Research, 397–400. https://doi.org/10.1145/1882362.1882443

3.11 Empirical Methods in HCI

EMH	Empirical Methods in HCI	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd semester	
Language	English	
Assignment to subarea	Human-Computer Interaction	
Prior knowledge	Design-oriented HCI	
Blocked	No	
Participants	All Students	
Learning outcomes	Students can:	
	define usability and user experience according to the	ISO 9241. (L1)
	understand the differences between descriptive, relat	ional, and
	experimental empirical investigations. (L2)	
	select the appropriate usability and user experience e	valuation
	methods according to the problem. (L4)	
	• design a user test and write a guideline for it. (L3)	
	• document, summarize, and interpret the results of a te	est through
	descriptive and inferential statistics. (L4)	
Unit examinations	None	
Contribution to following	Creative Code Lab 3: Mobile Applications	
units	Scientific Writing	
	Bachelor Thesis	
Literature	Android. (o. J.). Develop for Android. https://developer.android	.com/docs
	Beizer, B. (1990). Software testing techniques (2. ed). Intern. Thomson Computer Press.	
	Burnstein, I. (2010). Practical software testing—A process-orie Springer-verlag New York Inc.	nted approach.
	Copeland, L. (2004). A practitioner's guide to software test des House.	ign. Artech

	Usability and Experience Evaluation
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning methods	Lecture units with theory
	Exercises with feedback
	Development, execution, and presentation of a user study.
Workload	5 ECTS & 3 SWS
Position in curriculum	3rd semester
Language	English

Prior knowledge	Design-oriented HCI
Learning outcomes	 Students can: define usability and user experience according to the ISO 9241. (L1) understand the differences between descriptive, relational, and experimental empirical investigations. (L2) select the appropriate usability and user experience evaluation methods according to the problem. (L4) design a user test and write a guideline for it. (L3) document, summarize, and interpret the results of a test through descriptive and inferential statistics. (L4)
Contents	 User experience and usability evaluation of interactive applications. Methods of expert evaluation (e.g. Heuristics, Cognitive walkthrough). Goals of different empirical investigation types and basics on designing experiments (including the definition of hypothesis, dependent and independent variables, validity, reliability, randomization, between- and within-subjects test designs, etc.). Qualitative and quantitative methods for user testing (laboratory and field tests, moderated and unmoderated user tests, formative and summative usability tests, standardized instruments for usability and user experience evaluation such as SUS and UEQ), applied to the assessment of web and mobile applications. Indirect observation methods such as log file analysis based on instrumentation of the user interfaces. Data process, analysis, and report using a programming language such as Python or R, as well as descriptive and inferential statistics. Recruiting and running tests with human subjects, and athics
Exam modalities	Course-immanent exam
Literature	 Chiasson, T., & Gregory, D. (o. J.). Data + Design: A Simple Introduction to Preparing and Visualizing Information. Cooper, A., Reimann, R., Cronin, D., Noessel, C., Csizmadi, J., & LeMoine, D. (2014). About face: The essentials of interaction design (Fourth edition). Wiley. Goodman, E., Kuniavsky, M., & Moed, A. (2012). Observing the user experience: A practitioner's guide to user research (2nd ed). Morgan Kaufmann. Lazar, J., Feng, J. H., & Hochheiser, H. (2017). Research Methods in Human-Computer Interaction. Elsevier.

Norman, D. A. (2013). The design of everyday things (Rev. and expanded edition). MIT press.

Olson, J. S., & Kellogg, W. A. (Hrsg.). (2014). Ways of knowing in HCI. Springer.

Preece, J., Rogers, Y., & Sharp, H. (2015). Interaction design: Beyond human-computer interaction (Fourth edition). Wiley.

Robertson, J., & Kaptein, M. (2016). Modern statistical methods for HCI. Springer Berlin Heidelberg.

Rubin, J., & Chisnell, D. (2008). Handbook of usability testing: How to plan, design, and conduct effective tests (2nd ed). Wiley Pub.

Sauro, J. (2016). Quantifying the user experience: Practical statistics for user research. Morgan Kaufmann.

Travis, D., & Hodgson, P. (2019). Think like a UX researcher: How to observe users, influence design, and shape business strategy. CRC Press, Taylor & Francis Group.

Tullis, T., & Albert, B. (2013). Measuring the user experience: Collecting, analyzing, and presenting usability metrics (Second edition). Elsevier/Morgan Kaufmann.

Wickham, H., & Grolemund, G. (2017). R for data science: Import, tidy, transform, visualize, and model data. O'Reilly Media, Inc.

3.12 Mobile and Tangible User Interface Design

MTUID	Mobile and Tangible User Interface Design	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd semester	
Language	English	
Assignment to subarea	User Interface Design	
Prior knowledge	Foundations of Creative Computing	
	User Interface Design and Game Graphics	
	Design-Oriented HCI	
	Web Design	
Blocked	No	
Participants	All Students	
Learning outcomes	 explain what a responsive design is. (L2) describe and analyze important principles of design for mobile devices. (L4) Choose Mobile Design Patterns and Compose App UI Design. (L4) present relevant and current UI design trendstinguidelines. (L3) create an app design with graphic software argiven briefing. (L3) explain and apply common Lo-Fi and Hi-Fi p and/or techniques. (L3) use software to develop a clickable hi-fi prototok know and understand concepts of usability w haptic devices. They can apply such concept and implement smart devices that are easy to and use (L5) can design and realize smart and haptic devides and implement Natural User Inter basis of existing frameworks to track objects 	user interface nents for an s. (L2) s and ccording to a rototyping tools otype. (L3) rith regard to is to develop o understand ices using ies (e.g. 3D faces on the and humans.
	(L3)	and numbro.
Unit examinations	None	

Contribution to following units	Creative Code Lab 3: Mobile Applications 3D Design
Literature	Banga, C., & Weinhold, J. (2014). Essential mobile interaction design: Perfecting interface design in mobile apps. Addison-Wesley.
	Coleman, B. (with Goodwin, D. J.). (2017). Designing UX: Because Modern Design Is Never Static (1st ed). SitePoint Pty, Limited.
	Cooper, A., Reimann, R., Cronin, D., Noessel, C., Csizmadi, J., & LeMoine, D. (2014). About face: The essentials of interaction design (Fourth edition). Wiley.
	Eyal, N., & Hoover, R. (2019). Hooked: How to build habit-forming products (Revised and updated). Portfolio/Penguin.
	Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web usability (Third edition). New Riders.
	Marcotte, E. (2015). Responsive design: Patterns & principles. A Book Apart.
	McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann.
	Myers, C. (2015). Responsive web design patterns: Learn how to build your own pattern library and fill it with the most popular responsive web design patterns. Packt Publishing.
	Neil, T. (2014). Mobile Design Pattern Gallery: UI Patterns for Smartphone Apps (2nd ed). O'Reilly.
	Nielsen, J., Loranger, H., & Nielsen, J. (20). Web Usability (Nachdr. der Ausg. 2006). Addison-Wesley.
	Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.
	OSullivan, D., & Igoe, T. (20). Physical computing: Sensing and controlling the physical world with computers (Nachdr.). Course Technology.
	Peterson, C. (2014). Learning responsive Web design: A beginner's guide (First edition). O'Reilly Media, Inc.
	Platt, D. S. (2016). The joy of UX: User Experience and interactive design for developers. Addison-Wesley.
	Shaer, O., & Hornecker, E. (2010). Tangible user interfaces: Past, present and future directions. now publ.
	Tidwell, J., Brewer, C., & Valencia, A. (2020). Designing interfaces: Patterns for effective interaction design (Third edition). O'Reilly.
	Whalen, J. (2019). Design for How People Think: Using Brain Science to Build Better Products. O'Reilly Media, Incorporated.
	Wigdor, D., & Wixon, D. (2011). Brave NUI world: Designing natural user interfaces for touch and gesture. Morgan Kaufmann.
	Wroblewski, L. (2011). Mobile first. A Book Apart.

