Modulkatalog des Studiengangs Games & Immersive Media

Kürzel:	GMB
Abschluss:	Bachelor of Arts
SPO-Version:	10
SPO-Paragraph:	87
Fakultät:	Digitale Medien
Veröffentlichungsdatum:	
Letzte Änderung:	

Inhaltsverzeichnis

Ziele des Studiengangs

Fachliche Qualifikationsziele

The alumni of Games & Immersive Media have ...

- a strong expertise in designing and implementing visual arts, software, sound, and interactive elements.
- in-depth knowledge and abilities in team management, production, and marketing.
- a comprehensive theoretical understanding of media design and technology
- experience in collaborating with diverse teams on multiple projects using agile methodologies.

Überfachliche Qualifikationsziele

The alumni of Games & Immersive Media have ...

- the ability to effectively work within multicultural teams in both German and English.
- a sensitivity to the societal impact of the development and utilization of games and immersive media.
- competence and self-assurance in employing complex technologies in creative and artistic contexts.

Berufliche Qualifikationsziele

The alumni of Games & Immersive Media have ...

- a robust foundation for pursuing various careers in the gaming industry.
- a strong groundwork for exploring diverse professions within immersive media outside the gaming sector.
- opportunities for further specialization in chosen fields such as computer science, media technologies, digital asset creation, media management, and media design.

Studiengangsstruktur

Modul/Semester	1	2	3	4	5
7	Project 6			WPM 3	WPM 4
6	Project 5	Business 2	WPM 1	WPM 2	
5	Internship				
4	Project 4	Subject Module 3			
3	Project 3	Subject Module 2			
2	Project 2	Subject Module 1			
1	Project 1	STEM 1	Code 1	Theory 1	Visual 1

Umsetzungsmatrix

Qualifikationsziel	Project 1	STEM 1	Code 1	Theory 1	Visual 1	Project 2	Subject Module 1	Project 3	Subject Module 2
a strong expertise in designing and implementing visual arts, software, sound, and interactive elements.	0	0	2	1	2	1	2	1	2
in-depth knowledge and abilities in team management, production, and marketing.	0	0	0	0	1	2	1	2	1
a comprehensive theoretical understanding of media design and technology	0	2	1	1	2	0	2	0	2
experience in collaborating with diverse teams on multiple projects using agile methodologies.	2	0	1	0	2	2	2	2	2
the ability to effectively work within multicultural teams in both German and English.	2	2	1	0	1	2	1	2	1
a sensitivity to the societal impact of the development and utilization of games and immersive media.	1	0	0	2	1	1	2	1	1
competence and self-assurance in employing complex technologies in creative and artistic contexts.	0	0	2	1	2	2	2	2	2
a robust foundation for pursuing various careers in the gaming industry.	1	1	2	1	1	2	2	2	2
a strong groundwork for exploring diverse professions within immersive media outside the gaming sector.	0	1	2	1	1	2	1	2	2
opportunities for further specialization in chosen fields such as computer science, media technologies, digital asset creation, media management, and media design.	0	0	0	0	0	0	0	0	0

The column group is headed **Modul**.

Qualifikationsziel	Project 4	Subject Module 3	Internship	Project 5	Business 2	WPM 1	WPM 2	Project 6	WPM 3	WPM 4	Summe
a strong expertise in designing and implementing visual arts, software, sound, and interactive elements.	0	0	2	1	2	1	2	1	2	1	**16**
in-depth knowledge and abilities in team management, production, and marketing.	0	0	0	0	1	2	1	2	1	2	**16**
a comprehensive theoretical understanding of media design and technology	0	2	1	1	2	0	2	0	2	0	**13**
experience in collaborating with diverse teams on multiple projects using agile methodologies.	2	0	1	0	2	2	2	2	2	2	**22**
the ability to effectively work within multicultural teams in both German and English.	2	2	1	0	1	2	1	2	1	2	**21**
a sensitivity to the societal impact of the development and utilization of games and immersive media.	1	0	0	2	1	1	2	1	1	1	**16**
competence and self-assurance in employing complex technologies in creative and artistic contexts.	0	0	2	1	2	2	2	2	2	2	**21**
a robust foundation for pursuing various careers in the gaming industry.	1	1	2	1	1	2	2	2	2	2	**27**
a strong groundwork for exploring diverse professions within immersive media outside the gaming sector.	0	1	2	1	1	2	1	2	2	2	**25**
opportunities for further specialization in chosen fields such as computer science, media technologies, digital asset creation, media management, and media design.	0	0	0	0	0	0	0	0	0	0	**10**

1. Semester

Project 1					
Kennnummer DM-2023-GMB103	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 1	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**		**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) Entry Project - No Code		a) Deutsch/ English	a) 33,75 Std.	a) 146,25 Std.	a) 20

2	**Lernergebnisse/Kompetenzen**
	After successful participation in the module the students ...

3	**Inhalte**

4	**Lehrformen**
	a) Project

5	**Teilnahmevoraussetzungen**
	Keine Eingabe vorhanden

6	**Prüfungsformen**
	a) Graded Assessment 1sbA (Practical Work) (6 LP)

7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)

8	**Modulbeauftragte/r und hauptamtlich Lehrende**

9	**Literatur**

STEM 1					
Kennnummer DM-2023-GMB101	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 1	**Häufigkeit des Angebots** Only summer semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**		**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) STEM 1 Seminar b) STEM 1 Practica		a) Deutsch/ English b) Deutsch/ English	a) 33,75 Std. b) 11,25 Std.	a) 90 Std. b) 45 Std.	a) 35 b) 15

2	**Lernergebnisse/Kompetenzen**
	After successful participation in the module the students ... **Wissen (1)** ... reliably reproduce central basic concepts of projection (set theory) ... know how to articulate geometric questions precisely using the appropriate technical terms **Verständnis (2)** ... recognise, understand and reproduce, meaningful connections and proof elements or derivations in the field of geometry and the mapping of three-dimensional objects on two-dimensional planes. **Anwendung (3)** ... apply techniques of vector calculus and matrix algebra to geometrical problems and to questions of the position and representation of spatial objects. **Analyse (4)** ... analyse geometric problems in the plane and space, while selecting the appropriate tools from those provided **Synthese (5)** ... recognise and exploit common structures and patterns in different mathematical areas. ... present an overview of a suitable delimited model relevant to computer graphics or computer vision. **Evaluation / Bewertung (6)** ... weigh up different procedures (e.g. for linking affine or projective transformations) in terms of clarity and effort.

3	**Inhalte**

	a) Geometry of 2D and 3D spaces:
	
	   - Coordinates of Points and Vectors
	   - Change of Coordinate Frames
	   - Systems of Linear Equations
	   - Metric Spaces: Distances, Lengths, Angles
	   - Matrices and Linear Transformations
	   - Homogeneous Coordinates
	   - Matrices and Affine Transformations

Graphical Representations of 3D Objects

- Parallel Projections / Axonometric Projections / Orthographic Projections
- Linear Perspective: Image Construction using Desargues' Theorem
- Points at Infinity and Vanishing Points
- Projection Matrices: Unified Approach

Camera Models in Computer Graphics and Computer Vision

b) Identical with a) STEM 1 Seminar

4	**Lehrformen**
	a) Lecture
	b) Practical / Lab
5	**Teilnahmevoraussetzungen**
	None
6	**Prüfungsformen**
	a) Graded Assessment 1K (Written Exam) (4 LP)
	b) Non Graded Assessment 1sbA (Practical Work) (2 LP)
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
	Prof. Dr. Thomas Schneider (Module Responsible)
	Prof. Dr.-Ing. Uwe Hahne (Lecturer)
	Prof. Dr. Ruxandra Lasowski (Lecturer)
	Prof. Dr. Thomas Schneider (Lecturer)
9	**Literatur**
	a) H. Anton, C. Rorres, A. Kaul: Elementary Linear Algebra, Applications Version
	E. Lengyel: Mathematics for 3D Game Programming and Computer Graphics
	b) identical to a)

Code 1					
Kennnummer DM-2023-GMB102	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 1	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Code 1	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 45 Std.	**Selbststudium** a) 135 Std.	**Geplante Gruppengröße** a) 35

2 **Lernergebnisse/Kompetenzen**

After successful participation in the module, students will be able to / or have gained the ability for ...

Wissen (1)
... know the basic concepts of interactive audiovisual applications

Verständnis (2)
... understand basic information structures for interactive 2D-graphics and audio as implemented by web-technologies

Anwendung (3)
... can work with a programming language and use software development and source control environments

Analyse (4)
... can analyse simple human-computer-interactions and use computational thinking formulate algorithms for their realization

Synthese (5)
... are able to be creative and experiment with procedural coding, web- and other technologies

Evaluation / Bewertung (6)
... can evaluate and improve their coded creations

3 **Inhalte**

a) - Creative Coding
   - Web Fundamentals
   - 2D-Scenegraph
   - Procedural Code
   - Coding Audiovisuals
   - Computational Thinking