	User Interface Design for Mobile Devices
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lectures interwoven with exercises Individual and group projects
Workload	2 ECTS & 2 SWS

Position in curriculum	3rd semester
Language	English
Prior knowledge	User Interface Design and Game Graphics
	Web Design
Learning outcomes	nts can
	• explain what a responsive design is. (L2)
	describe and analyze important principles of user interface
	design for mobile devices. (L4)
	Choose Mobile Design Patterns and Components for an App
	UI Design. (L4)
	 present relevant and current UI design trends. (L2)
	 implement an app design using mobile UI kits and
	guidelines. (L3)
	create an app design with graphic software according to a
	given briefing. (L3)
Contents	Introduction to responsive design
	 Introduction to elements and principles of user interface
	design for mobile devices
	Mobile Design Patterns and Components
	Relevant UI design trends
	Mobile UI Kits and Guidelines
	Design and concept for accessible offers
	Briefing and Steps of an App Design Project
	Industry standard software Training
Exam modalities	Course-immanent exam
Literature	Banga, C., & Weinhold, J. (2014). Essential mobile interaction design: Perfecting interface design in mobile apps. Addison-Wesley.
	Coleman, B. (with Goodwin, D. J.). (2017). Designing UX: Because Modern Design Is Never Static (1st ed). SitePoint Pty, Limited.
	Cooper, A., Reimann, R., Cronin, D., Noessel, C., Csizmadi, J., & LeMoine, D. (2014). About face: The essentials of interaction design (Fourth edition). Wiley.
	Eyal, N., & Hoover, R. (2019). Hooked: How to build habit-forming products (Revised and updated). Portfolio/Penguin.
	Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web usability (Third edition). New Riders.
	Marcotte, E. (2015). Responsive design: Patterns & principles. A Book Apart.
	McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann.
	Myers, C. (2015). Responsive web design patterns: Learn how to build your own pattern library and fill it with the most popular responsive web design patterns. Packt Publishing.
	Neil, T. (2014). Mobile Design Pattern Gallery: UI Patterns for Smartphone Apps (2nd ed). O'Reilly.

Nielsen, J., Loranger, H., & Nielsen, J. (20). Web Usability (Nachdr. der Ausg. 2006). Addison-Wesley.
Peterson, C. (2014). Learning responsive Web design: A beginner's guide (First edition). O'Reilly Media, Inc.
Platt, D. S. (2016). The joy of UX: User Experience and interactive design for developers. Addison-Wesley.
Tidwell, J., Brewer, C., & Valencia, A. (2020). Designing interfaces: Patterns for effective interaction design (Third edition). O'Reilly.
Whalen, J. (2019). Design for How People Think: Using Brain Science to Build Better Products. O'Reilly Media, Incorporated.
Wroblewski, L. (2011). Mobile first. A Book Apart.

	Tangible User Interfaces
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lectures interwoven with exercises Exercises
Workload	3 ECTS & 2 SWS
Position in curriculum	3rd semester
Language	English
Prior knowledge	Foundations of Creative Computing Design-Oriented HCI
	User Interface Design and Game Graphics
Learning outcomes	 Students: know and understand concepts of usability with regard to haptic devices. They can apply such concepts to develop and implement smart devices that are easy to understand and use (L5) can design and realize smart and haptic devices using design tools and rapid prototyping technologies (e.g. 3D print) and physical computing systems. (L3) can design and implement Natural User Interfaces on the basis of existing frameworks to track objects and humans. (L3)
Contents	 Interaction and experience design of tangible user interfaces Concepts of discoverability: affordances, signifiers, constraints, mapping, feedback as well as mental model and system image Basics of Human Factors concerning tangible and multisensory interfaces Design and concept for accessible offers 3D print and laser cutting Computer Vision Frameworks (Reactivision or similar)

Exam modalities	Course-immanent exam
Literature	Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.
	OSullivan, D., & Igoe, T. (20). Physical computing: Sensing and controlling the physical world with computers (Nachdr.). Course Technology.
	Shaer, O., & Hornecker, E. (2010). Tangible user interfaces: Past, present and future directions. now publ.
	Wigdor, D., & Wixon, D. (2011). Brave NUI world: Designing natural user interfaces for touch and gesture. Morgan Kaufmann.

3.13 Physical Computing and Algorithms

PCA	Physical Computing and Algorithms	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd semester	
Language	English	
Assignment to subarea	Human-Computer Interaction	
Prior knowledge	Foundations of Creative Computing	
	Web Programming	
	Foundations of Creative Computing 2	
Blocked	No	
Participants	All Students	
Learning outcomes	Students can:	
	 Understand basic concepts of electronics ar them when building and analyzing simple cire. Know and understand how to apply various digital sensors to transform physical quantitie voltages and digital values (L3) Know and understand the application of varie LEDs, motors (servos, steppers, DC-motors piezo, etc. Understand the conceptual differences between microcontroller platforms to PCs using operation (L2) Can implement digital applications consisting an electronic circuit at I/O ports using the Arr (or similar). Know and can integrate communication prodidigital circuits and online data sources (L3) understand the concepts of managed programmeters. 	nd can apply rcuits (L4) analogue and es to electric ous actors:), solenoids, reen ating systems g of software and duino platform cocols to network
	 languages (e.g., runtime environment, garbatype safety, interoperability) (L2). manage to use the right variable types and computation (L3). Understand the basics of complexity in practice. Understand the principles of logic and the batagorithms in programming (L2). link and convert abstract problems to practice implementation (L3). 	age collection, data structure for tice (L2). asics of

	 understand the concepts of modern object-oriented
	programming (L2).
Unit examinations	None
Contribution to following units	Extended Reality Coding
	Creative Code Lab 3: Mobile Applications
	Creative Code Lab 4: Extending Realities
Literature	Albahari, J. (2022). C# 10 in a nutshell: The definitive reference (First edition). O'Reilly Media, Inc.
	Bhargava, A. Y. (2024). Grokking algorithms (Second edition). Manning Publications Co.
	Bosse, S., Lehmhus, D., Lang, W., & Busse, M. (2018). Material- integrated intelligent systems: Technology and applications. Wiley.
	Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). Introduction to algorithms (Fourth edition). The MIT Press.
	Deitel, H. M., & Deitel, P. J. (2006). C# for programmers (2nd ed). Pearson/Prentice Hall.
	Igoe, T. (2007). Making things talk: Practical methods for connecting physical objects ; projects and ideas to create talking objects from anything (1. ed). O'Reilly.
	Jamro, M. (2018). C# Data Structures and Algorithms: Explore the possibilities of C# for developing a variety of efficient applications. Packt Publishing.
	Karumanchi, N. (2015). Data structures and algorithms made easy: Data structure and algorithmic puzzles. Careermonk Publications.
	Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.
	OSullivan, D., & Igoe, T. (20). Physical computing: Sensing and controlling the physical world with computers (Nachdr.). Course Technology.
	Perallos, A., Hernandez-Jayo, U., Onieva, E., & García-Zuazola, I. J. (2015). Intelligent Transport Systems: Technologies and Applications (1. Aufl.). Wiley. <u>https://doi.org/10.1002/9781118894774</u>
	Sedgewick, R., & Wayne, K. D. (2011). Algorithms (4th ed). Addison- Wesley.
	Shaer, O. (2009). Tangible User Interfaces: Past, Present, and Future Directions. Foundations and Trends® in Human–Computer Interaction, 3(1–2), 1–137. <u>https://doi.org/10.1561/1100000026</u>
	Skiena, S. S. (2010). The algorithm design manual (2. ed., [Nachdr.]). Springer.
	Troelsen, A. (with Japikse, P.). (2022). Pro C# 10 With . NET 6: Foundational Principles and Practices in Programming (11th ed). Apress L. P.
	Weiss, M. A. (1997). Data structures and algorithm analysis in C (2nd ed). Addison-Wesley.
	Wigdor, D., & Wixon, D. (2011). Brave NUI world: Designing natural user interfaces for touch and gesture. Morgan Kaufmann.

	Physical Computing and Connectivity
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Lectures interwoven with exercises Exercises Individual Projects
Workload	2 ECTS & 2 SWS
Position in curriculum	3rd semester
Language	English
Prior knowledge	Foundations of Creative Computing
Learning outcomes	 Students can: Understand basic concepts of electronics and can apply them when building and analyzing simple circuits (L4) Know and understand how to apply various analog and digital sensors to transform physical quantities to electric voltages and digital values (L3) Know and understand the application of various actors: LEDs, motors (servos, steppers, DC-motors), solenoids, piezo, etc. Understand the conceptual differences between microcontroller platforms to PCs using operating systems (L2) Can implement digital applications consisting of software and an electronic circuit at I/O ports using the Arduino platform (or similar). Know and can integrate communication protocols to network digital circuits and online data sources (L3)
Contents	 digital circuits and online data sources (L3) Electronics: Current, voltage, resistance, Ohm's law, voltage divider Transistor circuits, op-amps Sensors: analog and digital for various physical quantities Actuators: for light, sound and movement Programming languages for microcontrollers (Arduino-C, C++) Software patterns for Microcontroller programming (e.g. state machines) Hardware communication protocols: serial, I2C, SPI, RFID
Exam modalities	Sortware communication protocols. HTTP, REST, MQTT, OSC Course-immanent exam

Literature	Bosse, S., Lehmhus, D., Lang, W., & Busse, M. (2018). Material- integrated intelligent systems: Technology and applications. Wiley.
	Igoe, T. (2007). Making things talk: Practical methods for connecting physical objects; projects and ideas to create talking objects from anything (1. ed). O'Reilly.
	Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.
	OSullivan, D., & Igoe, T. (20). Physical computing: Sensing and controlling the physical world with computers (Nachdr.). Course Technology.
	Perallos, A., Hernandez-Jayo, U., Onieva, E., & García-Zuazola, I. J. (2015). Intelligent Transport Systems: Technologies and Applications (1. Aufl.). Wiley. <u>https://doi.org/10.1002/9781118894774</u>
	Shaer, O. (2009). Tangible User Interfaces: Past, Present, and Future Directions. Foundations and Trends® in Human–Computer Interaction, 3(1–2), 1–137. <u>https://doi.org/10.1561/1100000026</u>
	Wigdor, D., & Wixon, D. (2011). Brave NUI world: Designing natural user interfaces for touch and gesture. Morgan Kaufmann.

	Data Structures and Algorithms
Course number	Course title
Course type	Exercise (UE)
Teaching and learning	Lectures interwoven with exercises
methods	Exercises
Workload	3 ECTS & 2 SWS
Position in curriculum	3rd semester
Language	English
Prior knowledge	Web Programming
	Foundations of Creative Computing 2
Learning outcomes	Students are able to:
	 understand the concepts of managed programming
	languages (e.g., runtime environment, garbage collection,
	type safety, interoperability) (L2).
	• manage to use the right variable types and data structure for
	computation (L3).
	 Understand the basics of complexity in practice (L2).
	 Understand the principles of logic and the basics of
	algorithms in programming (L2).
	 link and convert abstract problems to practical
	implementation (L3).
	 understand the concepts of modern object-oriented
	programming (L2).
Contents	Transition to object-oriented programming with C#
	Language features of C#
	Concepts of object-oriented programming

	Desktop console programming
	Basic data structure concept, including the static and
	dynamic data structure, the performance and limitation of
	commonly used data structures (e.g., array, list, sorted list,
	tree, graph, etc.).
	Basic algorithm concept, including basic measures for
	examining time and space complexity, and general tips for
	writing good codes.
Exam modalities	Course-immanent exam
Literature	Albahari, J. (2022). C# 10 in a nutshell: The definitive reference (First edition). O'Reilly Media, Inc.
	Bhargava, A. Y. (2024). Grokking algorithms (Second edition). Manning Publications Co.
	Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2022). Introduction to algorithms (Fourth edition). The MIT Press.
	Deitel, H. M., & Deitel, P. J. (2006). C# for programmers (2nd ed). Pearson/Prentice Hall.
	Jamro, M. (2018). C# Data Structures and Algorithms: Explore the possibilities of C# for developing a variety of efficient applications. Packt Publishing.
	Karumanchi, N. (2015). Data structures and algorithms made easy: Data structure and algorithmic puzzles. Careermonk Publications.
	Sedgewick, R., & Wayne, K. D. (2011). Algorithms (4th ed). Addison-Wesley.
	Skiena, S. S. (2010). The algorithm design manual (2. ed., [Nachdr.]). Springer.
	Troelsen, A. (with Japikse, P.). (2022). Pro C# 10 With . NET 6: Foundational Principles and Practices in Programming (11th ed). Apress L. P.
	Weiss, M. A. (1997). Data structures and algorithm analysis in C (2nd ed). Addison-Wesley.

3.14 Elective Module

EM	Elective Module	10 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd and 4th semester	
Language	English	
Assignment to subarea	Elective Modules	
Prior knowledge	All courses of semester one and two	
Blocked	No	
Participants	All students	
Learning outcomes	In the third and fourth semesters, students choose a selective module, each worth 5 ECTS. It is possible the modules build on each other.	specialized at these two
	As learning outcome, the students have in-depth know chosen special field.	wledge in a self-
Unit examinations	None	
Contribution to following units	Creative Code Lab 5	
Literature		

3.15 Creative Code Lab 3: Mobile Applications

CCL3:MA	Creative Code Lab 3: Mobile Applications 5 ECTS	
Unit number	Unit title Workload	
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	3rd semester	
Language	English	
Assignment to subarea	Projects	
Prior knowledge	Creative Code Lab 2	
	All courses of the third semester	
Blocked	Yes	
Participants	All Students	
Learning outcomes	 The students are able to plan the design and implementation of a mobile application in a team of two students. (L4) design the interaction for a mobile application. (L3) design the visual elements of a mobile application. (L3) implement a native mobile application. (L3) design, carry out, and interpret a user test. (L4) present their work suitably on-site. (L3) present their work including the most essential design and planning documents, and the user test design and test results in a public repository. (L3) 	
Unit examinations	None	
Contribution to following units	Creative Code Lab 4 Creative Code Lab 5	
Literature	All literature of the third semester	

	Creative Code Lab 3: Mobile Applications
Course number	Course title
Course type	Project (PR)
Teaching and learning methods	Project work in teams of two
Workload	5 ECTS & 3 SWS
Position in curriculum	3rd semester
Language	English
Prior knowledge	All courses of the third semester
Learning outcomes	 The students are able to: plan the design and implementation of a mobile application in a team of two students. (L4)

	 design the interaction for a mobile application. (L3)
	• design the visual elements of a mobile application. (L3)
	• implement a native mobile application. (L3)
	• design, carry out, and interpret a user test. (L4)
	• present their work suitably on-site. (L3)
	 present their work including the most essential design and
	planning documents, and the user test design and test
	results in a public repository. (L3)
Contents	In addition to the contents of the lectures of the third semester, the
	students are coached regarding:
	 the planning of their projects for a small team of two
	students;
	 writing a user test design and an evaluation report;
	creating a page about the project results and the making-of
	in their project repository.
	Throughout the two blocked weeks, tutors are available to support the students.
Exam modalities	Course-immanent exam
Literature	All literature of the third semester

3.163D Design

3DD	3D Design	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	4th semester	
Language	English	
Assignment to subarea	User Interface Design	
Prior knowledge	Foundations of Creative Computing User Interface Design and Game Graphics	
Blocked	No	
Participants	All Students	
Learning outcomes	The students	
	 can design and create 3D characters and elefigures, environment elements, obstacles an 3D modeling software (L3). can rig 3D characters and create the correspanimations (L3). learn basic sculpting techniques using 3D mand create normal maps for low poly models can render still images and animations (L3). export 3D assets to common 3D formats as Collada and how to import and use them in C (L3). understand how to evaluate the quality of 3D different usage scenarios (L2). know and understand different post-WIMP (wmenus, pointer) interfaces and interaction manus, pointer) interfaces and interaction manus (L3) create low- and high-fidelity prototypes for an and mixed reality interfaces. (L3) evaluate the user experience, usability and a augmented, virtual and mixed reality interfaces. Name 	ements (e.g. d pick-ups) using bonding odeling software (L3). FBX, OBJ or Game Engines 0 models for vindows, icon, odalities. (L2) ral interactions, reality interfaces. ugmented, virtual accessibility of es. (L4)
Unit examinations	None	
Contribution to following units	Creative Code Lab 4: Extending Realities	
Literature	Anderson, K., Cady-Lee, D., Carre, C., & Mengert, H. J.). (2019). Creating characters for the entertainment Character design for animation, illustration & video ga Publishing.	(with Woods, industry: mes. 3dTotal