4 **Lehrformen**

a) Seminar

5 **Teilnahmevoraussetzungen**

Keine Eingabe vorhanden

6	**Prüfungsformen** a) Graded Assessment 1K (Written Exam) (6 LP)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende** Prof. Jirka Dell'Oro-Friedl (Module Responsible) Prof. M.F.A. Regina Reusch (Lecturer)
9	**Literatur** a) Robbins, Jennifer: HTML5 pocket reference, Sebastopol, CA: O'Reilly, 2013 Meyer, Eric A.: CSS pocket reference, Sebastopol, CA: O'Reilly Media, 2018 Vanderkam, Dan: Effective TypeScript. Sebastopol, CA: O'Reilly Media, 2019

Theory 1					
Kennnummer DM-2023-GMB104	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 1	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Computer Science and HCI Theory	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 45 Std.	**Selbststudium** a) 135 Std.	**Geplante Gruppengröße** a) 30

2	**Lernergebnisse/Kompetenzen** After successful participation in the module the students ... **Wissen (1)** ... Basic knowledge in HCI including cognition and perception, UCD and UCD Process ... Basic knowledge on computer hardware, concepts and history of computer science **Verständnis (2)** ... Understanding concepts in computer science like computer architecture, bits&bytes ... Unterstanding user-centered, pyschological and HCI concepts **Anwendung (3)** ... applying computer science concepts ... applying user-centered design, UI design concepts **Analyse (4)** ... analysing programs / code for concepts ... analysing user interfaces for patterns and interaction concepts **Synthese (5)** ... design and create interactions and user interfaces ... realize basic algorithms / programs **Evaluation / Bewertung (6)** ... evaluate user interfaces using heuristics and design prinicples ... evaluate code for programming principles

3	**Inhalte**
	
	a) - Why Computer Science?
	    - Current Research and Technology
	    - History of the Computer
	    - Technology Hardware, von NeumannComputer
	    - Science Basics: Bits & Bytes, Pixels
	    - Boolean Logic
	    - Perception (Visual, Auditive and Haptic), including Colors
	    - Cognition and Memory, HCI topics
	    - User-Centered Design & User-Centered Design Process

4	**Lehrformen**
	a) Lecture / Seminar
5	**Teilnahmevoraussetzungen**
	Keine Eingabe vorhanden
6	**Prüfungsformen**
	a) Non Graded Assessment 1R (Review) (6 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung)[1]
	a) Graded Assessment 1sbK (Written Exam)[1]
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
	Prof. Dr.-Ing. Thomas Schlegel (Module Responsible)
9	**Literatur**
	a) will be given in lecture as applicable

[1] The entire examination is only passed if all partial examinations are graded at least "sufficient" (4.0). In the case of a fail, only the partial examinations that have not been passed must and may be repeated.

Visual 1					
Kennnummer DM-2023-GMB105	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 1	**Häufigkeit des Angebots** Only summer semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Visual 1	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 45 Std.	**Selbststudium** a) 135 Std.	**Geplante Gruppengröße** a) 20

2	**Lernergebnisse/Kompetenzen**
	After successful participation in the module, students will be able to ... **Wissen (1)** ... gain knowledge of and practice the essential basics of visual design **Verständnis (2)** ... understand artistic processes and assess composition and design **Anwendung (3)** ... develop and implement design concepts **Analyse (4)** ... break down creative processes, analyze design parameters and visualize production processes **Synthese (5)** ... combine creative processes to create coherent design concepts for immersive media **Evaluation / Bewertung (6)** ... iterative evaluation of own work and implementation of visual adjustments

3	**Inhalte**

	a) - Draft and sketching
	      - Figurative thinking
	      - Storyboard
	      - Color theory and practical application
	      - Visual Character-Developement
	      - UI-Design-Basics

4	**Lehrformen**
	a) Seminar / Practical

5	**Teilnahmevoraussetzungen**
	None

6	**Prüfungsformen**
	a) Graded Assessment 1sbA (Practical Work) (6 LP)
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
	Prof. Christian Fries (Module Responsible)
9	**Literatur**

2. Semester

Project 2					
Kennnummer DM-2023-GMB201	**Workload** 270 Std.	**Credits/LP** 9	**Studiensemester** 2	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Project 2 - Physical Game	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 33,75 Std.	**Selbststudium** a) 236,25 Std.	**Geplante Gruppengröße** a) 20

2	**Lernergebnisse/Kompetenzen** After successful participation in the module the students ... **Wissen (1)** ... gain experience working on a project in a team **Verständnis (2)** ... understand agile project management **Anwendung (3)** ... can apply the skills and knowledge acquired in the other modules so far **Analyse (4)** ... can analyse a theme for a game, do research and detect opportunities to deduct rules to play from it **Synthese (5)** ... can design, create and present a physical game prototype **Evaluation / Bewertung (6)** ... can evaluate their prototype e.g. by conducting user tests and recommend improvements