Apple. (o. J.). Designing for iOS [Apple]. https://developer.apple.com/design/human-interfaceguidelines/designing-for-ios

Augmented reality design guidelines. (o. J.). ARCore. https://developers.google.com/ar/design

Blender Reference Manual. (o. J.). https://docs.blender.org/manual/en/latest/

CG Cookie. (o. J.). [YouTube]. <u>https://www.youtube.com/@cg_cookie</u>

CG Geek. (o. J.). [YouTube]. <u>https://www.youtube.com/@CGGeek</u>

CGBoost. (o. J.). [YouTube]. <u>https://www.youtube.com/@cgboost</u>

Ciccarelli, M., Brunzini, A., Papetti, A., & Germani, M. (2022). Interface and interaction design principles for Mixed Reality applications: The case of operator training in wire harness activities. Procedia Computer Science, 204, 540–547. <u>https://doi.org/10.1016/j.procs.2022.08.066</u>

Cooper, A., Reimann, R., Cronin, D., Noessel, C., Csizmadi, J., & LeMoine, D. (2014). About face: The essentials of interaction design (Fourth edition). Wiley.

Farnell, A. (2010). Designing sound. MIT Press.

Gleb Alexandrov. (o. J.). [YouTube]. https://www.youtube.com/@GlebAlexandrov

Grant Abbitt (Gabbitt). (o. J.). [YouTube]. https://www.youtube.com/@grabbitt

Hillmann, C. (2021). UX for XR: User Experience Design and Strategies for Immersive Technologies. Apress L. P.

KNIERIM, P. (2020). ENHANCING INTERACTION IN MIXED REALITY: The impactof modalities and interaction techniques on the.. INDEPENDENTLY PUBLISHED.

Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web usability (Third edition). New Riders.

Material Design. (o. J.). https://m3.material.io/

McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann.

Möller, T., Haines, E., & Hoffman, N. (2008). Real-time rendering (3rd ed). A.K. Peters.

Murdock, K. (2018). Autodesk Maya 2018: Basics guide. SDC Publications.

Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.

Platt, D. S. (2016). The joy of UX: User Experience and interactive design for developers. Addison-Wesley.

Price, A. (o. J.). Blender Guru. YouTube.

https://www.youtube.com/@blenderguru

Stylized Station. (o. J.). [YouTube]. https://www.youtube.com/@StylizedStation

Tidwell, J. (2011). Designing interfaces (2nd ed). O'Reilly.

Vaughan, W. (2018). Topology workbook. Volume 1: Topology workbook / William Vaughan. Hickory Nut Publishing.

Vaughan, W. (2019). Topology Workbook. Volume 2: Topology Workbook / William Vaughan. Hickory Nut Publishing.

Williams, R. (2009). The animator's survival kit: A manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators (expanded edition). Faber and Faber.

Yan. (o. J.). YanSculpts.

	3D Modeling and Animation
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Mix of teacher-centred learning for the basics and student-centred learning for solving given exercises (with the support of the teacher).
Workload	3 ECTS & 3 SWS
Position in curriculum	4th semester
Language	English
Prior knowledge	Foundations of Creative Computing User Interface Design and Game Graphics
Learning outcomes	The students
	 can design and create 3D characters and elements (e.g. figures, environment elements, obstacles and pick-ups) using 3D modeling software (L3). can rig 3D characters and create the corresponding animations (L3). learn basic sculpting techniques using 3D modeling software and create normal maps for low poly models (L3). can render still images and animations (L3). export 3D assets to common 3D formats as FBX, OBJ or Collada and how to import and use them in Game Engines (L3). understand how to evaluate the quality of 3D models for different usage scenarios (L2).
Contents	 sition from 2D to 3D graphic content generation Designing and creating 3D characters and elements (e.g. figures, environment elements, obstacles and pick-ups) Working with materials and textures Working with modifiers Working with skeletons (rigging) and creating the associated animations Sculpting techniques for low-poly models Generation of normal and bump maps Lighting Rendering (EEVEE)
Exam modalities	Course-immanent exam
Literature	 Anderson, K., Cady-Lee, D., Carre, C., & Mengert, H. (with Woods, J.). (2019). Creating characters for the entertainment industry: Character design for animation, illustration & video games. 3dTotal Publishing. Blender Reference Manual. (o. J.). <u>https://docs.blender.org/manual/en/latest/</u> CG Cookie. (o. J.). [YouTube]. <u>https://www.youtube.com/@cg cookie</u> CG Geek. (o. J.). [YouTube]. <u>https://www.youtube.com/@CGGeek</u> CGBoost. (o. J.). [YouTube]. <u>https://www.youtube.com/@cgboost</u> Gleb Alexandrov. (o. J.). [YouTube]. <u>https://www.youtube.com/@GlebAlexandrov</u>

Grant Abbitt (Gabbitt). (o. J.). [YouTube]. <u>https://www.youtube.com/@grabbitt</u> Möller, T., Haines, E., & Hoffman, N. (2008). Real-time rendering (3rd ed). A.K. Peters.

Price, A. (o. J.). Blender Guru. YouTube. https://www.youtube.com/@blenderguru

Stylized Station. (o. J.). [YouTube]. <u>https://www.youtube.com/@StylizedStation</u> Vaughan, W. (2018). Topology workbook. Volume 1: Topology workbook / William Vaughan. Hickory Nut Publishing.

Vaughan, W. (2019). Topology Workbook. Volume 2: Topology Workbook / William Vaughan. Hickory Nut Publishing.

Williams, R. (2009). The animator's survival kit: A manual of methods, principles and formulas for classical, computer, games, stop motion and internet animators (expanded edition). Faber and Faber.

Yan. (o. J.). YanSculpts.

	Interface and Interaction Design for Extended Realities
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	• Lectures • Hands-on Exercises • Project
Workload	2 ECTS & 1.5 SWS
Position in curriculum	4th semester
Language	English
Prior knowledge	Foundations of Creative Computing User Interface Design and Game Graphics
Learning outcomes	 The students are able to know and understand different post-WIMP (windows, icon, menus, pointer) interfaces and interaction modalities. (L2) conceive and design voice, touch and gestural interactions, especially for augmented, virtual and mixed reality interfaces. (L3) create low- and high-fidelity prototypes for augmented, virtual and mixed reality interfaces. (L3) evaluate the user experience, usability and accessibility of augmented, virtual and mixed reality interfaces. (L4)
Contents	 Overview of Post-WIMP interfaces Selected interaction modalities: Voice, touch and gestural For application in augmented, virtual and mixed reality Design of voice, touch and gestural interfaces Prototyping for voice, touch and gestural interfaces Tracking and calibration, head tracking, hand and controller tracking, room-scale tracking, and environment (guardian/play area) setup UX and usability evaluation for voice, touch and gestural interfaces
Exam modalities	Course-immanent exam

Literature	Apple. (o. J.). Designing for iOS [Apple]. <u>https://developer.apple.com/design/human-interface-guidelines/designing-for-ios</u>
	Augmented reality design guidelines. (o. J.). ARCore. https://developers.google.com/ar/design
	Ciccarelli, M., Brunzini, A., Papetti, A., & Germani, M. (2022). Interface and interaction design principles for Mixed Reality applications: The case of operator training in wire harness activities. Procedia Computer Science, 204, 540–547. https://doi.org/10.1016/j.procs.2022.08.066
	Cooper, A., Reimann, R., Cronin, D., Noessel, C., Csizmadi, J., & LeMoine, D. (2014). About face: The essentials of interaction design (Fourth edition). Wiley.
	Hillmann, C. (2021). UX for XR: User Experience Design and Strategies for Immersive Technologies. Apress L. P.
	KNIERIM, P. (2020). ENHANCING INTERACTION IN MIXED REALITY: The impactof modalities and interaction techniques on the INDEPENDENTLY PUBLISHED.
	Krug, S. (2014). Don't make me think, revisited: A common sense approach to Web usability (Third edition). New Riders.
	Material Design. (o. J.). <u>https://m3.material.io/</u>
	McKay, E. N. (2013). UI is communication: How to design intuitive, user centered interfaces by focusing on effective communication. Elsevier, Morgan Kaufmann.
	Norman, D. A. (2013). The design of everyday things (Revised and expanded edition). Basic Books.
	Platt, D. S. (2016). The joy of UX: User Experience and interactive design for developers. Addison-Wesley.
	Tidwell, J. (2011). Designing interfaces (2nd ed). O'Reilly.

3.17 Extended Reality Coding

Unit title Workload e Programme Creative Computing
e Programme Creative Computing Creative Computing and Algorithms e able to d the concepts of managed languages (L2).
Creative Computing and Algorithms e able to I the concepts of managed languages (L2).
Creative Computing and Algorithms e able to I the concepts of managed languages (L2).
Creative Computing and Algorithms e able to I the concepts of managed languages (L2).
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use the right variable types and data structure for in (L3). nvert abstract problems to practical implementation if the concepts of modern object-oriented ing (L2). indently implement object-oriented software and functionality, taking into account common software terns. (L4) create virtual worlds that can be experienced y using game engines (L3). implement small game-like mechanics by using the ents provided by high-level game engines (L1). game engines work behind the scenes and what in developing realtime 3D games and experiences, takes over (L1, L2). equirements for the creation of XR systems. This he technical components as well as human factors in XR applications (L3, L4). d component based systems in game engines and nent application logic for interactive realtime 3D I experiences (L4). roperties of the used Game Engines regarding theid d graphic engine and can apply them in a targeted

	 can plan and implement 3D realtime-projects and XR projects on their own (L4, L5)
	 can debug code to identify non-intended behavior. (L4)
	can integrate current frameworks for augmented and mixed-
	reality to merge real and virtual worlds (I 4)
	understand basic methods for parameter settings and can tune
	these parameters systematically (L2).
	 understand how to use agile methods in larger contexts (e.g.
	SAFe or LeSS) (L2)
	understand common product owner and product management
	methods (L2)
	are able to communicate and document software requirements
	(by using diagrams) (L3)
	are able to prioritize software requirements by using agile
	methods (L3)
	 Learn about challenges with larger files in VC systems as GIT
	and how to deal with it (L3).
Unit examinations	None
Contribution to following units	Creative Code Lab 4: Extending Realities
Literature	Alten, S. R. (2011). Audio in media (International ed., 9. ed). Wadsworth.
	Ament, V. T. (2014). The Foley grail: The art of performing sound for film, games, and animation (Second edition). Focal Press.
	Bucher, J. (2017). Storytelling for Virtual Reality. Taylor and Francis.
	Bucher, J. K. (2018). Storytelling for virtual reality: Methods and principles for crafting immersive narratives. Routledge, Taylor & Francis Group.
	Buttfield-Addison, P., Manning, J., & Nugent, T. (2019). Unity game development cookbook: Essentials for every game (First edition). O'Reilly Media.
	Cardoso, A. F. M. (2021). Implementing Design Patterns in C# And. NET 5. BPB Publications.
	Collins, K. (2008). Game sound: An introduction to the history, theory, and practice of video game music and sound design. MIT Press.
	Cormen, T. H. (Hrsg.). (2009). Introduction to algorithms (3rd ed). MIT Press.
	Farnell, A. (2010). Designing sound. The MIT Press.
	Gamma, E. (Hrsg.). (1995). Design patterns: Elements of reusable object-oriented software. Addison-Wesley.
	Gregory, J. (2019). Game engine architecture (Third edition). CRC Press, Taylor & Francis Group.
	Hughes, J., van Dam, A., McGuire, M., Sklar, D., Foley, J., Feiner, S., & Akeley, K. (2014). Computer graphics: Principles and practice (Third edition). Addison-Wesley.
	Jamro, M. (2018). C# Data Structures and Algorithms: Explore the possibilities of C# for developing a variety of efficient applications. Packt Publishing.
Lengyel, E. (2012). Mathematics for 3D game programming and computer graphics (3. ed). Course Technology.

Price, M. J. (2020). C# 9 and .NET 5 - modern cross-platform development: Build intelligent apps, websites, and services with Blazor, ASP.NET Core, and Entity Framework Core using Visual Studio Code, 5th edition (5th ed). Packt Publishing.

Robinson, C. (2019). Game audio with FMOD and Unity. Routledge, Taylor & Francis Group.

Schmalstieg, D. (with Höllerer, T.). (2016). Augmented reality: Principles and practice. Addison-Wesley.

Thorn, A. (2018). Unity 2018 by example: Learn about game and virtual reality development by creating five engaging projects, second edition (2nd ed). Packt Publishing.

Whitaker, R. B. (2021). The C# player's guide (Fourth edition). Starbound Software.

	Practical Software Design Principles
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	 Lectures Hand-on exercises Peer discussions and quizzes Final project
Workload	3 ECTS & 2 SWS
Position in curriculum	4th semester
Language	English
Prior knowledge	Foundations of Creative Computing Data Structures and Algorithms
Learning outcomes	 The students are able to use the concept of abstraction and encapsulation (L2). link and convert abstract problems to practical implementation (L3). understand the concepts of modern object-oriented programming (L2). independently implement object-oriented software and analyze its functionality understand modern software design patterns and principles. (L4) understand the basic difference between imperative programming and declarative programming (L2). understand the fundamental concept of functional programming (L2).
Contents	Advanced language features of C#

	Concepts of object oriented programming
	Desktop console programing
	 Integration and usage of released libraries from NuGet
	Implementation of object oriented applications with Visual
	Studio Code
	User interface implementation principles
	Basic thread concept for parallel computing
	Fundamentals of file systems and task management in the
	operating system
	Software design patterns in practice
	Imperative programming and declarative programming
	Functional programming using Lambda expression
Exam modalities	Course-immanent exam
Literature	Cardoso, A. F. M. (2021). Implementing Design Patterns in C# And. NET 5. BPB Publications.
	Cormen, T. H. (Hrsg.). (2009). Introduction to algorithms (3rd ed). MIT Press.
	Gamma, E. (Hrsg.). (1995). Design patterns: Elements of reusable object-oriented software. Addison-Wesley.
	Jamro, M. (2018). C# Data Structures and Algorithms: Explore the possibilities of C# for developing a variety of efficient applications. Packt Publishing.
	Price, M. J. (2020). C# 9 and .NET 5 - modern cross-platform development: Build intelligent apps, websites, and services with Blazor, ASP.NET Core, and Entity Framework Core using Visual Studio Code, 5th edition (5th ed). Packt Publishing.
	Whitaker, R. B. (2021). The C# player's guide (Fourth edition). Starbound Software.

	Engine-based Extended Reality Development
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	 Teacher-centered approach for the new theory at the begin of every lesson Student-centered approach for solving small given tasks during the lessons Project-centered approach for doing bigger tasks at home between the lessons
Workload	5 ECTS & 3 SWS
Position in curriculum	4th semester
Language	English
Prior knowledge	Foundations of Creative Computing 2D Browser Game Development
Learning outcomes	The students are able to

	create virtual worlds that can be experienced interactively using
	game engines (L3).
	 implement small game-like mechanics by using the core
	elements provided by high-level game engines (L1).
	 know how game engines work behind the scenes and what
	tasks, when developing realtime 3D games and experiences,
	the engine takes over (L1, L2).
	 know the requirements for the creation of XR systems. This
	applies to the technical components as well as human factors
	that pertain XR applications (L3, L4).
	 understand Entity-Component-Systems in game engines and
	can implement application logic for interactive realtime 3D
	games and experiences (L2).
	 know the properties of the used Game Engines regarding their
	physics and graphic engine and can apply them in a targeted
	manner (1.3)
	can plan and implement 3D realtime-projects and XR projects
	on their own (1.4, 1.5)
	 can debug code to identify non intended behavior (L4)
	• can debug code to identify non-intended behavior. (L4)
	can integrate current frameworks for augmented and mixed-
	reality to merge real and virtual worlds. (L4)
	Understand basic methods for parameter settings and can tune
	these parameters systematically (L2).
	Learn about challenges with larger files in VC systems as GII
	and how to deal with it (L3).
Contents	Use of game engines for the creation of interactive, virtual
	worlds
	Creation and design of projects in the editor
	 Integration of static and interactive objects considering their
	properties with regards to physics and shading in the
	environment
	 Implementation of application logic for objects in the virtual
	environment and the necessary user interaction using C#
	Usage of XR-platform specific IO modules
	 Deployment of the applications on various XR devices
Exam modalities	Course-immanent exam
Literature	Bucher, J. (2017). Storytelling for Virtual Reality. Taylor and Francis. Buttfield-Addison, P., Manning, J., & Nugent, T. (2019). Unity game development cookbook: Essentials for every game (First edition). O'Reilly Media.
	Gregory, J. (2019). Game engine architecture (Third edition). CRC Press, Taylor & Francis Group.