3	**Inhalte**
	
	a) - Design and creation of a physical game, optionally with digital augmentation
	    - Practical application of various skills acquired in previous modules
	    - Team- and projectmanagement
	    - Practice visualization, documentation, communication, presentation
	    - Work with physical material to create prototypes

4	**Lehrformen** a) Project
5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden
6	**Prüfungsformen** a) Graded Assessment 1sbA (Practical Work) (9 LP)

7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

Subject Module 1					
Kennnummer DM-2023-GMB202	**Workload** 630 Std.	**Credits/LP** 21	**Studiensemester** 2	**Häufigkeit des Angebots** Jedes Semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**	**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) Sound 1 - Concepts and Techniques in Interactive and immersive Audio Design b) Visual 2 c) Theory 2 - Game Design d) Theory 2 - Data Driven Game Design e) Code 2	a) Deutsch/ English b) Deutsch/ English c) Deutsch/ English d) Deutsch/ English e) Deutsch/ English	a) 45 Std. b) 45 Std. c) 22,5 Std. d) 22,5 Std. e) 45 Std.	a) 105 Std. b) 105 Std. c) 52,5 Std. d) 52,5 Std. e) 135 Std.	a) 36 b) 36 c) 36 d) 30 e) 35

2	**Lernergebnisse/Kompetenzen**

After successful participation in the module, students will be able to / or have gained the ability for ...

Wissen (1)
... a) outline the basics of acoustics, psycho acoustics, and digital audio processing
... c) / d) acquire a basic command of probabilty concepts
... c) / d) evaluate selected games by their typologies and the corresponding strategy algorithms
... e) know basics of a graphic design language (UML)

Verständnis (2)
... a) understand basic concepts and techniques of interactive and immersive audio
... c) / d) understand how games can be modelled
... e) understand common patterns and techniques for realtime applications in three dimensions

Anwendung (3)
... a) apply the learned concepts and techniques to the design of interactive and immersive audio
... c) / d) apply concepts of probability and game theory to selected types of games
... e) can create experimental prototypes of games and interactive applications using a game engine and its integrated editor

Analyse (4)
... a) identify essential concepts and techniques of interactive and immersive audio applications
... c) / d) analyze game types and strategies by means of game theoretical methods
... e) can analyse simple problems in interactive threedimensional environments

Synthese (5)
... a) design interactive and immersive audio applications
... e) are able to create object- and component oriented designs for interactive applications

	Lernergebnisse/Kompetenzen **Evaluation / Bewertung (6)** ... a) critically discuss the design of interactive and immersive audio applications ... e) can evaluate and improve their coded creations

3	**Inhalte**
	
	a) • Basics of sound, listening and sonic interaction
	
	• Basics of acoustics and psychoacoustics
	
	• Basics of digital audio (in sound and music processing)
	
	• Tools for the design and deployment of interactive audio in immersive media and games
	
	• Immersive audio techniques
	
	• Concepts and techniques of interactive audio design
	
	c) - Game Studies
	     - Design Graphs
	     - Design Methodologies
	
	d) - Elementary Combinatorics
	     - Finite Probability Spaces: Examples
	     - Bernoulli Processes and Binomial Distributions
	     - Expected Value and Variance
	     - Conditional Probabilities, Bayes' Theorem
	     - Game Theory
	     - Categories of Games
	     - Representation of games
	     - Players' Strategies
	     - Nash Equilibria

4	**Lehrformen** a) Seminar b) Seminar / Praktikum c) Seminar d) Seminar e) Seminar
5	**Teilnahmevoraussetzungen** None

6	**Prüfungsformen**
	a) Prüfungsleistung 1sbA (Praktische Arbeit) (5 LP)
	b) Prüfungsleistung 1sbA (Praktische Arbeit) (5 LP)
	c) Prüfungsleistung 1sbK (Klausur) (2 LP)
	d) Prüfungsleistung 1KO (Kolloquium) (3 LP)
	e) Prüfungsleistung 1sbK (Klausur) (6 LP)
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
	Prof. Jirka Dell'Oro-Friedl (Modulverantwortliche/r)
	Prof. Christoph Müller (Modulverantwortliche/r)
	Prof. Dr. Norbert Schnell (Modulverantwortliche/r)
9	**Literatur**
	e) Kecher, Hoffmann-Elbern, Will: UML 2.5, Rheinwerk Computing (2021)
	Nystrom, Game Programming Patterns (2014) - online at https://gameprogrammingpatterns.com/contents.html

3. Semester

Project 3					
Kennnummer DM-2023-GMB301	**Workload** 270 Std.	**Credits/LP** 9	**Studiensemester** 3	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Project 3 - Simple Digital Project	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 33,75 Std.	**Selbststudium** a) 236,25 Std.	**Geplante Gruppengröße** a) 20

2	**Lernergebnisse/Kompetenzen** After successful participation in the module the students ... **Wissen (1)** ... gain experience working on a project in a team **Verständnis (2)** ... understand agile project management **Anwendung (3)** ... can apply the skills and knowledge acquired in the other modules so far **Analyse (4)** ... can analyse and detect interesting opportunities for human-computer-interaction within given constraints **Synthese (5)** ... can design, create and present a simple digital prototype of an interactive, immersive application or game **Evaluation / Bewertung (6)** ... can evaluate their prototype e.g. by conducting user tests and recommend improvements

3	**Inhalte**
	
	a) - Design and creation of a simple interactive application
	    - Practical application of various skills acquired in previous modules
	    - Implementation of graphics, sound, behaviour, animation, text
	    - Team- and projectmanagement
	    - Practice visualization, documentation, communication, presentation
	    - Work with digital material to create prototypes

4	**Lehrformen** a) Project
5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden

6	**Prüfungsformen**
	a) Graded Assessment 1sbA (Practical Work) (9 LP)
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

Subject Module 2					
Kennnummer DM-2023-GMB302	**Workload** 630 Std.	**Credits/LP** 21	**Studiensemester** 3	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	Lehrveranstaltungen	Sprache	Kontaktzeit	Selbststudium	Geplante Gruppengröße
	a) Sound 2 - Sound and Music Design b) Visual 3 c) STEM 2 d) Code 3	a) Deutsch/ English b) Deutsch/ English c) Deutsch/ English d) Deutsch/ English	a) 45 Std. b) 22,5 Std. c) 45 Std. d) 22,5 Std.	a) 105 Std. b) 127,5 Std. c) 105 Std. d) 157,5 Std.	a) 36 b) 35 c) 30 d) 35

2   **Lernergebnisse/Kompetenzen**

After successful participation in the module, students will be able to ...

Wissen (1)
... a) outline the basic concepts and techniques in the design of sound and music for immersive media and games
... c) reliably reproduce essential concepts of geometrical (ray) optics.
... c) accurately articulate relationships of differential calculus and kinematics.

Verständnis (2)
... a) understand the basics of designing sound and music for immersive media and games
... c) capture basic principles of the paraxial processing model for imaging systems
... c) understand mathematical modeling of simple dynamical systems

Anwendung (3)
... a) apply the learned concepts and techniques to design sound and music for immersive media and games
... c) apply the basic laws of ray optics to the imaging properties of camera lenses
... c) apply methods for the description of dynamic systems to simple systems

Analyse (4)
... a) identify essential concepts and techniques in the design of sound and music for immersive media and games
... c) study the effect of varying system parameters and initial conditions on system behavior

Synthese (5)
... a) design sound and music for immersive media and games
... c) compare optical imaging in photography / cinematography and computer graphics / computer vision.

Evaluation / Bewertung (6)
... a) critically discuss the sound and music design of immersive audio applications
... c) evaluate different physics engines in terms of their functionality and simulation fidelity and realism.

3	**Inhalte**
	a) • Basics of sound design
	• Foley and sound effects
	• Sound libraries
	• Music genres
	• Music and emotion
	• Music in context
	• Music analysis
	• Basics of music composition
	• Basics of instrumentation and orchestration
	c) Foundations
	- Basic Calculus - Parametrized Curves in the plane and in three-dimensional space - Elements of Kinematics
	Dynamical Systems
	- Deterministic Models, Differential Equations - Setting up and Evaluating Models for Example Systems - Project Work: Visualization of the Behavior of Simple Systems by Means of Web Applications
	Foundations of Camera Optics
	- Paraxial Ray Tracing - Camera Lenses and their cardinal points - Focus, Magnification, Depth of Focus - Comparison: Optical Properties of the Human Eye vs. Camera Optics
	Physics Engines
4	**Lehrformen**
	a) Seminar
	b) Seminar / Practical
	c) Seminar
	d) Seminar

5	**Teilnahmevoraussetzungen**
	None

6	**Prüfungsformen**
	a) Graded Assessment 1sbA (Practical Work) (5 LP)
	b) Graded Assessment 1sbA (Practical Work) (5 LP)
	c) Graded Assessment 1K (Written Exam) (5 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung)[2]
	c) Non Graded Assessment 1sbA (0%) (Practical Work)[2]
	d) Graded Assessment 1sbA (Practical Work) (6 LP)

7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)

8	**Modulbeauftragte/r und hauptamtlich Lehrende**
	Prof. Dr.-Ing. Uwe Hahne (Module Responsible)
	Prof. Christoph Müller (Module Responsible)
	Prof. Dr. Thomas Schneider (Module Responsible)
	Prof. Dr. Norbert Schnell (Module Responsible)

9	**Literatur**
	c) D. Kleppner et al.: Quick Calculus : A Self-Teaching Guide
	G. Strang: Differential Equations and Linear Algebra
	R. Erb: Optik mit GeoGebra
	D.M. Bourg: Physics for Game Developers

[2] The entire examination is only passed if all partial examinations are graded at least "sufficient" (4.0). In the case of a fail, only the partial examinations that have not been passed must and may be repeated.