Hughes, J., van Dam, A., McGuire, M., Sklar, D., Foley, J., Feiner, S., & Akeley, K. (2014). Computer graphics: Principles and practice (Third edition). Addison-Wesley.
Lengyel, E. (2012). Mathematics for 3D game programming and computer graphics (3. ed). Course Technology.
Schmalstieg, D. (with Höllerer, T.). (2016). Augmented reality: Principles and practice. Addison-Wesley.
Thorn, A. (2018). Unity 2018 by example: Learn about game and virtual reality development by creating five engaging projects, second edition (2nd ed). Packt Publishing.

	Audio for 3D Engines	
Course number	Course title	
Course type	Integrated course (ILV)	
Teaching and learning methods	Lecturing, instruction, tutorials, DIY activities, feedback discussions	
Workload	2 ECTS & 2 SWS	
Position in curriculum	4th semester	
Language	English	
Prior knowledge	Foundations of Creative Computing User Interface Design and Game Graphics	
Learning outcomes	The students are able to	
	 understand the basic principles of sound design in the field of game audio (L2). 	
	• are familiar with the workflow of REAPER, Fmod or Wwise and the	
	subsequent implementation in Unity (L3).	
	can independently design and implement sound scenarios for simple game	
	situations (L3).	
Contents	Basics of sound design for 3D engines	
	Recording dialogue and sounds with REAPER	
	Use of sound libraries	
	Sound editing	
	Basics game audio for 3D games	
	 Implementation of audio using middleware (e.g.: Fmod, Wwise) 	
Exam modalities	Course-immanent exam	
Literature	Alten, S. R. (2011). Audio in media (International ed., 9. ed). Wadsworth. Ament, V. T. (2014). The Foley grail: The art of performing sound for film, games, and animation (Second edition). Focal Press.	
	Collins, K. (2008). Game sound: An introduction to the history, theory, and practice of video game music and sound design. MIT Press.	
	Farnell, A. (2010). Designing sound. The MIT Press.	
	Robinson, C. (2019). Game audio with FMOD and Unity. Routledge, Taylor & Francis Group.	

3.18 Scientific Writing

SW	Scientific Writing	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	4th semester	
Language	English	
Assignment to subarea	Scientific Work	
Prior knowledge	None	
Blocked	No	
Participants	All students	
Learning outcomes	The students	
	 know scientific methods. (L2) understand citation rules and can apply them can identify relevant publications on a topic a correctly. (L4) can summarise a scientific text (L2). are able to write the concept, in particular the questions for a bachelor thesis (L4) can plan research and writing processes (L3) are able to write short scientific texts. (L5) can document (L6) and reflect (L5) on their in learning development. 	n. (L2) and quote them e research). ndividual
Unit examinations	None	
Contribution to following units	Bachelor Thesis: Plan and Research	
Literature	 Booth, W. C., Colomb, G. G., & Williams, J. M. (2008) research (3rd ed). University of Chicago Press. Datta, D. (2017). LaTeX in 24 Hours: A Practical Guid Writing. Springer. <u>https://doi.org/10.1007/978-3-319-4</u> Davis, M., Davis, K. J., & Dunagan, M. M. (2012). Sciand presentations (3d edition). Elsevier/AP. Skern, T. (2011). Writing scientific English: A workbood Strunk, W., & White, E. B. (1999). The elements of sty Allyn and Bacon. 	b. The craft of re for Scientific <u>7831-9</u> entific papers ok. facultas wuv. yle (4th ed).
	Scientific Writing	

	Scientific writing
Course number	Course title
Course type	Seminar (SE)
Teaching and learning methods	Inputs from research experts from the IC\M/T Exercises
Workload	5 ECTS & 3 SWS

Position in curriculum	4th semester
Language	English
Prior knowledge	Empirical Methods for HCI
Learning outcomes	The students
	 know scientific methods. (L2) understand citation rules and can apply them. (L2) can identify relevant publications on a topic and quote them correctly. (L4) can summarise a scientific text (L2). are able to write the concept, in particular the research questions for a bachelor thesis (L4) can plan research and writing processes (L3). are able to write short scientific texts. (L5) can document (L6) and reflect (L5) on their individual
	learning development.
Contents	 Overview of scientific methods. Planning and structuring of a scientific work, research problem, goal, object. Writing a concept for the bachelor thesis. Formal criteria of a scientific thesis such as citation, writing style, structure of the text. Excerpting and quoting with literature management software. Desk research, search in scientific databases. Requirements for sources. Ethics in research.
Exam modalities	Course-immanent exam
Literature	 Booth, W. C., Colomb, G. G., & Williams, J. M. (2008). The craft of research (3rd ed). University of Chicago Press. Datta, D. (2017). LaTeX in 24 Hours: A Practical Guide for Scientific Writing. Springer. <u>https://doi.org/10.1007/978-3-319-47831-9</u> Davis, M., Davis, K. J., & Dunagan, M. M. (2012). Scientific papers and presentations (3d edition). Elsevier/AP. Skern, T. (2011). Writing scientific English: A workbook. facultas wuv. Strunk, W., & White, E. B. (1999). The elements of style (4th ed). Allyn and Bacon.

3.19 Creative Code Lab 4: Extending Realities

CCL4: ER	Creative Code Lab 4: Extending Realities 5 ECTS
Unit number	Unit title Workload
Course of studies	Bachelor Degree Programme Creative Computing
Position in curriculum	4th semester
Language	English
Assignment to subarea	Projects
Prior knowledge	Creative Code Lab 3 All courses of the fourth semester
Blocked	Yes
Participants	All students
Learning outcomes	 The students are able to plan the design and implementation of a 3D or an XR application in a team of three to four students. (L4) work with team members through version control system (e.g., git, Unity VC, etc) (L3). design the interaction for the 3D or the XR application. (L3) design the 2D and 3D visual elements of the 3D or the XR application. (L3) implement the 3D or the XR application. (L3) use a fitting technical architecture, e.g. using state management, serialization, package management and well structured, reusable logical units. (L4) design, carry out and interpret a user test of the 3D or the XR application. (L3) present their work suitably on-site. (L3) present their work including the most essential design and planning documents as well as the user test design and test results in a public repository. (L3)
Unit examinations	None
Contribution to following units	Creative Code Lab 5
Literature	Complete literature of the fourth semester

	Creative Code Lab 4: Extending Realities
Course number	Course title
Course type	Project (PR)
Teaching and learning methods	In two weeks at the end of the semester, the students will use all knowledge and competences that they acquired during the semester

	for small projects. Within the two weeks, they will conceive, design and implement a project which will be demonstrated in different formats at the end. The documentation of the Making-of and the finished project will be an essential part of the students' ePortfolios.
	In the fourth semester, the augmented- and/or virtual reality (XR) projects are carried out in groups of three students. The presentation of the projects will happen at a fair at the end of the two weeks, where the visitors can use the XR worlds. The ePortfolio includes the
	finished project, the most important planning and design documents
	and the user experience evaluation plan with user test results.
Workload	5 ECTS & 3 SWS
Position in curriculum	4th semester
Language	English
Prior knowledge	All courses of the fourth semester
Learning outcomes	The students are able to
	 plan the design and implementation of a 3D or an XR application in a team of three to four students. (L4) work with team members through version control system (e.g., git, Unity VC, etc) (L3). design the interaction for the 3D or the XR application. (L3) design the 2D and 3D visual elements of the 3D or the XR application. (L3) implement the 3D or the XR application. (L3) use a fitting technical architecture, e.g. using state management, serialization, package management and well structured, reusable logical units. (L4) design, carry out and interpret a user test of the 3D or the XR application. (L3) present their work suitably on-site. (L3) present their work including the most essential design and planning documents as well as the user test design and test results in a public repository. (L3)
Contents	In addition to the contents of the lectures of the fourth semester, the
	students are coached regarding
	• the planning and carrying out of their projects in a small
	team of three to four students.
	creating an entry about the project results and the making-of
	in a public repository. Throughout the two blocked weeks, tutors are available to support the students.
Exam modalities	Course-immanent exam