4. Semester

Project 4					
Kennnummer DM-2023-GMB401	**Workload** 270 Std.	**Credits/LP** 9	**Studiensemester** 4	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Project 4 - Advanced Digital Project	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 33,75 Std.	**Selbststudium** a) 236,25 Std.	**Geplante Gruppengröße** a) 20

2	**Lernergebnisse/Kompetenzen** After successful participation in the module the students ... **Wissen (1)** ... gain experience working on a project in a team **Verständnis (2)** ... understand agile project management **Anwendung (3)** ... can apply the skills and knowledge acquired in the other modules so far **Analyse (4)** ... can analyse and detect interesting opportunities for the implemention of advanced technologies **Synthese (5)** ... can design, create and present an advanced digital prototype of an interactive, immersive application or game **Evaluation / Bewertung (6)** ... can evaluate their prototype e.g. by conducting user tests and recommend improvements

3	**Inhalte**
	
	a) - Design and creation of an advanced interactive application
	   - Practical application of various skills acquired in previous modules
	   - Implemention of advanced technologies e.g. AR/VR, spatial audio/video, tangible interfaces
	   - Team- and projectmanagement
	   - Practice visualization, documentation, communication, presentation
	   - Work with digital material to create advanced prototypes

4	**Lehrformen** a) Project

5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden

6	**Prüfungsformen**
	a) Graded Assessment 1sbA (Practical Work) (9 LP)
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

Subject Module 3					
Kennnummer DM-2023-GMB402	**Workload** 630 Std.	**Credits/LP** 21	**Studiensemester** 4	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**	**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**	
	a) Business 1	a) Deutsch/ English	a) 45 Std.	a) 135 Std.	a) 30	
	b) STEM 3 - Physical Computing	b) Deutsch/ English	b) 22,5 Std.	b) 67,5 Std.	b) 30	
	c) STEM 3 - Physical Interfaces	c) Deutsch/ English	c) 22,5 Std.	c) 37,5 Std.	c) 30	
	d) Theory 3	d) Deutsch/ English	d) 45 Std.	d) 105 Std.	d) 30	
	e) Code 4 - AI	e) Deutsch/ English	e) 22,5 Std.	e) 52,5 Std.	e) 35	
	f) Code 4 - Network	f) Deutsch/ English	f) 22,5 Std.	f) 52,5 Std.	f) 50	

2	**Lernergebnisse/Kompetenzen**

After successful participation in the module, students will be able to / or have gained the ability for ...

Wissen (1)
... a) know the fundamentals of business economy and community management
... e) know algorithms for game AI

Verständnis (2)
... a) understand the dependencies between the various parts of a project and the implications
... e) choose the right algorithm for a specific scenario

Anwendung (3)
... a) can act as a teamleader to produce interactive and immersive applications
... e) implement basic algorithms for game AI

Analyse (4)
... a) can analyse an immersive application at different stages of development and assess quality
... e) analyse existing algorithms for patterns and use cases

Synthese (5)
... can estimate and calculate the costs of development of immersive applications
... e) combine multiple algorithms or patterns to create sophisticated systems for specific purposes

Evaluation / Bewertung (6)
... a) can evaluate the results of user researches and their implications
... e) evaluate AI with a data-driven approach to incorporate feedback and improvements

3	**Inhalte**

a) - Producing
   - Quality Management
   - User Research
   - Community Management
   - Financial calculation

d) - Level Design
   - Mission Design
   - Narrative Design
   - Storytelling
   - Environmental
   - UX-Design

e) - Game AI: Finite Automata und Behaviour Trees, Agents, Search Problems, Uninformed Search, Informed Search (A* and Heuristics)
   - Adversarial Search and Games I: Minimax,
   - Alpha-beta Pruning Adversarial Search and Games II: Expectimax, MCTS
   - Reinforcement Learning