3.20 Bachelor Thesis

BT	Bachelor Thesis 12 ECT	ſS
Unit number	Unit title Worklo	ad
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	5th and 6th semester	
Language	English	
Assignment to subarea	Scientific Work	
Prior knowledge	Scientific writing	
Blocked	No	
Participants	All students	
Learning outcomes	The students are able to	
	 plan and partially write their first own scientific paper. (I understand what distinguishes scientific work from othe work. (L4) limit topics and to formulate research questions and work hypotheses. (L6) plan a practical investigation and an according evaluation for their research topic assess the relevance and seriousness of sources and the quote them correctly. (L4) structure their own text in a meaningful way. (L3) present their state of the art and research plan give feedback to other students w.r.t. this presentation 	L6) er orking ion to
Unit examinations	None	
Contribution to following units	-	
Literature	Topic-specifically researched by students	

	Bachelor Thesis: Plan and Research
Course number	Course title
Course type	Seminar (SE)
Teaching and learning methods	Supervision in small groups Peer-review
Workload	5 ECTS & 1,5 SWS
Position in curriculum	5th semester

Language	English
Prior knowledge	Scientific writing
Learning outcomes	The students are able to
	 plan and partially write their first own scientific paper. (L6) understand what distinguishes scientific work from other work. (L4) limit topics and to formulate research questions and working hypotheses. (L6) assess the relevance and seriousness of sources and to quote them correctly. (L4) structure their own text in a meaningful way. (L3) plan a practical investigation and a methodically correct evaluation prepare materials for the practical investigation depending on its type, such as software architecture of the prototype, interview guidelines, survey designs, data, ground truth, UX test protocol, etc. use Al tools for scientific work correctly and document the use of these present their state of the art and research plan give feedback to other students with respect to this presentation
Contents	 Research science. Localizing a topic. Formulating a research question. Finding and assessing sources. Excerpting and quoting (with Zotero). Structuring and writing. Selecting methods according to research question Using Al-based tools and understanding the rules w.r.t. good scientific practice and plagiarism. Presentation guidelines Forms of peer review
Exam modalities	Final exam
Literature	Topic-specifically researched by students

	Bachelor Thesis: Implementation and Evaluation
Course number	Course title
Course type	Seminar (SE)
Teaching and learning methods	Supervision in small groups

Workload	5 ECTS & 1,5 SWS
Position in curriculum	6th semester
Language	English
Prior knowledge	Scientific writing, Bachelor Thesis: Plan and Research
Learning outcomes	The students are able to:
	Implement the practical part of their thesis
	Evaluate the practical part with appropriate methods
	Aggregate and discuss results
	Draw and summarize conclusions
Contents	The students are individually supervised during the practical part of their thesis.
Exam modalities	Final exam
Literature	Topic-specifically researched by students

	Bachelor Exam
Course number	Course title
Course type	Seminar (SE)
Workload	2 ECTS & 0,1 SWS
Position in curriculum	6. Semester
Language	English
Prior knowledge	All Units
Learning outcomes	Students are able to apply the knowledge acquired during their studies in the context of
	the board examination based on the specified criteria
	formal requirements
	content requirements and
	attitude and ability to reflect.
	They are able to
	argue comprehensibly
	respond to questions
	 position themselves as a socio-educational professional
	 present according to a logical structure
	 prepare content visually in a suitable form (handout,
	presentation)
	use appropriate, non-discriminatory and gender-equitable
	technical language
	 present specialist knowledge appropriately
	 link theoretical knowledge with practical examples
	justify selected theories
	 justify and legitimize the use of techniques and methods

	critically reflect on methods, practice, social developments
	and their own actions
Contents	In accordance with § 3 Abs 2 Z 6 FHG, the final examination at the end of the degree programme must be taken as a board examination - referred to here as the Bachelor's examination - before a relevant examination board. In accordance with § 16 Abs. 1 FHG, the examination consists of the examination parts 1. examination discussion on the Bachelor's thesis completed and 2. its cross- references to relevant subjects in the curriculum.
Exam modalities	Final exam

3.21 Creative Code Lab 5: Applications in Creative Computing

CCL5:ACC	Creative Code Lab 5: Applications in Creative Computing	25 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	5th semester	
Language	English	
Assignment to subarea	Projects	
Prior knowledge	All courses from the first to the fourth semester	
Blocked	No	
Participants	All Students	
Learning outcomes	Students are able to:	
	 include implicit and explicit requirements a conditions from relevant stakeholders (suc coordinators or external partners) and commimplement innovative solutions together with determine the international state of knowled scientific approaches, and select and apply appropriate methods and tools to solve the handle an extensive project in one of the s Creative Computing within a team. This indic in the formulation of the project goals, self-management of a whole project or parts of assumption of coordination and management project on demand. (L5) understand and live their role within a project know their peers (team building). (L3) recognize and solve conflicts during the project communication skills according to the stud apply technical specialisation to their project 	nd general h as project ceptualize and th their peers. (L6) dge, assess existing y the most e given problem. (L5) ubject areas of cludes participation rreliant project if the project, and the ent tasks within the ect. (L3) oject. (L4) results (develop ent's goals) . (L3) ct content. (L3)

Unit examinations	None
Contribution to following units	Internship
Literature	Beck, K. (2003). Test-driven development: By example. Addison- Wesley.
	Crispin, L., & Gregory, J. (2009). Agile testing: A practical guide for testers and agile teams. Addison-Wesley.
	Desikan, S. (with Ramesh, G.). (2006). Software testing: Principles and practices. Dorling Kindersley (India).

Freeman, S., & Pryce, N. (2010). Growing object-oriented software, guided by tests. Addison-Wesley.

Graham, D. (2009). Foundations of Software testing: ISTQB certification (Rev. ed). Cengage Learning.

Kaner, C., Bach, J., & Pettichord, B. (2002). Lessons learned in software testing: A context-driven approach (Online-Ausg). Wiley.

Larman, C., & Vodde, B. (2013). Scaling Agile Development. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=6d31 6274a747abe0f288ce9984812acd4352bdfc

Pezzè, M., & Young, M. (2008). Software testing and analysis: Process, principles and techniques. Wiley.

Rubin, K. S., Cohn, M., & Jeffries, R. (2013). Essential Scrum: A practical guide to the most popular agile process. Addison-Wesley.

Schwaber, K., & Beedle, M. (2002). Agile software development with Scrum. Prentice Hall.

Schwaber, K., & Sutherland, J. (2020). The Scrum Guide: The Definitive Guide to Scrum: The Rules of the Game. https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide-US.pdf

Sutherland, J., & Sutherland, J. J. (2014). Scrum: The art of doing twice the work in half the time (First edition). Currency.