4	**Lehrformen**

a) Seminar

b) Seminar

c) Seminar

d) Seminar

e) Seminar

f) Seminar / Practical

5	**Teilnahmevoraussetzungen**

Keine Eingabe vorhanden

6	**Prüfungsformen**

a) Graded Assessment 1sbK (Written Exam) (6 LP)

b) Graded Assessment 1sbA (Practical Work) (3 LP)

c) Graded Assessment 1sbA (Practical Work) (2 LP)

d) Graded Assessment 1sbK (Written Exam) (5 LP)

e) Graded Assessment 1K (Written Exam) (3 LP)

f) Graded Assessment 1K (Written Exam) (2 LP)

7	**Verwendung des Moduls**

Games & Immersive Media B.A. (GMB)

8	**Modulbeauftragte/r und hauptamtlich Lehrende**

9	**Literatur**

e) Russell, Stuart ; Norvig, Peter: Artificial Intelligence: A Modern Approach, Pearson, 2021

5. Semester

Internship					
Kennnummer DM-2023GMB501	**Workload** 900 Std.	**Credits/LP** 30	**Studiensemester** 5	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**	**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) Internship b) Seminar Intership	a) Deutsch/ English b) Deutsch/ English	a) 0 Std. b) 22,5 Std.	a) 840 Std. b) 37,5 Std.	a) 1 b) 50

2	**Lernergebnisse/Kompetenzen**
3	**Inhalte**
4	**Lehrformen** a) b) Seminar
5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden
6	**Prüfungsformen** a) Non Graded Assessment 1sbB (Report) (28 LP) b) Non Graded Assessment 1R (Review) (2 LP)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

6. Semester

Project 5					
Kennnummer DM-2023-GMB601	**Workload** 360 Std.	**Credits/LP** 12	**Studiensemester** 6	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Project 5 - Complex Digital Project	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 33,75 Std.	**Selbststudium** a) 326,25 Std.	**Geplante Gruppengröße** a) 20

2	**Lernergebnisse/Kompetenzen**

After successful participation in the module the students ...

Wissen (1)
... gain experience working professionally on a project in a team

Verständnis (2)
... understand professional project management including economic considerations

Anwendung (3)
... can apply the skills and knowledge acquired in the other modules so far

Analyse (4)
... can analyse and detect interesting technical and economical opportunities of an immersive media application or game

Synthese (5)
... can professionally design, create and present an interactive, immersive application or game

Evaluation / Bewertung (6)
... can evaluate application e.g. by conducting user tests and recommend improvements

3	**Inhalte**

a) - Professional design and creation of a complex interactive application
 - Practical application of various skills acquired in previous modules
 - Consideration and calculation of professional publishing, marketing, monetization, quality assurance.
 - Practice professional workflow

4	**Lehrformen**

a) Project

5	**Teilnahmevoraussetzungen**

Keine Eingabe vorhanden

6	**Prüfungsformen**

a) Graded Assessment 1sbA (Practical Work) (12 LP)

7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

Business 2					
Kennnummer DM-2023-GMB604	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 6	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**		**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) Business 2		a) Deutsch/ English	a) 45 Std.	a) 135 Std.	a) 35

2	**Lernergebnisse/Kompetenzen**
	After successful participation in the module the students ...
	Wissen (1) ... can act as a teamleader to produce interactive and immersive applications ... know the fundamentals of the publishing business and marketing
	Verständnis (2) ... understand the lifecycles of games and immersive media and how to manage them
	Analyse (4) ... can analyse game concepts with a focus on monetization and suggest best options
	Synthese (5) ... can draft a business plan for a small startup based on a concept of a product to create

3	**Inhalte**
	a) - Publishing - Entrepreneurship - Monetization - Marketing - Lifecycle Management

4	**Lehrformen**
	a) Seminar

5	**Teilnahmevoraussetzungen**
	Keine Eingabe vorhanden

6	**Prüfungsformen**
	a) Graded Assessment 1sbK (Written Exam) (6 LP)

7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)

8	**Modulbeauftragte/r und hauptamtlich Lehrende**

9	Literatur

WPM 1					
Kennnummer DM-2023-GMB602	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 6	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Elective Course (WPM) see (5)		**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 22,5 Std.	**Selbststudium** a) 157,5 Std.	**Geplante Gruppengröße** a) 50

2	**Lernergebnisse/Kompetenzen** After successful participation in the module, students will be able to ... **Wissen (1)** ... X, depending on the chosen elective course (WPM)
3	**Inhalte** a) Depending on the elective course and the lecturer
4	**Lehrformen** a)
5	**Teilnahmevoraussetzungen** - Depending on the elective course and lecturer - The level of the elective course, higher levels require the lower levels to be completed
6	**Prüfungsformen** a) Graded Assessment PL (Undetermined) (6 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung) a) Non Graded Assessment SL (Undetermined)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