	Project Work	
Course number	Course title	
Course type	Project (PR)	
Teaching and learning methods	Weekly meetings with feedback Presentation of preliminary results to teammates and other groups	
Workload	19 ECTS & 3 SWS	
Position in curriculum	5th semester	
Language	English	
Prior knowledge	All courses from the first to the fourth semester	
Learning outcomes	 Students are able to: include implicit and explicit requirements and general conditions from relevant stakeholders (such as project coordinators or external partners) and conceptualize and implement innovative solutions together with their peers. (L6) determine the international state of knowledge, assess existing scientific approaches, and select and apply the most appropriate methods and tools to solve the given problem. (L5) handle an extensive project in one of the subject areas of Creative Computing within a team. This includes participation in the formulation of the project goals, self-reliant project methods are project on the project goals. 	

	project, and the assumption of coordination and
	management tasks within the project on demand. (L5)
Contents	 The project semester allows a specialisation on certain
	subject areas of Creative Computing (e.g., Web, Games,
	Mobile, XR, AI, etc.).
	Each project offered to the students comprises an in-depth
	task from a topic area of the previous Creative Code Labs in
	semesters 1 to 4.
	Projects are based on the standard of the European Project
	Semester (EPS): in a project team, the students
	independently plan the selected project out of a few project
	offers and carry it out during the semester.
	Students are supported by their project supervisors. The
	project supervisor is available for weekly meetings or after
	individual agreement. Depending on need and necessity,
	external experts can be called in for specific questions.
	The project work begins at the beginning of the semester
	with a kick-off week, followed by blocked project-related
	courses .
Exam modalities	Course-immanent exam
Literature	

	Team Development
Course number	Course title
Course type	Workshop (WS)
Teaching and learning methods	Workshop sessions with teams
Workload	3 ECTS & 2 SWS
Position in curriculum	5th semester
Language	English
Prior knowledge	none
Learning outcomes	Students are able to:
	• understand and live their role within a project. (L3)
	 know their peers (team building). (L3)
	 recognize and solve conflicts during the project. (L4)
	carry out pitch and presentation of project results (develop
	communication skills according to the student's goals). (L3)
Contents	The kick-off week focuses on team development (team
	phases, team building, roles, leadership, cooperation, case
	study: failure of a project).

	In the working phase, the project groups are accompanied
	by a systematic promotion of result-oriented self-reflections,
	process reflections, problem reflections and solution
	reflections, as well as consulting of the project groups in
	connection with the project work (presentations, and
	feedback).
	Preliminary results are presented with the goal of supporting
	improving communication skills.
	Conflict coaching is provided on demand according to the
	needs of the project team.
Exam modalities	Course-immanent exam
Literature	-

	Scrum Coaching
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning methods	Lecture units with theory Group work
Workload	2 ECTS & 2 SWS
Position in curriculum	5th semester
Language	English
Prior knowledge	All courses from the first to the fourth semester
Learning outcomes	 Students are able to: apply technical specialisation to their project content. (L3)
Contents	 Introduction to Scrum methodology and tools for agile development and project management. Counselling specific to the project during the development process.
Exam modalities	Course-immanent exam
Literature	Larman, C., & Vodde, B. (2013). Scaling Agile Development. https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=6d 316274a747abe0f288ce9984812acd4352bdfc
	Rubin, K. S., Cohn, M., & Jeffries, R. (2013). Essential Scrum: A practical guide to the most popular agile process. Addison-Wesley. Schwaber, K., & Beedle, M. (2002). Agile software development with Scrum. Prentice Hall.
	Schwaber, K., & Sutherland, J. (2020). The Scrum Guide: The Definitive Guide to Scrum: The Rules of the Game. https://scrumguides.org/docs/scrumguide/v2020/2020-Scrum-Guide- US.pdf
	Sutherland, J., & Sutherland, J. J. (2014). Scrum: The art of doing twice the work in half the time (First edition). Currency.

	Software Testing
Course number	Course title
Course type	Exercise (UE)
Teaching and learning methods	Compact theory inputs Group work
Workload	1 ECTS & 1 SWS
Position in curriculum	5th semester
Language	English
Prior knowledge	All courses in the subject area "Programming"
Learning outcomes	Students are able to: • apply technical specialisation to their project content. (L3)
Contents	 Introduction to test-driven development, test types, and tools for implementing unit, integration, and automated UI tests. Counselling specific to the project during the development process.
Exam modalities	Course-immanent exam
Literature	Beck, K. (2003). Test-driven development: By example. Addison- Wesley. Crispin, L., & Gregory, J. (2009). Agile testing: A practical guide for testers and agile teams. Addison Wesley.
	Desikan, S. (with Ramesh, G.). (2006). Software testing: Principles and practices. Dorling Kindersley (India).
	Freeman, S., & Pryce, N. (2010). Growing object-oriented software, guided by tests. Addison-Wesley.
	Graham, D. (2009). Foundations of Software testing: ISTQB certification (Rev. ed). Cengage Learning.
	Kaner, C., Bach, J., & Pettichord, B. (2002). Lessons learned in software testing: A context-driven approach (Online-Ausg). Wiley.
	Pezzè, M., & Young, M. (2008). Software testing and analysis: Process, principles and techniques. Wiley.

3.22 Window of Opportunity

WOOP	Window of Opportunity	5 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	6th Semester	
Language	English	
Assignment to subarea	-	
Prior knowledge	-	
Blocked	Partially	
Participants	All students	
Learning outcomes	Students are able to	
	 analyse social challenges from multiple perspective their personal, social and methodological skills and transdisciplinary working groups, follow sci discourses beyond their own discipline and critic their own role and values as responsible citizer 	ctives, apply in (international) entific ically reflect on is.
Unit examinations	None	
Contribution to following units	-	
Literature	•	

	Window of Opportunity
Course number	Course title
Course type	Integrated course (ILV)
Teaching and learning methods	
Workload	5 ECTS & 2 SWS
Position in curriculum	6th Semester
Language	English
Prior knowledge	-
Learning outcomes	Through the learning opportunities selected within the Window of Opportunity - in accordance with their personal objectives - students are able to
	acquire an awareness of social challenges and participate in
	a discourse on solutions.
	 apply the acquired personal, social and methodological skills
	in (international) working or learning situations and, if
	necessary, relate them to their own profession.
	 follow (selective) academic discourses beyond their own

	discipline
	contribute to transdisciplinary and international working
	groups and reflect on the collaboration
	approach a topic from multiple perspectives and adopt
	different points of view.
	question their own values and reflect on their contributions as
	responsible citizens.
Contents	In addition to the disciplinary specialisations and competence objectives set out in the curriculum
	short mobility initiatives and/or international collaborations at
	your own UAS (Internationalisation@home) enable cross-
	border thinking, learning and studying.
	 interdisciplinary projects and formats open up new
	perspectives and promote the success of students across
	disciplinary and programme boundaries.
	individually selected learning formats offer space to question
	one's own values and gain a greater awareness of global
	challenges in order to help shape society responsibly as
	university graduates.
Exam modalities	Course-immanent exam
Literature	

3.23 Internship

IS	Internship	18 ECTS
Unit number	Unit title	Workload
Course of studies	Bachelor Degree Programme Creative Computing	
Position in curriculum	6th semester	
Language	English	
Assignment to subarea	Internship	
Prior knowledge	All courses from semesters 1-5	
Blocked	No	
Participants	All students	
Learning outcomes	The students are able to:	
	• assess at the end of the internship whether	the chosen
	professional field represents a possible futu	re professional
	field. (L6)	
	reflect on one's own competence profile and	to know where
	one's own strengths and weaknesses are. (_4)
Unit examinations	None	
Contribution to following units		
Literature		

	Internship
Course number	Course title
Course type	Vocational internship (BP)
Teaching and learning methods	Active participation in a professional environment
Workload	18 ECTS & 1 SWS
Position in curriculum	6th Semester
Language	English
Prior knowledge	All courses from semesters 1-5
Learning outcomes	The students are able to:
	assess at the end of the internship whether the chosen
	professional field represents a possible future professional
	field. (L6)
	 reflect on one's own competence profile and to know where
	one's own strengths and weaknesses are. (L4)
Contents	Students complete the internship or the work experience
	during their studies in a company or field of activity of their
	choice.

	It offers students the opportunity to gain their first work
	experience and thus paves the way for a career start.
	• On the one hand, students should test and deepen the
	competences acquired during their studies in practice. On
	the other hand, students acquire specific new knowledge,
	skills and abilities from the professional field of the
	internship.
	Through internship reports in the format of an ePortfolio and
	discussions with an internship supervisor from the University
	of Applied Sciences and the supervisor from the company,
	the students can reflect on their role, strengths and
	weaknesses in the professional field.
Exam modalities	Course-immanent exam
Literature	