WPM 2					
Kennnummer DM-2023-GMB603	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 6	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Elective Course (WPM) see (5)	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 22,5 Std.	**Selbststudium** a) 157,5 Std.	**Geplante Gruppengröße** a) 50

2	**Lernergebnisse/Kompetenzen** After successful participation in the module, students will be able to ... **Wissen (1)** ... X, depending on the chosen elective course (WPM)
3	**Inhalte**
4	**Lehrformen** a)
5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden
6	**Prüfungsformen** a) Graded Assessment PL (Undetermined) (6 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung) a) Non Graded Assessment SL (Undetermined)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

7. Semester

Project 6					
Kennnummer DM-2023-GMB701	**Workload** 540 Std.	**Credits/LP** 18	**Studiensemester** 7	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen**		**Sprache**	**Kontaktzeit**	**Selbststudium**	**Geplante Gruppengröße**
	a) Thesis b) Thesis Seminar		a) Deutsch/ English b) Deutsch/ English	a) 0 Std. b) 22,5 Std.	a) 360 Std. b) 157,5 Std.	a) 1 b) 40

2	**Lernergebnisse/Kompetenzen**
	After successful completion of the thesis module, students will be able to ... **Wissen (1)** ... present central topics and results in a concise way ... use the aquired skills and knowledge to create a coherent scientific submission **Verständnis (2)** ... develop an in-depth knowledge of patterns and connections within a subject ... understanding the process of creating and solidifying knowledge in the scientific context **Anwendung (3)** ... use media, material and scientific methods to permeate a complex subject **Analyse (4)** ... analyse scientific articles and theses critically ... define a subject through scientific questions and derive a concise result **Synthese (5)** ... reworking the thesis based on supervisor and professional audience feedback ... developing solution-oriented approaches and methods through their findings **Evaluation / Bewertung (6)** ... evaluating solutions, while integrating and arguing findings

3	**Inhalte**

	a) - Depending on the chosen topic and thesis supervisor
	
	b) - Continous discussion of the thesis topic and current progress between student and supervisors
	  - Creation of milestones and the review of the planned milestones
	  - Presentation and discussion of the thesis with a professional audience

4	**Lehrformen**
	a) b) Seminar

5	**Teilnahmevoraussetzungen**
	Keine Eingabe vorhanden
6	**Prüfungsformen**
	a) Graded Assessment 1T (Thesis) (12 LP)[3]
	b) Non Graded Assessment 1PN (Presentation) (6 LP)[3]
7	**Verwendung des Moduls**
	Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**
	a) Depending on the subject and supervisors
	b) Depending on the subject and supervisors

[3] Not applicable.

WPM 3					
Kennnummer DM-2023-GMB702	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 7	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Elective Course (WPM) see (5)	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 22,5 Std.	**Selbststudium** a) 157,5 Std.	**Geplante Gruppengröße** a) 50

2	**Lernergebnisse/Kompetenzen** After successful participation in the module, students will be able to ... **Wissen (1)** ... X, depending on the chosen elective course (WPM)
3	**Inhalte**
4	**Lehrformen** a)
5	**Teilnahmevoraussetzungen** Keine Eingabe vorhanden
6	**Prüfungsformen** a) Graded Assessment PL (Undetermined) (6 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung) a) Non Graded Assessment SL (Undetermined)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**

WPM 4					
Kennnummer DM-2023-GMB703	**Workload** 180 Std.	**Credits/LP** 6	**Studiensemester** 7	**Häufigkeit des Angebots** Each semester	**Dauer** 1 Semester

1	**Lehrveranstaltungen** a) Elective Course (WPM) see (5)	**Sprache** a) Deutsch/ English	**Kontaktzeit** a) 22,5 Std.	**Selbststudium** a) 157,5 Std.	**Geplante Gruppengröße** a) 50

2	**Lernergebnisse/Kompetenzen** After successful participation in the module, students will be able to ... **Wissen (1)** ... X, depending on the chosen elective course (WPM)
3	**Inhalte** a) Depending on the elective course and the lecturer
4	**Lehrformen** a)
5	**Teilnahmevoraussetzungen** - Depending on the elective course and lecturer - The level of the elective course, higher levels require the lower levels to be completed
6	**Prüfungsformen** a) Graded Assessment PL (Undetermined) (6 LP insgesamt für alle Teilprüfungsleistung dieser Lehrveranstaltung) a) Non Graded Assessment SL (Undetermined)
7	**Verwendung des Moduls** Games & Immersive Media B.A. (GMB)
8	**Modulbeauftragte/r und hauptamtlich Lehrende**
9	**Literatur**